

Project-based learning module on creativity and entrepreneurship products subject: Validity and empirical effect

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Abstract: The learning process for Creativity and Entrepreneurship Products subjects in Vocational High Schools still uses printed books which are verbal in nature so this will make it difficult for students to learn the learning material. Apart from that, the learning method used the lecture method which is certainly less effective in supporting students' understanding of the material so that learning is more teacher-centred. Meanwhile, the demand for the current 'Merdeka' curriculum is that learning must be student-centered. This research aimed at developing learning tools of PjBL (Project Based Learning) based teaching modules on the Product Creativity and Entrepreneurship subjects. This research was a type of research and development using the ADDIE development model. There were 12 experts who validate this module from 3 aspects, namely material, media and model, and language aspects and there were 30 students for limited trials. The results of this research showed that this module was valid and has a positive effect in supporting the learning process for the Product Creativity and Entrepreneurship subjects. This research had implications for the effectiveness of Creativity and Entrepreneurship Products learning and being one method that can be used by teachers in this learning

Keywords: Project Based Learning, Creativity and Entrepreneurship Products, TVET, Vocational Education

1. Introduction

According to Law of the Republic of Indonesia Number 20 of 2003, article 1 number 1 concerning the National Education System, education is a conscious, planned effort to create a comfortable learning and teaching atmosphere and process, if students can actively develop the potential that exists within them to have religious spiritual strength, self-control, personality, intelligence, noble morals, as well as skills needed by themselves, society, nation and state, all of those can be achieved by undergoing mandatory education starting from elementary school, middle school and high school/vocational school. Vocational High School is a formal education unit that provides vocational education (Fuller, 2015). Vocational education is at the same level as high school which aims to prepare students to hone their skills, interests and talents to compete in the DU/DI

(Business/Industrial World) which currently has very tight competition ([Kennedy, 2011](#); [Waskito et al., 2022](#)).

Creativity and Entrepreneurship Product is one of the subjects taught at vocational schools and is included in the skills competency (C3) ([Antonietti et al., 2022](#); [Huda et al., 2021](#)). In Creativity and Entrepreneurship Product learning, Student activities must include activities and learning materials that can increase the knowledge, skills and attitudes needed to create real work, create market opportunities and create real activities that have economic value from product output. Creativity and entrepreneurship and interactive learning include creating projects ([Olumide, 2015](#)). In the Creativity and Entrepreneurship Product subjects, the learning process is currently still based on conventional learning activities in most vocational schools, so that the learning objectives in current curriculum are still unable to achieve the learning achievement indicators that have been previously designed, as we know that conventional learning is a lecturing methods which in their approach pattern emphasize the skills/abilities of an educator in delivering learning, and this pattern is still widely criticized by various educational groups because it is considered less effective in supporting students' critical thinking abilities, activeness and creativity ([Novalinda et al., 2023](#)). At this time an new curriculum has been developed which requires students to be more active during the learning process so that learning is more teacher-centred ([Monim, 2016](#); [Prasetya et al., 2023](#)).

Learning is a process of internalizing knowledge that occurs in the classroom involving teachers and students ([Özoğul et al., 2020](#)). The success of the learning process requires learning tools that support the learning process. Learning tools are currently undergoing updates, where previously the world of education in Indonesia implemented new curriculum and continued in early 2022 with the existence of an 'Merdeka' curriculum. In this curriculum, learning tools are called teaching modules. Teaching modules are learning tools which have been completely accumulated as a complement to previous learning tools and are the key in helping teachers organize the learning process ([Hartanto et al., 2020](#); [Jalinus, Syahril, et al., 2023](#); [Schwendimann et al., 2018](#)). The teaching module in its creation contains Learning Outcomes (CP), Learning Objectives Flow (ATP), teaching materials, student worksheets, assessment rubrics, and evaluation. The teaching modules are completely arranged in such a way that the learning process takes place more effectively and is able to achieve the learning objectives ([Rozendaal et al., 2003](#)).

Apart from learning tools, the use of learning methods that suit the characteristics of the teaching material is very important in supporting the learning process. The learning method that suits the characteristics of the Creativity and Entrepreneurship Product learning material is the Project Based Learning (PjBL) method ([Jalinus, Sukardi, et al., 2023](#); [Syahril et al., 2019](#)). The Project Based Learning method is a learning method that provides students with the opportunity to process learning in the classroom where the students are the object and centred by involving project work so that students are able to find solutions to a real situation ([Amamou & Cheniti-Belcadhi, 2018](#); [Le et al., 2022](#)), Project Based Learning is a learning model that carries out learning activities around student-centred project activities ([Alves et al., 2011](#)), projects are complex tasks based on problems that involve students in problem solving, decision making, designing, or investigation activities. This method will give students the opportunity to work in a structured, scheduled manner, and which in the end will provide an output that is based on the input that the students have received, where the output is a real and functional product ([Syahril et al., 2020](#)).

Learning tools based on Project Based Learning are learning tools that contain learning processes that accordance with Project Based Learning syntaxes. The learning process that uses Project Based Learning tools will make learning more structured because each learning activity is guided based on

the stages contained in the learning tools. This will be the latest innovation that is able to provide an interesting learning experience for students and will have a positive impact on students' understanding of the material ([Magleby & Furse, 2007](#)). Thus, this research aims to develop Project Based Learning modules for the Creativity and Entrepreneurship Product subjects for vocational school students and determine the validity value of this module.

2. Methods

Research Type

This research is Research and Development (R&D) type which is to develop a product as well as validate the product that will be used. Research and Development is a research method used to produce and test certain products ([Alias & Hasim, 2012](#)).

Research Procedures

The development model used is ADDIE since the ADDIE model is an approach that emphasizes an analysis of how each component is related. The ADDIE model is used because the stages are systematic for instructional development. However, the researchers apply the ADDIE model which has been modified into 3 steps, namely analysis, design and development.

- a) *Analysis*. This stage was carried out to determine the urgency that researchers needed, and also to observe as an effort to find solutions to problems at school. The things the researcher did in this analysis stage included: 1) analyzing the needs of students to find out what problems existed. 2) analysis of learning outcomes is carried out so that researchers know what learning outcomes students have learned and mastered. 3) Analyze the material/content according to the existing Learning Objectives Flow (ATP).
- b) *Design*. At this stage the researchers prepare a plan for making modules which begins with developing a framework for making teaching modules based on PjBL. The reference in preparing teaching modules based on PjBL is product specifications/references that have been created in different subjects but developed on a PjBL basis.
- c) *Development*. In this stage, the researchers continue to create a validation questionnaire to assess the feasibility of the module which consists of 3 aspects: the material expert aspect, the media and model expert aspect, and the language expert aspect. After that, the limited trial took place to see the effectiveness of module to be applied broadly.

Research Participants

There are 12 experts who validate this module from 3 aspects, namely material, media and model, and language aspects and there are 30 students for limited trials to ensure the validity of the model whether it can be applied for wider trials.

Research Instruments

The instruments or data collection tools in this research use questionnaires for product validation and limited trials. Before carrying out validity tests and limited trials, a pilot study was carried out to see the validity and reliability of the questionnaires. The validity and reliability of these instruments can be seen in the table below.

Table 1: Instrument Validity and Reliability Results

Instruments	Validity Score	Cronbach's Coefficient	Alpha
Materials	0.86	0.95	
Media And Model	0.88	0.89	
Linguist	0.84	0.92	
PjBL Module Efficiency	0.81	0.87	
Learning Outcomes	0.91	0.83	

Table 1 above shows the validity and reliability results of the research instrument after conducting the pilot study. The results of data processing show that this research instrument is in the valid and reliable category, so that the instrument can be used for research data collection activities.

Data Analysis Techniques

There are 2 types of data analysis used in this research. In the validity test carried out by experts, the data analysis used is Aiken's V coefficient, while for limited trial analysis using regression analysis. This regression analysis is used to find out whether there is a relationship between the two variables PjBL module efficiency and Learning Outcomes, and if there is a relationship, what direction is the relationship and how big is the relationship. So the null hypothesis appears; There is no relationship between the PjBL module and Learning Outcomes.

3. Results

This PjBL module was designed based on needs analysis, namely to overcome the difficulties experienced by students in learning Creativity and Entrepreneurship Products. The material in learning Creativity and Entrepreneurship Products must be accompanied by a project and students not only study theory but also understand what field conditions are like when doing entrepreneurship. For this reason, it is necessary to design a PjBL Module that can make it easier for teachers and students both to convey material in class and for students to learn independently outside of face-to-face activities in class.

Analysis of student characteristics was carried out to assist researchers in developing Module. The results of this analysis are used as consideration for researchers in designing products. Test subject in use Module being developed are Vocational High School students. Their ages range from 15 years to 18 years, where they are entering the developmental stage of adolescence. At this age, career development experiences a period of exploration, they like to have new experiences from new situations. During adolescence, they look for identity, both related to intellectual, social-emotional, vocational and spiritual aspects.

According to Piaget's theory, the cognitive development of students aged over 15 years is at the formal operational growth stage. In this period, ideally students already have their own mindset in trying to solve complex and abstract problems, and can imagine many alternative problem solutions and their possible consequences or outcomes. At this stage students no longer accept information as it is, but will process the information and adapt it to their own thinking. Generally at this operational stage, students can think critically and logically. However, every student's critical thinking ability is not the same. The projects contained in the PjBL module can help students construct knowledge more easily.

Next, the design of the PjBL module that will be developed is carried out. The aim of the design stage is to design the PjBL module, so a prototype is obtained. At this stage, test preparation, media selection, format selection and initial design are carried out. The initial design of the PjBL module is a PjBL module design that must be worked on before it is validated and trials are carried out. At this stage, the framework for the PjBL module is prepared in the form of a PjBL module appearance design.

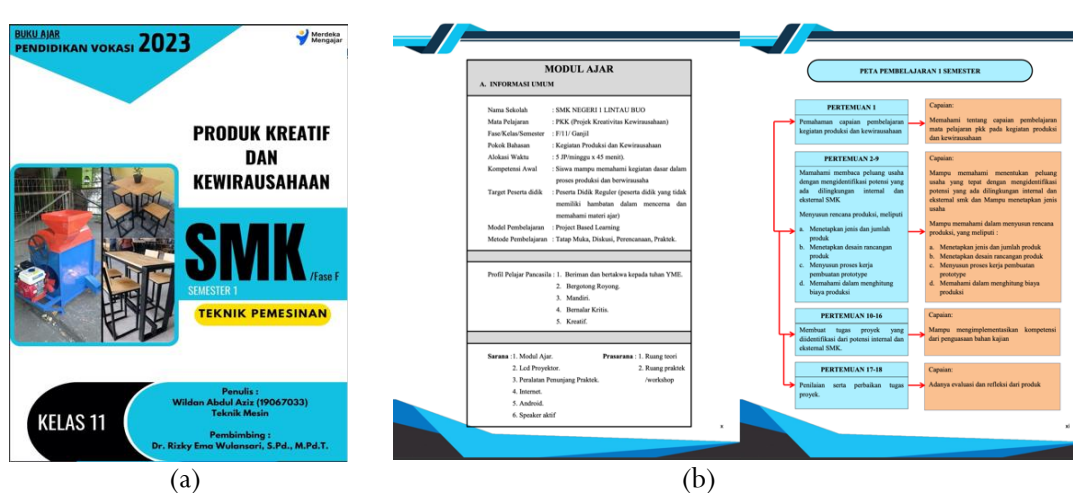


Figure 1: (a) Cover and (b) Identity and Mind Map for 1 Semester of PjBL Module

Figure 1 shows the PjBL module cover, module identity and learning map for 1 semester in Creativity and Entrepreneurship Products subjects. The teaching module for Creativity and Entrepreneurship Products subjects and machining engineering entrepreneurship by applying project-based learning methods is expected to improve the quality of learning and intelligence of students so that students can be more active and collaborative in theoretical and practical learning activities and can also help teachers in carrying out the learning process.

This teaching module can also be used as learning material and resources for students at school, so this teaching module must be declared valid first so that it can be implemented. The module undergoes a validation process to obtain a validity category by experts in their field who are called validators, who will validate 3 aspects of the teaching module, namely material experts, media and model experts, and linguist experts. Validation of this module begins by proving the validity of the module from the material, media and model, and linguist aspects, these aspects are assessed by 12 experts. The validity results obtained by researchers are as shown in table 2 as follows.

Table 2: Results of the validity value of the PjBL module

Expert	Score	Category
Materials Expert	0.89	Valid
Media Expert And Model	0.93	Valid
Linguist	0.91	Valid

Table 2 displays the results of teaching modules the validity scores that have been validated by validators which are divided into 3 aspects and then processed using the Aiken's coefficient technique. In the material aspect, an average validity score of 0.89 was obtained in the "valid" category. media and models obtained an average validity score of 0.93 in the "valid" category, and the language aspect obtained an average validity score of 0.91 in the "valid" category.

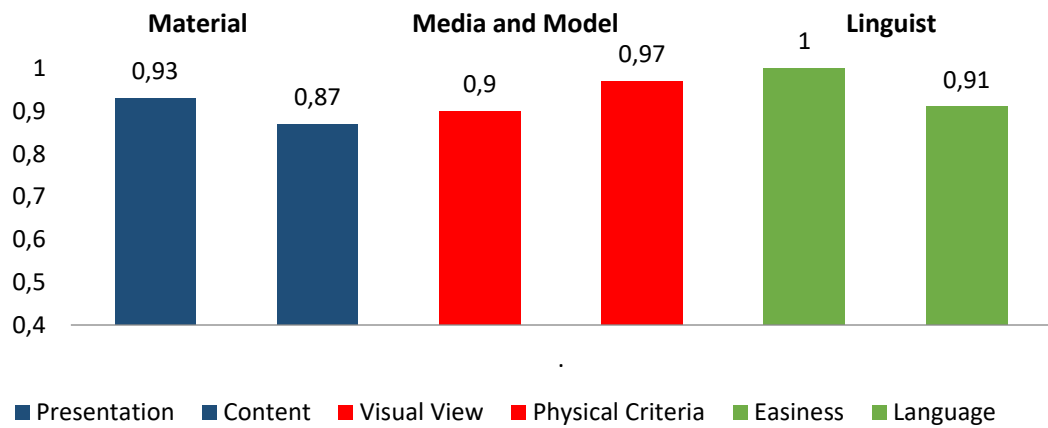


Figure 2: Per-aspect Validity Value Graph

Figure 2 shows the scores per aspect of the three aspects, in the first aspect, namely the material shown in blue, which is divided into the presentation aspect with a score of 0.93, and the content aspect with a score of 0.87. The second aspect, namely the media and model aspect which is shown in red, is divided into the visual appearance aspect with a score of 0.90, the physical criteria aspect with a score of 0.97, and the convenience aspect with a score of 1. The linguist aspect also gets a score. in the linguist aspect it was 0.91. Based on the data from the graph above, it can be concluded that the Creativity and Entrepreneurship Products teaching module based on Project Based Learning is suitable for implementing in learning as evidenced by the validity scores of the 3 aspects which are in the " Valid" category as well as the validity scores of all aspects also getting the "Valid" category. The teaching module can be applied to vocational school students by implementing the Project Based Learning method.

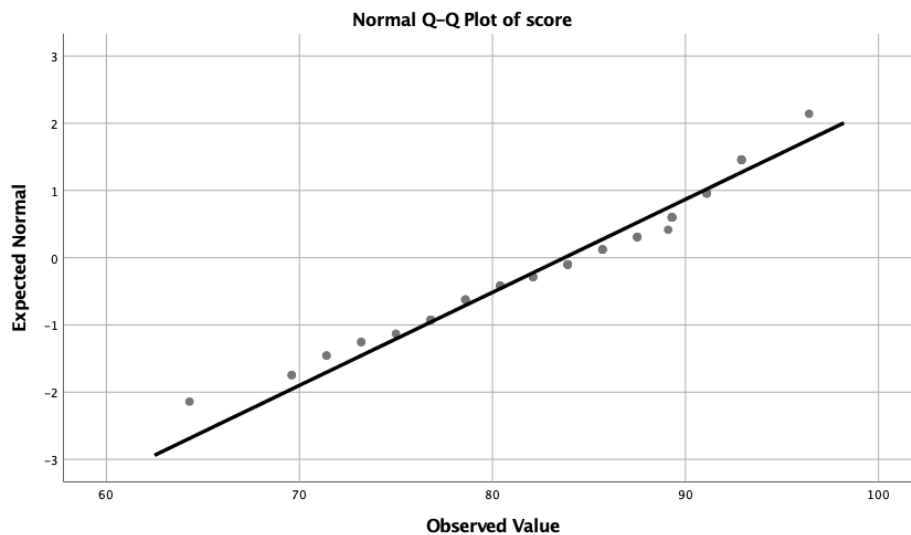


Figure 3: Normality Test's QQ Plots

Figure 3 shows the QQ plots of the normality test. The test results showed that data from PjBL Module Efficiency ($P > 0.05$, $Z = 1.116$) and Learning Outcomes ($P > 0.05$, $Z = 1.101$) indicate that the data for these two variables are normal. The linearity of these two variables can be seen in Table 3 below.

Table 3: Linearity Test of PjBL Module Efficiency and Learning Outcomes

Sig.	F	df
0.063	1,783	29

The results of the linearity test also show that the two variables are linear ($P > 0.05$, $F = 1.783$). So that the two prerequisite tests for carrying out regression analysis have been fulfilled, namely normality and linearity. To be able to continue with the regression test, it is necessary to fulfill 1 more prerequisite test, namely the multicollinearity test in Table 4 below.

Table 4: Multicollinearity Test

Variables	VIF	Sig	Tolerance	B	t
PjBL Module Efficiency (X1)	1,313	0.304	0.941	0.766	1,168
Learning Outcomes (X2)	1,382	0.240	0.878	0.240	1,506

Multicollinearity is a phenomenon in regression analysis where two or more independent variables in a regression model are highly correlated with each other. In this context, the VIF value of all variables ($X1 = 1.313$; $X2 = 1,382$) is smaller than 10, it can be concluded that there is no multicollinearity disturbance in this variable, so it can be continued to carry out regression analysis.

Table 4: Regression Analysis Results

Model		Unstandardized Coefficients		Standardized Coefficients		
		B	Std. Error	Beta	t	Sig.
1	(Constant)	58,946	6,450		25,120	,000
	Learning Outcomes	,855	,090	,830	10,864	,008

Table 4 above shows the results of regression analysis to see the relationship between the efficiency of the PjBL module and learning outcomes. Based on this analysis, it was found that there was an influence of the PjBL module on learning outcomes ($P < 0.05$, $t = 10.864$). The influence of the PjBL module on learning outcomes is 85.5%.

4. Discussion

This research began with data collection before creating the PjBL module, namely the analysis stage. The analysis stage is the initial stage of developing the PjBL module. This stage was carried out as a basis for developing the PjBL module in Creativity and Entrepreneurship Products subjects and it can be used to facilitate students independently. The results of the analysis that have been carried out are used as guidelines and considerations in preparing the module. At the definition stage, several activities are carried out, namely learning needs and student analysis.

In the learning needs analysis, a curriculum analysis is carried out where this analysis refers to the Independent Learning Curriculum (MBKM). Based on the curriculum used in the learning process at Vocational High Schools. Then, in the student analysis, an analysis of the conditions and characteristics of the students was carried out. The test subjects for using the PjBL module developed were Vocational High School students aged 15 to 18 years, where the students were at the formal operational stage. In accordance with cognitive development according to Piaget, the cognitive development of children aged 15 years and over has reached the formal operational stage, which means it has advanced from the concrete operational stage. At this stage, ideally students already have their own mindset in trying to solve complex problems, and can imagine many alternative solutions to problems along with possible consequences or outcomes. This is in accordance with opinion ([Knight & T., 2017](#)) which states that individuals/children at the formal operational stage are able to think critically.

After the analysis stage is complete, the product design stage is then carried out and continued with product development. This research produces a product in the form of a PjBL module on the subjects of Creativity and Entrepreneurship Products which is suitable for use as a learning medium. This is in accordance with opinion ([Lamar et al., 2010](#)) which states that the module can facilitate students to learn independently. The PjBL model in the module developed can help students develop problem solving and critical thinking skills ([Frank et al., 2003](#)).

Stage by stage has been implemented according to development needs. Next, the development stage is carried out, namely validation by media, language and material experts, development trials in the form of limited trials. The purpose of validation by experts is to obtain input, criticism and suggestions for improvement to perfect the module being developed. Validation of the PjBL module developed in this research emphasizes three assessment aspects, namely material aspects, language aspects and media aspects. Validation test data was obtained through a validation instrument filled in by 12 validators who were media/learning model experts, language experts and learning material experts.

This material expert validation is more focused on the correctness of the concepts presented in the PjBL module ([Jun, 2010](#)). Experts assess the suitability of the material listed in the PjBL module with the learning objectives that must be met. From this assessment, input, criticism and suggestions for improvement are obtained so that the material presented does not deviate from the correct concepts and competencies that students must master. Validation by material experts is carried out once and then an evaluation is obtained from filling out a questionnaire by the expert regarding the correctness of the material and learning concepts. From the results of material validation by experts, it can be seen that the PjBL module that has been developed reaches the valid category with an overall average score of 0.89. The results of this assessment are also in line with the results of previous research conducted by ([Lamar et al., 2010](#)), so that in terms of the correctness/accuracy of the material in the PjBL module, the PjBL module is suitable for testing in the field.

Media and model expert validation is focused on the appearance and presentation of the model in the PjBL module. Validation by media and model experts aims to ensure that the PjBL module product developed becomes a quality product. This validation was carried out twice. In the final stage of validation, an evaluation is obtained from filling out the questionnaire by experts. The questionnaire data was analyzed to determine the validity of the PjBL module in terms of media and model. From the results of data analysis, it can be seen that the PjBL module that has been developed reaches the valid category with an average of 0.93. The results of this assessment are also in line with the results of previous research conducted by ([S.Y. Chen et al., 2019](#)), so that in terms of the

quality of the display/presentation of the model in the module, this PjBL module is suitable for testing in the field. Furthermore, the language aspect is 0.91 which is included in the valid category. So the teaching module that has been developed is said to be valid for use.

Next, to see how much influence this PjBL module has on student learning outcomes, a limited trial was carried out on 30 students. The results of this limited test show that there is an influence of the PjBL module on learning outcomes ($P < 0.05$, $t = 10.864$). The influence of the PjBL module on learning outcomes is 85.5%. Research on the influence of Project-based Learning (PjBL) modules on student learning outcomes is important in the context of modern education. PjBL is a learning method in which students learn through real projects or assignments that include problem solving, collaboration, and application of knowledge in practical contexts (Gonzalez-Rubio et al., 2016). This is in line with research conducted by (Lei et al., 2012), where modules integrated with the PjBL model are effective in improving students' learning outcomes, problem solving abilities and critical thinking (P. Chen et al., 2015; Jalinus et al., 2020; Syahril et al., 2022). This is because the PjBL module allows students to learn in a more in-depth and contextual way. Students learn through projects that require a strong understanding of concepts to achieve project goals. This can improve students' understanding of lesson concepts (Lehmann et al., 2008).

5. Conclusion

Development research shows that PjBL-based teaching module products in Creativity and Entrepreneurship Products subjects have been developed and development is carried out first with the needs analysis stage, then product design is carried out, creating learning flows and learning materials. The overall validity of the teaching module according to material experts, media and model experts, and language experts is "valid" with a validity percentage of 0.89 respectively according to material experts, 0.93 according to media and model experts, and 0.91 according to Linguist experts. The results of the limited trial also showed that the PjBL module had a positive effect on student learning outcomes by 85%. This research contributes to knowledge in adding references to the use of teaching modules in vocational education. This research will also have implications for curriculum development and decision making related to vocational education. This research only looks at the effect of the PjBL module on learning outcomes and has not looked at other variables. This could be a suggestion for future researchers who want to conduct similar research.

Author contribution

Wildan Abdul Aziz plays the role of data collector, instructional module creator, data analyst, and article writer. Rizky Ema Wulansari acts as the provider of guidance and methods in module development. Randi Purnama Putra has made a significant contribution to the final article. Meanwhile, Hla Myo Tun, Chau Trung Tin, and Kyaw Zay Ya have provided direction in the compilation of the article.

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Competing interest

The authors declare that we have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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