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Framework for Culinary Entrepreneurship Learning System Integrating Pedagogy and Analytics

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Abstract

Entrepreneurship education in Indonesian vocational higher education remains constrained by theoretical approaches and generic learning management systems (LMS) that do not fully capture the multidimensional competencies required for entrepreneurial readiness. The culinary sector, which contributes nearly 42% of the creative economy's GDP and is dominated by micro, small, and medium enterprises (MSMEs), highlights the urgent need for tailored pedagogical and technological solutions. This study proposes a conceptual framework for a culinary entrepreneurship learning information system, designed by integrating Deep Learning pedagogy, Innovation Canvas, and learning analytics. Drawing on preliminary findings from focus group discussions with practitioners and surveys of student competence, the research employed a conceptual design methodology guided by human-centered design principles. The resulting framework maps stakeholder needs into system components, including competency dashboards, e-portfolios, gamified features, and analytics-driven monitoring of five core entrepreneurial competencies: mentality, management, legality, branding, and networking. The framework demonstrates how reflective pedagogy can be operationalized into an information system architecture, bridging the gap between entrepreneurship education and digital innovation. Academically, it extends the literature on integrating pedagogy and information systems, while practically, it offers a replicable blueprint for higher education institutions seeking to enhance graduate employability and entrepreneurial readiness. The novelty of this study lies in integrating deep learning pedagogy, innovation canvas, and learning analytics into a unified conceptual framework for vocational entrepreneurship education—an approach not previously applied in the culinary education context. Future research should focus on prototyping, usability testing, and empirical validation to ensure the framework's effectiveness and scalability.

Keywords: culinary entrepreneurship, deep learning pedagogy, e-portfolio, learning analytics, vocational education

1 Introduction

Vocational education in Indonesia has long faced the challenge of balancing theoretical instruction with practice-oriented learning [1]. While entrepreneurship education has been widely promoted, many programs remain overly focused on classroom-based lectures and business plan writing rather than authentic, experiential learning [2], [3]. As a result, graduates often struggle to translate knowledge into practice, particularly in industries such as the culinary sector that require not only technical production skills but also managerial literacy, branding, legal compliance, and networking. Existing learning management systems (LMS) widely adopted in universities, such as Moodle or Google Classroom, provide generic features for course delivery but rarely accommodate the specific competencies needed for entrepreneurial readiness [4]. This mismatch creates a gap between what students learn and what they need to succeed in entrepreneurial ventures.

To address this issue, emerging studies in vocational entrepreneurship education have sought to integrate diverse pedagogical and managerial frameworks to make learning more authentic and

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holistic [5]. Drawing on preliminary findings from focus group discussions with vocational lecturers and practitioners, and survey data on students' entrepreneurial competence, we developed a culinary entrepreneurship learning model that combines Deep Learning pedagogy, the DMAIC instructional cycle, and the Pentahelix collaboration framework. Deep Learning pedagogy emphasizes *mindful, meaningful, and joyful learning* to move beyond rote memorization toward reflective and contextual learning experiences [6]. The adoption of the DMAIC cycle—commonly applied in quality management—introduces a structured and iterative process for defining challenges, measuring competencies, analyzing gaps, improving interventions, and controlling outcomes [7], [8]. Meanwhile, the Pentahelix collaboration model incorporates universities, industry, government, communities, and media to strengthen ecosystem engagement and align student projects with real-world entrepreneurial contexts [9].

The model emphasizes five core dimensions of entrepreneurial competence: mentality, management, legality, branding, and networking. These dimensions echo prior findings that entrepreneurial resilience, managerial literacy, regulatory compliance, digital branding, and collaborative networks are decisive for sustaining micro and small businesses [10], [11], [12]. Preliminary pilot testing at the classroom level indicated that embedding these dimensions into structured learning cycles improved student self-confidence, entrepreneurial identity, and readiness to engage in business ventures. Such findings are consistent with global research highlighting that experiential and ecosystem-based learning significantly increases entrepreneurial intention among students [13], [14].

Although initial results are promising, the proposed model is still conceptual and lacks integration with a dedicated digital platform. Existing practices in vocational entrepreneurship education continue to depend on conventional assessment methods and fragmented documentation, which are inadequate for systematically mapping, recording, and analyzing student development across multiple competency domains. This highlights the necessity of a customized learning management system (LMS) or e-portfolio, enhanced with learning analytics, to evolve the model from a classroom-based innovation into a scalable solution for vocational higher education.

The lack of a specialized platform constitutes a significant gap. Generic LMS applications provide limited functionality for tracking entrepreneurial competence, while most e-portfolio tools are not equipped with analytics capable of capturing multidimensional skills [15]. In Indonesia, this issue is particularly relevant to the higher education performance indicators (Indikator Kinerja Utama, IKU), which prioritize graduate employability and entrepreneurial outcomes. Considering that more than 97% of the national workforce is employed by micro, small, and medium enterprises (MSMEs) and that the culinary sector alone contributes approximately 42% of the creative economy's GDP [16], [17], providing graduates with digitally monitored entrepreneurial competencies has both academic importance and strategic economic value.

Accordingly, this study is driven by a central research question: How can a culinary entrepreneurship learning information system framework be designed that integrates Deep Learning pedagogy with learning analytics. To address this, the study propose a conceptual framework grounded in the Innovation Canvas, intended to serve as the foundation for developing an LMS or e-portfolio specifically tailored to culinary entrepreneurship education. This framework advances information systems scholarship by applying human-centered design and learning analytics in a vocational context, while also offering practical pathways to strengthen entrepreneurship education in Indonesia and beyond.

2 Literature Review

2.1 Learning Management Systems and E-Portfolios in Vocational Education

Learning Management Systems (LMS) have become central tools in higher education for delivering instructional content, managing assessments, and facilitating communication between instructors and students [18]. Platforms such as Moodle, Blackboard, and Google Classroom are widely adopted due to their open-source nature, scalability, and user-friendly features [4]. However, in the context of vocational and entrepreneurship education, these generic LMS platforms often fail to capture the multidimensional competencies required by students. For example, while they support

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assignment submissions and grading, they rarely provide mechanisms for documenting experiential learning, industry engagement, or entrepreneurial skill development [15].

E-portfolios have been introduced as complementary tools to address this limitation. By allowing students to curate evidence of skills, projects, and reflections, e-portfolios can support self-directed learning and competency-based assessment [19]. Recent studies indicate that e-portfolios enhance employability by enabling students to showcase professional growth and entrepreneurial readiness [20]. Yet, most existing e-portfolios remain static repositories, lacking analytics features to monitor performance trends or provide feedback for continuous improvement. This limitation underscores the need for more advanced, analytics-enabled digital platforms tailored to the vocational and entrepreneurial context.

2.2 Human-Centered Design and Design Thinking in Information Systems

Designing effective educational technologies requires methodologies that prioritize user needs, usability, and contextual relevance. Human-Centered Design (HCD), as standardized in ISO 9241-210, emphasizes iterative design processes grounded in user participation, ensuring that systems are accessible, usable, and aligned with stakeholders' goals [21], [22], [23]. Similarly, Design Thinking has been widely adopted in education and information systems to encourage empathizing with users, defining challenges, ideating solutions, prototyping, and testing [24], [25].

In higher education, HCD and Design Thinking have been applied to design digital learning platforms, mobile applications, and e-learning tools that enhance engagement and adoption [26], [27]. Their relevance to entrepreneurship education lies in their ability to integrate diverse perspectives—including students, educators, and industry partners—into the design process. This participatory approach ensures that systems are not only technically functional but also contextually appropriate for tracking entrepreneurial competencies.

2.3 Learning Analytics in Higher Education

Learning Analytics (LA) refers to the collection, analysis, and reporting of data about learners and their contexts for the purpose of improving learning and teaching [15]. In higher education, LA has been used to identify at-risk students, personalize learning pathways, and provide real-time feedback to both learners and instructors. For example, dashboards that visualize student engagement and progress can help educators intervene early, while predictive models can forecast performance outcomes [28], [29].

The potential of LA extends to entrepreneurship education, where competence development is complex and multidimensional. By tracking performance across domains such as management, creativity, and networking, LA can provide actionable insights for students to refine their skills and for educators to tailor instruction [30]. However, empirical studies applying LA to entrepreneurial competence development remain scarce, signaling a critical research opportunity.

2.4 Innovation Canvas for Educational Technology Design

The **Innovation Canvas**, inspired by frameworks such as the **Business Model Canvas**, provides a structured approach to mapping stakeholder needs into features of educational technologies. It emphasizes aligning value propositions, customer segments, key activities, and resources to ensure that innovations are both feasible and impactful [25], [31], [32]. In the education domain, the Innovation Canvas has been used to design digital platforms that integrate pedagogical goals with technological functionality, ensuring that system features correspond to specific learning outcomes.

Applied to vocational entrepreneurship learning, the Innovation Canvas can serve as a bridge between pedagogical frameworks—such as Deep Learning pedagogy—and system features, such as competency dashboards, e-portfolio functions, and analytics engines. This systematic mapping ensures that digital platforms address the real needs of students, educators, and industry partners rather than offering generic functionalities.

2.5 Identified Gap

Despite advances in LMS, e-portfolios, human-centered design, learning analytics, and innovation frameworks, there remains a lack of integrative approaches that combine these elements for entrepreneurship education in vocational contexts. Existing LMS platforms are largely generic, e-portfolios are underutilized as analytic tools, and few studies apply learning analytics to entrepreneurial competence development. Moreover, while the Innovation Canvas has been employed

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in business and educational technology design, its application to entrepreneurship-focused information systems is still limited. This study addresses these gaps by proposing a conceptual framework for a culinary entrepreneurship learning information system that integrates Deep Learning pedagogy with learning analytics, structured through the Innovation Canvas approach.

3 Research Method

This study adopts a conceptual design approach, focusing on the development of a framework rather than the implementation of a working prototype. Conceptual design studies are widely used in information systems research because they provide structured models that can guide future system development, prototyping, and empirical testing [33], [34]. The framework proposed in this study builds on prior empirical findings from entrepreneurship education, particularly focus group discussions (FGDs) with practitioners and academics, as well as baseline surveys of student entrepreneurial competence. These earlier findings form the empirical basis for translating pedagogical models into system requirements.

The primary data sources for this study are drawn from research that identified key entrepreneurial competence gaps among vocational students in the culinary sector. FGDs with lecturers, alumni entrepreneurs, and industry partners revealed persistent challenges in mentality, management, legality, branding, and networking, while surveys with undergraduates provided quantitative measures of their entrepreneurial readiness. Together, these insights provide the foundation for designing a digital platform that directly addresses user needs and aligns with the realities of entrepreneurship education in vocational contexts.

The methodological approach combines principles of Human-Centered Design (HCD), the Innovation Canvas, and a Learning Analytics Pipeline. Guided by ISO 9241-210 standards, HCD ensures that the design process is iterative, participatory, and responsive to user needs. In this study, HCD is employed through empathizing with students and educators to identify learning challenges, defining the problem of limited digital systems for tracking entrepreneurial competence, and ideating potential solutions in the form of system features such as e-portfolios, competency dashboards, and analytics modules. To systematically translate these user needs into concrete system features, the study applies the Innovation Canvas framework. Originally derived from the Business Model Canvas, the Innovation Canvas provides a structured mapping of stakeholder expectations, value propositions, and technological functionalities, ensuring that the proposed platform effectively integrates pedagogical goals with digital innovation.

In addition, the study incorporates a conceptual pipeline for learning analytics to embed data-driven monitoring within the system design. The pipeline involves the collection of data from student activities, reflective journals, rubric-based assessments, and peer evaluations, followed by the application of descriptive and predictive analytics to monitor progress across the five competence domains. The output of this process is intended to be visualized in dashboards that provide real-time insights for both students and educators. As prior studies have shown, learning analytics can significantly enhance educational outcomes by identifying at-risk students, personalizing learning pathways, and providing actionable feedback [15]. Embedding analytics into the proposed framework thus moves beyond static documentation toward continuous, evidence-based competence development.

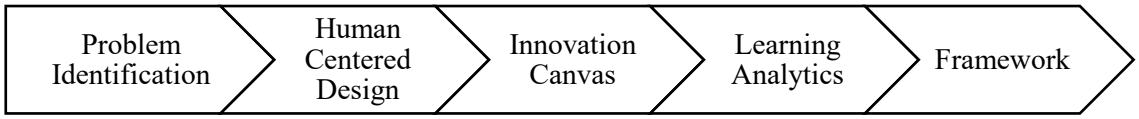

Figure 1 Research methodology

The overall flow of the research methodology begins with identifying the problem through preliminary data from FGDs and surveys, which highlight the gaps in entrepreneurial competence among vocational students. The next stage applies Human-Centered Design to empathize with user needs, define the system requirements, and ideate potential solutions. These insights are then structured using the Innovation Canvas to map stakeholder needs into specific system features. Finally, the Learning Analytics Pipeline is integrated to provide a mechanism for data-driven

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monitoring and evaluation. The culmination of this flow is the formulation of a conceptual framework that connects pedagogy, system design, and analytics into a coherent model for future implementation.

The expected outcome of this methodological approach is a conceptual framework for a culinary entrepreneurship learning information system. Rather than presenting a functional prototype, this framework offers a blueprint that details the relationships between pedagogical requirements, stakeholder needs, and technological features. It is designed to serve as a foundation for future system development and empirical validation, aligning entrepreneurship pedagogy with digital innovation in vocational higher education.

4 Results and Analysis

The proposed framework for a culinary entrepreneurship learning information system was developed by systematically aligning pedagogical requirements with information system design principles. Using the Innovation Canvas as a foundation, the framework identifies key stakeholders, value propositions, and technological resources necessary for supporting entrepreneurship education in vocational higher education. This design builds upon the preliminary pedagogical model developed in earlier studies, which is illustrated in Figure 2 below as the basis for translating entrepreneurship education into a digital system.

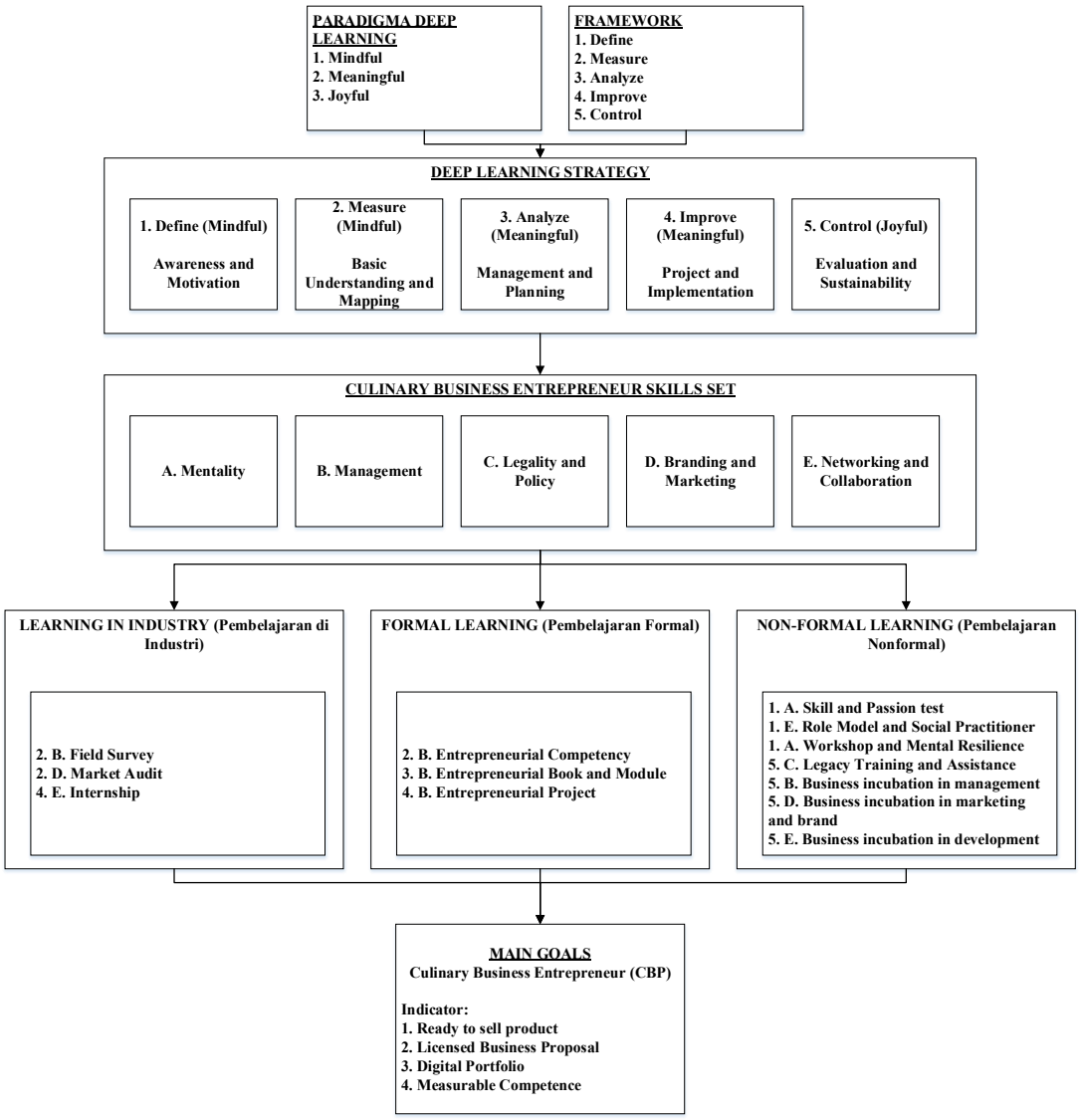

Figure 2 Preliminary study model

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From the perspective of Innovation Canvas mapping, the primary customer segments include students, lecturers, micro, small, and medium enterprises (MSMEs), and local government agencies. In Indonesia, MSMEs represent more than 97 percent of the national workforce and contribute around 61 percent to the GDP, with the culinary sector alone accounting for approximately 42 percent of the creative economy's GDP [16], [17]. Given this scale, the inclusion of MSMEs and government actors as stakeholders ensures that the platform is grounded in real economic needs. The framework offers value propositions in the form of personalized learning paths, competency dashboards, and e-portfolio showcases that enable students to track and demonstrate their entrepreneurial progress. Similar to findings, e-portfolios not only improve employability but also foster reflective practices in professional learning [19]. The system is envisioned to operate through web- and mobile-based LMS channels, with potential integration into social media platforms to strengthen student branding and networking strategies, which are crucial in Indonesia where more than 167 million people are active social media users [21].

The system architecture concept translates these components into an information flow. At the input stage, the platform collects diverse forms of student learning data, including quiz results, activity logs, rubric-based performance assessments, and reflective journals. Similar approaches have been effective in higher education settings where log data and peer evaluations have been used to monitor collaborative learning and engagement [15]. These inputs are processed through an analytics engine capable of clustering student progress and predicting entrepreneurial readiness. Predictive analytics has been widely applied in higher education to identify at-risk students and forecast academic success [30]. The outputs of the system are visualized in dashboards for students, monitoring reports for lecturers, and digital showcases that function as professional e-portfolios. This ensures that the platform does not merely store evidence of learning but transforms it into actionable insights.

Integration with Deep Learning pedagogy is central to the framework, ensuring that technological design reinforces pedagogical values. Mindful learning is supported by reflective features within the e-portfolio, where students record their experiences and self-assessments. Meaningful learning is embedded by incorporating real projects with MSME partners into the system, allowing students to document authentic entrepreneurial activities. This aligns with findings, who emphasized that authentic project-based learning significantly improves entrepreneurial intention [10], [35]. Joyful learning is encouraged through gamified features such as badges, progress trackers, and milestone achievements, which prior studies have shown to increase learner motivation and engagement in digital learning environments [36]. By embedding these three principles, the system promotes not only technical competence but also reflective and experiential learning.

The design of learning analytics features is another key contribution. The framework tracks the development of five core entrepreneurial competencies—mentality, management, legality, branding, and networking—by aggregating and analyzing student activity data. Both individual and group dashboards provide real-time progress tracking, while data-driven reports supply instructors with comprehensive overviews of student performance. Prior studies demonstrate that such dashboards can improve academic decision-making and enable early intervention [15], [37]. In the context of entrepreneurship education, analytics-driven monitoring supports continuous formative assessment, which is critical for preparing graduates to meet the challenges of MSME-driven economies.

In discussing its broader contribution, the framework demonstrates how a pedagogical model for culinary entrepreneurship can be operationalized into a digital information system. It bridges the gap between theory and practice by translating reflective pedagogy into measurable and analyzable data flows. The framework is highly relevant to the field of information systems research, as it intersects with domains such as knowledge-based systems, human–computer interaction (HCI), and intelligent systems for education. Moreover, its practical implications are significant for vocational higher education institutions in Indonesia, particularly as a pilot project at Universitas Negeri Yogyakarta (UNY), which could serve as a model for other universities seeking to align their entrepreneurship programs with national performance indicators (IKU) on graduate employability.

Nevertheless, the framework remains conceptual and has not yet been implemented as a functional prototype. While it provides a detailed mapping of pedagogical and technological requirements, further research is required to develop a working system. Future studies should include

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prototyping, usability testing, and iterative refinement using human-centered design methods to ensure that the system meets user expectations. Longitudinal research is also recommended to examine how analytics-driven monitoring influences graduate entrepreneurial success and business sustainability over time.

5 Conclusion

This study proposed a conceptual framework for a culinary entrepreneurship learning information system by integrating the Innovation Canvas approach with a learning analytics pipeline. The novelty of this framework lies in its integration of pedagogical and analytical dimensions, providing a new perspective that connects reflective learning design with data-driven competence tracking in entrepreneurship education. The framework successfully mapped stakeholder needs into system design components, providing a structured blueprint that aligns pedagogical goals with technological functionalities. By embedding the principles of Deep Learning pedagogy—mindful, meaningful, and joyful learning— within the system, the framework ensures that experiential and reflective aspects of entrepreneurship education are reinforced through digital features such as competency dashboards and e-portfolios.

The academic contribution of this study lies in extending the literature on the integration of pedagogy and information systems within vocational education, particularly in entrepreneurship learning contexts. Practically, the framework offers higher education institutions a replicable blueprint for developing specialized LMS or e-portfolio systems tailored to the needs of vocational students and entrepreneurial ecosystems.

Nevertheless, the study remains conceptual in nature. Future research should focus on developing and testing a functional prototype, conducting usability evaluations through a human-centered design approach, and validating the framework in diverse institutional and regional contexts. Such efforts will help ensure the scalability, adaptability, and long-term impact of the proposed system in preparing graduates for entrepreneurial success in the culinary sector and beyond.

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