Journal of Education and Islamic Management
EmaiL: jurnal-benchmarking@uinsu.ac.id
Available online at http://jurnal.uinsu.ac.id/index.php/hijri

DEVELOPING CREATIVITY IN VOCATIONAL HIGH SCHOOL (SMK) CULINARY ARTS STUDENTS TO ENHANCE PRODUCT INNOVATION: A SCOPING REVIEW

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Received: 18-12-2025
Revised: 19-12-2025
Accepted: 30-01-2026

Abstract
Rapid technological advancement and shifts in learning paradigms require vocational education, particularly in the culinary field, to continuously innovate in order to enhance students' creativity and product development skills. Creativity and innovation are essential competencies for Vocational High School (SMK) students to remain competitive in the context of Industry 4.0. This study employs a systematic literature review to examine learning strategies that effectively promote creativity and culinary product innovation in SMK. A total of eight peer-reviewed scientific articles were analyzed, focusing on the implementation of Project-Based Learning (PjBL), the integration of Virtual Reality (VR) and gamification, and contextual learning approaches based on local culture. The findings indicate that PjBL contributes significantly to the development of students' creative thinking, collaboration, and problem-solving abilities through authentic project experiences. Furthermore, the use of VR and gamification enhances learning motivation, student engagement, and reflective thinking during the learning process. In addition, the incorporation of local cultural elements strengthens the contextual relevance and social value of culinary products, allowing students to connect learning outcomes with real-world and cultural contexts. Collectively, these approaches create an effective learning environment that supports meaningful, technology-enhanced, and authentic culinary education. The practical implication of this study highlights the importance for SMK teachers to design integrated learning environments that combine project-based activities, digital simulations, and gamified elements as a sustainable creative learning ecosystem aligned with the demands of Industry 4.0.

Keywords: creativity, product innovation, culinary vocational school, Project-Based Learning, Virtual Reality, gamification..

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INTRODUCTION

The changing dynamics of the creative industry demand that vocational education institutions, specifically Vocational High Schools (SMK) in the culinary field, prepare graduates who are not only technically competent but also adaptive and innovative. In this context, creativity is no longer viewed as an additional skill but rather as the core of culinary expertise. A creative student possesses the capacity to discover new solutions, modify food

ingredients, and create culinary product innovations that hold both cultural and economic value.

Amabile (1996) defines creativity as the ability to produce novel works that are valuable, both aesthetically and functionally. In the culinary world, creativity serves as the foundation for the food innovation process, where new ideas, modern cooking techniques, and local values blend to produce unique and competitive products. Furthermore, Csikszentmihalyi (1996) adds that creativity emerges when individuals are in a state of *flow*—a condition where skills and challenges meet in balance within a meaningful learning experience.

Digitalization and the integration of learning technology have become the primary drivers of innovation in vocational education. Research by *Bouck et al. (2025)* demonstrates that non-immersive Virtual Reality (VR) can assist students with special needs in mastering life skills such as cooking. Furthermore, research by *Filothei Manalu (2025)* confirms the effectiveness of the Project-Based Learning (PjBL) model in improving learning outcomes and creativity among culinary students at SMKN 6 Surabaya, while *Winanti et al. (2024)* found that VR-based gamification enhances motivation and innovation in culinary learning.

The synergy between PjBL, VR, and gamification illustrates a new direction for vocational education, oriented toward forming a creative mindset, adaptive abilities, and the courage to experiment. This approach aligns with the spirit of *Merdeka Belajar* (Emancipated Learning), which emphasizes students' freedom to explore and create. Therefore, this literature review aims to systematically examine learning strategies and empirical results that contribute to the development of creativity and culinary product innovation in Vocational High Schools.

RESEARCH METHOD

This study applies a Systematic Literature Review (SLR) to construct an integrated understanding of how creativity and culinary product innovation are developed within Vocational High School (SMK) education. Rather than merely summarizing existing studies, the SLR is designed to identify recurring instructional patterns, technological affordances, and contextual mechanisms that later form the basis for the analysis in the Results and Discussion sections. The review focuses on peer-reviewed articles published between 2021 and 2025 to ensure relevance to contemporary vocational learning challenges in the era of digital transformation and Industry 4.0.

The review process followed three sequential and analytically driven stages. First, the identification stage applied strict inclusion criteria to select studies that explicitly examined creativity, innovation, or instructional interventions in culinary vocational education. Second, during the data extraction stage, each study was analyzed to capture key variables that directly inform the results discussion, including learning models, technological tools, learner engagement, creative outcomes, and reported instructional impacts. Third, a thematic synthesis was conducted to cluster findings into core analytical themes that structure the Results section, namely: (1) project-based and experiential learning models, (2) technology-enhanced learning through virtual reality and gamification, and (3) contextual and cultural factors shaping culinary innovation.

To reinforce analytical consistency, this SLR integrates evidence from three representative studies that exemplify each thematic category discussed in the results. *Filothei Manalu (2025)* provides empirical evidence through a quasi-experimental non-equivalent control group design demonstrating the effect of Project-Based Learning (PjBL) on students' creativity and learning outcomes in culinary programs at SMKN 6 Surabaya. Bouck et al. (2025) contribute a single-case study perspective illustrating how non-immersive virtual reality supports procedural learning, skill generalization, and reflective

practice. *Winanti et al. (2024)* complement these findings through a conceptual and simulation-based study that integrates gamification and virtual reality to enhance motivation and sustained engagement in culinary learning.

The convergence of these studies allows the Results and Discussion to interpret creativity as a multidimensional learning outcome shaped by authentic project engagement, experiential digital simulation, and motivational learning design. PjBL emphasizes collaboration and real-world problem solving, VR facilitates repeated practice and reflection, while gamification sustains learner involvement—patterns that are systematically examined in the subsequent analysis.

All data were analyzed qualitatively using narrative synthesis to compare similarities, contrasts, and instructional implications across studies. This analytical strategy ensures that the discussion of findings is grounded in methodologically coherent evidence and supports the formulation of practical and theoretical implications for innovative culinary education in SMK.

RESEARCH RESULTS AND ANALYSIS

Results

Summary of Previous Research Studies

The review of the eight articles reveals a thematic consistency regarding the role of creativity as the core of the vocational learning process in the culinary field. Five primary studies highlight the pedagogical aspects and cultural contexts that support the formation of creativity, while three additional studies expand the scope to include digital technology approaches and interactive learning.

Previous research, such as that conducted by *Febriani et al. (2021)* and Sutianah (2021), demonstrates that culinary creativity plays a vital role in increasing student engagement within the Teaching Factory framework and fostering entrepreneurial skills. *Sukerti and Marsiti (2024)* further add that the integration of local culture through Project-Based Learning (PjBL) can foster a sense of identity pride as well as divergent thinking abilities.

The research by *Bouck et al. (2025)* enriches these findings by showing how non-immersive Virtual Reality (VR) is capable of enhancing students' life skills within a cooking context, particularly for students with special needs. These findings prove that digital simulation-based learning can improve work accuracy and the ability to generalize skills to the real world.

Meanwhile, *Filothei Manalu (2025)* found that the application of PjBL at SMKN 6 Surabaya significantly increased technical skills, creativity, and innovation in culinary product processing. This model is proven to foster a spirit of collaboration and responsibility toward work outcomes. *Winanti et al. (2024)* added a motivational dimension by developing gamification-VR based culinary learning, which successfully increased student interest, participation, and awareness of the importance of technology in the modern world of gastronomy.

Table 1. Summary of Previous Research Studies

Researcher & Year	Design & Subjects	Research Focus	Key Findings	Implications
Febriani et al., 2021	Quantitative Experimental	Culinary student creativity through Teaching Factory	Improvement in entrepreneurial skills and creativity	Authentic practice models support product innovation
Sutianah, 2021	Qualitative	Industry-based learning in SMK	Industry collaboration	School-industry relationships are vital for creativity

			enriches culinary ideas	
Sukerti & Marsiti, 2024	Descriptive Qualitative	Local culture-based PjBL	Increased creativity based on local wisdom	Contextual learning fosters originality
Bouck et al., 2025	Single-case study	Use of non-immersive VR	Improved cooking skills & generalization	VR technology is effective for practical learning
Filothei Manalu, 2025	Quasi-experimental	Implementation of PjBL	PjBL enhances creativity & learning outcomes	PjBL is highly relevant for culinary students
Winanti et al., 2024	Conceptual study	Gamification & VR in culinary arts	Increased student motivation & participation	Gamification fosters technopreneurship

Source: *Synthesized literature results (2021–2025).*

Analysis

The six studies demonstrate an interconnectedness between active learning, the use of technology, and the strengthening of creativity. The studies by Bouck et al. (2025) and Winanti et al. (2024) expand the traditional focus by incorporating VR technology, while Filothei (2025) reinforces the relevance of PjBL as a primary pedagogical approach.

Definition and Measurement of Creativity

Generally, creativity within the context of culinary education is defined as the ability for divergent thinking that produces new, original, and applicable ideas. The measurement of creativity does not rely solely on psychometric scales but is also based on the observation of processes and the culinary products generated by students. Febriani et al. (2021) utilized a Likert scale with indicators of fluency, flexibility, originality, and elaboration. Sukerti & Marsiti (2024) utilized student responses to PjBL worksheets. Bouck et al. (2025) and Winanti et al. (2024) emphasized practical skill performance and active participation in digital simulations.

These findings indicate a paradigm shift from merely "measuring creative ideas" toward "observing the creative process." Creativity in culinary education is performative—it is evidenced by how students explore local ingredients, modify recipes, and present products that hold both aesthetic and economic value.

Table 2. Definition and Measurement of Creativity in Culinary Learning

Researcher	Definition of Creativity	Instrument/Measurement	Dominant Indicators
Amabile (1996)	Ability to produce valuable ideas	Product-based assessment	Originality, aesthetic value
Csikszentmihalyi (1996)	Individual–environment interaction	Observation of *flow* state	Full engagement, balanced challenge
Febriani et al. (2021)	Student divergent ability	4-aspect Likert scale	Fluency, flexibility, elaboration
Filothei Manalu (2025)	Creativity through projects	Product assessment rubric	Recipe innovation, collaboration
Bouck et al. (2025)	Digital adaptive skills	VR performance observation	Accuracy, reflection on action
Winanti et al. (2024)	Game-based motivation	Activity observation	Enthusiasm, healthy competition

Source: *Compiled and adapted from literature (2021–2025).*

Analysis:

The measurement of creativity now emphasizes **performative processes** rather than just abstract ideas. The use of VR and gamification allows for the direct observation of creative learning dynamics.

Synthesis of Findings and Thematic Analysis

The integrated results from the eight studies reveal four primary themes:

1. Innovative Learning Models as Catalysts for Creativity

   PjBL, Teaching Factory, and gamification-based learning are proven to foster curiosity, collaboration, and responsibility. Project-based approaches encourage students to learn from real-world experience and develop ownership over their work (Filothei, 2025; Sukerti & Marsiti, 2024).

2. Digital Technology as a Facilitator of Creative Learning

   The use of virtual reality—both immersive and non-immersive (Bouck et al., 2025; Winanti et al., 2024)—expands the students' space for exploration, providing simulations that are safe, engaging, and contextualized to modern industry needs. This technology facilitates learning by doing within a digital space without losing practical aspects.

3. Integration of Soft, Hard, and Entrepreneurial Skills

   Culinary creativity develops optimally when students master not only technical skills (hard skills) but also critical thinking, communication, and innovation (soft and entrepreneurial skills), as shown by Sutianah (2021) and Febriani et al. (2021). This aligns with the demands of the culinary industry, which prioritizes product uniqueness alongside market sensitivity.

4. Contextualization of Culture and Local Industry

   Studies by Sukerti & Marsiti (2024) and Filothei Manalu (2025) demonstrate that learning which incorporates local culture—such as the Megibung tradition or regional specialty foods—increases the relevance and meaning of learning. In this sense, creativity becomes not only personal but also social and cultural.

Table 3. Synthesis of Key Findings and Their Implications

Key Theme	Synthesis of Findings	Implications for Culinary SMK
Innovative Learning Models	PjBL, Teaching Factory, and gamification effectively foster collaboration and responsibility.	Teachers need to develop authentic team-based projects.
Digital Technology	VR enhances exploration and reflection in learning.	Technology integration must be accompanied by teacher guidance.
Soft–Hard Skills Integration	Creativity grows from the synergy of technical and social skills.	The curriculum must balance practice and reflection.
Local Cultural Context	Culture-based learning enriches meaning and identity.	Innovative culinary products can preserve local wisdom.

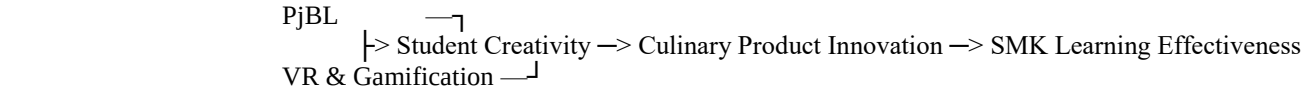
Source: *Author's synthesis based on 8 articles (2021–2025).*

General Synthesis

The integration of findings from various studies indicates that developing creativity and culinary product innovation in SMK students requires a multidimensional approach. The PjBL model fosters collaboration and critical thinking; VR expands explorative and reflective capabilities; while gamification strengthens learning motivation and persistence.

These three approaches complement one another: PjBL provides a real-world context, VR offers safe and engaging simulative experiences, and gamification provides the psychological drive to continue learning and innovating. These results support the conclusion that culinary students' creativity cannot be developed linearly, but rather through learning experiences that integrate cognition, affect, and action within both real-world and digital contexts.

Conceptual Diagram



The diagram above illustrates the synergistic relationship between PjBL, VR, and gamification as the driving factors of creativity, leading to improved product innovation and learning effectiveness.

Discussion

Overview of Findings

The findings confirm that creativity development is not the result of a single intervention, but a product of simultaneous interaction between instructional design (e.g., PjBL and Teaching Factory), educational technology (e.g., VR and gamification), and cultural/local industry contexts. This is consistent with literature highlighting the multidimensional nature of creativity (Amabile, 1996; Csikszentmihalyi, 1996).

Theoretical and Empirical Integration

The findings align with Amabile's (1996) components of creativity: expertise, creative processes, and motivation. PjBL supports the "expertise" and collaboration aspects, while VR and gamification reinforce the motivational components, creating conditions conducive to the "flow" state described by Csikszentmihalyi (1996). Furthermore, the results resonate with the Investment Theory (Sternberg & Lubart, 1999), where students "invest" in novel ideas despite initial unpopularity—evidenced by their courage to experiment with new recipes.

The Role of PjBL, VR, and Gamification

PjBL: Provides an authentic framework for problem-solving and fosters "ownership" of the work.

VR (Non-immersive): Serves as a safe medium for repetitive psychomotor practice (e.g., cooking techniques) without real-world risks, supporting the generalization of skills.

Gamification: Increases persistence through level structures, instant feedback, and healthy competition.

Soft Skills, Entrepreneurship, and Local Culture

Culinary creativity is deeply tied to soft skills (communication and project management) which are crucial for commercializing ideas (Febriani et al., 2021). Additionally, incorporating local wisdom (e.g., regional culinary traditions) adds a layer of cultural authenticity and market appeal to the innovative products created by students.

Pedagogical Implications and Challenges

For SMK teachers, this necessitates a paradigm shift from procedural teaching to project-and-technology-based learning. However, implementation faces real obstacles: infrastructure limitations, teacher technological capacity, and development costs. Since many studies are case-based or quasi-experimental (Bouck et al., 2025; Filothei Manalu, 2025), generalizations should be made with caution.

Literature Gaps and Future Research Directions

This review identifies several research gaps: 1) the need for longitudinal studies to assess the sustainability of innovation; 2) large-scale quantitative research comparing the combined effects of PjBL–VR–Gamification; 3) cost-benefit analyses for rural schools; and 4) the development of standardized yet contextual creativity assessment methods for vocational education.

Final Reflection

Overall, the literature demonstrates the strong potential of combining project-based pedagogy and digital technology to foster creativity in culinary SMK. However, practical success requires a systemic approach: teacher training, infrastructure support, industry collaboration, and assessments that balance both process and product. By addressing these factors, SMK can become incubators for culinary innovation that are both economically and culturally relevant.

Conclusion and Recommendations

This study concludes that the development of creativity in culinary Vocational High School (SMK) students is highly effective when supported by a combination of Project-Based Learning (PjBL), Virtual Reality (VR), and Gamification.These three elements are mutually reinforcing: (1) PjBL builds authentic and collaborative experiences. (2) VR expands the scope for practical exploration and (3) Gamification increases motivation and learning persistence.The integrated implementation of this model contributes to an increase in culinary product innovation, learning effectiveness, and the students' *technopreneurship* spirit.

Recommendations:

1. SMK Teachers are encouraged to integrate local culture-based projects with simple VR media.
2. Educational Institutions need to provide technology training for vocational teachers.

Future Research should empirically assess the effectiveness of the PjBL–VR–Gamification combination within a classroom setting

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