Al-Ishlah: Jurnal Pendidikan
Vol.17, 3 (September, 2025), pp. 4181-4191
ISSN: 2087-9490 EISSN: 2597-940X, DOI: 10.35445/alishlah.v17i3.7066

Enhancing 4C Skills Through Project-Based Learning: A Needs Analysis and Impact Study in Cosmetology Education

Laila Fajri[1], Rahmiati[2] , Linda Rosalina[3], M.Giatman[4] , Prima Minerva[5] **

[1] Universitas Negeri Padang, Padang, Indonesia; lailafajrimua1@gmail.com
[2] Universitas Negeri Padang, Padang, Indonesia; rahmiati@fpp.unp.ac.id
[3] Universitas Negeri Padang, Padang, Indonesia;linda.rosalina@fpp.unp.ac.id
[4] Universitas Negeri Padang, Padang, Indonesia; giatman@ft.unp.ac.id
[5] Universitas Negeri Padang, Padang, Indonesia;prima.minerva@fpp.unp.ac.id

ARTICLE INFO

Keywords:

Project-Based Learning;
4C skills;
department of cosmetology and beauty

Article history:

Received 2025-01-30
Revised 2025-03-18
Accepted 2025-09-06

ABSTRACT

This study investigates the implementation of Project-Based Learning (PjBL) to enhance 21st-century skills—specifically the 4Cs: Critical Thinking, Creativity, Communication, and Collaboration—in Cosmetology courses at the Department of Cosmetology and Beauty. Preliminary analysis revealed key challenges, including over-reliance on printed materials and limited use of interactive media, which hinder the development of these essential competencies. Using Plomp's development model, the research involved a needs analysis to assess student learning characteristics and identify gaps. The PjBL approach was then designed and implemented in alignment with these findings. Data were collected through pre-tests and post-tests to evaluate skill development before and after PjBL integration. The findings indicate substantial improvement across all four skill areas following PjBL implementation. Critical thinking improved from 60% to 85%, creativity from 65% to 88%, communication from 58% to 80%, and collaboration from 62% to 84%. The average increase in overall 21st-century skill competency was 69.12%. Although the results demonstrate significant progress, further refinement is needed to sustain and deepen these skills. Strengthening these competencies is essential for preparing students to meet the demands of the increasingly competitive beauty industry. This study underscores the value of integrating PjBL into vocational curricula and highlights its potential to support holistic skill development. The findings contribute to the ongoing discourse on curriculum enhancement in alignment with industry expectations.

Corresponding Author:
Rahmiati
Universitas Negeri Padang, Padang Indonesia; rahmiati@fpp.unp.ac.id

1. INTRODUCTION

Higher education plays a crucial role in equipping students to navigate the demands of the contemporary workforce, particularly in the context of the Industrial Revolution 4.0. This era is defined

by rapid technological advancement, the integration of digital systems, and the increasing need for multidisciplinary skills and adaptability (Griffin & Care, 2019; Saavedra & Opfer, 2020). Consequently, universities are expected not only to provide academic knowledge but also to foster essential 21st-century skills—commonly known as the 4Cs: Critical Thinking, Creativity, Communication, and Collaboration. These competencies are widely regarded as fundamental in preparing a workforce capable of responding to global challenges and excelling in innovation-driven environments (World Economic Forum, 2020).

The beauty industry, in particular, is undergoing significant transformation due to technological advancements, shifting consumer preferences, and globalization. Professionals in this field must possess more than just technical expertise; they also need strong critical thinking to solve client-specific problems, creativity to innovate and personalize beauty solutions, communication skills to interact effectively with diverse clients and colleagues, and the ability to collaborate in multidisciplinary teams (Miller & Stevenson, 2021; Johnson, Brown, & Carter, 2020). The World Economic Forum (2020) highlights the increasing demand for these 4C competencies across all industries, including beauty and cosmetology, emphasizing their critical role in employability and professional success.

Integrating 4C skills into vocational and higher education curricula, particularly in cosmetology programs, offers numerous benefits. First, it enables students to adapt to technological changes, such as augmented reality (AR) applications used for makeup simulations or digital platforms for client consultations. These technologies are becoming essential tools in modern beauty training and service delivery (Rojas & Chen, 2022). Second, embedding 4C competencies enhances graduates' competitiveness in the job market. For instance, professionals who combine creative design thinking with data-driven personalization of cosmetic products are more likely to offer unique and effective solutions to clients (Miller & Stevenson, 2021). Third, fostering collaboration and communication prepares students to function efficiently in team-based environments where interdisciplinary knowledge is key to innovation (Johnson et al., 2020).

In vocational education, particularly in the Department of Cosmetology and Beauty, the relevance of 4C skills is exceptionally high. The dynamic nature of the beauty industry requires workers to possess both technical capabilities and the soft skills necessary to meet diverse client needs, solve practical challenges, and develop innovative approaches to service delivery. Haryati and Wangid (2023) emphasize that implementing 4C skills in vocational education significantly enhances students' overall competency development. Their findings suggest that when students are given opportunities to practice these skills in contextually relevant scenarios, they become more adept at addressing real-world challenges.

One instructional approach that has proven particularly effective in fostering 4C skills is Project-Based Learning (PjBL). This pedagogical strategy encourages students to engage in meaningful, real-world projects that promote active learning through inquiry, collaboration, and problem-solving. According to Bell (2020) and Hmelo-Silver (2022), PjBL not only supports content mastery but also cultivates critical and creative thinking, communication, and teamwork skills—traits that are indispensable in professional practice.

In the context of cosmetology education, PjBL allows students to immerse themselves in hands-on, industry-relevant projects, such as designing customized beauty solutions, simulating client consultations using AR, or collaborating on product development initiatives. These projects enable students to apply theoretical knowledge while simultaneously building the competencies required in today's competitive beauty landscape (Hmelo-Silver, 2022; Yuliani, Suharyat, & Wulandari, 2020).

Project-Based Learning (PjBL) is distinguished from traditional teaching methods through a set of core features that emphasize active, student-centered learning. According to Larmer, Mergendoller, and Boss (2015), high-quality PjBL is characterized by a driving question that initiates learning with a complex, relevant problem meant to guide the entire project. This is followed by in-depth inquiry, where students engage in thorough research and critical analysis to explore the issue. A strong emphasis on authenticity ensures that projects reflect real-world challenges and professional practices, making the learning experience more meaningful and relevant. Collaboration is another essential component, as students work in teams to co-construct knowledge and achieve shared goals, fostering interpersonal and teamwork

skills. PjBL also involves the creation of tangible products, where learners produce concrete outcomes—such as presentations, models, or demonstrations—that showcase their understanding and skills. Finally, reflection plays a critical role in the process, allowing students to evaluate their own work, assess the learning journey, and develop greater self-awareness and metacognitive skills. These integrated elements make PjBL a dynamic and effective strategy for developing both academic and professional competencies in learners. These elements are particularly aligned with the learning goals of cosmetology programs, where practical application and reflection are essential components of skill development.

Furthermore, PjBL involves a systematic learning process that includes identifying a relevant problem, planning the project, conducting research, developing a product or solution, presenting outcomes, and reflecting on the experience (Krajcik & Shin, 2018; Hmelo-Silver, 2022). This structured approach not only supports academic learning but also mirrors professional workflows, thus bridging the gap between education and industry.

A thorough needs analysis is essential to ensure the effective implementation of PjBL. This involves identifying students' learning preferences, existing skill levels, and the challenges they face in mastering 4C competencies. By understanding these factors, educators can tailor instructional strategies to meet students' needs and enhance learning outcomes (Gall, Gall, & Borg, 2003; Haryati & Wangid, 2023).

In the Department of Cosmetology and Beauty, such a needs analysis is particularly critical. Students must be prepared to work in an industry where innovation, client engagement, and teamwork are core to professional success. Research by Fauzan, Suharyat, and Wulandari (2022) supports this approach, indicating that project-based learning not only makes education more engaging but also aligns better with the demands of the evolving job market.

This study aims to analyze student needs and evaluate the impact of implementing Project-Based Learning (PjBL) strategies on the development of 4C skills—Critical Thinking, Creativity, Communication, and Collaboration—among students in the Department of Cosmetology and Beauty. Additionally, the study explores how PjBL can enhance the overall effectiveness of teaching and learning processes within the cosmetology curriculum. By focusing on real-world applications and aligning learning experiences with industry expectations, this research seeks to contribute to curriculum innovation that supports both academic excellence and career readiness. Ultimately, the findings are expected to offer valuable insights into the development of educational practices that cultivate holistic, future-ready professionals in the beauty industry.

2. METHODS

This research uses a quantitative approach with a pseudo-experimental design that aims to analyze the needs and measure the impact of the Project-Based Learning (PJBL) strategy on the development of 4C skills (Critical Thinking, Creativity, Communication, Collaboration) in Cosmetology courses at the Department of Cosmetology and Beauty, Padang State University. In developing this learning product, this research adopted the educational design development model developed by Plomp and Nieveen (2019). This model includes several interconnected stages, starting with initial research involving needs and context analysis, followed by a prototyping phase focusing on validity and practicality, and ending with an assessment phase to measure the practicality and effectiveness of the developed product (Plomp, T., & Nieveen, 2019). Table 1 illustrates these stages in detail within the context of developing a learning product that focuses on the needs analysis and the impact of the PJBL learning strategy on the development of 4C skills in the Cosmetology course at the Department of Beauty and Cosmetology.

Table 1. Preliminary Research Procedure of the Plomp Development Model

Phase	Focus	Activity
Preliminary Research	Needs and context analysis, literature review	The results of needs analysis, curriculum analysis, student analysis, material analysis, and literature review form the guidelines for the framework and first blueprint or prototype I of the developed product.
Prototyping Phase	Focused on validity and practicality, gradually moving towards effectiveness	Prototypes are created in stages, tested, and refined according to the formative evaluation stage, conducted through expert judgment.
Assessment Phase	Practicality and effectiveness	Assess whether the product's use is practical and effective, and whether users are willing to use the product.

Sumber: (Plomp, T., & Nieveen, 2019)

The research design used was the Pretest-Posttest Control Group Design, where the study subjects were divided into two groups: the experimental group, which applied the PJBL strategy, and the control group, which used conventional teaching methods. The details of the research design are presented in Table 2.

Table 2. Research Design

Group	Pretest	Intervention	Posttest
Experimental	Measuring 4C skills	Application of the PJBL strategy	Measuring 4C skills
Control	Measuring 4C skills	Conventional teaching methods	Measuring 4C skills

Sumber: (Sugiyono, 2019)

2.1 Research Procedure

This study was conducted in several stages as follows:

1. Preparation Stage
   1) Needs Analysis**:** Conducted through a questionnaire to understand the relevance of applying PJBL in the cosmetology course.
   2) Instrument Development: Preparing 4C skill tests and a needs questionnaire.
2. Implementation Stage
   1) Experimental Group: The PJBL strategy was applied over 4 sessions, with projects designed to develop 4C skills, such as creating herbal-based cosmetic products.
   2) Control Group: Learning was conducted using lecture and discussion methods without the implementation of projects.
3. Data Collection Stage
   1) Pretest and posttest were used to measure the development of 4C skills.
   2) The needs questionnaire was used to understand the suitability and challenges of implementing PJBL.
4. Data Analysis Stage
   1) Data were analyzed using statistical software such as SPSS.
   2) Independent Sample t-Test was used to test the significant difference in posttest results between the control and experimental groups.
   3) Multivariate Analysis of Variance (MANOVA) was used to analyze the effect of PJBL on each dimension of 4C skills simultaneously.

2.2 Research Instruments

The instruments used in this study include:

1. 4C Skill Tests
   1) Critical Thinking**:** Case study-based test to measure the ability to analyze and solve problems.

2) Creativity**:** Assessment of project ideas based on originality and uniqueness.
3) Communication**:** Assessment of the ability to convey ideas through presentations.
4) Collaboration: Observation of group work effectiveness.

2. Needs Questionnaire
To identify the relevance and challenges of implementing PJBL in the cosmetology course.

Table 3. Components of Research Instruments

4C Skills	Measurement Method	Indicator
Critical Thinking	Case study-based test	Ability to analyze and solve problems
Creativity	Project idea assessment	Originality and innovation of ideas
Communication	Presentation assessment	Clarity in conveying ideas
Collaboration	Group work observation	Effectiveness of teamwork

Source: (Brookhart, 2010)

2.3 Population and Sample

The population in this study consisted of students enrolled in the Cosmetology course at the Department of Cosmetology and Beauty, Padang State University, which comprised five class sessions (Session A, B, C, D, and E). The research sample was selected using a simple random sampling technique so that each member of the population has an equal chance of being selected (Sugiyono, 2019). Based on random selection, two classes were obtained as samples, namely Cosmetology Class Session A and Session B, each consisting of 30 students, so that the total sample was 60 students. The determination of the experimental and control groups was carried out randomly, where Class Session A was designated as the control group that received conventional learning, while Class Session B became the experimental group that applied the Project-Based Learning (PJBL) strategy. The selection of this sampling method was carried out to ensure that the research sample was representative, so that it could validly measure the effect of the application of PJBL on 4C skills (Critical Thinking, Creativity, Communication, Collaboration) in the Cosmetology course.

2.4 Data Analysis

Table 4. Data Analysis

Analysis	Purpose	Statistic
Independent Sample t-Test	To test the difference in posttest between groups	t-Test
MANOVA	To test the effect of PJBL on 4C skills	Wilks' Lambda, F-Test

Source: (Joseph F. Hair Jr., Barry J. Babin, Rolph E. Anderson, 2019)

To further examine the effectiveness of the Project-Based Learning (PjBL) strategy on the development of students' 4C skills, two statistical analyses were conducted: an independent sample t-test and a Multivariate Analysis of Variance (MANOVA). The independent sample t-test was used to determine whether there were significant differences in posttest scores between the experimental and control groups. The results revealed statistically significant differences, indicating that the group exposed to the PjBL strategy outperformed the group that received conventional instruction. Additionally, MANOVA was employed to assess the overall impact of the PjBL intervention on the combined dimensions of the 4C skills. Using Wilks' Lambda and the F-test, the MANOVA results confirmed that the PjBL strategy had a significant multivariate effect, demonstrating its comprehensive influence on enhancing students' Critical Thinking, Creativity, Communication, and Collaboration skills. These findings provide robust statistical support for the integration of PjBL in vocational education settings, particularly within the Cosmetology curriculum.

3. FINDINGS AND DISCUSSION

This section presents a comprehensive analysis of the study's findings regarding the implementation of Project-Based Learning (PjBL) in developing 21st-century skills—particularly the 4C

competencies: Critical Thinking, Creativity, Communication, and Collaboration—among students of the Cosmetology and Beauty Department. The discussion is organized into key subheadings to provide clarity and depth when analyzing the research outcomes.

3.1 Learning Needs Analysis

The initial stage of this study involved a needs analysis to identify gaps in the current learning process and determine the necessity of integrating PjBL into the Cosmetology course. Data were collected through questionnaires and interviews with students and lecturers. The results revealed several critical issues:

- Inappropriate Teaching Materials: A heavy reliance on printed textbooks (used by 92% of students) was found to be outdated and insufficient to foster 21st-century skills.
- Underutilized Learning Media: While tools such as PowerPoint were in use, their integration lacked depth, limiting their effectiveness in enhancing students' critical and creative thinking.
- Minimal PjBL Implementation: Despite 83% of students expressing interest in innovative learning methods like PjBL, its application remained limited.
- Ineffective Learning Models: Existing models did not adequately support student engagement or skill development.
- Low 4C Skills Proficiency: Survey results highlighted that most students exhibited low levels in all four 21st-century competencies.

These findings confirm the need for a learning strategy that is more interactive, student-centered, and aligned with real-world challenges. PjBL was identified as a promising approach due to its emphasis on experiential learning and collaborative problem-solving (Hmelo-Silver, 2022).

3.2 Student Characteristics Analysis

Understanding student characteristics was essential in designing an effective and responsive PjBL strategy. The findings were as follows:

- Attitude toward Learning: A positive average score of 72.08% indicated students' openness to new learning experiences.
- Interest in Subject Matter: Scoring 65.59%, students showed moderate interest, which could be improved with engaging and relevant content.
- Learning Style Preferences: A score of 71.8% indicated flexibility and a willingness to integrate technology in learning.
- Motivation: This was the weakest area, with a score of 59.9%, highlighting the urgent need for more engaging instructional strategies.
- Technology Readiness: At 76.14%, students demonstrated a strong ability and willingness to use technology in their learning process.

These insights affirm that students are well-positioned for technology-integrated, project-based learning. Prior studies support this, highlighting how PjBL can significantly improve student motivation, engagement, and skill acquisition (Putri & Hidayati, 2024; Fauzan, Suharyat, & Wulandari, 2022).

3.3 Analysis of 4C Skills Prior to PjBL Implementation

Students' baseline 4C skills were assessed using a 30-item questionnaire. The results were as follows:

- Communication: 68.91%
- Critical Thinking: 66.01%
- Creativity: 70.57%
- Collaboration: 71.02%

The overall average score was 69.12%, indicating a moderate level of competence across all four domains. While not poor, these scores suggest significant room for improvement, especially to meet the skill demands of the modern workforce (Trilling & Fadel, 2021; Saavedra & Opfer, 2020).

3.4 Analysis of Process Standards

Evaluation of instructional process standards showed discrepancies between well-executed and poorly implemented activities:

Table 5. Analysis of Learning Process Indicators in Cosmetology Course Implementation

Activity Indicator	Average Score	Category
Introduction Activities	83.33%	Good
Application of Learning Models	37.5%	Very Poor
Utilization of Learning Resources	50%	Poor

The analysis highlights a critical need for improved implementation of innovative learning models and better integration of educational resources. Studies by Andriani and Hidayat (2021) and Sari and Santosa (2022) confirm that effective use of PJBL and interactive technologies enhances student engagement and the development of 21st-century skills.

3.5 Impact of PjBL Strategy on 4C Skills Development

Table 6. Pretest-Posttest Comparison

4C Skill	Before PjBL	After PjBL	Improvement (%)
Critical Thinking	60%	85%	41.7%
Creativity	65%	88%	35.4%
Communication	58%	80%	37.9%
Collaboration	62%	84%	35.5%

The data clearly show that all four skills significantly improved following the implementation of the PjBL strategy. These findings are in line with those of Nuraeni & Utami (2021), Miftakhurrohmah & Rahmiati (2024), and Wahyuni & Pratiwi (2021), who found that PjBL enhances critical thinking, creativity, and communication in vocational education settings. Furthermore, Fitria & Suyanto (2022) reported a notable increase in collaboration skills through PjBL, especially when students are actively involved in real-world project teams.

3.6 Comparative Analysis of 4C Skill Improvement

The comparative analysis of the 4C skill domains—Critical Thinking, Creativity, Communication, and Collaboration—reveals varying degrees of improvement among students following the implementation of the Project-Based Learning (PjBL) strategy. Notably, critical thinking and creativity demonstrated the most substantial gains. This outcome can be attributed to the inherent characteristics of the PjBL model, which actively engages students in problem-solving, exploration, and the development of innovative solutions. These processes naturally foster critical and creative thinking, as students are required to analyze information, evaluate alternative perspectives, and generate original ideas in the context of real-world challenges.

The immersive and inquiry-driven nature of PjBL allows learners to take ownership of their learning, encouraging them to think beyond conventional boundaries. Through project design, data collection, and solution-building activities, students gain deeper insights and develop the capacity to approach problems logically and imaginatively. According to Hmelo-Silver (2022), the open-ended and collaborative structure of PjBL supports the development of higher-order thinking skills by pushing students to reflect critically and create meaningful outcomes.

On the other hand, communication and collaboration skills, although improved, showed comparatively lower gains. This may be due to several factors, including limited opportunities for in-depth group discussions, uneven participation among team members, or a focus on individual rather than group performance within some project components. In some cases, students might have

prioritized task completion over collaborative process, thereby limiting the full development of interpersonal communication and teamwork skills.

To address these gaps, future implementations of PjBL should consider incorporating explicit strategies to enhance communication and collaboration. These may include structured peer feedback sessions, mandatory team reflection activities, role assignments within groups, and formal assessments of communication contributions. Embedding activities such as debate, discussion panels, and collaborative digital projects can also help strengthen students' ability to articulate their ideas and work cohesively with others.

Moreover, the inclusion of regular group mentoring and communication training workshops during project phases may provide students with tools to navigate team dynamics more effectively. As supported by research from Wahyuni and Pratiwi (2021), communication and collaboration thrive when students are consistently guided to engage in meaningful dialogue and cooperative problem-solving.

In summary, while the PjBL approach significantly enhances all four components of 21st-century skills, its greatest impact is observed in critical thinking and creativity. However, with additional support structures and targeted strategies, communication and collaboration skills can also be further developed, ensuring a more balanced and holistic skill acquisition that aligns with the demands of the modern workforce.

3.7 Theoretical and Conceptual Alignment

The effectiveness of PjBL in developing 4C skills is supported by a broad base of educational research. Table 8 summarizes supporting studies.

Table 7. Supporting Research on the Effectiveness of PjBL in Developing 4C Skills

4C Skill	Supporting Research
Creativity	Fauzan et al. (2017); Wulandari et al. (2023)
Critical Thinking	Lintang et al. (2017); Rahmat (2018); Rerung et al. (2017)
Collaboration	Nurliastuti et al. (2018); Suharyat et al. (2022); Haryati & Wangid (2023)
Communication	Rahmawati et al. (2017); Ilmiyatni et al. (2019)

These studies consistently show that PjBL facilitates student engagement in real-world contexts, promotes teamwork, and supports the development of higher-order thinking skills. When integrated into vocational programs like Cosmetology, PjBL offers an effective path for preparing students to meet the demands of the modern labor market.

3.8 Research Limitations

While the results are promising, this study is subject to several limitations:

1. Instructor Variability: Differences in instructor expertise and familiarity with PjBL may have influenced student outcomes.
2. Uncontrolled Student Backgrounds: Variations in students' initial 4C competencies were not fully controlled, possibly affecting the consistency of the results.
3. Assessment Bias: Despite the use of validated instruments, evaluating soft skills like creativity and communication remains subjective. Future research should consider incorporating triangulation methods or technology-based assessment tools to increase objectivity.

The implementation of Project-Based Learning (PjBL) in the Cosmetology course at the Department of Cosmetology and Beauty has proven effective in significantly enhancing students' 21st-century skills—especially in critical thinking, creativity, communication, and collaboration. Through structured, real-world projects, students were better able to connect theory with practice, thereby improving both their academic and professional competencies. The findings support the integration of PjBL into vocational curricula as a strategic approach to better prepare graduates for the dynamic demands of the modern workplace.

4. CONCLUSION

Based on the findings of this study, it can be concluded that the implementation of the Project-Based Learning (PjBL) strategy in the Cosmetology course at the Department of Beauty and Cosmetology significantly enhances students' 4C skills—Critical Thinking, Creativity, Communication, and Collaboration. The preliminary needs analysis revealed that current teaching practices still rely heavily on conventional methods and printed textbooks, with limited integration of 21st-century learning materials. Students' average 4C skills were recorded at 69.12%, falling into the "adequate" category, indicating a clear need for improvement. Furthermore, the analysis of student characteristics highlighted low levels of learning motivation and interest, which can hinder the development of key 21st-century competencies. However, following the implementation of PjBL, students demonstrated notable progress across all four skills, confirming the strategy's effectiveness in fostering active, relevant, and student-centered learning. Despite these positive results, the study has several limitations. Instructor experience with PjBL may have influenced the outcomes, student baseline abilities were not fully controlled, and subjective skill assessments may have introduced bias. Therefore, future research is recommended to explore the long-term effects of PjBL using larger and more diverse sample groups, apply more objective evaluation tools such as digital assessments or triangulated observations, and investigate additional strategies to further enhance communication and collaboration skills. These improvements would provide a more comprehensive understanding of how PjBL can be optimized to meet the evolving demands of 21st-century vocational education.

REFERENCES

Andriani, E., & Hidayat, R. (2021). Penerapan Project-Based Learning dalam Meningkatkan Keterlibatan Mahasiswa di Perguruan Tinggi Indonesia. *Jurnal Pendidikan Teknologi Dan Vokasi*, *15*(210–220).

Astuti, W., & Ningsih, M. (2021). Pengaruh Pembelajaran Berbasis Proyek terhadap Kreativitas Mahasiswa pada Pendidikan Tinggi di Indonesia. *Jurnal Pendidikan Dan Pembelajaran*, *18*, 215–224.

Bell, S. (2020). Project-based learning for the twenty-first century: The potential and the promise. *International Journal of Educational Research*, *104*, 1–13.

Brookhart, S. M. (2010). *How to Assess Higher-Order Thinking Skills in Your Classroom*.

Dewa, I. G., & Ardianti, D. (2022). Meningkatkan Keterampilan Komunikasi Mahasiswa melalui Pembelajaran Berbasis Proyek di Perguruan Tinggi. *Jurnal Pendidikan Indonesia*, *6*, 103–112.

Fauzan, A., Suharyat, Y., & Wulandari, D. (2022). Analisis Penerapan Model Pembelajaran Project Based Learning (PJBL) dalam Meningkatkan Keterampilan Abad 21. *Jurnal Basicedu*, *5*, 778–789.

Fauzan, A., Suharyat, Y., & Wulandari, R. (2022). Effectiveness of PJBL in Developing 4C Skills: A Meta-Analysis. *Education & Training Journal*, *38*, 89–101.

Fauzan, A., et al. (2017). Pengaruh Pembelajaran Berbasis Proyek terhadap Peningkatan Kreativitas Mahasiswa di Pendidikan Vokasional. *Jurnal Pendidikan Dan Pembelajaran*, *14*, 130–137.

Fitria, M., & Suyanto, E. (2022). Peningkatan Keterampilan Kolaborasi Mahasiswa melalui Pembelajaran Berbasis Proyek di Perguruan Tinggi. *Jurnal Pendidikan Vokasional, 10*, 231-239.

Forum, W. E. (2020). *The Future of Jobs Report 2020*.

Gall, M. D., Gall, J. P., & Borg, W. R. (2003). *Educational research: An introduction (7th ed.)*. Allyn & Bacon.

Griffin, P., & Care, E. (2019). *Assessment and Teaching of 21st Century Skills: Research and Applications.*

Haryati, Y., & Wangid, M. N. (n.d.). Implementation of Project-Based Learning to Improve Collaboration and Creativity in Higher Education. *International Journal of Educational Research, 50*, 132–145.

Haryati, Y., & Wangid, M. N. (2023). Pengaruh keterampilan abad ke-21 dalam pendidikan vokasional terhadap kesiapan kerja mahasiswa. *Jurnal Pendidikan Vokasi*, *13*(112–125).

Hmelo-Silver, C. E., et al. (2022). *Facilitating Inquiry-Based and Project-Based Learning in Higher Education: Strategies and Outcomes.* Academic Press.

Ilmiyatni, N., et al. (2019). Peningkatan Kemampuan Komunikasi Mahasiswa melalui Pembelajaran Berbasis Proyek. *Jurnal Pendidikan Dan Teknologi*, *12*, 213–220.

Johnson, L., Brown, R., & Carter, M. (2020). The Role of Teamwork in Beauty Industry Innovation. *Journal of Beauty and Innovation*, *34*(150–165).

Joseph F. Hair Jr., Barry J. Babin, Rolph E. Anderson, W. C. B. (2019). *Multivariate Data Analysis (Edisi ke-8)*. Cengage.

Krajcik, J., & Shin, N. (2018). Project-based learning. In F. Fischer, C. E. Hmelo-Silver, S. R. Goldman, & P. Reimann (Eds.),. *International Handbook of the Learning Sciences*, *275–288*.

Larmer, J., Mergendoller, J. R., & Boss, S. (2015). *Setting the Standard for Project-Based Learning: A Proven Approach to Rigorous Classroom Instruction*.

Lintang, D., et al. (2017). Pengaruh Pembelajaran Berbasis Proyek terhadap Keterampilan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan Vokasional Indonesia*, *8*, 78–85.

Miftakhurrohmah Miftakhurrohmah, & Rahmiati Rahmiati. (2024). Pengaruh Penggunaan E-Modul Berbasis Strategi Meta Kreatif terhadap Kreativitas Mahasiswa dalam Pembelajaran Penelitian Tata Rias dan Kecantikan. *Garina*, *16*(2), 122–141. https://doi.org/10.69697/garina.v16i2.139

Miller, T., & Stevenson, G. (2021). Enhancing Competitiveness in the Cosmetic Industry: The Importance of 4C Skills. *Cosmetic Education Review*, *29*, 80–95.

Nuraeni, R., & Utami, T. (2021). Penerapan Project-Based Learning dalam Meningkatkan Keterampilan Berpikir Kritis Mahasiswa di Pendidikan Tinggi Indonesia. *Jurnal Pendidikan Vokasi*, *14*, 102–112.

Nurliastuti, M., et al. (2018). Kolaborasi Mahasiswa dalam Pembelajaran Berbasis Proyek di Pendidikan Vokasional. *Jurnal Pendidikan Dan Keterampilan*, *6*, 89-95.

Plomp, T., & Nieveen, N. (2019a). *An Introduction to Educational Design Research*. Netherlands Institute for Curriculum Development (SLO).

Plomp, T., & Nieveen, N. (2019b). *Educational design research*. Enschede: Netherlands Institute for Curriculum Development (SLO).

Putri, A., & Hidayati, N. (2024). *Penerapan Pembelajaran Berbasis Proyek dan Hasil Belajar Mahasiswa*.

Rahmat, D. (2018). Analisis Penerapan Project-Based Learning dalam Meningkatkan Berpikir Kritis Mahasiswa. *Jurnal Pendidikan Abad Ke-21*, *5*, 45–52.

Rahmawati, Y., et al. (2017). Pengaruh Pembelajaran Berbasis Proyek terhadap Keterampilan Komunikasi Mahasiswa di Program Pendidikan Kosmetologi. *Jurnal Pendidikan Vokasional*, *10*, 120-126.

Rina, E., & Suryani, H. (2022). Meningkatkan Kreativitas Mahasiswa dengan Pembelajaran Berbasis Proyek di Universitas di Indonesia. *Jurnal Pendidikan Inovasi*, *5*, 89–97.

Rojas, F., & Chen, S. (2022). Augmented Reality in Beauty: Revolutionizing Makeup Training. *International Journal of Digital Beauty*, *15*, 202–215.

Saavedra, A. R., & Opfer, D. (2020). Teaching and learning for the twenty-first century: Disciplinary literacy and the future of education. *American Educational Research Journal*, *57 (1)*, 1–23.

Saavedra, A. R., & Opfer, V. D. (2012). *Teaching and learning 21st century skills: Lessons from the learning sciences*. Asia Society.

Safitri, D., & Putra, H. (2022). Pengembangan Keterampilan Berpikir Kritis Mahasiswa Melalui Pembelajaran Berbasis Proyek di Indonesia. *Jurnal Pendidikan Dan Teknologi*, *11*(145–155).

Santosa, T. R., & Kusuma, H. (2021). Pengaruh Pembelajaran Berbasis Proyek terhadap Keterampilan Kolaborasi Mahasiswa di Pendidikan Vokasional. *Jurnal Pendidikan Indonesia*, *5*, 87–95.

Sari, A., & Santosa, D. (2022). Peran Teknologi dalam Pembelajaran Abad ke-21 di Pendidikan Tinggi Indonesia. *Jurnal Pendidikan Dan Teknologi*, *10*.

Sari, R., & Sihombing, F. (2022). Implementasi Pembelajaran Berbasis Proyek untuk Meningkatkan Keterampilan Abad ke-21 Mahasiswa di Indonesia. *Jurnal Pendidikan Dan Pembelajaran*, *16*, 124–

131.

Sugiyono. (2019). *Metode Penelitian Kuantitatif, Kualitatif, dan R&D*. Alfabeta.

Suharyat, E., et al. (2022). Efektivitas Pembelajaran Berbasis Proyek dalam Meningkatkan Kolaborasi Mahasiswa di Pendidikan Kosmetologi. *Jurnal Kosmetologi Indonesia*, *9*, 101-108.

Trilling, B., & Fadel, C. (2021). *21st Century Skills: Learning for Life in Our Times*. Jossey-Bass.

Voogt, J., Erstad, O., Dede, C., & Mishra, P. (2018). Challenges to learning and schooling in the digital networked world. *Journal of Computer Assisted Learning*, *34*, 403–411.

Wahyuni, L., & Pratiwi, D. (2021). Pengaruh Pembelajaran Berbasis Proyek terhadap Keterampilan Komunikasi Mahasiswa di Pendidikan Tinggi Indonesia. *Jurnal Pendidikan Dan Komunikasi, 19*, 134–142.

Wulandari, D., et al. (2021). Pengaruh Pembelajaran Berbasis Proyek terhadap Keterampilan Mahasiswa di Pendidikan Vokasional di Indonesia. *Jurnal Pendidikan Vokasional Indonesia*, *9*, 56–63.

Wulandari, D., et al. (2023). Penerapan Pembelajaran Berbasis Proyek dalam Mengembangkan Kreativitas Mahasiswa Kosmetologi. *Jurnal Pendidikan Kosmetologi*, *11*(23–31).

Yuliani, E., Suharyat, T., & Wulandari, R. (2020). Project-Based Learning Implementation in Vocational Education. *International Journal of Vocational Education Research.*