



Food Processing Learning Strategies for Vocational High School Students Majoring in Culinary Arts in Tondano, Minahasa Regency: Opportunities and Challenges

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Abstract: This study aims to analyze learning strategies for processing food applied to students of Vocational High School (SMK) majoring in culinary arts in Tondano, Minahasa Regency, and to examine the opportunities and challenges faced in the implementation process. Research: This use-method study literature with a qualitative approach combined with contextual analysis. Search article in the Scopus database, with publications from 2020–2026, using the keywords "food", "process", and "vocational" to obtain relevant literature on learning to process food in vocational education. Selected articles were then analyzed using a bibliographic use tool, Soft VOSviewer, through network visualization to map interword relatedness, identify key themes, and see the trend of topic research. Research results show that learning about food in vocational education is closely related to learning strategies, student and teacher roles, industry relevance, and learning evaluation results. Visualization network confirms that learning is not only process-oriented but also results-oriented, in the form of a product that is applicable and useful. Findings. This emphasizes the importance of learning contextual, practice-based skills for vocational school students majoring in culinary arts. If associated with the context of Tondano, Minahasa Regency, there is a big opportunity to develop learning based on local potential, such as traditional food materials, local agricultural practices and animal husbandry, as well as Minahasa culinary culture. However, the challenge still faced, including limitations, means practice, lack of innovation, a gap between the curriculum and industry needs, as well as the influence of modern culinary trends. Therefore, adaptive, collaborative, and learner-based learning strategies are needed. wisdom local to be sustainable.

Keywords: Processing Food, Vocational School Students Majoring In Culinary Arts, Learning Strategies, Tondano Minahasa Regency, Vosviewer

Introduction

The teaching technique processing food in an effective way for vocational school students majoring in culinary arts, a comprehensive approach is required, integrating pedagogical strategies, utilizing technology, and strengthening experiential learning (Yudhanto et al, 2023). Approaches such as blended learning, which combine face-to-face and online learning, can increase students' involvement and understanding in food processing. In addition, developing critical thinking, problem-solving, and reflection through collaborative learning, modeling, and reasoning is essential for equipping students to face real-world challenges in the culinary field (Handayani et al, 2020) (Kumar et al, 2023). Utilization of technology learning, including digital media and simulation, can create an

experience that is more interactive and approachable, and work, actually, although still requiring competent educators and adequate facilities.

On the other hand, direct experience is the main element in learning to process food. Activities, practice, training, and simulation of the world of work allow students to apply theoretical knowledge in real-world situations, thereby enabling the optimal development of technical skills and self-confidence (Gebremeskel, 2023) (Handayani et al, 2021) (Karimov et al, 2024). Strengthening learning through local context, culture, and wisdom can also increase relevance and motivation among students. Although there is still a challenge in the form of limitations in source power and systems assessment that has not been fully reflected in competence practice, the application of integrated, contextual, and innovative learning strategies has the potential to increase the quality of learning as well as readiness of Vocational school students majoring in culinary arts.

Processing education food for vocational school students majoring in culinary arts, with the opportunity to prepare graduates who are ready to enter the world of work. Through vocational education, students can develop 21st-century skills, such as working on a team, solving problems, and processing food through practical, applicable learning (Gebremeskel, 2023) (Yudhanto et al, 2023). Opportunities: This is further strengthened by partnerships between schools and industry in food processing, such as internship programs, work-based learning, and opportunities to study directly in the industrial world. Collaboration not only gives students real experience but also helps align the curriculum with industry needs, so that the competencies acquired are more relevant to job-market demands. In this context, mastery of culinary basics, understanding of food security, business management, culinary ability, communication, and an adaptive attitude to change are important competencies that need to be developed in an integrated way.

On the other hand, education in processing food also faces various challenges that can hinder effective learning. Social factors, such as the economy, students, limitations of the PowerSchool source, a lack of practice facilities, and limited access to technology and teaching materials, pose the main constraints on the implementation of vocational education (Pedrini et al, 2025) (Ujjaman et al, 2025). In addition, the industry's development trends include sustainability, innovation in food technology, and increased demand for healthy food. Update the curriculum sustainably. Therefore, this is a necessary strategic effort that involves strengthening partnerships with local industry, developing an adaptive curriculum aligned with technology and market trends, and providing adequate learning support. With the approach said, education in food processing at a culinary vocational school can optimize existing opportunities and minimize challenges, so that capable students can produce competent and empowered graduates who are competitive.

The culinary arts expertise program at Tondano Vocational School, Minahasa Regency, is designed to equip students with the skills and competencies needed to be empowered to compete in the culinary industry (Maukar et al, 2018). Curriculum learning emphasizes mastery of competencies relevant to the profession of culinary, such as creativity, cooking skills, application of hygiene and food safety, aesthetics and presentation, insight into business, interpersonal skills, managerial skills, and leadership (Auliana, 2019). Learning is directed not only to the theoretical aspect but also to practice

through real-world scenarios, so that students can develop innovative and adaptive learning skills based on experience. This is in line with character education in vocational education that emphasizes readiness for work and mastery of skills applicable in accordance with industry standards.

In addition, the culinary arts program at Tondano Vocational School is designed to align with industry needs and development through collaboration with partner businesses, culinary activities, internships, field practice, and on-site training (Elly et al, 2024). Work becomes an important part of preparing students entering the world of work, at the same time increasing the opportunities for graduates. Work: The same with restaurants and businesses that cater to local help, bridging the world of education and the world of work. Support experienced educators in the field of culinary, as well as a commitment to professional development and sustainability, to increase the quality of learning. Supported by facilities like a kitchen and a laboratory, adequate culinary training, and access to study resources, this program provides an environment that supports optimal learning, mastery, and competence. It prepares students to address industry service challenges professionally. Based on the analysis of various literature, further research is needed to determine the opportunities and challenges faced in the process of implementing food processing learning strategies for culinary arts students at Vocational High Schools (SMP) in Tondano, Minahasa Regency. Therefore, this study will analyze the food processing learning strategies applied to culinary arts students at Vocational High Schools (SMP) in Tondano, Minahasa Regency, and to examine the opportunities and challenges faced in the implementation process.

Methodology

Study this use method: study literature with a qualitative approach combined with contextual analysis. Search article done through the Scopus database, with publications from 2020 to 2026, using the keywords "food", "process", and "vocational" to obtain relevant literature on learning to process food in vocational education (Figure 1). Selected articles were then analyzed using a bibliographic use tool, Soft VOSviewer, through network visualization to map interword relatedness, identify key themes, and see the trend of topic research. Furthermore, the results are qualitatively mapped to the main research findings. Analysis results: This is then associated with opportunities and challenges in learning to process food in Tondano, Minahasa Regency, with consideration of potential local factors such as availability of food materials and culinary resources, as well as challenges that include limitations in means of practice, availability of human power sources, and suitability with industry needs. Approach: This allows study do not only describe trends and findings scientifically globally, but also to produce an applicable and relevant understanding for the development of learning strategies for processing food in the culinary arts department of vocational schools in the local context.

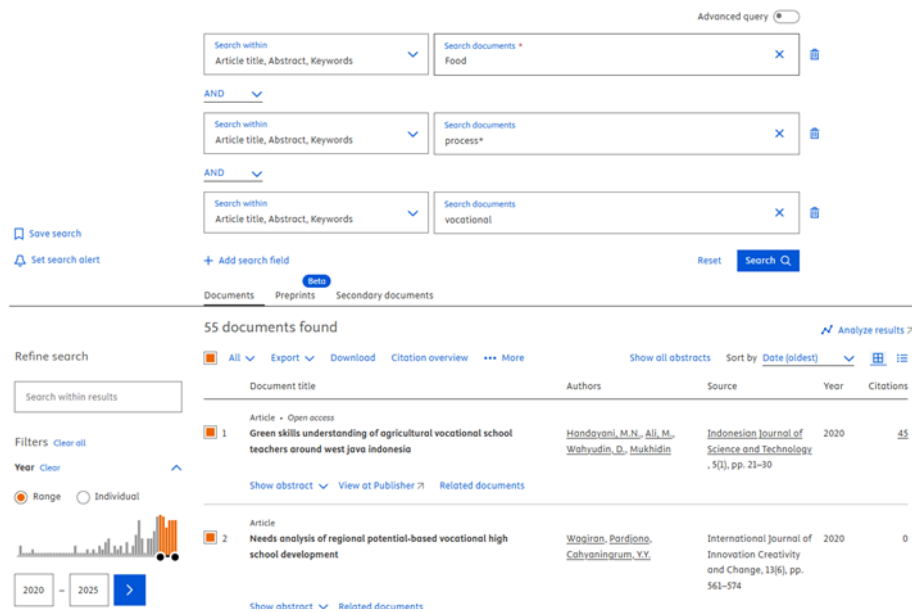


Figure 1. Search results about food processing learning strategies for vocational high school students

Result and Discussion

Table 1. The results of the literature search are summarized in Table 1 below

No	Aspects / Themes	Key Points	Key Findings / Benefits	References
1	Development Skills Problem-Solving Skills	Analogizing, Modelling, Reasoning, Arguing	Skills solution problem: the student is still at the moderate level, so they require more directed learning to improve.	(Techanamurthy et al, 2018)
2	Competency Integration Professional	Contextual Learning Tools	Develop device-based contextual learning with the world of hotels, restaurants, and services to increase the relevance and effectiveness of learning.	(Legahati, 2019)
3	Source Study Specific	Fusion Food Pocket Book	Book proven fusion food pocket, feasible and effective as a source. Study practical and relevant for students.	(Lestari & Komariah, 2020)
4	21st Century Learning Media	AR-Based Learning Media	Augmented Reality-based media increases skill practice and readiness. Work through interactive, real-time, simulation-accurate learning.	(Mahanani et al, 2025)
5	Learning model Cooperative	Think Pair and Share	This model increases motivation and improves students' study results, as demonstrated by learning about healthy food made from fresh vegetables.	(Mahyiddin, 2019)
7	Blended Approach	Learning OP + DP (Face to Face + Online)	A combination of live and recorded demonstrations is more effective than traditional lectures in increasing understanding and application of knowledge.	(Abdulsalam et al, 2017)
8	Project-Based Learning	Hands-on Activities	Learning-based projects help develop skills, experiments, and understanding of food security and food processing.	(Huang et al, 2025)
9	Education & Culinary	Skills Food Literacy Programs	Literacy program: increase the ability to select, prepare, and consume healthy food) (support the welfare and professional competence of students.	(Rhea et al, 2021)

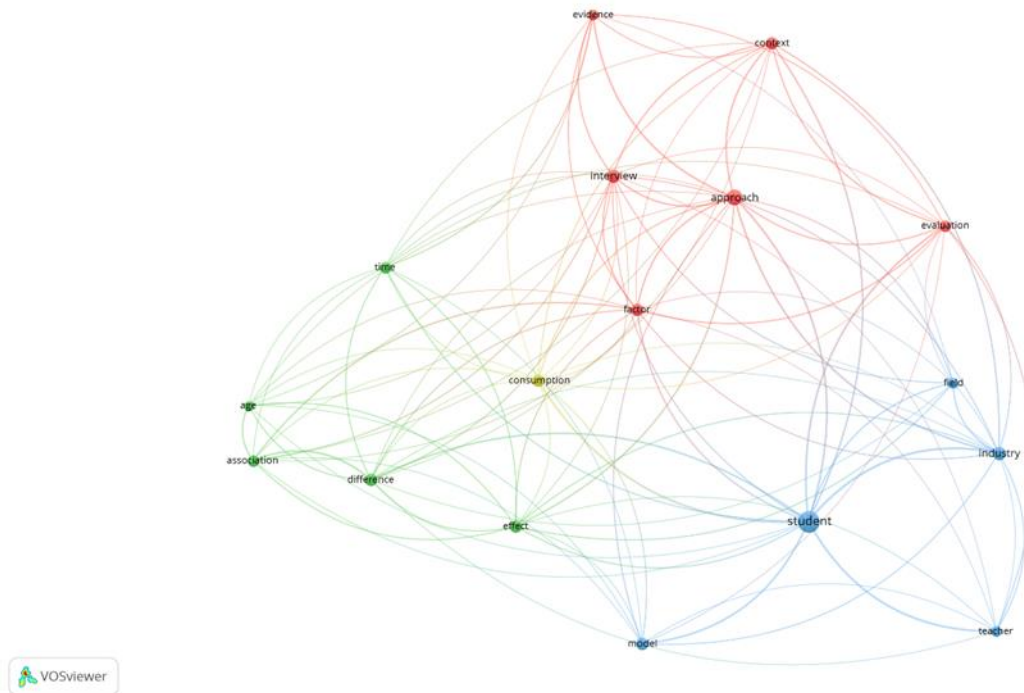


Figure 2. VOSviewer network visualization

The picture is a map-generated keyword network (network visualization) with VOSviewer, which shows the conceptual connections between topics in gathering article research (Figure 2). Each node (point) represents a keyword) (the size of the node indicates the level of occurrence/recurrence) (the connecting lines show relatedness between keywords) (whereas the color marks the cluster theme, with mutually supportive research close together.

Description Clusters in the Image

1. Cluster red (approach and evaluation learning): Consists of keywords such as approach, interview, evaluation, context, evidence, and factors. Cluster: This describes the focus research on the approach to learning, methods of data collection, and the evaluation of the effectiveness of the strategy in the context of education.
2. Cluster blue (subject and environment education): Contains the keywords student, teacher, field, industry, and model. Cluster: This shows the relatedness between students and teachers, the application of learning models, and relevance to the industrial world, which is very typical of vocational education, such as in vocational schools.
3. Cluster green (characteristics and impacts) learning): Consists of age, association, difference, effect, and time. Cluster: This represents differences in students' characteristics, influences time, and impacts or affects learning outcomes.
4. Keywords connector (yellow): The word consumption is in the central position as an intercluster connector, which can be interpreted as the result of the learning process of processing food, namely the product consumed or the assessment of its quality.

Keyword network map the relevant study. This is about learning strategies for processing food for vocational school students majoring in culinary arts, because it shows a strong connection between the approach to learning, subject education, and the results achieved (Mahanani et al, 2025) (Techanamurthy et al, 2018). Keywords such as 'approach' and 'model' emphasize the importance of selecting the right learning strategy when processing food. At the same time, connectedness between students and teachers reflects the role of culinary arts vocational school students as participants in guided education directly under the teacher's guidance (Auliana, 2019) (Chande et al, 2023) (Mahanani et al, 2025) (Techanamurthy et al, 2018) (Yudhanto et al, 2023). The presence of industry and field keywords strengthens the alignment between school-based learning and the demands of the world of work, enhancing the suitability of the vocation. In addition, the keywords evaluation, effect, and factor indicate the need for a systematic evaluation of the effectiveness of learning strategies to improve students' competence. The position of the word consumption as a connector intercluster indicates that results of learning about food processing extend not only to the process but also to the quality of the food produced. In general, the visualization shows that the learning strategy for processing food at a culinary vocational school is comprehensive, integrating pedagogical approaches, student characteristics, industry relevance, and evaluation results (Hegarty, 2011) (Wulandari & Handayani, 2021).

The development of food traditions around Lake Tondano is generally driven by small businesses, especially those managed by women, with a focus on products in demand among consumers for their good taste and affordable prices, and on the use of local agricultural products (Elly et al, 2024). Although businesses have great potential and opportunities, they still face various obstacles, such as limited knowledge of entrepreneurship, insufficient capital, inadequate equipment for food businesses, and low sanitation standards, which limit innovation and the quality of products.

On the side, practice agriculture and ensure the availability of food materials) (the Minahasa Regency has supporting potential for local culinary development. Farming ducks locally is a commodity, and it is important for providing meat and eggs, with system maintenance integrated with traditional land rice fields) (meanwhile, rice productivity in this region is classified as tall, although it depends more on the farmer's experience (Maukar et al, 2018). Apart from that, there is an opportunity to diversify food through the utilization of local commodities, such as taro, which has diverse varieties and nutritional content, so that potential processed products become various food and nutrition products. However, the local system of food also faces challenges in the form of overuse of agricultural land, limitations on superior seeds, and difficulties in providing feed for livestock. Therefore, continuous support and mentoring are essential. To increase quality, innovation, and power competition in culinary-based sources, power local in Tondano and Minahasa Regency.

Culinary arts in Tondano, Minahasa Regency, reflect a strong inheritance of culture through the use of local materials and traditional cooking techniques. Many main ingredients used originate from local results of agriculture, especially tubers such as taro and sweet potato, which become main foods at the time and reflect the diversity of biological

agriculture in the area (Mattila et al, 2024). Red and white taro have high starch content, making them suitable for a wide range of processed traditional foods. In contrast, Wongkai sweet potato has a high protein and fiber content, making it a potential functional food ingredient. In addition, local poultry like chickens and ducks are also an important ingredient in Tondano cuisine, especially in the area around Lake Tondano, with traditional systems of support for public food during times of economic hardship. The cooking techniques used are generally slow-cooking, with the use of spices typical of Minahasa, which not only enrich the taste but also maintain the food's nutritional value. Techniques This is influenced by local culture and intergroup interactions, producing a unique and distinct culinary character from other areas in Indonesia.

Besides materials and techniques in cooking, the development of culinary Tondano is also influenced by the role of local festivals and dynamics. trend modern culinary. Festivals and activities in the community become important means to promote and preserve traditional food, where the dish is typically served as part of the celebration culture and identity of the Minahasa society. Through this activity, knowledge and skills in culinary are inherited intergenerationally, at the same time strengthening the sense of community pride. On the other hand, the trend in contemporary cuisine pushes innovation by blending traditional and modern techniques, both in processing and presentation, so that it can interest a wider range of consumers. Although there is a challenge in the form of a decrease in authenticity, the traditional recipe is still authentic) (efforts by adaptive actors in the culinary local scene show that innovation can walk alongside preservation of cultural values. Thus, culinary Tondano continues to develop as a combination of tradition and modernity, as well as its own potential to be known more at the local, national, and international levels.

Conclusion

Based on the results of keyword mapping using VOSviewer, we can conclude that the study is related to learning about food processing in education, the vocational placement of learning strategies, the roles of students and teachers, the relationship with the industrial world, and evaluation results—these themes and main mutual connections. The visualization network shows that learning about food is not only oriented towards pedagogical processes, but also towards real results in the form of products relevant to society and industry. Findings: This confirms the importance of an approach that is contextual, applicable, and based on learning practice in increasing competence Among Vocational school students majoring in culinary arts. When the findings for the Tondano context in Minahasa Regency are presented, it is evident that this area has significant potential for food processing based on local conditions. Wealth in traditional material culture, local agricultural and animal husbandry practices, and a strong culinary culture are reflected in traditional food and cultural festivals, which serve as important capital for relevant and meaningful learning strategies. On the other hand, challenges such as limited facilities and infrastructure, a lack of innovation, a gap between the curriculum and industry needs, and the influence of modern culinary trends towards authenticity in traditional recipes need serious attention. In a way overall, integration results study literature,

mapping VOSviewer, and analysis context local show that development of learning strategies processing food at culinary vocational school Tondano need directed at utilization potential local optimally, strengthening collaboration with industry and community, as well as innovation continuous learning based on mark culture and wisdom local to be able to answer existing opportunities and challenges in a way sustainable.

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