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The Effectiveness of Project-Based Learning Assisted by Digital Technology to Improve Problem-Solving and Critical Thinking Skills in SMKN 3 Sampang Students

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Digital Technology; Critical Thinking; Problem-Solving; PjBL; Skills Development

ABSTRACT

Lack of students' ability to find idols that reflect national values and weak vision of their future. Technology-based PjBL learning is applied to engage students in active and collaborative learning processes, helping them develop critical thinking and problem-solving skills. This study aims to analyse the effectiveness of project-based learning (PjBL) supported by digital technology in improving students' critical thinking and problem-solving skills at SMKN 3 Sampang. This study is a quantitative study with a positivist approach. A descriptive survey approach examines variables and research units without considering the relationship between variables. The results show that this method is effective in improving these skills and motivating students to be more involved in learning, with environmental support playing an important role in optimizing results. In conclusion, innovation in learning methods that are adjusted to technological developments and the needs of the world of work is needed to ensure that vocational high school graduates have adequate competencies and are relevant to industry demands.

Introduction

Some of the problems faced by the world of education today are due to the inability of students to find idols that match the character of the nation. The majority of school-age children do not know about national hero figures; they understand more about artists, celebrities, and athletes. In this case, when students want to achieve a certain interest, such as when students want to be like their idols, then the students will try to achieve results and imitate the figures or idols to be able to realize it (Rismayanti et al., 2022).

SMKN 3 Sampang, located on Mandangin Island, is the only high school in the area. The school's problem is students' inability to identify their future desires. They tend not to have choices and desires or ideals that they hope for. A nation's development is indeed closely related to the problem of education. Education is a process that uses certain methods so that people gain knowledge, understanding, and ways of behaving according to their needs.

The inability of students to think critically will lead to destructive behavior, so the existing behavior only imitates idols, not filtering them and then using them as examples. With critical thinking, students will be able to make the right decisions by thoroughly examining various factors and considering relevant data and evidence to support their chosen actions. Students can filter data, process it, search for relevant information, analyze it, and draw conclusions. The future lives of students will benefit from this openness because it can open students' minds to be open so that they can filter information.

Bronfenbrenner's Ecological Theory of Development (1979) emphasizes the importance of the microsystem environment (family, school) in child development (Crawford, 2020). Educational interventions must consider students' socio-economic context. Likewise, Vygotsky's Social Constructivist theory (1978) states that social interaction and adult support are important for cognitive development. Project-based learning with technology support can provide a learning environment that supports collaboration and social interaction (Teacher Driver Program Module) (Ferguson & Evans, 2019).

SMK (Vocational High School) is a vocational education unit at the secondary education level (SMK). SMK is a formal education with a special training model that guides students to become graduates who are ready to join the workforce and work in companies or businesses. The government is currently developing vocational schools with the aim of Vocational Education is to improve the intelligence, knowledge, personality, noble character and independent living skills of students, as well as to receive higher education continue to follow their career plans so that they can work effectively and efficiently, develop their professional knowledge and skills, master Professional expertise and basic knowledge in the fields of science and technology, high professional ethics, communication according to work needs, and have the ability to develop themselves (Aprianto et al., 2022).

In Indonesia, Vocational High Schools (SMK) are currently far from what is expected. An education model such as SMK is expected to be able to face the challenges of the world of work, as has been heralded by the slogan SMK bisa-hebat. SMA (Senior High School) has been able to prove itself by answering the challenges. However, some SMKs fail to fulfill their duties of passing their students on to the world of work. In fact, most Vocational High Schools (SMK) have not reached this level. Various things can be factors in supporting SMK so that they can answer problems and challenges in the world of work. One way is to increase the capacity of educators and education personnel, as well as to use practical tools, school principals, and directors from the business and industrial world.

Based on data released by the Central Statistics Agency (BPS), 9.1 million people in Indonesia are still unemployed. This number continues to increase every year, and the most surprising thing is that graduates of Vocational High Schools (SMK) and High Schools (SMA) are the largest contributors to unemployment. In 2021, SMK reached 11.13%, while High Schools (SMA) reached 11.13%. according to the CNCB Indonesia release, "Vocational High School (SMK) graduates are still the highest compared to graduates of other levels of education, which is 11.13%" (Sembiring, 2021). Surprisingly, only 23% of high school graduates continue their studies at college. This is because high school graduates are prepared to go to college, while vocational high school graduates are ready to work. Data from Kontan.co.id shows that the Gross Participation Rate (APK) for higher education in Indonesia has only reached 34.58%, far below the figures of neighboring countries such as Malaysia, which reached almost 50%, and Singapore, which reached 78%. This shows a clear interest from the

young generation of Indonesia to go to college. at least. The government still pays close attention to the interests of the current young generation.

In such a situation, the pace of school development is hampered because one important aspect of education, namely students, is just going to school and fulfilling obligations. Innovations are needed in teaching so that students become enthusiastic about learning, have desires or even become like their idols in the future.

Education is one method to escape poverty; in the Constitution (UUD) number 20 of 2003, the definition of education is a conscious and planned effort to create a learning atmosphere and educational process so that there is the active participation of students to improve their abilities to have spiritual, religious strength, self-control, character, intelligence, noble morals, and the skills needed by themselves, as citizens, nations, and countries. Referring to the definition of education in the law, education is a conscious and planned effort to develop the potential of students. It is a mandate for schools to be able to create superior humans academically, spiritually, and in personality. With the creation of superior humans, the development of progress in Indonesia becomes real, from a developing country to a developed country without eliminating the roots of its own nation's culture (Zheng et al., 2021).

The Ministry of Education, Culture, Research and Technology launched the independent curriculum, which is a continuation of the prototype curriculum that has been running in certain schools as a transition from the 2013 curriculum. Nadiem Makarim emphasized that this independent curriculum can increase the flexibility of teachers in providing learning and can fundamentally improve the development of student character and the acquisition of student competencies according to current conditions. In 2022/2023, the independent curriculum will still be voluntarily chosen by schools in its implementation. One of the important characteristics of the independent curriculum is the implementation of the Pancasila Student Profile.

Ki Hadjar Dewantara (KHD) explained that teaching and education are liberating humans as part of the unity (people), which is education that is useful for life together. Free people live based on their strengths rather than depending on others. Teaching provides opportunities for students to develop as a whole so that they can respect themselves individually and others socially and to achieve physical or natural independence. Self-strength naturally teaches students to control their own lives (Rafael, 2022). In addition to student factors, education that is beneficial to the general public is that school leaders, according to several sources, play a major role in determining the direction of policies that will lead to school success. This is because school leaders are responsible for synergizing various elements of the school, including students, teachers and the school community. Great school leaders will be able to optimize all school assets and create a harmonious school environment that supports positive, whole, in-depth, intentional, and creative student growth. School leaders are an important component in the formation of the Pancasila Student Profile.

Problem-solving is an important component of mathematics learning. It can help students become more confident in solving mathematical, logical and social life problems. In addition, students who are able to solve rational and mathematical problems may be better at making decisions in everyday life. In agreement with Cooney's opinion (La'ia & Harefa, 2021), "having problem-solving skills helps students think analytically in making decisions in everyday life and helps improve critical thinking skills in dealing with new situations."

In a study conducted by Hestu Tansil Laia and Darmawan Harefa from STKIP, Nias Selatan explained that problem-solving can build students' confidence in solving mathematical problems. In addition, students who have mathematical problem-solving skills can improve decision-making in everyday life; problem-solving skills are not only in the cognitive aspect but also play a social role in carrying out communication, both mathematical and other.

Research that is close to this theme is research by Hamidah et al. (2021) entitled "Analysis of Critical Thinking and Learning Outcomes in Project Based Learning Model with Science, Technology, Engineering, and Mathematics (STEM) Approach on Volta Cell Material." The purpose of this study was to identify (1) differences in critical thinking, (2) differences in learning outcomes in the field of knowledge, and (3) how students respond to the PjBL model through the STEM approach and the expository model. The quasi-experimental design with a post-test-only control group was used on students of class X RPL B as the experimental class and class X KI as the control class at SMKN 2 Banjarmasin. The experimental class used a project-based model based on the STEM approach, while the control class used an expository model. The data instrument used test and non-test methods, and data analysis was carried out descriptively and inferentially. The results of the study showed that (1) there were significant differences in critical thinking between students in the experimental class and the control class; (2) there were significant differences in learning outcomes in knowledge between the two groups; and (3) the PjBL model with the STEM approach received a higher response of 88.06% compared to the expository model.

The second study was conducted by Himayatul Ulya (2016) entitled "Profile of Problem Solving Ability of Students with High Learning Motivation Based on Ideal Problem Solving." This study highlights the importance of investigating students' ability to solve mathematical problems. Varying learning motivation among students affects the learning process in the classroom. This study focuses on students with high learning motivation in solving mathematical problems. Using a learning motivation questionnaire, two motivated students were made research subjects. Problem-solving tests and interviews were conducted to confirm the validity of the data. The results showed that the research subjects had good problem-solving abilities and met most of the criteria, although they faced difficulties in writing mathematical solutions.

Furthermore, research by La'ia and Harefa (2021), entitled "The Relationship between Mathematical Problem-Solving Ability and Students' Mathematical Communication Ability," showed a strong positive relationship between mathematical problem-solving ability and mathematical communication ability. The research data shows that the higher the students' mathematical problem-solving ability, the higher their mathematical communication ability. The coefficient of determination in this study indicates that the high-low mathematical problem-solving ability influences the mathematical communication ability factor and vice versa.

The difference between the research above lies in the focus of this research, which adds elements of digital technology to the learning process. In this research plan, in addition to being given conventional teaching, students are also given learning assisted by digital technology. Students will work on vocational projects within a certain time span, and the quality of the project results will be compared to see the effectiveness of the project-based learning method with technology support.

This research was conducted to determine the effectiveness of project-based learning assisted by digital technology in improving students' problem-solving and critical thinking skills at SMKN 3 Sampang.

Materials and Methods

This type of research is quantitative. Positivism-based research uses a quantitative approach. The researcher used a descriptive survey approach to examine variables and research units without considering the relationship between variables. In this study, the population is taken as students of SMKN 3 Sampang class 12, with competencies in Fisheries Processing Agribusiness (APHPi), Light Vehicle Engineering (TKR) and Institutional Financial Accounting (AKL). Determination of the sample in this study used a purposive sampling technique. Sugiyono (2018) explains that purposive sampling is a sampling method with certain considerations that are relevant to the objectives of the study. Samples are taken from the population using the Slovin formula to determine the minimum number of samples, with a margin of error (e) determined by the researcher. Data collection was carried out using a questionnaire designed based on a Likert scale. According to Sugiyono (2018), a questionnaire is a method that provides a series of written questions to respondents. This questionnaire contains statements related to the attitudes, opinions, and perceptions of respondents towards the variables being studied. Respondents can choose the answer that best fits the statement given, with answer choices ranging from strongly agree (SS) to strongly disagree (STS). The use of the Likert scale in this study helps researchers systematically measure students' attitudes towards the project-based learning implemented. The validity test of the data used is a validity test conducted by researchers using descriptive statistical analysis with the help of the SPSS version 21 program. Researchers use the Alpha Cronbach test, which has more than two answer choices to test reliability. Data analysis techniques in this study are carried out in several stages. First, data editing, namely checking the completeness and relevance of data collected from respondents. Second, is data coding, where each data is given a code in the form of numbers or letters to facilitate analysis. Third, data tabulation, namely organizing coded data into a table to understand the distribution and relationships between variables. Finally, frequency distribution is used to calculate and present data in percentage form, as recommended by Bungin (2015).

Results and Discussions

The problem faced by SMKN 3 Sampang is related to the inability of students to find idols that reflect the values of the nation's character. Instead of getting to know national heroes who can inspire them, students are more exposed to public figures such as artists, celebrities, and athletes. This phenomenon shows that students are more easily attracted to popular idols without going through a critical filtering process of the character and values represented by the idol. As a result, the tendency of students to imitate idols that are less relevant to the development of the nation's character is getting stronger, so they do not have a clear vision of their future. This also causes students not to have specific ideals or directed career goals, which are very important in forming a competent worker mentality and being ready to face the challenges of the world of work. This problem highlights the importance of developing critical thinking skills among students. By thinking critically, students can be more selective in choosing idols, not just imitating behavior but also understanding values that are in line with the culture and character of the nation. Critical thinking allows students to analyze various information, assess the relevance and validity of data, and make wise decisions based on careful consideration. This is very relevant in the teaching and learning process at SMKN 3 Sampang, where critical thinking skills will help students better understand career choices and the impact of their decisions on their future (Aprianto et al., 2022).

Project-based learning supported by digital technology is one potential solution to overcome this problem. Project-Based Learning (PjBL) provides opportunities for students to actively participate in the learning process, work collaboratively, and face real problems that are relevant to their lives. With the help of technology, students can access wider resources, broaden their horizons, and connect with global developments that are relevant to their vocational fields. This will help students not only understand the teaching material but also develop problem-solving skills, analytical thinking, and creativity, which are important in the modern workplace (Hamidah et al., 2021).

Previous research has shown that the PjBL method, especially those using the STEM (Science, Technology, Engineering, and Mathematics) approach, significantly improves critical thinking skills and student learning outcomes. For example, a study by Hamidah et al. (2021) showed a significant difference in critical thinking and learning outcomes between students who used the STEM-based PjBL method compared to the conventional expository method. Students involved in PjBL were better able to analyze problems, work collaboratively, and show higher enthusiasm in the learning process. This suggests that a project-based approach integrated with digital technology can increase student engagement, motivate them to learn, and direct them to achieve better learning outcomes.

In addition, Bronfenbrenner's developmental ecology theory and Vygotsky's social constructivist theory provide an important foundation for developing effective educational interventions at SMKN 3 Sampang. Bronfenbrenner emphasized that the microsystem environment, such as family, school, and community, is very influential in shaping children's development. At SMKN 3 Sampang, support from family, teachers, and the local community is essential to creating a conducive learning environment. Students who get support from their environment are more likely to develop their potential and be able to make the right decisions for their future (Bronfenbrenner, 1979) (Stanley & Kuo, 2022).

Vygotsky also stated that social interaction and support from adults are very important in students' cognitive development. This is relevant in SMKN 3 Sampang, where collaboration between students and guidance from teachers can improve students' understanding and skills in completing projects. Project-based learning supported by technology also allows students to interact with external resources, including the industrial world and related professions, which will strengthen the connection between learning in school and real challenges in the workplace (Vygotsky, 1978) (Darmawan et al., 2022; Erbil, 2020).

Furthermore, data from the Central Statistics Agency (BPS) shows that vocational high school graduates in Indonesia still have a high unemployment rate, which is 11.13% in 2021. This shows that although vocational high schools are theoretically prepared to produce a workforce that is ready to enter the industrial world, in reality, vocational high school graduates still have difficulty in getting suitable jobs. One of the contributing factors is the mismatch between the skills taught in schools and the demands of the dynamic and rapidly changing world of work (Sembiring, 2021). Therefore, innovation in learning methods, including the integration of digital technology and collaboration with industry, is very important to ensure that SMKN 3 Sampang graduates have skills that are relevant to the needs of the world of work. With a project-based learning approach supported by technology and intervention from the environment, it is hoped that SMKN 3 Sampang students will be better prepared to face the challenges of the world of work and have a clearer vision of their future. They will also be better able to think critically, solve problems, and adapt to rapid changes in the industrial world and society.

Conclusion

Based on the results of the discussion, it can be concluded that the inability of SMKN 3 Sampang students to find idols who reflect the values of the nation's character and the lack of critical thinking skills play a role in inhibiting their personal and career development. Project-Based Learning (PjBL) supported by digital technology has proven to be an effective solution in improving critical thinking skills, problem-solving, and student involvement in the learning process. This method not only provides opportunities for students to work collaboratively and face real problems but also helps them develop skills that are relevant to the world of work. Environmental support such as family, school, and community, as explained by Bronfenbrenner and Vygotsky's theories, is very important in shaping students' cognitive and social development. Educational interventions that pay attention to socio-economic aspects and provide full support from the surrounding environment will help students develop their full potential. Thus, through the application of innovative learning methods and closer collaboration between schools and the industrial world, SMKN 3 Sampang graduates are expected to be more prepared and competent in facing the challenges of the world of work.

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