Development of Project-Based Science Modules To Improve Students' Critical Thinking Skills at SMK Center of Excellence Negeri 1 Adiwerna

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Abstract. The development of a Project-Based IPAS Module (Project Based Learning) to Improve Students' Critical Thinking Skills has begun to be applied at SMKN 1 adiwerna, but not all schools have implemented this. The development of Project-based IPAS modules (PjBL) on Earth and Space materials can help as support for IPAS learning resources. The study aims to determine the feasibility of PjBL-based IPAS modules on the developed Earth and Space materials and the effectiveness of the modules developed in improving students' critical thinking skills. Applied methods Research and Development (R&D). Product trials were carried out at SMK Negeri 1 Adiwerna, Tegal Regency. The results showed that the assessment of project-based IPAS modules by experts obtained an average score of 3.6 with decent criteria. The effectiveness of the module in improving students' critical thinking skills obtained an average score of 0.6 with moderate criteria. Based on the results of the study, it can be concluded that the IPAS module based on the Earth and Space material project is feasible and effectively applied in the class X learning process at SMK Negeri 1 Adiwerna, Tegal Regency.

Keywords: Module, Project-Based IPAS, Students' Critical Thinking

1. Introduction

Education must have a balance in building learners as citizens of the world, nation and society. Education will lead a person to be able to think critically and process it into something that can be accounted for. Education is a conscious effort made by a person to improve the dignity of life to become a human being who has a high personality and dignity. *Human education for all human being*.

The learning process will focus on developing intellectual abilities that take place socially and culturally, encouraging students to build their own understanding and knowledge, constructing in a social context, and learning starting from the initial knowledge and cultural perspective. The task of studying in the design is challenging and interesting to achieve a high level of thinking. Learning becomes a challenge but it is fun because students will gain knowledge from high-minded and complex processes and based on knowledge built from that mind. Of course, it becomes fun because students manage to find something meaningful from themselves. The teacher is only accompanying and guiding.

The curriculum is defined as stated in Law Number 20 of 2003 concerning the National Education System Article 1 point 19, namely: the curriculum is a set of plans and arrangements regarding the objectives, content, and learning materials as well as the methods used as guidelines for the implementation of learning activities to achieve certain educational goals. The curriculum is an important and major part of the learning process. The curriculum can guide and

can be a guide in the implementation of learning in schools, where other functions of the curriculum here can shape the character of students and have a noble character.

There is a very significant change in the curriculum structure of the SMK Center of Excellence, where the curriculum structure is divided into three parts, namely the general group and vocational groups and the third part is the Pancasila Student Profile Strengthening Project and Work Culture. In the vocational group there are subjects of the Natural and Social Science Project which are new project-based subjects. The Subjects of the Natural and Social Science Project contain content on natural and social science literacy formulated in contextual and actual themes of life.

Teachers find it very helpful if there is an IPAS module that has been developed as a learning resource. For the sake of this, students feel that they need learning resources in the form of modules. It is hoped that with the existence of learning resources in the form of modules, students will be able to learn *independently (self-education)*, construct their own understanding, be able to think critically and solve problems. The teacher is only guiding and accompanying.

One of the focuses of improving education in Indonesia is improving students' learning creativity. Creativity has become an important part of the discourse on improving the quality of learning, until now creativity has been well accepted as a competency inherent in learning processes and outcomes. Creativity is the result of a combination of thinking, skills and the application of accepted science as well as understanding things [1]. The essence of creativity is to produce something better or something new. New can be meaningful as a result of refining, adding, changing, and repositioning from something that existed before so that something changes for the better. If teachers use this concept as a basis for learning development, then the quality of human resources must be better. Project-based learning is student-centered (*student center learning*) where students investigate a theme or topic. Students constructively deepen learning with a research-based approach to problems and questions that are weighty, real, and relevant.

Studying the Curriculum of smk center of excellence, then we are faced with something new. In the smk curriculum center of excellence, the discussion cannot be separated from the Teaching Module. Teaching modules are a number or means of systematically designed and interesting media, methods, instructions, and guidelines. The teaching module is an implementation of the learning objectives flow developed from Learning Outcomes with the Pancasila Student Profile as the target. Teaching modules are arranged according to the phase or stage of development of students, consider what will be learned with learning objectives, and based on long-term development and in the course of the learning process are more interesting and meaningful.

The reality in the field is that the subject of the Natural and Social Science Project (PIPAS) at smk Pusat Unggul Negeri 1 Adiwerna, Tegal Regency, which is relatively new, really needs materials or materials for the teaching and learning process. Teaching materials in the form of available materials are still lacking and fundamental and need development towards the demands of 21st century learning. It is necessary to develop a project-based IPAS module so that the benchmark for material achievement will be carried out properly.

The Learning Of Natural and Social Sciences Project (PIPAS) is directed at the *student center learning*. But it is undeniable that the availability of learning resources is also very necessary. Considering that PIPAS is a new subject, it is necessary to study learning resources or teaching materials for project-based students. For this reason, development efforts are needed in order to meet the desired learning outcomes of students at smk Center of Excellence Negeri 1 Adiwerna in Tegal Regency.

Development of Project-Based IPAS Modules To Improve Students' Critical Thinking

Development is defined as an active process carried out with the aim of reviewing existing products, being studied and their shortcomings equipped. Developing modules or in the curriculum of the Center of Excellence called teaching material means teaching a subject through writing. Therefore, the principles used in developing modules are the same as those used in ordinary learning.

In this study, what was developed was a module or teaching material for the subject of the Natural and Social Science Project (PIPAS) made by the Ministry of Education and Education. The module has been exemplified by the government but is not perfect and is still fundamental in nature. This PIPAS module needs further development so that it can be used by students in the learning process. Project Based Learning or PjBL for short is the application of active and constructive learning. The project-based learning model is a learning model that in its implementation can teach students to master process skills and their application in everyday life so that the learning process becomes meaningful. No. 2]

The module to be developed is a project-based module that leads to *project-based lerning* (PjBL) learning, which is conceived by the intention that in the content of the module there is material and assignments that are project-wise. The material is described with a very broad point of view and has a background in natural and social sciences. Modules are developed with the aim of adding and completing the content / content so that students who learn can independently understand and do assignments to the maximum. The hope is that with the process of developing this module, students will be more critical in thinking. It can be said that the *Project Based Learning* learning model provides a very large opportunity for students to produce interesting and meaningful learning experiences, especially for Vocational High School (SMK) students. This is because students at the SMK level are included in the category of adult students, able to think critically, innovatively and creatively and are ready to enter the workforce or the industrial world.

The Natural and Social Sciences Project is the name of a new subject contained in the curriculum structure of the vocational section of the SMK Center of Excellence. This subject is very new and is applied only to the SMK Center of Excellence. This subject is project-based with a background in physics, chemistry and biology and emphasizes social aspects in the learning implementation process. The hope is that after studying this subject, students get a comprehensive picture and can work in a team or group so that certain projects are produced and have high social sensitivity and are responsive to problems in the surrounding community.

In IPAS learning critical thinking is very necessary. Critical thinking can be interpreted as a person's ability to think rationally and in an orderly manner. The purpose of critical thinking is to understand the relationship between ideas and/or facts. In the 21st century, it requires a person to be able to live well with society by having qualified skills. People must be able to compete in a healthy manner, work to create new things and be ready for the future. Skills in the 21st century are popularly called 4C, namely *Communication, Collaboration, Critical Thinking and Problem Solving, Creativity and Innovation* or in Indonesian can be translated as 4K, namely communication, collaboration, critical and able to solve problems, creative and innovative. No. 3]

Learning Resources

According to Rusyan (2019:22) learning resources are a system consisting of a set of materials or situations that are created intentionally and created to allow learners to learn individually.

Hendra Kurniawan (2020: 134) said that teaching materials are "finished goods" as a product of knowledge that has been concocted and interpreted by its compilers. This is certainly important for learning, but in the idea of learning in the 4.0 era, students also need to be encouraged to be able to think critically and creatively with the help of various existing learning resources. Students are also invited to construct their own knowledge by compiling a product of knowledge that they understand. For example, making papers, working on projects, making learning videos, and so on that can be realized into various other forms of learning media. Thus, students are actively involved in utilizing learning resources and learning media as constructive teaching materials.

The types of learning resources that can be utilized in learning in the 4.0 era include: (1) Place or environment, (2) People or speakers, (3) objects, (4) Printed and non-printed materials

Module

According to Rili Konita Zahara (2021) the module is a printed teaching material whose content is about summaries of material explained in simple language so that it is easily understood by students. Modules can also be called one of the learning tools needed in the learning process made by educators by adjusting materials and basic competencies. Modules are used to make it easier for students to understand the material presented, independently or through the guidance of educators with interesting module material content. Educators see that learners have to go through intellectual abilities and processes with a variety of experiences. Modules are one of the teaching materials in the form of print or a book written with the aim that students can learn independently and are very well used in the learning process. Modules are printed teaching materials designed to be learned independently by students [4].

At the time of learning the teacher does not directly give a lesson or teach something to the student face-to-face, but simply with a module containing material, methods, limitations, and ways of evaluating that are systematically designed and interesting to achieve the expected competencies of course with the characteristics of the available modules. One of the important factors in achieving learning objectives is the availability of modules as a source of student learning and this is a necessity, namely to make students more interested in learning and can improve learning outcomes. Modules are created and developed, one of which is to increase learning motivation, interest in the material being taught and aims to increase learning achievement or students' critical way of thinking about the material. Another purpose of developing modules with methods is to involve students in the learning process so that there is activity and play a direct role so that the desired goals are achieved.

To produce modules that are able to increase learning motivation, module development must pay attention to the characteristics required as modules. This is in accordance with the KTSP Implementation Technical Guidance Material Series: Module Preparation Techniques (2008). The characteristics of module preparation consist of: (1) Self Instruction, (2) Self Contained, (3) Stand Alone, (4) Adaptive, (5) Friendly / Friendly (User Friendly)

Natural and Social Science Project

Natural and Social Sciences (IPAS) is a science that examines living things and inanimate objects in the universe and their interactions, and examines human life as individuals as well as social beings who interact with their environment. In general, science is defined as a combination of various knowledge that is arranged logically and systematically by taking into account cause and effect (Big Dictionary of Indonesian, 2016). This knowledge encompasses

natural knowledge and social knowledge. IPAS education has a role in realizing the Pancasila Student Profile as an ideal picture of the profile of Indonesian students. IPAS helps learners cultivate their curiosity about the phenomena occurring around them. This curiosity can trigger learners to understand how the universe works and interacts with human life on earth. This understanding can be used to identify various problems faced and find solutions to achieve sustainable development goals. The basic principles of scientific methodology in IPAS learning will train scientific attitudes (high curiosity, critical thinking ability, analytical and the ability to draw the right conclusions that give birth to wisdom in learners.

Characteristics of IPAS Education

Science is not stagnant. Along with the times, science is also constantly evolving. What we know as a scientific truth in the past may have shifted in the present as well as the future. That is why science is dynamic and is a continuous effort made by man to uncover the truth and use it for life. Science is a process of continuous formation of knowledge to the point of explaining phenomena that originate from revelation, the heart and the universe so that it can be examined or studied critically with the aim of understanding its nature, basic foundations and origins, so that it can also obtain logical results. The carrying capacity of nature in meeting human needs over time is also decreasing. The exponential increase in the human population also triggers many of the problems faced.

Often the problems that arise cannot be solved by looking at it from one point of view: natural science or from the point of view of social sciences alone, but rather a more holistic approach that includes various cross-disciplines (Yanitsky, 2017 in Copy of Decree No. 028 on Learning Outcomes, 2021). To provide this understanding to students, the learning of natural sciences and social sciences needs to be combined into a single entity which we then call the term IPAS.

The subjects of the Natural and Social Science Project have objects of study in the form of concrete objects found in nature and developed based on empirical experience, that is, real experiences that are perceived by everyone and have systematic steps and use logical ways of thinking. Natural and Social Sciences learning is packaged in the form of projects (project-based learning) that integrates several elements of content / material. Each project is carried out to achieve elements of Natural and Social Science competence consisting of three elements of scientific literacy and contextualized with the characteristics of each Field of Expertise. In one theme, it can contain several projects according to the scope or breadth of a material. Based on the elements of the material content, the subjects of Natural and Social Sciences consist of living beings and their environment; substances and their changes; energy and its changes; earth and space; spatiality and connectivity between time and space; interaction, communication, socialization, social institutions and social dynamics; and economic behavior and well-being. Learning is carried out in project-based Natural and Social Sciences subjects.

Project-Based Learning Model

The definition of Project Based learning is quoted from Gulay's opinion written by Ermaniatu Nyihana (2021:44):

Gulay (2015) posits that "…Project Based Learning model which lays its foundations on project studies is an approach which positionsthe learners in the centre of the learning process and prepares them to the actual life by exposing them to real life problem"

Project Based Learning is defined as learning directly involving students in the learning process through research activities to work on and complete a certain learning project. The 21st

century requires students to be more critical and creative so that project-based learning is one of the innovative learning that is very useful.

Project based learing is one of the innovative learnings that is very useful in the 21st century. Viewed from the point of view of students or students, PjBL is student-centered learning, motivating and encouraging collaboration and cooperation. Based on the teacher's point of view, PjBL is a learning process with authentic content, objectives and assessments with explicit educational objectives, based on constructivistic theory and the role of the teacher only as a facilitator. We can see that PjBL is a strategic method that makes students active, creative and able to build logical and scientific thinking in solving problems. It can be said that students become able to think critically in solving problems. Here the teacher only becomes a facilitator and partner in collaborating during the learning.

Muhammad Fathurohman (2015:118) in Sugiyono (2019:193) stated that project-based learning is a learning model that involves a project in the learning process of one particular material that has been determined. Project tasks undertaken by learners can be either individual project tasks or group tasks.

According to Ermaniatu Nyihana (2021:45) the notion of project-based learning can be seen from two different points of view, namely from the point of view of students and teachers. Based on the student's point of view, Project Based Learning is student-centered learning, motivating and encouraging collaboration and cooperation. Not only studying a theory but also doing an activity in order to produce and develop products, communicate and the ability to think at a high level. Based on the teacher's point of view, Project Based Learning is a learning process with authentic content, objectives and assessments with explicit educational objectives, based on constructivistic theory and the role of the teacher only as a facilitator.

Performance assessment in Project Based Learning can be carried out individually by taking into account the quality of the products produced, the depth of understanding of the content shown, and the contribution made to the ongoing project realization process. Project Based Learning also allows learners to reflect on their own ideas and opinions, and make decisions that affect the outcome of the project and the learning process in general, and present the final product result. The Natural and Social Sciences Project consists of three elements of competence that refer to the competence of scientific literacy, namely explaining phenomena scientifically, designing and evaluating scientific investigations, translating data and evidence scientifically.

Muhammad Fathurohman quoted Bell's opinion (in Sugiyono, 2019: 194-195), defining project-based learning as follows:

a. *Project Based Learning is curriculum fueled and standards based.*
b. *Project Based Learning ask a question or proses a problem that each student can answer.*
c. *Project Based Learning asks students to investigate issues and topics sdressing real_word problems while integrating subjects across the curriculum.*
d. *Project Based Learning is a models that fosters abstract, intellectual tassks to explore complex issues.*

In project-based learning has the following principles:

1. Centralistic, b) *Driving questions*, c) *Constructive investigation*, d) Autonomy, e) Realistic (*relism*)

The main requirements in the use of project-based learning models to develop the learning process in the classroom are: 1) mastery and deepening of the material, 2) mastery of scientific skills. While the characteristics of the project-based learning model according to Tinenti (2018: 5) are:

1. In its implementation begins with students doing planning,
2. Students do the design,
3. The student carries out the conduct of the investigation,
4. Students perform

According to (Sugiyono, 2019:201-202), the steps for Implementing Project Learning include:

2. Project determination, b) Design of project completion steps, c) Preparation of project implementation schedules, d) Completion of projects facilitated and monitored by teachers, e) Preparation of reports and presentations or publication of project results, f) Evaluation of project processes and results

Project-based learning or then referred to as Project Based Learning (PjBL) has advantages and disadvantages. According to Kemedikbud (2013) in Ermaniatu Nyihana (2021:51-52) detailing the advantages of this model are:

1. Increases students' learning motivation to learn, encourages their ability to do important work and they need to be appreciated.
2. Improve problem-solving skills.
3. Make students become active and successfully solve complex problems.
4. Improve collaboration.
5. Encourage students to develop and practice communication skills.
6. Improve students in managing resources.
7. Provide learner and practice student experience in organizing projects, and allocate time and other resources such as equipment to complete tasks.
8. Provides a learning experience that engages students in a complex way and is designed to evolve according to the real world.
9. Involves the students to learn to take information and show the knowledge they have, then implemented with the real world.
10. Make the learning atmosphere fun so that students and educators enjoy the learning process.

The weaknesses of Project Based Learning according to Ermaniatu Nyihana (2021:52) are

1. It costs a lot.
2. Requires a lot of media and learning resources.
3. It requires teachers and students who are both ready to learn and develop.
4. There are concerns students will only master one particular topic being worked on.

Critical Thinking

Today we are faced with an education ere in the 21st century where learning requires high critical thinking power. Along with the changes and demands of the times that are increasingly global, the demands on human thinking must also be high. One of the goals of 21st Century education is to develop students' thinking skills, one of which is critical thinking skills.

According to Ennis (2011) in [5] critical thinking is the ability to think reflectively that focuses on decision-making patterns about what to believe, to do and to be accountable for. Critical thinking skills are very necessary because a person who thinks critically will be able to think logically, answer problems well and be able to make rational decisions about what to do or what to believe. Critical thinking is a higher-order thinking skill that has the potential to increase the critical analytical power of learners. Therefore, developing students' critical thinking skills in learning is an effort to improve student learning outcomesCritical thinking is not quick to believe, always trying to find mistakes or mistakes, and being sharp in analyzing.

Critical thinking is independent, departing from self-discipline, being able to monitor themselves, to improving one's own thinking process. For a person who is able to think critically means being able to determine the credibility of the sources of information he obtains, distinguishing the relevant and irrelevant, distinguishing facts and assumptions, identifying and evaluating assumptions, biases, and points of view, as well as evaluating the evidence offered to support a thing [3].

Teachers have a very important task in directing and encouraging students to have the ability to think critically. Learning that only emphasizes students' ability to memorize does not provide space for students to think critically, so it needs learning that invites students to be able to analyze, dare to argue, and solve problems (problem solving). The ability to think critically is indispensable in learning in the 21st century and the 4.0 era which requires humans to have better thinking skills. In the end, the ability to think critically is expected to be able to produce the ability to solve problems and make decisions (problem solving). There are four mindsets that are important compared to the content of knowledge itself, namely: analysis, interpretation and accuracy, problem solving, and reasoning. It is necessary to realize that the process of learning is not in the content of learning (comtent of learning). Students are able to think critically in learning so that they are able to answer questions about "how" (how) and "why" (why) using principles and concepts. The hope is that after the student is able to think critically, then it ends by making rational decisions related to the work or things he believes in. Developing students' critical thinking skills is very important. The mainstream approach used is scientifik. One of these approaches is questioning which is a step to stimulate students' critical thinking skills. Students who have the ability to think critically will respond systematically and accurately every time they make decisions and solve complex problems.

2.   Method

The research carried out is Research and Development or R&D. According to Borg and Gall (1998) in Sugiyono (2019: 28) research and development is a process used to develop and a validate educational product. While Richey and Kelin (2010) in Sugiyono (2019: 28-29), in the field of learning stated that this research called Design and Development Research is: the systematic study of design, development and evaluation processes with the aim of establishing an empirical basis for the creation of instructional and noninstructional product and tool and new or enhanced model that govern their development. This type of research and development serves to validate and develop the product. Validating the product, means that the product already exists, and the researcher only tests the effectiveness or validity of the product. Developing a product in a broader sense can be either refurbishing an existing product (so that it becomes more practical, effective, and efficient) or creating a new product (which did not exist before).

Based on this, it can be said that R &D is carried out to produce certain products and test the effectiveness of these products. To be able to produce the product, it is necessary to analyze the needs and test the effectiveness of the product through experimental methods.

According to Sumarni (2019: 7) the characteristics of research and development according to Borg and Gall consist of four main characteristics, namely:

1. *Studying Research Findings Pertinent to the product to be developed /Exploration)*
   The researcher performs the exploratory stage, this is related to a search and analysis of the initial problem consisting of: literature analysis or concept analysis and needs analysis

2. *Developing the product base on this finding:* At this stage of development, it is necessary to validate by experts or experts on the module development prototype so that modules that have undergone development are worthy of trial. The development of the module consists of two steps, namely: Expert Validation and development trials
3. *Field testing where it will be used eventually through examination (Field testing it in the setting where it will be used eventually /examination)* In the next stage, product trials will be carried out in the actual situation. The trial will be carried out through two stages of trials, namely limited trials (small scale) and wider trials (large scale
4. *Revising it to correct the deficiencies found in the field-testing stage/dissemination)* According to Sugiyono (2019: 404) states that in general the description of the *Research and Development* process cycle.

According to Sukmadinata (2017:184) are the stages of research and development modified from the ten steps of research and development of Borg and Gall. Broadly speaking, the steps of this research are: Preliminary Study, Model Development, Model Test

Virtually the modified research and development steps can be seen in the following chart:
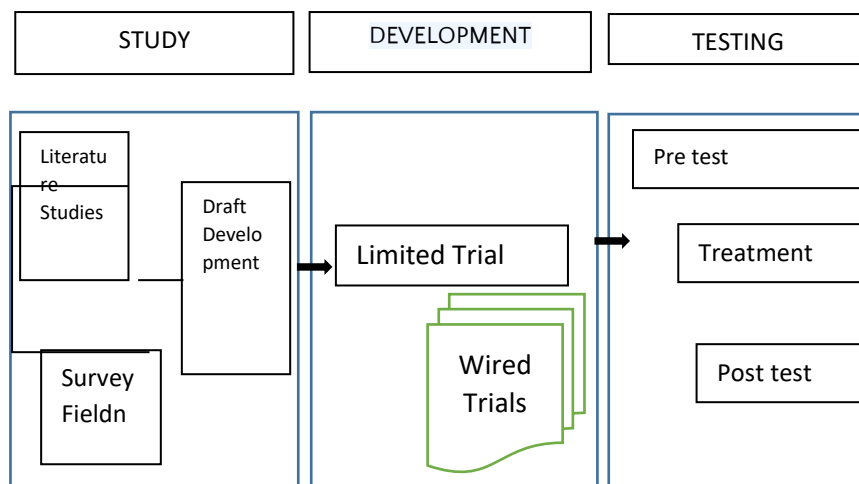
Figure 3. Research and development steps
(Sukmadinata; 2017:189)

2.1. Data Type

The types of data that will be obtained from this development are: 1) Qualitative data. Data is taken based on questionnaires, inputs, suggestions, and revisions to problems in product development and research on field trials. The data is taken from expert lecturers, students, teachers, supervisors.2) Quantitative data. The data is taken in the form of pretest and post-test results on the results of experimental research after development is carried out through tests and observation sheets.

Data stacking instruments, which are used are: a) Product assessment sheet, b) Observation Sheet, c) Questionnaire sheet/ questionnaire, d) Critical Thinking Skills Test Sheet

2.2. Pre-Test and Post Test Giving

To obtain data on the achievement of the level of critical thinking of students who use module development, it is a benchmark for student success in learning, it is necessary to have a Pretest and Post Test. The provision of pre-tests and post tests itself is based on the learning materials of IPAS subjects. At this stage, a test will be held on how influential the development of project-based IPAS modules will be to improve the critical thinking of students at SMK Pusat Unggul Negeri 1 Adiwerna, Tegal Regency.

In this study, there are several main steps, namely the implementation of pretest as a form of measuring bound variables, the implementation of experimental treatment and the implementation of Post Test to measure the results or impact of the prescribed treatment by comparing pretest and posttest scores.Variables which are the object of research become the point of attention of a study where there are 2 variables, namely: 1) Free variables: In this study the free variables are Project-based IPAS Modules and 2) Bound variables : In this study there is 1 bound variable used, namely The Way of Critical Thinking of Students at SMK Center of Excellence Negeri 1 Adiwerna.

2.3. Student Critical Thinking Ability Result Test

The implementation of the module tested uses a one group pretest-postest design, because it is carried out in one group without a comparison group. Before the questions in the pretest-postest are used, a question test is carried out, namely by testing the validity of the construct. Validity relates to the accuracy of the assessment tool on the concept being assessed so that it actually assesses what should be assessed. Suharsimi (2010) the validity of constructs aims to measure / reveal concepts in a material. The validated questions were then given to students and data analysis of pretest-postest results was carried out with the N-gain test (Meltzer: 2002 in Herman, H., et al: 2021) with the following formula:

$$Ngain = \frac{Score\ post\ test - score\ pretes}{Score\ maksimal - score\ pretest}$$

Score post test = final test result scores
Score pre test = initial test result scores
Score Maksimal = max test score

Table 1. Formula Criteria N-gain

Interval	Kriteria
G > 0,07	Highly Effective
0,3 < g < 0,7	Effective
G< 0 ,3	Ineffective

3.   Discussion

This study aims to determine the feasibility of a Project-based IPAS module developed to improve students' critical thinking skills in learning and student learning resources. This study also aims to determine the effectiveness of modules developed to improve students' critical thinking skills. The results of the research on the development of the Project-based IPAS module to improve students' critical thinking skills include the results of the module feasibility assessment, the results of teacher responses to the module, the results of student responses to the module, the effectiveness of the module through the results of the student critical thinking ability test.

The results of the feasibility assessment of the Project-Based IPAS Module through the phase I assessment instrument and the phase II assessment instrument by the internal validator team, namely the IPAS teacher of SMKN 1 Adiwerna and external lecturers from related agencies with the results of the feasible category, which means that all components received a positive response "Yes" referring to the results of the assessment, the project-based IPAS module was declared to have passed the assessment instrument phase I. Project-based IPAS module phase II assessment instrument consists of two components, namely: the content feasibility component, and the presentation feasibility component. Each component is assessed by 3 experts whose results are then averaged. Validators I, II and III give an assessment then the results are on average. The scoring scores of the three validators were obtained on average with decent criteria. Based on this assessment, the modules developed are stated to be able to be used in the learning process in the classroom.

Table 2. Phase II Assessment Results

Component	Average Score	Information
Eligibility of contents	3,68	Proper
Serving	3,76	Proper

There are two types of questionnaires used in this study, namely teacher response questionnaires and student response questionnaires to the modules developed. The questionnaire was given to find out the responses of teachers and students to the Project-based IPAS module developed. The teacher response questionnaire was given by the IPAS teacher of SMKN 1 Adiwerna. The response from IPAS teachers is averaged with excellent criteria, meaning that the modules developed are feasible to use.

The results of student responses on a small scale to the developed IPAS module received a percentage score of 80% with excellent criteria. The assessment of the results of the student response questionnaire on the small-scale trial showed a positive response from students to the IPAS module developed. Furthermore, in large-scale trials, the percentage of student response questionnaires to the module was obtained at 84.96%. This shows a positive response from students in one class, namely class X TKRO 1, so that the IPAS module developed can be used at the next stage, namely the stage of applying the module in IPAS learning in class. The results of the questionnaire of 36 student responses obtained at the implementation stage in the classroom amounted to 90.9%

The effectiveness of the module at the field implementation test stage to measure students' critical thinking ability is measured using pretest and post-test results so that it can be known the increase in results obtained by students after learning is carried out. The improvement of the given test results was analyzed using the normalized N-gain formula whose results are presented in the table below.

Table 3. Improved Student Critical Thinking Test Result

Indicators of critical thinking	Average score			Criterion
	Pretest	Postest	N-gain	
Provide a Simple Explanation	60,92	79,6	0,47	Medium
Building basic skills inferring	47,84	86,64	0,75	High
Give further explanations	67,82	97,41	0,91	High
Setting Strategies and Techniques	46,26	75,2	0,53	Medium
Problem solving	23,28	48,29	0,34	Medium
Average total	49.22	77.38	0.6	Medium

Based on Table 3 above, it is known that the results obtained from the normalized N-gain test were 0.6. Then it can be concluded that the improvement of students' critical thinking ability in medium criteria.

4. Conclusion

Based on the results of the study, it can be concluded that: 1. The Poyek-based IPAS module developed is feasible to use based on the assessment of experts. The results obtained based on validation assessments by experts on the content feasibility component and presentation component obtained an average score of 3.6 with very decent criteria. 2. Developed project-based IPAS module, effectively improving students' critical thinking skills. This is shown in the data on the improvement of the results of students' critical thinking ability with an average score of 0.6 with moderate improvement criteria.

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