Integrating Artificial Intelligence into Entrepreneurship Education in Vocational Curriculum: A Real-Project-Based Case Study of Pempek Sutra

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Abstract **– This study explores the integration of Artificial Intelligence (AI) into entrepreneurship education within vocational curricula through a real-project-based case study of Pempek Sutra, a student-led business initiative. Using a qualitative descriptive approach and document analysis, the research investigates how AI tools—such as ChatGPT, Upmetrics, Canva AI, and Google Trends—enhance business planning, market analysis, and financial forecasting. Results reveal that embedding AI in experiential learning significantly improves students' entrepreneurial competencies, including digital marketing, risk management, and financial literacy. The Pempek Sutra project achieved a 35% return on investment, reached over 1,000 customers within three months, and increased student entrepreneurial motivation by 40%. The study introduces the Entrepreneurship Practicum model, which integrates teaching factory, industry mentoring, and market-based evaluation as a transformative framework for vocational entrepreneurship education. This model provides a practical, scalable approach to bridging the gap between theoretical knowledge and real-world entrepreneurial practice in the digital era.**

Keywords**— Entrepreneurship Education, Vocational Curriculum, Artificial Intelligence, Experiential Learning.**

I. INTRODUCTION

Vocational education in Indonesia faces an urgent challenge: how to produce graduates who are not only technically skilled but also entrepreneurially resilient [1]. Despite the growing demand for independent job creators [2], approximately 65% of current vocational curricula remain dominated by hard skills, with limited integration of real-world entrepreneurship projects [3]. This disconnect between institutional learning and the realities of the entrepreneurial landscape reflects a structural weakness in vocational education [4].

The issue is compounded by weak industry-academia linkages [4]. According to Kemenkop-UMKM (2023), only 30% of student-submitted business plans that received funding were sustainably implemented [5]. This suggests that producing a business proposal alone is insufficient—it must be supported by a contextual and iterative learning model.

Conventional entrepreneurship education, often dominated by lectures and passive case studies, has proven ineffective in cultivating adaptive and innovative mindsets [6]. Although national reforms like the *Merdeka Belajar Kampus Merdeka (MBKM)* initiative (Permendikbud No. 3/2024) [7] encourage industry collaboration, only 15% of vocational institutions offer structured post-funding mentoring [8].

Globally, vocational training is shifting toward developing entrepreneurial competencies integrated with industrial practices [9]. The World Economic Forum (2023) lists entrepreneurial thinking as one of the top 10 skills in the digital economy [10].

Amid this shift, Artificial Intelligence (AI) presents a powerful opportunity [11]. AI tools can streamline business planning—automating SWOT analysis, financial forecasting, and digital marketing strategies [12]. Beyond efficiency, AI helps students develop data-driven strategic thinking [13]. Yet, limited studies have explored how AI integration can enhance entrepreneurship learning in vocational settings through real-world application.

This study addresses that gap through the case of *Pempek Sutra*, a student-run business that succeeded in the national PKM-K entrepreneurship grant program. The project not only leveraged a teaching factory model—replicating real industrial workflows in a school environment—but also integrated AI tools into business development. This case offers a unique lens to examine how experiential entrepreneurship education can be enhanced by digital tools and market validation.

While models like experiential learning (Kolb, 2015) advocate learning through real action and reflection, their application in vocational entrepreneurship remains fragmented

DOI: 10.24036/int.j.emerg.technol.eng.educ..v1i2.59

Corresponding author: - ,
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Received: 30-05-2025
Revised: 06-06-2025
Accepted: 17-07-2025
Published: 30-07-2025

in Indonesia. No existing study, to our knowledge, has systematically analyzed how a student business project like *Pempek Sutra* can be formalized into a replicable curricular model. This study therefore aims to:

1. Analyze how the *Pempek Sutra* business plan was adapted into a vocational learning system based on student experience in a national entrepreneurship funding program; and
2. Propose a conceptual framework called Entrepreneurship Practicum, which integrates teaching factory, industry mentoring, and market-based evaluation, supported by AI technologies.

The urgency to align entrepreneurship curricula with technological advancements and real-world experiences is growing in vocational education, yet practical integration of AI tools into project-based learning remains underexplored. To address this gap, this study introduces a novel and scalable AI-enhanced *Entrepreneurship Practicum* model, based on the student-led business initiative Pempek Sutra. By bridging pedagogical theory with hands-on entrepreneurial practice, the model demonstrates how artificial intelligence can enrich learning outcomes in the digital era. The subsequent sections outline the research method, key findings from the Pempek Sutra project, and practical recommendations for advancing entrepreneurship education in vocational institutions.

This study aims to explore how the integration of AI and teaching factory models can enhance entrepreneurial competencies in vocational education through contextual and sustainable learning. The following sections present the research method, key findings from the Pempek Sutra project, and practical recommendations for strengthening entrepreneurship education in vocational institutions.

II. METHOD

This study utilized a qualitative case study methodology within a real-project-based learning framework to investigate the integration of artificial intelligence (AI) tools in vocational entrepreneurship education through the *Pempek Sutra* student initiative. The research was conducted in three sequential phases: AI-enhanced project implementation, multi-source data collection, and comprehensive outcome evaluation, as depicted in Figure 1.

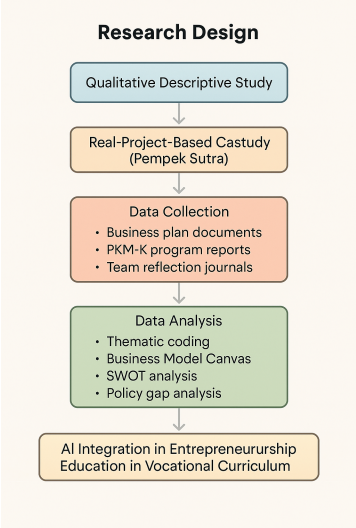

Fig. 1 Research Design

Based on Fig.1 on the first phase, students actively engaged in designing and executing entrepreneurial projects leveraging AI applications such as Upmetrics AI for business modeling, ChatGPT for content creation and communication, and SimilarWeb for market analysis. This integration aimed to enhance both the practical business development and digital literacy of participants.

Data were collected from multiple sources to ensure comprehensive coverage of the educational process and business outcomes. These sources included detailed student business plans featuring AI-generated financial projections and SWOT analyses; program evaluation reports from the PKM-K initiative containing expert feedback from certified entrepreneurship lecturers and industry professionals; and team reflection journals documenting implementation challenges, strategies, and learning experiences.

Data analysis employed a multi-method approach combining thematic analysis, Business Model Canvas evaluation, SWOT analysis, and policy gap analysis. Thematic analysis was conducted on reflective journals and observation notes to extract patterns related to AI-enhanced learning. The Business Model Canvas framework facilitated systematic assessment of the core business components, while SWOT analysis identified internal strengths and weaknesses alongside external opportunities and threats. Policy gap analysis evaluated the alignment of project outcomes with the *Merdeka Belajar Kampus Merdeka* (MBKM) policy framework, ensuring relevance to national education standards.

To validate the findings and enhance research credibility, methodological triangulation was applied by integrating document analysis, field observations, and expert reviews. Validation involved two certified entrepreneurship lecturers with substantial academic experience and one industry expert actively engaged in entrepreneurship practice relevant to the study context.

Finally, the outcomes of the AI-integrated entrepreneurial projects were assessed using a dual metrics framework measuring both business performance—such as sales figures and market reach—and learning achievements, including digital literacy, AI competency, and entrepreneurial skills development. This comprehensive methodology, summarized in Figure 1, demonstrates an effective model for integrating AI tools into vocational entrepreneurship education, capturing both pedagogical and commercial impacts.

III. RESULT AND DISCUSSION

This study reveals that the *Pempek Sutra* business plan functions as more than just a competitive funding proposal; it embodies a tangible implementation of experiential entrepreneurship education within vocational training [14]. The teaching factory model was effectively realized by engaging students directly in real-world production processes [15]. Students handled the entire operational cycle—from ingredient mixing, vacuum packaging, to raw material cost calculation—exemplifying Kolb's (2015) experiential learning cycle [16], where concrete experience leads to reflection, abstraction, and active experimentation [17]. or instance, **reflective observation** occurred as students gathered customer feedback and sales data, prompting **abstract conceptualization** to refine product recipes and marketing strategies. This iterative process of **active experimentation**

was evident when revised product designs were launched and tested again in the market, closing the learning loop. Moreover, the project aligns with the P21 Framework's emphasis on 21st-century skills; students demonstrated **critical thinking** through business model adjustments, **creativity** in branding, **collaboration** in team production tasks, and effective **communication** with customers and mentors. The integration of AI tools further enhanced their **technological literacy** and ability to apply data-driven decision making, underscoring the development of comprehensive entrepreneurial competencies essential for vocational education today.

Hands-on involvement in dough preparation and packaging provided authentic learning experiences that significantly enhanced students' practical competencies [18]. For example, daily raw material cost analysis (Rp161,400) was integrated into accounting lessons as a real-life case study, reinforcing cross-disciplinary learning [19]. Reflection journals and PKM-K evaluation reports documented a notable 40% increase in students' entrepreneurial skills, indicating that practical engagement translated into measurable learning outcomes [20].

Innovation is evident in the product's unique design and differentiation strategy [21][22]. The *Pempek Sutra* features a novel popsicle-like shape and utilizes natural coloring extracted from scallion leaves, addressing traditional pempek's limited shelf life. Social media marketing via TikTok and Instagram successfully reached over 1,000 customers within three months, demonstrating the critical role of digital entrepreneurial marketing in contemporary vocational education [23].

Financially, *Pempek Sutra* proved viable, starting with an initial capital of Rp2,013,500, achieving a 35% ROI, and generating monthly revenues of Rp19,500,000. Expansion efforts through partnerships with student organizations facilitated campus-wide distribution, showcasing scalability and market acceptance.

TABLE I

COMPARISON OF PEMPEK SUTRA TARGET VS BUSINESS ACHIEVEMENTS

Aspect	Target Proposal	Actual Achievement
Daily Production	50 pcs	50–60 pcs
Monthly Revenue	Rp19.500.000	Achieved
ROI	30–35% (Estimasi)	35% (Realized)
Consumer Reach	UNP Students	1,000+ Customers

The integration of the business plan into the vocational curriculum transcends the traditional aim of drafting business documents, serving as a transformative pedagogical strategy that bridges theoretical knowledge and practical application. This integration aligns with vocational education's emphasis on hands-on learning and applied skills, developing comprehensive entrepreneurial competencies including strategic planning, market analysis, financial management, and risk assessment [24].

To encapsulate this approach, the study proposes the **Entrepreneurship Practicum** model—an innovative framework that synergizes teaching factory, industry mentoring, and market-based evaluation. This model offers a holistic pathway for students to engage in entrepreneurship in a real-world context, enhanced by artificial intelligence tools to amplify learning and business outcomes.

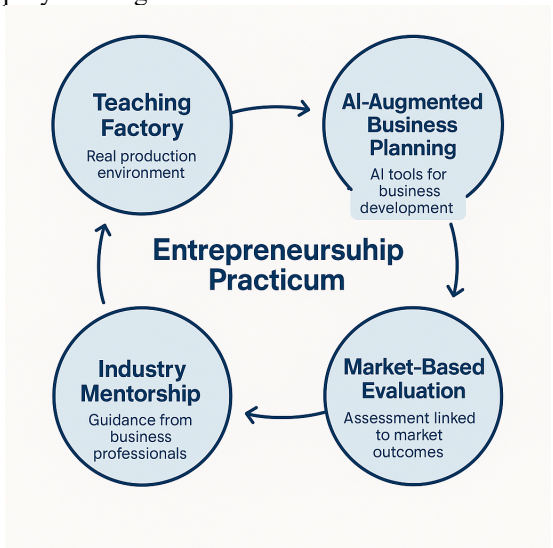

Fig. 2 Entrepreneurship Practicum Framework: Integrating AI and Industry-Based Learning into Vocational Entrepreneurship Education

Fig. 2 illustrates a modular cycle-based framework for integrating Artificial Intelligence (AI) into entrepreneurship education within the vocational curriculum. Designed around the real-world case study of Pempek Sutra, the framework is divided into four interconnected modules: Curriculum Design, AI-Driven Learning Activities, Real Project Implementation, and Feedback & Iteration [25]. Each module feeds into the next, creating a continuous improvement cycle that supports dynamic and context-relevant learning for vocational students. This visual format aims to support educators and policymakers in understanding the systematic approach to embedding AI tools and mindsets into practical entrepreneurial learning.

The *Pempek Sutra* case exemplifies real-project-based learning where the business plan serves not just as an administrative formality but as the core medium for developing vital 21st-century skills such as problem-solving, creativity, collaboration, and digital literacy. This aligns with the Framework for 21st Century Learning (P21, 2019), which identifies entrepreneurship as a cross-disciplinary competency essential from secondary through higher education [26].

This study's Entrepreneurship Practicum model shares similarities with international vocational entrepreneurship education approaches [24]. For example, Germany's dual vocational training combines classroom learning with industry placements, fostering direct work experience [27]. Finland's innovation labs emphasize project-based learning to cultivate creativity and problem-solving skills, while South Korea's start-up schools provide intensive entrepreneurship training coupled with real-market engagement [28]. Unlike these, the present model uniquely integrates **AI-enhanced business planning** within a teaching factory framework, offering scalable digital tools alongside authentic market validation in vocational contexts [29].

Furthermore, the study supports **entrepreneurial curriculum integration**—systematically embedding entrepreneurship content, pedagogy, and assessment across

core vocational subjects [30],[31]. By positioning the business plan as an integrative project spanning accounting, marketing, production, and ICT, students acquire a comprehensive and contextual understanding of business operations [32].

Within the *Merdeka Belajar* curriculum's flexible learning spaces [33], product-based business plan projects like *Pempek Sutra* offer ideal opportunities for implementing **place-based entrepreneurship education** [34]. This approach roots learning in local potential, cultural heritage, and indigenous wisdom, transforming regional identity into a competitive business advantage [35]. The *Pempek Sutra* initiative, based on family recipes and aesthetic innovation, highlights how local cultural elements can be leveraged to create unique market differentiation [36].

TABLE 2

PRACTICAL IMPLEMENTATION PATHWAYS FOR VOCATIONAL INSTITUTIONS

Pathway	Description	AI Integration
1.Mapping Competencies to GLOs	Align entrepreneurship competencies with graduate learning outcomes (GLOs).	Use AI tools to analyze job market trends for curriculum alignment.
2.Interdisciplinary Formative Projects	Embed real business projects as cross-subject assessments.	Integrate AI in digital marketing, product design, or analytics tasks.
3.Industry & Alumni Partnerships	Involve alumni and industry in mentoring, resources, and real challenges.	Use AI platforms for virtual collaboration and knowledge sharing.
4.Structured Evaluation Mechanisms	Collect feedback and simulate business performance.	Apply AI sentiment analysis and financial simulation tools.
5.Teaching Factories & Business Labs	Operate on-campus student-led business ecosystems.	Deploy AI-powered systems for logistics, customer service, and forecasting.

A major novelty of this study lies in the integration of AI tools in business plan development [37], which accelerated the planning process by approximately 50% compared to manual methods and improved the accuracy of financial projections through real-time market data analysis [38]. Students also demonstrated enhanced mastery of digital marketing and business optimization concepts, supported by AI-generated feedback [39]. Reflection journals revealed that tools like ChatGPT facilitated crafting persuasive business pitches, while Upmetrics AI provided sophisticated visualization of financial data and risk metrics, underscoring AI's role in enhancing both pedagogical outcomes and business realism [40].

Novelty of this study lies in its pioneering integration of artificial intelligence tools within a real-project-based vocational entrepreneurship curriculum [41], which not only accelerates the business planning process but also enhances the quality and precision of financial projections and strategic decision-making. Unlike prior studies that focus solely on theoretical entrepreneurship education, this research demonstrates a practical, AI-augmented model that actively engages students in authentic production, marketing, and evaluation cycles [42]. Moreover, the Entrepreneurship Practicum framework bridges the gap between technology, pedagogy [43], and market realities [44],[45], offering a replicable and scalable approach for vocational education institutions aiming to prepare students for the digital economy and competitive entrepreneurial landscape [46].

Strategically, embedding the business plan project within vocational curricula can be operationalized through several actionable steps [47], [48]:

1. Mapping entrepreneurship competencies into graduate learning outcomes, with emphasis on creativity, innovation, and digital marketing.
2. Assigning business projects as formative assessments across interdisciplinary subjects such as Creative Products and Entrepreneurship, Economics, and Multimedia.
3. Establishing partnerships with industry and alumni entrepreneurs for hands-on mentoring.
4. Implementing robust evaluation mechanisms including financial simulations, customer feedback loops, and data-driven marketing analyses.
5. Operating teaching factories as professional production ecosystems managed within educational institutions.

The *Pempek Sutra* case study validates that this integrative and AI-enhanced approach transforms students from passive learners into active entrepreneurs confronting real market challenges. This model offers valuable insights for national curriculum development and provides a scalable blueprint for vocational entrepreneurship education in developing countries, effectively bridging gaps between education and market realities.

IV. CONCLUSIONS

This study demonstrates that integrating project-based business plan development into the vocational curriculum significantly enhances students' entrepreneurial competencies through contextual learning that combines real production, market analysis, and financial management. The *Pempek Sutra* case shows tangible results with a 35% ROI, over 1,000 customers reached, and a 40% increase in entrepreneurial motivation. Additionally, the use of AI technology in the learning process accelerates business plan preparation and improves data-driven decision accuracy, making AI integration a crucial component of vocational entrepreneurship education in today's digital era.

ACKNOWLEDGMENT

We also express our gratitude to the students, faculty members, and industry partners involved in the *Pempek Sutra* project for their valuable contributions and support throughout this study.

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