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Effectiveness of Project-Based Learning in Textile Dyeing Course to Improve Work Readiness as Entrepreneurs in the Digital Era

Sri Zulfia Novrita[1*], Nizwardi Jalinus[2], Ridwan[3], Rijal Abdullah[4], Weni Nelmira[1], Adriani[1]

[1]Department of Family Welfare Sciences, Faculty of Tourism and Hospitality, Universitas Negeri Padang, Padang, Indonesia
[2]Department of Mechanical Engineering, Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia
[3] Department of Electrical Engineering, Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia
[4]Department of Civil Engineering, Faculty of Engineering, Universitas Negeri Padang, Padang, Indonesia

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Corresponding Author:
Sri Zulfia Novrita
sriznovrita@fpp.unp.ac.id

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Abstract: Student work readiness in facing the world of digital entrepreneurship is still an obstacle that requires a more effective learning approach. This study aims to examine the effectiveness of project-based learning model on students' work readiness in digital era entrepreneurship. By using pre-test and post-test design, 40 students were prepared to be tested at the beginning and at the end who were taught using a project-based learning model. Students participated in the learning process for one semester with real-world projects relevant to the digital fashion industry. The t-test results indicate a significant difference between pretest and posttest scores (t-calculated = 38.561 > t-table = 1.990; sig. < 0.05), indicating a significant improvement in digital work readiness. This improvement includes technical skills, creativity, digital literacy, collaboration, and business management skills based on technology. Additionally, project-based learning was proven to enhance students' motivation and engagement in the learning process. These findings reinforce the effectiveness of PjBL as an approach responsive to the demands of Industry 4.0. This study concludes that the project-based learning model is effective in preparing competent graduates in digital entrepreneurship and can be adopted as an adaptive and applicable vocational learning strategy in the era of digital transformation.

Keywords: Digital Age; Etrepreneurship; Job Readiness; Project Based Learning; Textile Dyeing

Introduction

The digital era demands entrepreneurs to acquire different skills and knowledge compared to the previous era. Digital transformation has reshaped the business landscape, requiring entrepreneurs to develop new competencies (Ernawati et al., 2021). In the context of education, particularly vocational entrepreneurial training, the integration of digital technology has become crucial in preparing students for increasingly complex business challenges. Integrating digital technology in vocational education is very important to prepare students to face modern business challenges(Asriati, 2019). The digital business concept involves the integration of digital technology into business processes, leading to new organizational structures, communication methods, and employee agility. This transformation is essential for survival in a rapidly growing market, emphasizing the need for adaptability and innovation(Vučeković et al., 2020). This understanding is important to create relevant market opportunities through the internet and to design

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appropriate strategies to win the market in an increasingly dynamic digital competition era (Tan et al., 2020). The digital business model includes customer focus, smart products, digital services, internal process digitalization, ecosystem operations, platform accessibility, and utilization of data analytics, reflecting the shift from traditional models to models that utilize digital transformation and emerging technologies (Ahmad et al., 2020).

However, the reality on the field shows that many entrepreneurial vocational education programs have not fully adopted effective learning approaches in the face of current industry needs (Rita et al., 2011). Many vocational programs still rely on traditional teaching methods, thus failing to meet current industry demands (Dadang, 2011). Project-based learning (PjBL) has been recognized as one of the effective methods in improving students' practical skills and career readiness. Project-Based Learning is effective in improving practical skills and career readiness (Rati et al., 2017). Through PjBL, students are given the opportunity to work on real projects relevant to the digital business world, so they can develop the necessary technical and non-technical skills. Real-world projects enable students to develop technical and soft skills essential for digital business (Rachman, 2019;Alimuddin, 2021). These projects not only involve real problem solving but also allow students to apply the theories they learn in a practical context. PjBL bridges the gap between theoretical knowledge and practical application (Hasani et al., 2017). However, despite the benefits of PjBL have been widely discussed, there is still little research that measures the specific impact of this approach on the readiness of digital entrepreneurship students. Although PjBL has many benefits, there is still a lack of specific research on the impact of its career readiness in digital entrepreneurship (Sahut et al., 2021; Frederick & Kuratko, 2009). Career readiness includes various aspects such as adaptability to new technologies, digital business management skills, creativity, communication skills, and problem solving (Ambiyar et al., 2020; Dewi et al., 2019). Without a clear understanding of how PjBL affects these aspects, educational institutions may struggle to design a truly effective curriculum without understanding the impact of PjBL on these competencies (Gozali et al., 2019).Students need to have skills in developing product ideas that match digital market preferences, as well as carrying out various business activities such as product promotion and sales through various online channels (Dewi et al., 2020). The ability to develop digital-based business strategies, improve product competitiveness, and optimize the sales process to be financially profitable are important indicators in assessing students' readiness to compete in the digital-based fashion market (Elfizon & Dewi, 2021). Being an entrepreneur in the digital era refers to a new way of thinking about business models, customer relationships, and organizational agility, emphasizing the integration of technology to improve processes, efficiency, and the overall customer experience, which requires a cultural change in the organization(Bogot, 2020). Many educational institutions still rely on traditional teaching methods that are more theoretical and less interactive. Traditional teaching methods are still prevalent and often lack interactivity (Wardina et al., 2019). As a result, students may not gain sufficient practical experience to deeply understand the dynamics of digital business. Students often miss out on the practical experience needed to understand the complexities of digital business (Holzmann et al., 2018). In addition, limitations in internship opportunities and collaborative projects with industry can also hinder the development of much-needed practical skills. Limited internship opportunities and industry collaboration hinders the development of practical skills (Novrita et al., 2024).

This study aims to measure the impact of project-based learning on the career readiness of digital entrepreneurship students of Diploma in Fashion Management, Faculty of Tourism and Hospitality, Padang State University in Textile Dyeing course. Students have been exposed to project-based learning for over two years in almost all subjects in the curriculum.Educators should measure how project learning benefits students in improving their ability to prepare themselves to become entrepreneurs in the digital era related to the textile dyeing business.

The study has novelty in integrating project-based learning models (PBL) contextually in Textile dyeing courses with digital entrepreneurship approaches. The focus on textile dyeing as the leading product in the digital fashion industry has not been widely researched in the context of PBL. The study not only tested the effectiveness of PBL in general, but also measured its impact on student digital work readiness, including technology literacy, utilization of digital media for promotion, project management, and industrial-based software use. This research is important because it can answer the gap between the education world and the needs of industry 4.0. With quantitative data-based results and valid measurements, the study can be the foundation for vocational higher education institutions to develop a more apparent, contextual and responsive curriculum to digital transformation in the creative industrial sector. In addition, the study contributes empirically to designing local product-based entrepreneurial learning strategies that have global competitiveness.

This is an effort to find proof and evaluation of the learning efforts that have been made. Is it true that project learning is useful for students to prepare them to

become entrepreneurs in the digital era. Becoming an entrepreneur is one of the main abilities that a vocational student is expected to achieve. The tough competition in the digital era, especially the world of fashion and clothing, cannot be considered ordinary.The learning model that has been applied should be examined for its effectiveness to ensure that learning goes according to the goals that it wants to achieve. The research aims to measure the impact of Project-Based Learning on career readiness in digital entrepreneurship. By understanding how PjBL can improve career readiness, it is expected that educational institutions can be more effective in integrating these methods into their curriculum. Understanding the impact of PjBL can help institutions integrate it into the curriculum more effectively (Wandira et al., 2024; Ambiyar et al., 2019; Jalinus & Nabawi, 2017). The results of this study are expected to provide useful insights for designing educational programs that are more responsive to the needs of the textile and fashion industry and help students develop skills that are relevant to business demands in the digital era. The findings are expected to provide insights for designing responsive education programs that meet the needs of the industry, especially in the field of fashion and clothing, especially textile dyeing.

Method

The study uses quantitative methods with experimental research types to measure the impact of project-based learning (PjBL) on the readiness of student diploma in fashion in digital entrepreneurship. The study involved 40 students of fashion diploma at Padang State University as a research subject. The selection of samples is classically set in consideration of one class of students who have studied using a project-based learning model. The study used experimental design with pretest-postest to evaluate changes in student career readiness after the application of PjBL.The selected student is the student who attended the textile dyeing courses. The design of the activity during pretest is the activity carried out before the application of PjBL.Students are tested first by using a likert-scale instrument with the elaboration of indicators related to the readiness of the student career. Student groups undergo project-based learning for one semester. The project provided will involve real tasks relevant to the digital business world in the fashion industry. Students will work in teams to complete these projects, which include the use of digital technology, digital marketing strategies, inventory management, etc. After one semester the student was given the same posttest as pretest to measure changes in their career readiness level. Posttest results will be compared to pretest results to evaluate the effectiveness of PJBL. Data analysis, data from pretest and posttest will be analyzed using statistical tests to determine if there are significant differences in student career readiness. T-test test will be used to test the average difference between pretest and posttest. The instrument used in this study is a career readiness questionnaire that covers various aspects of skills relevant to digital entrepreneurship. This questionnaire has been validated and tested for its reliability, which consists of 45 items. To analyze the data in this study, several statistical analysis techniques were used to evaluate changes in the career readiness of fashion design diploma students after the implementation of project-based learning (PjBL). Before the hypothesis test was carried out, an analysis of the analysis requirements was carried out, namely the normality test.

Result And Discussion

Research has been conducted by distributing questionnaires to research respondents who are objects in the experiment. To illustrate the results of the following research tables and graphics as well as the results of hypothesis testing that has been carried out on the two sets of data that have been obtained.

Table 1. Description of pretest and posttest results of business readiness in the digital age

Description	N	Score	
		Pretest	Postest
Understanding business opportunities through the internet	40	54	65
Understand the benefits of a website for a textile dyeing business or product	40	32	55
Understand the difference between a company website and e-commerce	40	43	65
Understand the process of business interaction through the internet	40	67	65
Understand how to create a viable business opportunity to capture the market for textile dyeing products through the internet.	40	59	55
Able to create ideas for textile dyeing products that can sell on the internet market	40	78	54
Able to conduct business activities of textile dyeing products through the internet	40	54	56
Able to promote text coloring products through the internet	40	66	56
Able to develop business strategies to create sales on the internet	40	76	54
Able to compete in selling textile dyeing products using internet media	40	43	76
Have secured market opportunities for textile dyeing products through the internet	40	56	54

Description	N	Score	
		Pretest	Postest
Able to create profitable sales through the internet	40	91	56
Able to increase business opportunities for textile dyeing products through the internet	40	34	45
Able to win business competition of textile dyeing products through the internet	40	56	66
Have a growing business through the internet	40	45	54
Confident in using digital design software (Adobe Illustrator, CorelDRAW, etc.)	40	67	87
Adequate frequency of using e-commerce platforms to sell fashion products	40	86	55
Convenience of using social media to promote fashion products and textile dyeing products	40	54	78
Participation in additional training or courses related to digital literacy	40	56	75
Ability to manage inventory using digital inventory management applications	40	67	77
Frequency of use of analytics tools to measure the effectiveness of digital marketing campaigns	40	54	65
Access to e-learning platforms to improve fashion design or business skills	40	33	66
Ability to use ERP software to manage business operations	40	45	57
Ability to create and manage digital content (videos, blogs, etc.) for fashion product promotion	40	78	78
Confidence in using digital platforms to collaborate with teams or peers	40	88	76
Frequency of following the latest trends in digital technology relevant to the fashion industry	40	65	56
Ability to manage textile dyeing product business finances using digital accounting software	40	66	77
Frequency of use of digital collaboration tools for textile dyeing product projects	40	65	72
Ability to plan and execute digital marketing campaigns for textile dyeing products	40	78	54
Frequency of participating in online communities or forums related to the digital textile dyeing products	40	88	74
Ability to use technology to optimize textile dyeing product processes	40	45	56
Frequency of utilizing augmented reality or virtual reality technology in the design or marketing of textile dyeing products	40	44	66
Ability to use CAD (Computer-Aided Design) software for fashion design	40	65	76
Frequency of attending webinars or online conferences related to the textile dyeing products industry	40	75	87
Ability to use project management software to manage timelines and tasks in textile dyeing products	40	44	69
Frequency of using digital platforms for market survey or consumer research of textile dyeing products	40	56	87
Convenience of using AI to improve customer service in textile dyeing products	40	78	88
Frequency of using email marketing tools to communicate with customers	40	91	85
Ability to use block chain technology to improve product transparency and authenticity of textile dyeing products	40	78	67
Ability to use big data to understand fashion trends and customer preferences	40	88	90
Amount	40	24.87	26.84
Average score		62	67

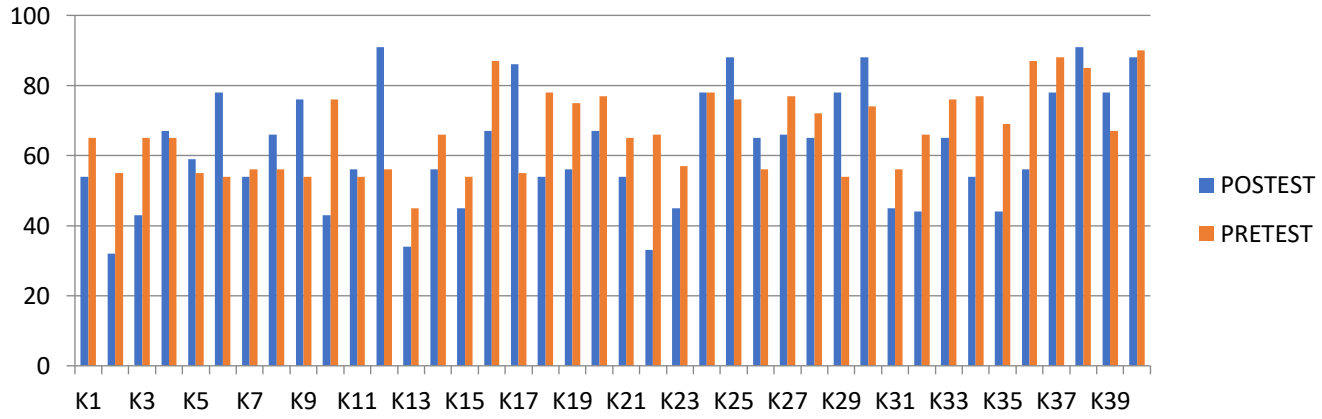

Figure 1. Comparison of Pretest and Posttest Digital Era Entrepreneurial Readiness

The hypothesis test is conducted to prove whether there is a difference in student work readiness in digital entrepreneurship skills before and after being taught with a project-based learning model. Before the hypothesis test, both sets of data must be tested for normality and linearity first. According to the results of the test it is known that the Kormogorov Smirnov (KS) score for the pretest data set is (0.342) while for the posttest data set has a score (0.544). This score states that both data sets are distributed normal data. Hypothesis testing is done by comparing thitung and ttable values. Hypothesis is accepted if calculated t-value>t-table or sig value<α0.05. The tables value at α0.05 for df (n-k = 79 is 1,990. The Test score showed the number of calculated t-value (38,561), thus it is stated that the study proved that there was a difference in student work readiness in entrepreneurship in the digital age before and after learning by using a project-based learning model for textile dyeing products.

The results of the hypothesis test show that there is a significant difference in students' work readiness in digital entrepreneurship before and after the implementation of the project-based learning model. This is in line with the findings (Jaenudin et al., 2023) Project-based learning (PJBL) effectively increases students' entrepreneurial intentions in digital business by providing hands-on experience, encouraging collaboration, and developing essential skills needed for entrepreneurship, as shown by a significant increase in student outcomes compared to conventional learning models. This paper emphasizes that Project-Based Learning (PjBL) improves students' skills in accounting, especially in the digital era, by integrating digital-based learning media, fostering creativity, collaboration, and practical application of knowledge that is essential for the digital business environment (Putri et al., 2024). PjBL provides a contextual learning experience that encourages them to think strategically and innovatively in responding to digital market opportunities. Research by Sundari et al. (2023) also revealed that entrepreneurship-based PjBL was effective in improving students' creative thinking skills. In the study, the application of PjBL successfully encouraged students to produce realistic and highly competitive digital business ideas. This strengthens the argument that project-based approaches foster the ability to design products and marketing strategies directly (Aziz & Rachmawati, 2024). Similar findings were presented by (Saasiprab et al., 2020) that student involvement in real projects encourages increased creativity, a sense of responsibility, and managerial skills that are needed in the digital business world. Students who learn with PjBL show a better understanding of digital literacy and the use of technology in entrepreneurship, which answers the challenges of the industrial era 4.0. The PjBL model is able to significantly increase students' entrepreneurial intentions, because the collaborative and applicable learning process is able to internalize the entrepreneurial spirit early on. These findings reinforce the conclusion that PjBL is highly effective in equipping students with digital entrepreneurship skills related to text dyeing products that are needed in the modern workforce.

Project-based learning has been widely recognized as one of the effective methods in improving students' practical skills and work readiness, this has been proven in various studies and research (Resmanti et al., 2024; Utomo, 2022; Prabowo et al., 2020). In line with the research studies that have been proven, this study also proves the same thing that there is also a significant difference between students' abilities before and after being taught with a project-based learning model by making entrepreneurial readiness in the digital era.The results showed a significant difference in students' work readiness in digital entrepreneurship before and after being taught with a project-based learning model.Project-based learning is able to improve students' practical skills that are needed in the world of work, especially in the field of digital entrepreneurship (Dewi et al., 2020). This improvement is not only limited to technical skills, but also includes students' analytical ability and creativity in developing digital business ideas. In addition, the implementation of project-based learning of textile dyeing products can also increase students' learning motivation and involvement in the learning process. The implementation of project-based learning of textile dyeing products can increase students' learning motivation and involvement in the learning process, which has a positive impact on their work readiness(Ardianti & Raida, 2022; Loindong et al., 2023). This high motivation and involvement contribute to increasing students' work readiness, because they are more actively involved in the learning process and are better prepared to face the challenges of the world of work. Research shows that students who study with a project-based learning model have a higher level of work readiness (Ganefri, 2013). This shows that the project-based learning model provides significant benefits in preparing students for the world of work, especially in the field of digital entrepreneurship (Muharika et al., 2022).

In the context of fashion studies programs, technical skills that support the digital design and production process are very important to master (Yulastri et al., 2021). Students need to have confidence in using graphic design software such as Adobe Illustrator and CorelDRAW, and be able to operate Computer-Aided Design (CAD) software to produce professional fashion designs (Eloy et al., 2020). The integration of cutting-edge technologies such as augmented reality (AR) and virtual reality (VR) is also

an important part of the process of visualizing and marketing fashion products in a more interactive manner. Managerial technology mastery includes the use of Enterprise Resource Planning (ERP) software in managing business operations, inventory management applications to control product stock, and digital accounting software to record and analyze financial reports (Kurtz et al., 2021). Students also need to be familiar with using project management software to ensure the successful implementation of team-based projects with good time and task management.

Digital business includes the integration of technologies such as cryptocurrency, blockchain, cloud computing, and the Internet of Things, facilitating new economic models and increasing productivity. This emphasizes the importance of digitalization and cybersecurity in the evolving digital economy during Industry 4.0 (Gasimov & Aliyeva, 2020). As part of digital era work readiness, students need to have cross-platform communication and collaboration skills (Zhang et al., 2024). Confidence in utilizing various digital platforms such as Google Workspace, Trello, and Slack to collaborate with teams is an important aspect in realizing work efficiency (Blakeman, 2018). Active participation in the fashion industry digital community, both in the form of discussion forums and professional partnerships, also has a significant impact on the development of entrepreneurial networks (Malitasari et al., 2022). Students need to be equipped with the skills to design and implement comprehensive digital marketing campaigns.

These skills include creating and managing digital content such as videos and blogs, using social media for promotion, and utilizing email marketing and digital analytics tools to evaluate campaign effectiveness (Mooij, 2021). Mastery of digital marketing techniques is an important indicator to assess student readiness in competing in the digital-based fashion market (Hunt, 2017). Students need to have a habit of following the latest digital trends in the fashion industry, such as through webinars, online conferences, and access to e-learning platforms. Utilization of artificial intelligence (AI) to improve customer service, blockchain technology to ensure product authenticity, and big data analysis to understand consumer preferences, all become integral to digital entrepreneurial readiness (Ahmad Tajuddin et al., 2022). The ability to actively integrate the latest technology in various aspects of the fashion business in the field of textile dyeing products demonstrates students' readiness to face challenges and opportunities in the evolving digital era(Mendoza et al., 2023).

In conclusion, this study proves that there is a significant difference in students' work readiness in digital entrepreneurship before and after being taught with a project-based learning model. These results support the use of project-based learning models for textile dyeing products as an effective method in improving students' work readiness in the digital era. Hopefully, the results of this study can be a reference for higher education institutions to adopt project-based learning methods in their curriculum to improve the quality of graduates who are ready to face future job world challenges. Thus, this research contributes to higher education, especially in the development of curriculum that is more effective and relevant to the needs of the industry.

Conclusion

The research has proven that there are significant differences in student work readiness in digital entrepreneurship before and after being taught with project-based learning model for textile dyeing products. The results of the study showed that students who follow project-based learning had significant improvements in their practical skills, analytical skills, and creativity. In addition, project-based learning also increases student motivation and engagement in the learning process, which positively impacts their work readiness. This learning model proves to be more effective than conventional methods in preparing students for entrepreneurial challenges in the digital age. The implementation of project-based learning in the curriculum can help improve the quality of graduates who are better prepared for the world of work, especially in the fast-growing digital entrepreneurship in fashion. Educational institutions are expected to adopt this learning model to create a more interactive and practical learning experience for students. This research also underlines the importance of adapting the teaching model to technological developments and the demands of the modern job market. The adoption of project-based learning for textile dyeing products can be a strategic step to improve the competitiveness of graduates in the job market and global business competition.

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