Improving Entrepreneurial Motivation and Character in Vocational Education Students through Project-Based Digital Learning: A Case in Merauke

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ABSTRACT

Vocational education plays a crucial role in preparing students not only for employment but also for entrepreneurship. However, many vocational graduates, especially in remote areas like Merauke, lack entrepreneurial motivation and character, limiting their potential to become job creators. This study aims to examine the effectiveness of Project-Based Digital Learning (PBDL) in enhancing entrepreneurial motivation and character among vocational students. A quasi-experimental approach with a non-equivalent control group design was applied, involving 74 students from three vocational high schools in Merauke. The research was conducted over three months, using pretest-posttest instruments including entrepreneurial motivation questionnaires, entrepreneurial character observation sheets, and PBDL implementation observation forms. Data were analyzed using paired sample t-tests and independent sample t-tests. The results showed that students in the experimental group experienced significantly higher improvements in both entrepreneurial motivation and character compared to the control group. These findings suggest that PBDL fosters active, contextual, and digitally enriched learning environments that enhance autonomy, leadership, innovation, and resilience. The study concludes that PBDL is a promising pedagogical model for entrepreneurship education, particularly in underdeveloped regions. It recommends that vocational schools adopt PBDL to strengthen entrepreneurial competencies and calls for future longitudinal and multi-regional studies to validate and expand the findings theoretically and practically.

Keywords: Entrepreneurial motivation; enrepreneurship character; project-based digital learning; vocational education

INTRODUCTION

Vocational education serves a dual responsibility in equipping students not only with job-specific competencies but also with entrepreneurial capabilities essential for responding to the challenges of the modern labor market (Billett, 2011; Clark & Winch, 2007; Prosser, 1950). In developing countries such as Indonesia, vocational education is expected to address the high unemployment rate among young people by preparing graduates to either enter the labor market or create their own employment through entrepreneurship (Ibrahim & Nashir, 2022; Kibrit et al., 2022). However, this ideal is often unmet. In practice, many vocational education graduates experience long waiting periods before securing employment, low absorption in the labor market, and misalignment between the fields they studied and the jobs they obtain (Kurniawan et al., 2021; Tran et al., 2020). Even more concerning is the extremely limited number of graduates who opt to become entrepreneurs. This problem is notably more pronounced in remote or rural areas such as Merauke, where economic infrastructure and access to resources are limited, making entrepreneurship both more necessary and more difficult (Doan & Phan, 2020; Ephrem et al., 2019; Pranić, 2023). If left unaddressed, the low rate of entrepreneurship among vocational graduates may lead to persistent unemployment, increased poverty, and a long-term socio-economic imbalance, especially in underdeveloped regions (Anggadwita et al., 2017; Martono et al., 2022).

This critical issue is strongly linked to the insufficient development of entrepreneurial motivation and character among vocational students (Kisubi et al., 2021; Triyono et al., 2023). Entrepreneurial motivation refers to the intrinsic drive to engage in entrepreneurial activities, while entrepreneurial character encompasses persistence, creativity, initiative, and risk-taking attitudes (Guo & Wang, 2021; Jaedun et al., 2024; Utami & Hitipeuw, 2019). Numerous studies affirm the significance of these two psychological dimensions in predicting entrepreneurial intentions and behaviors among youth. For instance, research by Mahfud et al. (2020), confirms that strong entrepreneurial self-efficacy and motivation significantly influence students' intentions to pursue self-employment. Similarly, Hoang et al. (2021) and Rahmawati et al. (2022), emphasize that without strong entrepreneurial character traits, vocational students are unlikely to sustain entrepreneurial efforts even when exposed to business opportunities. Yet, vocational students in remote areas like Merauke often display low levels of entrepreneurial motivation and character due to limited exposure to entrepreneurial role models, inadequate contextual learning environments, and a lack of supportive policies or ecosystems (Selfina Pare, 2021). If the lack of entrepreneurial drive and resilience continues, it will further perpetuate the cycle of dependency on limited job availability, resulting in structural unemployment and wasted vocational potential.

The root cause of these challenges lies in the prevailing instructional climate within vocational schools, which often fails to activate or cultivate students' entrepreneurial competencies (Kholifah et al., 2022; Mahfud et al., 2020; Mutohhari et al., 2023a). The learning environments are typically dominated by rigid, teacher-centered instruction with a heavy focus on technical skills, leaving little room for exploration, innovation, or real-world problem-solving (Nurtanto et al., 2021; Techanamurthy et al., 2020). The models of instruction employed tend to be conventional and disconnected from entrepreneurial realities, thereby stifling students' creative potential and motivation to initiate ventures (Sutiman et al., 2022). Furthermore, interactions between teachers and students, as well as among students themselves, are often limited and transactional, focused primarily on content delivery rather than collaboration and critical thinking (Fawaid et al., 2022; Mahfud et al., 2020). This lack of interactive and stimulating pedagogical methods significantly hampers the development of soft skills, including those necessary for entrepreneurship (Akhter et al., 2022; Hassan et al., 2021). In particular, the failure to embed entrepreneurship into the learning climate, especially in geographically isolated regions, has led to disempowered learners who are not equipped to become active economic agents in their communities (Cai et al., 2021).

To address this issue, there is a growing consensus among education researchers and practitioners that project-based learning (PjBL) offers an effective pedagogical strategy for enhancing entrepreneurial motivation and character in vocational students (Fan et al., 2021; Laptev & Shaytan, 2022). Project-based learning emphasizes student-centered activities that involve planning, implementing, and presenting solutions to real-world problems, which naturally cultivates entrepreneurial traits such as autonomy, creativity, leadership, and perseverance (Tomaselli et al., 2022). Empirical evidence supports this claim. For example, a study by (Mutohhari et al. (2023) and Sudira et al. (2022), found that PjBL significantly enhances entrepreneurial attitude and initiative among vocational students. Furthermore, the integration of digital technologies into project-based learning, commonly referred to as project-based digital learning (PBDL), can further amplify its benefits. Digital tools allow for greater flexibility, personalization, and access to real-time data, enabling students to interact more deeply with authentic business challenges and environments (Barbosa et al., 2024; Haryanto et al., 2021; Zen et al., 2022). In the context of remote vocational schools like those in Merauke, digitalization makes it possible to bridge physical distances and bring learners closer to industry mentors, business simulations, and entrepreneurial networks (Fan et al., 2021; Selfina Pare, 2021). PBDL also promotes a future-oriented learning approach that is adaptive to Industry 4.0 and Society 5.0 challenges, fostering resilience and readiness among learners to become job creators rather than job seekers (Jaedun et al., 2024).

In light of the problems and potential solutions described above, it becomes clear that vocational education, especially in peripheral regions, must adopt innovative instructional models that are grounded in real-world relevance and technological advancement. The synthesis of project-based learning with digital tools presents a promising avenue to invigorate students' entrepreneurial motivation and character. Such an approach not only addresses the cognitive and emotional dimensions of entrepreneurship but also fosters learning experiences that are meaningful, interactive, and empowering. This study, therefore, aims to explore and evaluate the effectiveness of project-based digital learning in improving entrepreneurial motivation and character among vocational education students in Merauke. By focusing on a marginalized context where these issues are most

acute, this research seeks to offer practical and scalable insights into how digital pedagogies can transform vocational education into a more responsive and empowering system for future entrepreneurs.

METHOD

This study uses a quasi-experimental approach that aims to test the effectiveness of project-based digital learning (PBDL) in improving entrepreneurial motivation and character in vocational education students in Merauke Regency. In this case, two different groups already existed, so to anticipate bias in the data produced, we used a non-equivalent group quasi-experimental design adopted from Campbell & Stanley (1963). We consider this design because of its rationality, and the level of accuracy that can prevent bias in treatment and measurement results, because it is carried out without randomizing existing groups (Kohan et al., 2024). This research approach and design are translated into 5 main stages: identification and focus, pretest implementation, treatment, posttest implementation, interpretation and conclusions. The study was conducted over a period of approximately three months, starting from the end of Early February to Early May 2025. The treatment process took place in four meetings in accordance with the 50% allocation of practical learning time in entrepreneurship learning.

Three vocational high schools (VHS) were involved in this study, in which all schools had two classes in the same current year with similar characteristics of entrepreneurship learning. The selection of VHS was also based on several other considerations to ensure the rationality and scientificity of the data without violating ethical procedures in the entire research process. First, the three schools are VHS, which has been accredited A, which is in line with what was proposed by Zilic (2018), that equality of ranking and standardization is one aspect that can increase the rationality of quasi-experimental research. Second, the two classes that are studying entrepreneurship in each school are taught by the same teacher. Third, the availability of digital infrastructure and its accessibility are considerations to ensure that PBDL can be implemented by students and teachers in the Entrepreneurship subject. Finally, the partnership between VHS and the world of work and business that has been running for more than five years is the main consideration to ensure the relevance of learning to actual work conditions (Rohm et al., 2021). A total of 74 students and three teachers were involved in a series of research processes, which were divided into two control classes and two experimental classes. Before deciding on the involvement of all participants, we ensure their legality through adequate licensing procedures.

Throughout the study, we used several data collection techniques to ensure a high level of accuracy and meet the adequacy of data to answer the stated research objectives. At the pretest stage, we involved a motivation questionnaire and an entrepreneurial character observation sheet to measure the initial abilities of both. This questionnaire and observation sheet became the basis for obtaining an initial picture and analyzing the equilibrium between groups (control and experiment) as a requirement for the non-equivalent group quasi-experimental design to be carried out. We also used a questionnaire and observation sheet to measure the motivation and entrepreneurial character values at the posttest stage. During the implementation of PBDL, we used observation techniques to observe and ensure the implementation of the stages and elements of PBDL in a series of entrepreneurship learning implementations. Therefore, the data collection instruments that we used included an entrepreneurial motivation questionnaire, and an entrepreneurial character observation sheet and the implementation of PBDL. Table 1 explains in detail the blueprint for both instruments in this study.

Table 1 Blueprint of Questionaire Instrument

Instrument	Indicator	Operational
Entrepreneurial motivation questionnaire (Fawaid et al., 2022)	Financial desire	the urge to be financially self-sufficient and not rely on others.
	Need for achievement	The drive to succeed and be recognized in the business field.
	Self-Actualization	The intention to express ideas, talents, & interests through business.
	Autonomy & freedom	The need to manage one's own time, goals, and strategies.
	Social impact	Intention to create jobs and have a positive social impact
Entrepreneurship character	Self-confidence	Confidence in one's own abilities and decision-making.
	Innovation	Ability to generate new ideas and improve products or services.

observation sheet (Mutohhari et al., 2023)	Goal orientation	Setting high goals and striving to achieve them effectively.
	Resilience	Ability to endure failure and continue trying
	Leadership	Ability to lead a team, delegate tasks, and establish systems
	Adaptability	Flexibility to adjust to changes in the market or technology
PBDL implementation observation sheet (Haryanto et al., 2021; Sudira et al., 2022)	Problem orientation	Asking questions about contextual issues or problems using digital technology
	Project planning & design	Designing projects, defining learning objectives, assigning roles, and developing work plans and project schedules collaboratively.
	Investigation & exploration	Conduct in-depth exploration and data/information collection through digital sources, observations, or online interviews.
	Project development	Develop solutions/prototypes/project works assisted by digital tools.
	Collaboration & communication	Share progress and work results among team members, including teachers and experts.
	Reflection & feedback	Evaluate the learning process, obstacles faced, and self and team evaluation, both individually and collectively.

The collected data were analyzed using t-test with two different specific methods. First, to test the effectiveness of PBDL in increasing entrepreneurial motivation and entrepreneurial character, it is necessary to look at the trend of differences in the average pretest-posttest scores in each class, both in the experimental class and the control class. In this case, the paired sample t-test is the most appropriate method in terms of accuracy and suitability of the results. In addition, the normality that is met in the data provides an opportunity for this testing method to be used more rationally (Reid, 2014). After seeing the trend of the differences, the independent sample t-test was then used to test the difference in the average posttest scores of collaboration and communication skills between the experimental class and the control class. The provision is, if the significance value (p) is below or equal to a significance level of 5% ($p \leq 0.050$), which indicates that the experimental class has a higher average value, then the hypothesis is accepted, or in other words there is a difference in the average posttest score between the two classes. The homogeneity standard that is met provides an opportunity for this testing method to be carried out (Johnson & Wichern, 2007).

RESULT

Analysis Prerequisite Test

Prerequisite analysis test was conducted to determine whether the data were normally distributed and had homogeneous variance as a requirement to perform paired sample t-test and independent sample t-test. The analysis prerequisite test contains tests for data normality and homogeneity of variance. The analysis prerequisite test was carried out using SPSS V 21 software. The results of the data normality test are shown in table 2 below.

Table 2 Normality test result

Variable	Pre-test p Value		Decision	Post-test p Value		Decision
	Experiment	Control		Experiment	Control	
Entrepreneurial motivation	0,166	0,121	Normal	0,224	0,214	Normal
Entrepreneurship character	0,180	0,196	Normal	0,147	0,206	Normal

Based on the results of the data normality test using the Kolmogorov Smirnov formula, the significance value in each class was greater than 0.050 at a significance level of 5%, so it can be concluded that the data is normally distributed. After the data is known to be normally distributed, then the homogeneity of variance test is then carried out. Based on the results of the homogeneity of variance test, it is known that the significance value for all variables is greater than 0.050 at a significance level of 5%, so it can be concluded that the variance of the experimental class posttest data and control class posttest data on the collaboration and communication skill variables is the same or homogeneous. The results of the homogeneity test are shown in table 3 below.

Table 3 Homogenity test results

Variable	Df1	Df2	Sig	Dec.
Entrepreneurial motivation	1	72	0,286	Homogeneous
Entrepreneurship character	1	72	0,231	Homogeneous

The effectiveness of project-based digital learning in improving entrepreneurial motivation and entrepreneurship character

Before assessing the effectiveness of the Project-Based Digital Learning (PBDL) model in improving students' entrepreneurial motivation and entrepreneurship character through inferential statistical analysis using t-tests, it was essential to first conduct an initial equivalence test on both skill variables between the experimental and control groups. This preliminary step aimed to ensure that both groups had comparable levels of initial ability prior to the implementation of the intervention, thereby allowing any subsequent differences in outcomes to be more confidently attributed to the PBDL treatment rather than to pre-existing disparities. The equivalence test was carried out using an independent sample t-test, which is a commonly used method to compare the means of two separate groups. The results of this analysis indicated that the significance values for both entrepreneurial motivation and entrepreneurship character were greater than 0.05, suggesting that there were no statistically significant differences in the pretest scores between the experimental and control classes. These findings confirm that the two groups were balanced in terms of their initial skill levels, which validates the appropriateness of proceeding with the effectiveness testing phase. The confirmation of this baseline equivalence is critical in quasi-experimental designs, especially those employing non-randomized groups, as it helps to ensure the internal validity of the study. The detailed results of the equivalence test, including the degrees of freedom, mean scores, t-values, and significance levels, are presented in Table 4 of the findings section.

Table 4 Initial Ability Test Result

Variabel	Experiment		Control		t Value	Sig	Decision
	Df	Mean	Df	Mean			
Entrepreneurial motivation	35	28,12	35	27,98	0,920	0,254	Balanced
Entrepreneurship character	35	34.64	35	34.21	1,008	0,204	Balanced

Following the completion of the initial ability testing, the next crucial step in the research process was the implementation of the Project-Based Digital Learning (PBDL) model as an instructional treatment for the experimental class. PBDL in the Entrepreneurship subject at Vocational High Schools (VHS) is designed to enhance students' entrepreneurial motivation and strengthen their entrepreneurial character through contextual, active, and technology-based learning. This learning process is carried out four structured sessions following six main stages. In the first stage, *problem orientation*, students are encouraged to identify entrepreneurship-related issues that are contextually relevant to their surroundings, such as creating job opportunities or initiating independent businesses, by utilizing digital technology such as online forums, inspirational videos, and case studies. In the *project planning & design* stage, students collaboratively design business projects, define learning objectives that reflect their need for achievement and self-actualization, assign roles based on individual strengths and interests, and develop work plans using digital tools. This stage fosters financial drive, achievement motivation, and a sense of autonomy in decision-making.

In the *investigation & exploration* stage, students conduct digital research to develop creative business ideas, reflecting dimensions of innovation and goal orientation. They are also required to perform market surveys, virtual interviews with entrepreneurs, and online market observations to deepen their understanding of business opportunities and demands. During the *project development* stage, students create business prototypes and digital promotional content, demonstrating leadership, resilience in overcoming challenges, and adaptability to technology and market changes. The projects also serve as a platform for students to express the social impact of their business ideas, such as contributing to the environment or local community. In the *collaboration & communication* stage, students share their project progress and challenges with team members, teachers, and business partners through virtual discussions, thus enhancing self-confidence and

teamwork skills. Finally, the *reflection & feedback* stage allows students to evaluate the learning process, identify their strengths and obstacles, and receive constructive feedback for personal and professional growth. Overall, the implementation of PBDL effectively fosters students' entrepreneurial motivation and character development through active, reflective, and digitally supported learning aligned with the demands of contemporary entrepreneurship. The outcomes of this paired sample t-test are comprehensively presented in Table 5 and serve as the basis for evaluating the significance of improvement observed in the experimental class following the PBDL intervention.

Table 5 Paired Sample T-Test Result

Variabel	Pre. – Post. Experiment			Pre. – Post Control		
	Mean Diff.	t Value	Sig	Mean Diff.	t Value	Sig
Entrepreneurial motivation	-18,261	-11,806	0,000	-9,102	-5,160	0,000
Entrepreneurship character	-21,016	-12,924	0,000	-10,780	-5.854	0,000

Based on the results of the paired sample t-test, the significance values for the pretest-posttest pairs in the experimental class for both entrepreneurial motivation and entrepreneurship character were 0.000 ($p \leq 0.05$), indicating a statistically significant improvement in students' motivation and character after receiving the Project-Based Digital Learning (PBDL) treatment. This outcome confirms that the implementation of PBDL had a meaningful and positive effect on enhancing these variables, thereby supporting the first research hypothesis. Following the confirmation of significant within-group improvement, an independent sample t-test was conducted to compare the posttest mean scores between the experimental class and the control class. This analysis aimed to determine whether the observed improvements in the experimental group were significantly greater than those in the control group, with detailed results presented in Table 6 below.

Table 6 Independent Sample T-Test Result

Variable	Mean difference	t Value	Sig.
Entrepreneurial motivation	9,159	8,164	0,000
Entrepreneurship character	10,236	10,010	0,000

Based on the results of the independent sample t-test, the significance values for both collaboration and communication skills were found to be 0.000 ($p \leq 0.05$), indicating a statistically significant difference in the mean scores between the experimental class, which received the Project-Based Digital Learning (PBDL) treatment, and the control class, which did not. These results confirm that students in the experimental group outperformed those in the control group in both variable areas following the intervention. The significantly higher average scores in the experimental class demonstrate the effectiveness of the PBDL model in fostering students' entrepreneurial motivation and entrepreneurship character, thus providing empirical support for the second hypothesis of the study.

DISCUSSION

The key findings of this study confirm that the Project-Based Digital Learning (PBDL) model is significantly effective in improving entrepreneurial motivation and character among vocational education students in Merauke. The results of both the paired-sample t-test and independent-sample t-test revealed substantial increases in these two variables following the implementation of PBDL, both within the experimental group and when compared to the control group. These findings theoretically reinforce the notion that project-based learning fosters active student engagement in the learning process and provides ample space for developing soft skills, including intrinsic motivation and character traits such as leadership, resilience, and adaptability (Ngereja et al., 2020; Rahman et al., 2022). Motivational dimensions such as the need for achievement, self-actualization, and social impact were also observed to improve during digital interaction and project exploration phases. These outcomes are consistent with Self-Determination Theory, which posits that learning environments supporting autonomy, competence, and relatedness are likely to enhance students' intrinsic motivation, particularly when they engage in meaningful tasks like designing entrepreneurial projects (Licardo & Schmidt, 2016).

From the perspective of entrepreneurial learning theory, PBDL can be viewed as an experiential approach that enables learning through cycles of exploration, action, reflection, and evaluation (Basilotta Gómez-Pablos et al., 2017; Nurdiansah et al., 2021). The findings of this study contribute a new dimension by integrating digitalization as a reinforcing element that allows students in remote regions like Merauke to access data, opportunities, and networks that are otherwise inaccessible through conventional learning. This is particularly important because, as Selfina Pare (2021) highlighted, one of the major barriers to entrepreneurship in underdeveloped regions is the lack of access to information and markets. Therefore, digitalization in PBDL not only strengthens the quality of instruction but also broadens the scope of entrepreneurial experiences in ways that are more contextual and authentic. Components such as reflection and feedback in the PBDL implementation also strengthen students' metacognitive awareness in assessing their readiness as future entrepreneurs, which aligns with the findings of Jaedun et al. (2024) regarding the development of interpersonal competencies in vocational education.

Nevertheless, these promising results are not without critique and ongoing debate in the literature. Several studies suggest that the success of PBDL is highly contingent on factors such as infrastructure readiness, teacher capacity, and the collaborative culture within schools (Rohm et al., 2021; Laptev & Shaytan, 2022). In the context of Merauke, although the participating schools had the necessary facilities and partnerships with the business sector, it is important to acknowledge that replicating this success in other underdeveloped regions may not be straightforward, especially where digital infrastructure is lacking (Khoo et al., 2024). Moreover, critics argue that project-based learning approaches can lead to cognitive overload among students with limited academic backgrounds, or create disparities in participation levels during team-based tasks (Bican & Brem, 2020; Sahut et al., 2021). In this study, it remains unclear to what extent each student experienced equitable learning opportunities within their project teams. Thus, these findings must be interpreted with caution, highlighting that the effectiveness of PBDL also depends on inclusive instructional design, appropriate formative assessment mechanisms, and sufficient teacher training to ensure that the approach is responsive to both local contexts and individual student needs.

The implications of this study are both practical and theoretical. Practically, the findings urge vocational schools, especially those in disadvantaged, remote, or frontier regions, to consider integrating PBDL into their entrepreneurship curricula as a strategy to overcome the low levels of entrepreneurial motivation and character among students. Schools must strengthen partnerships with industry, and at the same time enhance digital literacy among both teachers and students, to optimize the implementation of this learning model. Theoretically, this study extends the growing body of literature on the effectiveness of project-based learning in vocational education by underscoring the vital role of digitalization in strengthening pedagogical processes. It also opens new avenues for further research to explore other dimensions of entrepreneurial learning outcomes, such as self-efficacy, entrepreneurial intention, or the sustainability of student-led ventures after graduation. Longitudinal studies are also needed to assess the long-term impacts of PBDL and to validate the generalizability of these findings across cultural and vocational domains. In sum, this research lays a promising foundation for formulating vocational education policies that are adaptive, contextualized, and digitally enriched—ultimately aiming to cultivate a generation of young entrepreneurs who are resilient, innovative, and locally and globally relevant.

CONCLUSION

This study concludes that the implementation of Project-Based Digital Learning (PBDL) significantly improves both entrepreneurial motivation and character among vocational education students in Merauke. Empirical evidence demonstrates that students who participated in PBDL-based instruction outperformed those in the conventional learning group in terms of financial drive, autonomy, social impact, leadership, resilience, and adaptability. These findings validate the integration of technology-driven project learning as an effective approach to enhancing entrepreneurship-related competencies, particularly in underdeveloped or remote educational settings. However, the study has limitations, notably the short intervention period, the limited number of participating schools, and its focus on one geographic region, which may constrain the generalizability of findings. Therefore, future studies should apply longitudinal designs and explore multi-regional samples to examine long-term impacts and cross-contextual applicability. Practically, this research recommends vocational schools and policymakers adopt PBDL as a pedagogical strategy to strengthen

entrepreneurship education, especially in disadvantaged areas. Theoretically, it contributes to the growing literature by emphasizing the interplay between digital learning environments and entrepreneurial development. Overall, this study supports the call for more contextualized, interactive, and future-oriented learning models to better equip vocational students as job creators in the evolving economic landscape.

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