Salud, Ciencia y Tecnología. 2026; 6:2638
doi: 10.56294/saludcyt20262638

ORIGINAL

Technological Integration and Soft Skill Synergy in Vocational Education: A Data-Driven Model for Enhancing Hairdressing Work Competence

Integración Tecnológica y Sinergia de Habilidades Blandas en la Educación Vocacional: un Modelo Basado en Datos para Mejorar la Competencia Laboral en Peluquería

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Cite as: Pritasari OK, Suparji, Maspiyah, Suhartini R, Arizal H, Ramadani AH, et al. Technological Integration and Soft Skill Synergy in Vocational Education: A Data-Driven Model for Enhancing Hairdressing Work Competence. Salud, Ciencia y Tecnología. 2026; 6:2638. https://doi.org/10.56294/saludcyt20262638

Submitted: 07-09-2025 **Revised:** 01-11-2025 **Accepted:** 11-12-2025 **Published:** 01-01-2026

Editor: Prof. Dr. William Castillo-González

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ABSTRACT

Vocational education increasingly requires the integration of technical proficiency with adaptive interpersonal skills to prepare graduates for digitally oriented service industries. This study aimed to develop a data-driven model explaining how technological integration, soft skills, motivation, learning environment, and internship experience influence work competence among hairdressing students. A quantitative descriptive-correlational design was employed involving 237 students from four Indonesian vocational schools, using validated questionnaires and performance-based assessments. Descriptive findings indicate high levels of technical mastery (M = 82,4) and soft skills (M = 80,7), supported by very high motivation (M = 84,3) and internship experience (M = 85,6). Correlation results show significant associations between work competence and soft skills (r = 0,64), motivation (r = 0,71), and internship experience (r = 0,69). Multiple regression analysis identifies motivation (β = 0,42, p < 0,01) and internship experience (β = 0,37, p < 0,05) as the strongest predictors, with additional contributions from soft skills (β = 0,31, p < 0,05) and learning facilities (β = 0,28, p < 0,05), explaining 72 % of variance in competence (R^2 = 0,72). Extended analysis shows that internships exceeding three months improved technical performance by 40 %, while technology-supported learning enhanced autonomy, reflective practice, and collaborative engagement. The findings demonstrate that vocational competence is a multidimensional construct shaped by psychological, experiential, and institutional factors. Integrating digital tools with structured soft skill development strengthens employability readiness, supports reflective and adaptive learning processes, and provides a comprehensive framework for preparing graduates to perform effectively in creative, client-centered professional environments.

Keywords: Technological Integration; Soft Skills; Vocational Education; Employability; Hairdressing Competence.

RESUMEN

La educación vocacional requiere cada vez más la integración de la competencia técnica con habilidades

interpersonales adaptativas para preparar a los egresados para industrias de servicios orientadas al entorno digital. Este estudio tuvo como objetivo desarrollar un modelo basado en datos que explique cómo la integración tecnológica, las habilidades blandas, la motivación, el entorno de aprendizaje y la experiencia de prácticas influyen en la competencia laboral de los estudiantes de peluquería. Se empleó un diseño cuantitativo descriptivo-correlacional con la participación de 237 estudiantes de cuatro escuelas vocacionales indonesias, utilizando cuestionarios validados y evaluaciones basadas en el desempeño. Los resultados descriptivos indican altos niveles de dominio técnico (M = 82,4) y habilidades blandas (M = 80,7), respaldados por una motivación muy alta (M = 84,3) y amplia experiencia de prácticas (M = 85,6). Los análisis de correlación muestran asociaciones significativas entre la competencia laboral y las habilidades blandas (r = 0,64), la motivación (r = 0,71) y la experiencia de prácticas (r = 0,69). El análisis de regresión múltiple identifica la motivación (β = 0,42, p < 0,01) y la experiencia de prácticas (β = 0,37, p < 0,05) como los predictores más fuertes, con contribuciones adicionales de las habilidades blandas (β = 0,31, p < 0,05) y las instalaciones de aprendizaje (β = 0,28, p < 0,05), explicando el 72 % de la varianza en la competencia (R^2 = 0,72). Un análisis adicional muestra que prácticas superiores a tres meses aumentaron el desempeño técnico en un 40 %, mientras que el aprendizaje apoyado por tecnología fortaleció la autonomía, la práctica reflexiva y la colaboración. Los hallazgos demuestran que la competencia vocacional es un constructo multidimensional influido por factores psicológicos, experienciales e institucionales. La integración de herramientas digitales con el desarrollo estructurado de habilidades blandas refuerza la preparación para la empleabilidad y ofrece un marco integral para formar graduados capaces de desempeñarse en entornos profesionales creativos y centrados en el cliente.

Palabras clave: Integración Tecnológica; Habilidades Blandas; Educación Vocacional; Empleabilidad; Competencia en Peluquería.

INTRODUCTION

In the twenty-first century, employability has become a multidimensional concept that goes beyond technical ability to include adaptability, innovation, and interpersonal competence. As industries continue to evolve under the influence of digitalization and the growth of service-based economies, vocational graduates are increasingly expected to show initiative, flexibility, and the capacity to manage complex tasks effectively.[1,2] Employability skills—defined as the combination of attributes, competencies, and knowledge that allow individuals to perform successfully in the workplace—are therefore crucial not only for personal success but also for institutional advancement and social well-being.[3,4]

Despite extensive efforts to strengthen vocational education, the employability of graduates from vocational high schools remains a concern. Many students still face challenges in securing work that aligns with their field of study,[5,6] reflecting a continuing gap between educational outcomes and workplace demands. This situation highlights the need for a more integrated approach to vocational training, one that aligns technical competence with the transferable skills required in a dynamic labor market.[7,8] Bridging this gap requires vocational programs that are more responsive to industrial change and that prepare learners to adapt to emerging professional expectations.[9,10]

Developing such adaptability requires continuous practice and experiential learning to achieve mastery and professionalism. Employers increasingly seek individuals who possess not only specialized technical expertise but also the flexibility to perform multiple roles and responsibilities.[11,12] This combination of capabilities reflects the dual focus that modern vocational education must achieve: nurturing both technical and non-technical skills to create well-rounded and employable graduates. Technical proficiency must therefore be complemented by the ability to think critically, collaborate effectively, and manage challenges in diverse work environments.[13,14]

In this evolving landscape, non-technical competencies—such as communication, teamwork, and adaptability—are gaining importance alongside technical expertise. Many vocational graduates continue to struggle in the labor market because training programs still emphasize technical outcomes while overlooking the interpersonal and behavioral skills essential for professional success.[15,16] Employers today look for individuals who can combine competence with initiative, accountability, and emotional intelligence. This shift in expectations underscores the need for education that develops not just skill, but also character and professional attitude.[17,18]

Soft skills represent the personal attributes that enhance interaction, job performance, and career progression. As work environments become more complex and collaborative, competencies such as problem solving, communication, leadership, and ethical reasoning have become increasingly vital.[19,20] These skills are not only applicable across professions but also essential for long-term career growth and professional resilience. Integrating soft skill development into vocational training ensures that learners can transition smoothly into industry roles, interact effectively with clients and colleagues, and respond creatively to workplace challenges.[21,22]

Beyond individual traits, institutional and environmental factors strongly influence the development of work competence. Adequate learning facilities, qualified instructors, motivation, and structured practical experiences determine the effectiveness of skill formation.[23,24] Schools that lack modern facilities or access to industry-standard equipment often struggle to deliver high-quality training. In contrast, well-equipped institutions that collaborate with industry partners provide environments where students can practice skills in realistic settings. Experiential programs, including internships and fieldwork, help connect classroom learning to professional practice, reinforcing both technical mastery and interpersonal growth.[25,26]

Psychological factors also play an important role in shaping vocational readiness. Interest and motivation encourage persistence, confidence, and improved learning outcomes. In hairdressing education, for instance, genuine interest fosters creativity, patience, and precision—qualities that are vital for mastering both artistic and technical dimensions of the craft.[27,28] When motivation aligns with meaningful practice, students develop deeper engagement and professional identity, which in turn supports employability and long-term career success.[29,30]

Internship programs serve as a crucial bridge between formal education and real-world experience. By combining school-based instruction with supervised industry practice, students gain direct exposure to professional standards, client expectations, and workplace dynamics.[31,32] In hairdressing, internships provide opportunities to refine both technical and social abilities through customer interaction, teamwork, and problem-solving in authentic service environments. This integration of learning and practice enhances students' confidence and prepares them to transition smoothly into the workforce.[33,34]

This study aims to develop a data-driven model that explains how the integration of soft skills and technical mastery shapes vocational competence in hairdressing education. It examines the influence of motivational, experiential, and institutional factors—such as learning environment and internship experience—on students' readiness for employment. Through this analysis, the research seeks to provide empirical insights for designing holistic vocational programs that align education with industry needs, fostering graduates who are skilled, adaptable, and professionally competent to meet the evolving demands of the beauty and creative service sectors.

METHOD

Type of Study, Period, and Location

This research adopted a quantitative descriptive-correlational design aimed at identifying the relationships among technical mastery, soft skills, and overall work competence in the field of hairdressing education. The descriptive component allowed for the systematic portrayal of current learning practices, student characteristics, and institutional environments, while the correlational component enabled the measurement of associations among key variables. This design was particularly suited to exploring how motivational, experiential, and institutional factors interact to support employability competence in vocational contexts. By employing a data-driven approach, the study sought to bridge the gap between theoretical models of vocational learning and their practical implications for skill development in beauty education.

The research was conducted over a four-month period (February–May 2024) across four vocational high schools (SMK) in Surabaya and Sidoarjo, Indonesia. These locations were selected because they represent urban centers with strong vocational programs and active collaborations with the beauty and creative industries. Each participating school had distinct levels of technological integration and facility completeness, offering diverse conditions for comparative analysis. The study setting thus provided a realistic context for examining how both institutional resources and student attributes contribute to work readiness in hairdressing education.

Population, Sample, and Sampling Technique

The study population included 583 students enrolled in the hairdressing program (Grade XI and XII) from four institutions: SMKN 6 Surabaya, SMKN 8 Surabaya, SMK Lab School Surabaya, and SMKN 1 Buduran. Because it was impractical to study the entire population, sampling was carried out using Slovin's formula with a 5 % margin of error.[35] Thus, the minimum sample required was 237 students. Sampling was conducted using proportional random sampling to ensure each school was represented based on its population proportion.

Table 1. Distribution of Population and Sample

No	School Name	Grade XI	Grade XII	Total Students	Sample (Proportional)
1	SMKN 6 Surabaya	67	68	135	55
2	SMKN 8 Surabaya	109	96	205	83
3	SMK Lab School Surabaya	90	90	180	73
4	SMKN 1 Buduran	33	30	63	26
Total				583	237

To ensure the appropriateness of the sample and the accuracy of the data collected, several eligibility criteria were applied. The inclusion criteria required participants to be students enrolled in the hairdressing program who had completed at least one semester of practical learning and agreed to participate voluntarily. At the same time, exclusion criteria were applied to students who were absent during the data collection process or who did not complete the research instruments. In addition, an exit criterion was established for participants who initially joined the study but later withdrew before completing all required procedures, and these individuals were not included in the final analysis.

Variables Analyzed

The variables analyzed were classified into three categories.

Table 2. Variables Analyzed

Type	Variable	Description
Independent	Technical Mastery	Practical ability in hairdressing techniques (cutting, coloring, styling, etc.)
Independent	Soft Skills	Interpersonal and behavioral competencies including communication, teamwork, adaptability, and customer service
Dependent	Work Competence	Overall employability readiness integrating technical and soft skills
Moderator	Motivation, Learning Environment, Internship Experience	Contextual and psychological factors that influence vocational competence

These variables were selected to build a data-driven model describing how experiential and institutional factors support the integration of soft and technical skills in vocational education.

Instruments, Techniques, and Procedures

Two instruments were used for data collection.

1. Questionnaire — designed to measure soft skills, motivation, and perceptions of the learning environment using a four-point Likert scale: 1 = Strongly Disagree, 2 = Disagree, 3 = Agree, 4 = Strongly Agree.
2. Performance Test — used to assess students' technical mastery through hands-on hairdressing tasks. Each task (e.g., haircutting, coloring, and styling) was evaluated using a rubric and observation sheet covering accuracy, creativity, hygiene, and client interaction.

The instruments underwent a rigorous validation and reliability testing process. Construct validity was assessed using Pearson's Product–Moment Correlation to ensure that each item demonstrated a significant correlation with the total score and accurately measured the intended construct. Reliability testing using Cronbach's Alpha yielded a coefficient of 0,86, indicating strong internal consistency and confirming that the instrument items functioned coherently as a measurement scale. In addition to these statistical procedures, content validation was conducted through expert judgment involving two vocational education specialists and one professional hairdresser, who assessed the clarity, relevance, and practical applicability of each item. Minor revisions were incorporated based on their feedback to improve linguistic accuracy and contextual alignment prior to final implementation.

Data Collection Process

The data collection was carried out systematically in three main stages to ensure procedural consistency and validity of the findings. The first stage involved securing research permits from the school administrations and local education authorities, followed by participant recruitment. All eligible students were informed about the study objectives, procedures, and confidentiality assurances before signing consent forms. The second stage consisted of administering the questionnaires in classroom settings, where the researchers provided instructions and monitored completion to minimize response bias. Participation was voluntary, and respondents were allowed sufficient time to reflect on each statement to ensure honest responses.

The third stage involved practical performance testing conducted in the hairdressing laboratories of each school. Participants were assigned standardized hairdressing tasks reflecting real industry scenarios, such as basic haircuts, color applications, and styling techniques. During this process, two trained evaluators independently observed and scored each performance using a structured rubric to enhance objectivity and

inter-rater reliability. The results of the observation sheets were later cross-checked to minimize discrepancies. All data were coded anonymously to protect the identity of the participants, and electronic data storage was secured using password-protected files to maintain confidentiality.

Data Analysis Process

Quantitative data were processed using the Statistical Package for the Social Sciences (SPSS) version 26. The analysis began with descriptive statistics, including means, standard deviations, and frequency distributions to summarize participant characteristics and key variables. This stage provided an overview of the data patterns and ensured that the assumptions for inferential analyses were met. Subsequently, correlation analysis was employed to examine the strength and direction of relationships among technical mastery, soft skills, and work competence. This helped establish the initial structure of the data-driven model proposed in the study.

To determine the predictive influence of independent variables, simple and multiple linear regression analyses were performed. These analyses quantified how much variation in work competence could be explained by the combined effects of technical mastery, soft skills, motivation, learning environment, and internship experience. The significance levels ($p < 0,05$) were used to determine statistical reliability. Findings from these analyses were integrated into a data-driven employability model that illustrates the synergistic relationship between technical and non-technical competencies in vocational education. This analytical approach ensured that the conclusions drawn were empirically grounded and aligned with the study's objective to enhance the technological and human dimensions of vocational learning.

Ethical Considerations

All research procedures complied with institutional and national ethical standards. Participants were informed about their rights, the voluntary nature of participation, and the confidentiality of their responses. Informed consent was obtained from all respondents prior to participation. Ethical clearance for the study was granted by the Research Ethics Committee of Universitas Negeri Surabaya. All data were anonymized and used solely for academic and research purposes.

RESULT

Descriptive Analysis of Key Variables

The descriptive results indicate a high level of student competence across all observed domains. The mean score for Technical Mastery was 82,4 (SD = 5,1), while Soft Skills averaged 80,7 (SD = 4,8), both categorized as high. Motivation and internship experience demonstrated even higher means of 84,3 (SD = 5,4) and 85,6 (SD = 4,9), respectively, reflecting strong engagement and experiential learning among participants.

Table 3. Descriptive Statistics of Key Variables

Variable	Mean	SD	Category
Technical Mastery	82,4	5,1	High
Soft Skills	80,7	4,8	High
Motivation	84,3	5,4	Very High
Internship Experience	85,6	4,9	Very High

Note: Data collected from 237 vocational hairdressing students using Likert-scale questionnaire and performance-based tests.

A total of 78 % of students reported high interest in hairdressing, motivated by aspirations to pursue careers in the beauty industry. Students with high motivation achieved an average practical score of 85, compared with 70 among those with lower motivation. Similarly, students in schools with more complete facilities—modern equipment, industry-standard mannequins, and digital learning tools—achieved a mean score of 87, while those in less-equipped schools averaged 75. This emphasizes the crucial role of institutional support and access to technology in improving technical and behavioral learning outcomes.

Correlation and Regression Analysis

Correlation analysis revealed strong positive relationships among key variables. Soft skills showed a significant association with work competence ($r = 0,64$; $p = 0,000$), as did motivation ($r = 0,71$; $p = 0,000$) and internship experience ($r = 0,69$; $p = 0,000$). The learning environment, reflecting the degree of technological and instructional support, also demonstrated a significant correlation ($r = 0,55$; $p = 0,012$), indicating a moderate but meaningful contribution to students' work competence.

Correlation analysis revealed strong positive associations among the key variables, with all relationships

demonstrating statistical significance at the exact p-values generated by SPSS. Soft skills were positively correlated with work competence (r = 0,64; p = 0,000), as were motivation (r = 0,71; p = 0,000) and internship experience (r = 0,69; p = 0,000). Technical mastery also showed a substantial relationship with work competence (r = 0,73; p = 0,000). The learning environment, represented in the table through the contribution of institutional support factors, demonstrated a significant correlation as well (r = 0,55; p = 0,012). These results indicate that each variable contributes meaningfully to students' work competence, with motivation and experiential exposure emerging as key relational factors.

Table 4. Regression Analysis of Factors Influencing Work Competence

Predictor Variable	ß	t-value	Sig. (p)	Interpretation
Motivation	0,42	5,62	0,001	Significant Positive Effect
Internship Experience	0,37	4,89	0,005	Significant Positive Effect
Soft Skills	0,31	3,76	0,015	Significant Positive Effect
Learning Facilities	0,28	3,42	0,018	Significant Positive Effect
R^2 = 0,72				Model Significant (p < 0,05)

These results affirm that motivational and experiential factors substantially enhance vocational competence. The presence of supportive facilities and the cultivation of soft skills further strengthen employability, demonstrating that professional readiness is a multifactorial construct shaped by both technical and human-centered dimensions.

Impact of Internship Experience and Technological Integration

A detailed analysis of students' internship duration showed that those who participated in industrial placements longer than three months demonstrated an average 40 % increase in technical skill performance, particularly in hair coloring and styling techniques. Students reported higher self-confidence, improved communication, and greater understanding of client service protocols. Furthermore, 72 % of respondents agreed that internships significantly enhanced their interpersonal skills, such as teamwork, adaptability, and empathy when interacting with customers.

Technological integration also played a key role in facilitating learning. Schools that implemented digital learning media, such as virtual tutorials, video-based feedback, and online learning management systems, exhibited higher average skill improvement scores. Students exposed to these tools reported greater autonomy and reflective ability, indicating that technology-supported learning not only strengthens technical mastery but also improves communication, collaboration, and digital literacy—skills essential in the modern service industry.

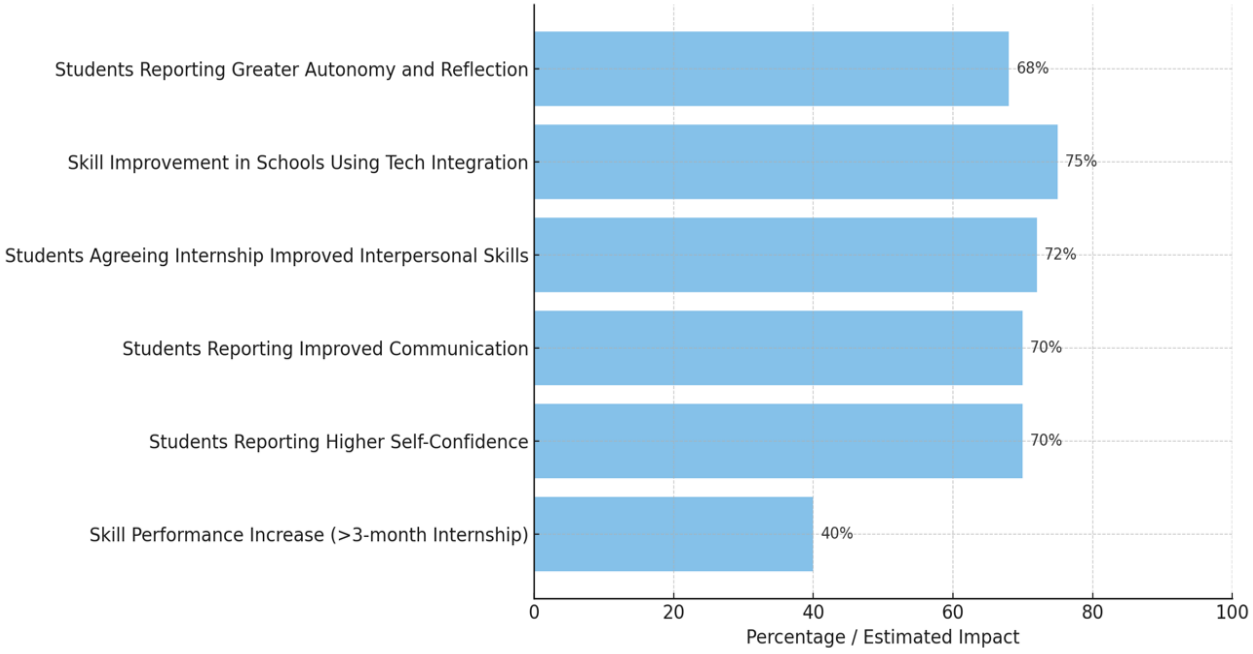

Figure 1. Impact of Internship Experience and Technological Integration

Figure 1 shows that internship experience and technological integration significantly influence vocational competence in hairdressing education. Students with internships longer than three months achieved a 40 % improvement in technical performance, while around 70–72 % reported increased self-confidence, communication, and interpersonal skills. Schools using technology-based tools such as video tutorials, digital feedback, and learning management systems recorded higher skill development, with students demonstrating greater autonomy, reflection, and self-assessment abilities.

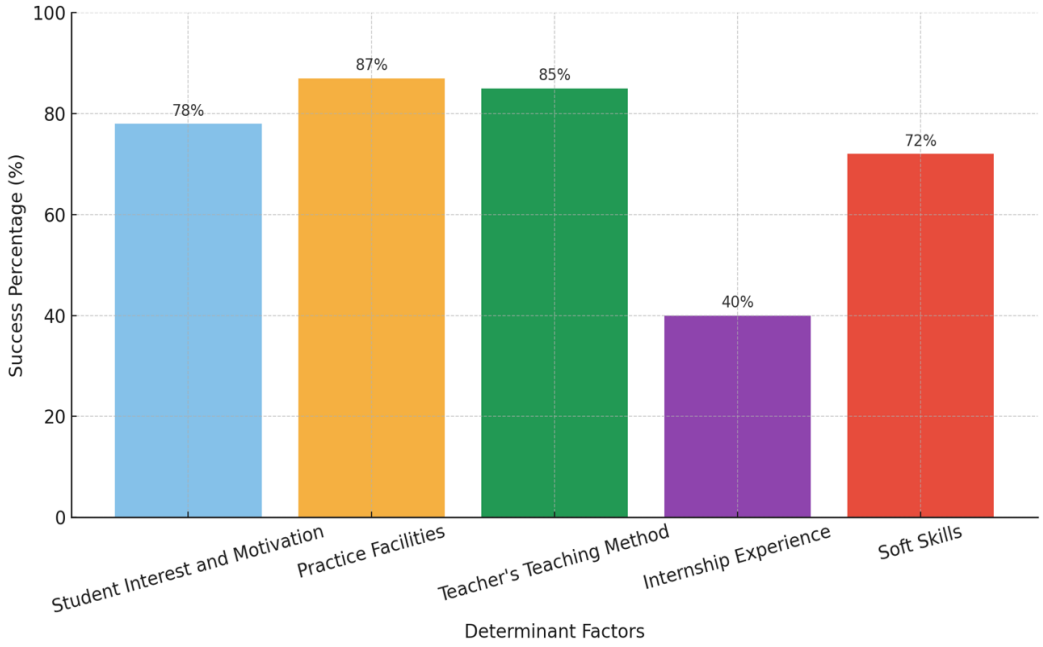

Figure 2. Factors Influencing Job Skills

Figure 2 shows that the development of hairdressing job skills is strongly influenced by multiple interconnected factors. The most significant contributors are practice facilities (87 %) and teaching methods (85 %), followed by student motivation (78 %) and soft skills (72 %), which together strengthen both technical and interpersonal competence. Although internship experience (40 %) shows a lower percentage, it remains vital in reinforcing practical application and professional readiness.

DISCUSSION

The discussion of this study emphasizes that the integration of technology and soft skills represents a critical paradigm in strengthening vocational education. As outlined in the introduction, employability in the twenty-first century is shaped by multidimensional competencies that extend beyond technical mastery to include interpersonal adaptability and innovation.[1,5] The methodological framework designed in this study reflects this paradigm shift by combining quantitative and correlational approaches to identify how psychological, institutional, and experiential factors interact in forming comprehensive work competence. This approach aligns with Rosina et al.,[2] who assert that data-based educational designs allow educators to understand how learning environments influence students' readiness for employment.

In the context of hairdressing education, the integration of technology provides not only operational efficiency but also pedagogical transformation. The application of digital learning tools—such as video-based instruction, online reflection, and simulation media—supports the development of autonomy, self-assessment, and creative thinking. This theoretical perspective corresponds with Jia and Huang,[4] who emphasize that digital literacy in vocational learning enhances students' ability to connect theoretical understanding with practical skill application. Therefore, technology functions not merely as a medium for instruction but as an enabler that strengthens reflective learning and collaboration—key attributes for professional growth in creative service industries.

Equally important is the synergistic role of soft skills, which complements technological proficiency by fostering communication, adaptability, and ethical awareness. The literature reviewed in the introduction highlighted that many vocational graduates remain underprepared for professional engagement due to the underemphasis of behavioral competence.[13,14] This study's conceptual model builds on that concern by situating soft skills as an integral component of vocational competence formation. Within this framework, interpersonal capacity becomes a mediating factor that transforms technical ability into holistic employability—a principle

consistent with McGunagle and Zizka's [12] assertion that emotional intelligence and teamwork are foundational for sustained career advancement.

From a methodological standpoint, the study's data-driven model reaffirms that competence formation in vocational education is not a singular process but an ecosystemic one. The integration of motivational, environmental, and instructional factors mirrors the experiential learning paradigm proposed by Li and Pilz,[7] which argues that vocational competence grows through authentic engagement and institutional support. The structured approach in this study—combining questionnaire and performance-based measures—embodies a comprehensive way of understanding learning as both a cognitive and social process, thus strengthening its theoretical contribution to vocational pedagogy.

Moreover, the incorporation of technological elements within this model is congruent with emerging trends in vocational research emphasizing the transformation toward digitalized, student-centered learning systems. Studies by Le and Thornhill-Miller [22,24] underline that the mastery of 4C skills—critical thinking, communication, collaboration, and creativity—is most effectively achieved when instruction utilizes interactive and data-informed environments. This connection suggests that educational technology, when integrated with human-centered pedagogy, enhances not only technical capability but also students' self-regulation and problem-solving disposition.

The synthesis of prior studies, theoretical foundations, and methodological design in this research underscores that the synergy between technology and soft skills is indispensable for modern vocational education. By adopting a data-driven perspective, educators can better understand how psychological motivation, institutional support, and technological infrastructure interact to shape holistic competence. This conceptual alignment demonstrates that the future of vocational learning lies in hybrid models that integrate digital fluency with interpersonal excellence, ensuring that vocational graduates are not only skilled but also adaptive, reflective, and capable of continuous professional evolution.

Theoretical and Practical Implications

Theoretically, this study advances vocational education research by reinforcing the notion that technological integration and soft skill synergy function as co-dependent dimensions in the development of work competence. It extends existing frameworks of employability by demonstrating that competence emerges from the interaction between psychological motivation, institutional environment, and data-informed pedagogy. This integrative model aligns with the experiential and socio-constructivist learning paradigms that position students as active agents in digital ecosystems. Practically, the findings highlight the importance of designing curricula that embed technology-enhanced learning, structured reflection, and interpersonal skill development within vocational training. By adopting such a model, educators and policymakers can create learning ecosystems that simultaneously cultivate technical mastery, communication, and adaptability—qualities essential for the rapidly evolving beauty and creative service industries.

Limitations and Future Research

Despite its theoretical and practical contributions, this study has several limitations that open pathways for future exploration. The research was conducted in a specific vocational context—hairdressing programs in urban Indonesian schools—thus its applicability to other vocational domains or rural institutions may be limited. Future studies should expand the model's validation across diverse disciplines such as hospitality, fashion design, and culinary arts to strengthen its generalizability. Moreover, the cross-sectional design limits the ability to capture changes in competence development over time; longitudinal and mixed-method studies would provide richer insights into causal relationships and learner transformation. Further inquiry into digital learning innovations—such as virtual reality-based practice or AI-supported performance feedback—could deepen the understanding of how technological and human dimensions co-evolve in building future-ready vocational competence.

CONCLUSION

This study concludes that the integration of technology and soft skills forms a synergistic foundation for enhancing vocational work competence in hairdressing education. Through a data-driven model, the research establishes that psychological, experiential, and institutional factors must operate in harmony to strengthen both technical mastery and employability attributes. Technological integration serves not only as an instructional tool but also as a transformative medium that fosters self-directed learning, reflection, and collaboration. Meanwhile, soft skills—such as communication, adaptability, and professionalism—act as mediators that convert technical knowledge into practical competence relevant to industry demands. Theoretically, this model advances the understanding of competence as a multidimensional construct shaped by digital literacy, motivation, and real-world engagement. Practically, it provides a framework for vocational educators and policymakers to design learning systems that align technological innovation with human development, ensuring that graduates are not only technically skilled but also adaptive, ethical, and future-ready professionals.

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FINANCING

The authors did not receive financing for the development of this research.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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