

Design and Evaluation of an AI API–Integrated Innovative Teaching Module: A Case Study of 3D Modeling and Printing in Jewelry Design

Wan-Ching, Cheuh^{1*}, Wei-Te, Liu²

¹ National Yunlin University of Science & Technology, Taiwan

² National Yunlin University of Science & Technology, Taiwan

**Corresponding author: jinger0517@gmail.com*

ABSTRACT

This study aims to design and validate an innovative teaching module that incorporates artificial intelligence (AI) application programming interface (API) technology to enhance the teaching effectiveness of 3D modeling and printing courses in jewelry design. While traditional jewelry education, primarily focused on handcrafting and metalworking, has gradually digitized, the diverse backgrounds and high technical barriers often create learning difficulties for students. To address this, this study incorporates AI API technologies such as Leonardo.ai, Vizcom, and Rodin to provide design suggestions, automated modeling, and personalized feedback, lowering technical barriers and stimulating creativity. The study employed a mixed-methods design approach, developing the teaching module based on the ADDIE model and collecting learning data from vocational trainees through questionnaires and interviews. Results showed that the AI API effectively improved student operational efficiency, creative thinking, and project accuracy, while also boosting learning motivation. However, lack of design and metalworking foundations can lead to structural and dimensional errors in the generated models. The study concluded that AI APIs have the potential to enhance teaching effectiveness and individualize learning, but also demonstrates that the application of technology still requires integration with professional knowledge and educational guidance. These findings serve as an important reference for promoting intelligent and innovative learning models in jewelry design education.

Keywords: Artificial Intelligence, AI API, 3D Modeling, 3D Printing, Jewelry Design, Innovative Teaching Module

1. INTRODUCTION

1.1 Research Background and Motivation

With the rapid advancement of technology, jewelry design has been transforming from traditional hand drawing and metalworking to a digital process centered on 3D modeling and 3D printing. 3D modeling software (such as Rhinoceros, Blender, and ZBrush) enables precise visualization of complex forms, while 3D printing technologies (such as SLA, DLP, and SLS) can rapidly convert digital designs into high-precision prototypes, thereby improving production efficiency and minimizing material waste. Research indicates that 3D printing has become a key technology in jewelry manufacturing, significantly enhancing design flexibility and accelerating product development (Bertacchini et al., 2021). The recent integration of artificial intelligence (AI) has further expanded the possibilities of digital jewelry design. In particular, AI APIs (such as the GPT API) can provide automated modeling suggestions, error detection, and parameter optimization, assisting learners in improving design accuracy and fostering creative thinking (GIA, 2024).

However, current jewelry design curricula still face several challenges. First, 3D technology presents a steep learning curve due to its technical complexity and the diverse backgrounds of learners, especially those without prior experience in design or metalworking (Bertacchini et al., 2021). In vocational training institutions, for instance, students vary widely in age, discipline, and skill level, leading to substantial differences in learning progress and comprehension (Forbes Business Council, 2023). Second, traditional teaching methods often lack individualized support and real-time feedback, which can cause some students to lose confidence and motivation (GIA, 2024). Furthermore, the absence

of immediate optimization and error detection during the design and production stages often results in poorly structured models or imbalanced proportions that require time-consuming corrections (Kamolov et al., 2023).

To address these issues, this study integrates AI API technology into jewelry 3D modeling and printing courses. By offering automated modeling suggestions, error detection, and real-time feedback, the approach aims to help learners overcome technical barriers, shorten the learning curve, and foster the integration of digital technology with traditional craftsmanship.

1.2 Research Questions and Objectives

This study aims to design and validate an innovative teaching module integrated with AI APIs, and explore its impact on students' learning outcomes, creative thinking, and production accuracy in a 3D modeling and printing course.

Research questions:

RQ1: How to design an innovative teaching module that integrates AI API technology to improve the learning outcomes of jewelry 3D modeling and printing?

RQ2: What impact does API technology have on students' operational processes, creative thinking, and the accuracy of their work?

(1) How does AI API optimize the operational processes of 3D modeling and printing?

(2) Can AI API stimulate creative thinking and design innovation?

(3) Can AI API improve the structural rationality and accuracy of the work?

Further sub-questions:

a. Are there differences in learning adaptability among students from different backgrounds?

b. How satisfied are students with the personalized learning support provided by the AI API?

c. Can the AI API effectively improve learning efficiency and project completion?

1.3 Study Scope and Limitations

This study focuses on the application of innovative teaching modules integrated with AI APIs in jewelry 3D modeling and printing education. The scope and limitations are as follows:

(1) Research Subjects and Field: The research subjects were 23 students from a vocational training institution's "Jewelry Design 3D Printing Course," who came from diverse backgrounds. Data were collected through a mixed method of small-group instruction, questionnaires, and interviews. Due to the limited sample size, this research is pilot-oriented and will require further expansion of the sample and field.

(2) Technology: The AI APIs introduced include Leonardo.ai and Vizcom and Rodin, combined with modeling software such as Rhinoceros and ZBrush. Because this does not cover all AI technologies, the application results are limited.

(3) Time and resource constraints: The total teaching module implementation time is 160 hours. Due to the limitations of course schedule and research manpower, the sample and data size are limited, and the results are not fully representative.

(4) Methodological limitations: The questionnaire and interview were conducted in parallel, which can reflect the subjective experience of the students. However, it may be affected by language expression and background differences. This is an exploratory study and needs to be verified later.

(5) External factors: The teaching process may be affected by students' attitudes, equipment conditions or course arrangements, and the results are still uncertain.

2. LITERATURE REVIEW

2.1 Application of AI Technology in Education

Artificial intelligence has become a core force in educational innovation, providing personalized and adaptive learning support. A bibliometric study by Durak et al. (2024) indicates that AI education research has grown rapidly over the past decade, with a particular focus on the application of smart teaching and generative AI. AI can analyze learner behavior data, provide differentiated learning paths, and enhance learning motivation and engagement. Furthermore, it can automate grading and curriculum planning, reducing teacher workload and allowing them to focus on creative and guided instruction (Durak et al., 2024).

2.2 3D Printing and the Development of Jewelry Education

3D printing offers advantages in high precision and customization in jewelry education and manufacturing. Sadiku et al. (2024) note that 3D printing can shorten development cycles, enhance design flexibility, and reduce material waste. Yap and Yeong (2014) also believe that it transcends the limitations of traditional casting processes, enabling designers to achieve more complex and innovative shapes. In educational applications, 3D printing enables students to quickly transform digital models into physical objects, fostering design thinking and practical skills, and promoting the digital transformation of jewelry education (Sadiku et al., 2024; Yap & Yeong, 2014).

2.3 Integration of AI and the Jewelry Industry

AI is reshaping the jewelry industry's design and marketing operations. Shah (2023) notes that AI-powered parametric design tools can help designers generate highly complex designs and leverage big data analysis to understand market trends. Yan (2024) further explains that AI is already widely used in retail and customer interaction, including 3D visual displays, intelligent recommendations, and production scheduling optimization, enhancing customer experience and brand competitiveness. Overall, AI has become a crucial technology in the jewelry industry, connecting design innovation with marketing strategies (Shah, 2023; Yan, 2024).

2.4 The Potential of AI API Technology in Innovative Teaching

AI APIs (such as Leonardo, Vizcom, Rodin (e.g., AI) provides flexible generative learning tools for educational settings. Faruqi et al. (2024) point out that while generative AI can quickly generate 3D models, a lack of structural consideration can easily lead to unworkable finished products. Applying AI APIs to teaching can provide instant feedback and optimization suggestions during modeling, helping students balance aesthetics and functionality. For vocational education, API-driven modular design can lower technical barriers, enhance individualized learning, and enhance the development of creative thinking (Faruqi et al., 2024).

3. RESEARCH METHODS

3.1 Study Design

This study adopted a mixed research method, combining qualitative and quantitative approaches to ensure data integrity and credibility. The research process was divided into four stages:

- (1) Expert interviews (pre-test): Collecting expert opinions to revise questionnaire items;
- (2) Teaching module design and implementation: Introducing AI API technology into the jewelry 3D modeling and printing course;
- (3) Questionnaires and student interviews: Analyzing students' learning performance in terms of operation process, creative thinking, and accuracy;
- (4) Data analysis: Integrating quantitative statistics and qualitative feedback to evaluate the effectiveness of the teaching module.

3.2 Research Objects and Fields

The research subjects were 23 participants in a "Jewelry Design 3D Printing Course" at a vocational training institution. They came from diverse backgrounds, most with no prior design or metalworking

experience. The research took place in the researcher's classroom, where the course lasted 160 hours. Twenty-three valid questionnaires were collected, and eight participants were selected for in-depth, semi-structured interviews. The questionnaires provided quantitative data for analysis, while the interviews supplemented the participants' real-life experiences and reflections. Qualitative data reached data saturation, ensuring the reliability and representativeness of the analytical results.

3.3 Research Tools and Data Sources

(1) Expert Interview Outline (Pre-test)

Invite five experts with experience in jewelry design education, 3D modeling, and AI teaching to review the questionnaire's relevance and research direction. Sample questions:

- a. What learning difficulties can AI APIs address in jewelry courses?
- b. What are some common operational errors students make?
- c. What metrics can be used to assess creative thinking and accuracy?

(2) Questionnaire Survey

A total of 23 valid questionnaires were collected. The questionnaires were designed based on expert opinions and covered five major aspects:

- a. Learning outcomes
- b. Operational procedures
- c. Creative thinking
- d. Production accuracy
- e. Phased application verification (from sketch to printed product).

The evaluation was conducted using a five-point Likert scale (1 = strongly disagree, 5 = strongly agree).

(3) Qualitative Interview (Post-test)

We interviewed 8 students in a semi-structured manner to explore their operational experience, creative inspiration, and learning experience in AI API teaching, to supplement the questionnaire results and provide in-depth analysis.

3.4 Research Process

This study is based on the ADDIE model (Analysis, Design, Development, Implementation, Evaluation) to conduct curriculum design and research implementation. The process is as follows:

Analysis:

Gather information on student backgrounds and learning needs, and consult relevant literature to understand the current state of jewelry 3D modeling and printing education, the development of AI in design and teaching applications, and the main challenges of current teaching. This will serve as a basis for teaching module design.

Design:

Develop course structure and learning objectives, plan how to implement AI API technologies (such as Leonardo.ai, Vizcom, and Rodin), and design learning activities that balance operational training, creative thinking, and work accuracy.

Development:

Create teaching materials, learning guides, and sample projects based on the curriculum design; establish AI API application scenarios (such as theme suggestions, automatic modeling, and gemstone layout design); and complete questionnaires and interview tools to collect learning process data.

Implementation:

Conduct a 160-hour course experiment at a vocational training institution, introducing AI APIs to assist teaching and combining them with traditional modeling processes. Observe students' operational and design performance and collect first-hand data.

Evaluation:

Analyze students' proficiency, creative thinking, and accuracy of their work through questionnaires, interviews, and expert opinions, and use triangulation to enhance reliability and validity.

3.5 Data Analysis Methods

Quantitative data analysis:

Descriptive statistics, t-tests, and one-way analysis of variance were conducted using SPSS to explore the differences in learning outcomes among learners from different backgrounds (Mishra et al., 2019; Kent State University Libraries, n.d.; La Trobe University Library, n.d.).

Qualitative data analysis:

Thematic analysis was used to summarize the feedback from participants and experts to verify the credibility of the questionnaire and research results (Nowell et al., 2017).

Triangulation:

Combining questionnaire data, expert interviews, and participant interviews to ensure the integrity and validity of research findings (Moon, 2019).

4. RESEARCH RESULTS AND ANALYSIS

4.1 Research Subjects and Data Sources

This study involved 23 participants in the "AI API-Integrated Jewelry Design and 3D Printing Innovative Teaching Module" course. The participants ranged in age from 22 to 55, with backgrounds in art design, industrial design, metalworking, computer engineering, mechanical drafting, military service, and the service industry. Most had little design and 3D modeling experience. The study took place at the vocational training institution where the researcher teaches. The 160-hour course covered key modeling software, including Rhino and Zbrush, as well as AI-assisted modeling (e.g., Leonardo.ai, Vizcom, and Rodin), 3D printing applications, and creative thinking training.

This study employed a mixed-methods approach, combining quantitative questionnaires with qualitative interviews. Twenty-three questionnaires were distributed, all of which were validly returned. Based on the questionnaire results and learning performance, eight participants from diverse backgrounds were selected for in-depth, semi-structured interviews to capture their diverse experiences. The interviews focused on five key areas: learning outcomes, operational processes, creative thinking, production accuracy, and phased application verification. Triangulation was used to cross-check the quantitative and qualitative data to ensure reliability and data saturation. All interviewees signed informed consent forms and provided anonymity. The data will be used for academic research purposes only.

4.2 Questionnaire Data Analysis

This study designed a questionnaire comprised five dimensions and used a five-point Likert scale, with 1 representing "strongly disagree" and 5 representing "strongly agree." A total of 23 valid questionnaires were collected, for a 100% response rate. The following statistical analysis and discussion of the results for each of the five dimensions are presented.

Table 1 Summary of Questionnaire Results by Dimension

Facet Name	Average value (M)	Standard deviation (SD)	Summary of key findings
Learning Effectiveness	4.38	0.72	Participants generally affirmed that AI improved their understanding of learning and self-efficacy. AI also helped shorten learning time and strengthen confidence (e.g., S2, a participant without a design background, noted that AI lowered the learning barrier).
Operational Process	4.07	0.91	AI tools (Rodin, Vizcom) can simplify modeling and debugging processes, improving operational efficiency. Some students noted that keywords and English commands remain challenging.
Creative Thinking	4.27	0.93	Students believe that AI can inspire creativity and diverse style concepts, promote styling breakthroughs and style extensions (for example, S4 believes that AI breaks the inertia of design).
Production Precision / 3D Printing Feasibility	3.83	1.14	AI can assist with proportion and structural analysis, but the generated models still require manual correction. Participants noted that structural fractures are common during the printing phase, demonstrating the continued importance of process integration.
Process-Specific Evaluation	Concept 4.70 Modeling 4.52 Print 3.83 Post-production 3.70	—	The trend is "high at the beginning and low at the end." AI is most beneficial during the conception and modeling stages, accelerating concept formation and modeling efficiency. Later stages of printing and post-production still require teacher and technical support.

Survey results show that after incorporating AI APIs into jewelry design and 3D printing courses, overall student satisfaction and learning outcomes were highly positive. Average scores across the five dimensions ranged from 3.70 to 4.38, demonstrating that AI significantly benefits the learning process.

Overall, AI APIs effectively support the creative conception and process efficiency of students from diverse backgrounds within the curriculum, demonstrating significant success in lowering the learning barrier and enhancing design creativity. However, back-end production remains limited by the physical feasibility of generative technology. Future teaching should strengthen the integration of AI design and manufacturing modules to cultivate students' ability to transform AI creativity into practical technologies.

4.3 Qualitative Interview Analysis

To supplement the quantitative results from the questionnaire, this study conducted in-depth semi-structured interviews with eight participants (S1-S8) to explore the practical impact of the introduction of AI API technology on their learning process, creative thinking, and work production. Thematic analysis of the data revealed five key themes:

- (1) AI lowers the learning threshold and boosts confidence
- (2) AI promotes creative thinking and style exploration
- (3) AI optimizes operational processes and provides immediate feedback
- (4) AI improves accuracy but is limited by process technology
- and (5) Differences in AI application at different learning stages.

4.3.1 Theme 1: AI-Assisted Learning Reduces Learning Barriers and Enhances Confidence

AI makes learning 3D modeling more intuitive, effectively lowering the barrier to entry, especially for those without a design background. Participants (S2, S5, and S7) noted that AI-generated example images and structural suggestions helped them understand proportions and forms. S2 stated, *"The AI's prompts helped me understand exactly what changes and modifications to make."* This suggests that AI's visual feedback reduced anxiety and boosted confidence. This is consistent with the "Learning Outcome" dimension of the questionnaire (M=4.38), indicating that AI has a positive impact on comprehension and self-efficacy.

4.3.2 Theme 2: AI Promotes Creative Ideas and Exploration of Diverse Styles

AI's multi-version generation fosters inspiration and stylistic expansion. Participants (S1, S3, S4, and S8) believe that AI-generated images can inspire diverse material combinations and atypical structures. S4 stated, *"AI has broken my stylistic inertia and allowed me to experiment with new structures."* However, some participants noted that the sheer number of generated images made selection difficult, requiring design judgment. Overall, AI demonstrated significant effectiveness in inspiring creativity, echoing the "Creative Thinking" dimension (M=4.27).

4.3.3 Theme 3: AI Optimization of Operational Processes and Instant Learning Feedback

Most students believe that AI can simplify operations and provide real-time corrections. S6, S4, and S1 stated that AI's modeling and scale correction features save time and provide quick feedback when teachers are unable to provide immediate guidance, thereby enhancing the continuity of self-study and after-class practice. This is consistent with the "Operational Process" dimension of the questionnaire (M=4.07).

4.3.4 Theme 4: AI Improves Work Precision, But Still Limited by Craftsmanship

Participants (S2, S3, S5, and S6) noted that while AI-generated models possess visual sophistication, they lack consideration for material thickness and support design. S5 commented, *"AI helps me identify problems, but it can't solve them for me."* This suggests that AI is only useful as a reference and still requires refinement based on metalworking experience. This is consistent with the "Fabrication Accuracy" dimension (M=3.83).

4.3.5 Theme 5: Differences in the Effectiveness of AI Applications at Different Learning Stages

AI is most effective during the conception and modeling stages (S1, S4, and S8), inspiring inspiration and providing design direction. However, its role is limited during the printing and post-production stages, which still require teacher guidance. Some participants believe that AI can serve as a "self-assessment tool" to help them reflect on their designs. The overall trend is "strong in the early stages, weak in the later stages," consistent with the survey's "stage-by-stage application review" results.

4.3.6 Summary

Based on the interview results, the introduction of AI API technology has shown three benefits and two challenges:

Benefits: (1) Lowering the learning threshold and enhancing confidence; (2) Promoting creativity and style diversity; (3) Optimizing operational efficiency and design accuracy.

Challenges: (1) Printing and post-production assistance are still limited; (2) Students need to be trained to judge AI instructions and generated content.

Overall, AI plays the role of "creative generation and learning assistant" in jewelry design education, especially in the conception and modeling stages. In the future, the integration of AI and practical production should be strengthened to promote a complete learning chain from "digital conception" to "craft implementation."

4.4 Triangulation and Integrated Analysis

To ensure research reliability and validity, this study employed triangulation, combining questionnaire (quantitative) and interview (qualitative) data for cross-comparison, enhancing the

credibility and depth of interpretation (Denzin, 2017). Overall, the results suggest that the implementation of AI APIs can enhance learner self-efficacy, creativity, and process efficiency, but there are still limitations in the accuracy of the work and post-production.

4.4.1 Convergence

The average questionnaire score was above 4.3, with "Learning Effectiveness" (M=4.38) and "Creative Thinking" (M=4.27) receiving the highest scores. Interviewers noted that AI lowers technical barriers and inspires creativity. This finding aligns with Dweck's (2016) theory of "growth mindset," demonstrating that learners' self-efficacy improves in a supportive environment and with immediate feedback. It also echoes Durak et al.'s (2024) research on AI-enhanced adaptive learning, which confirms that personalized AI support can improve learning outcomes.

4.4.2 Complementarity Analysis

Qualitative data revealed details not captured in the questionnaire, such as the fact that AI primarily assists in the initial stages of modeling, requiring fundamental technical skills and semantic input. Some participants reported experiencing "difficulty in making choices" and "creative loss" due to the excessive amount of generated content, suggesting that generative learning involves cognitive load (Sweller, 2011), further enhancing the interpretive depth of the quantitative results.

4.4.3 Divergence

Results from the "Phase-Based Application Review" revealed high scores during the conception phase (M=4.7) and lower scores during post-production (M=3.7). AI is most effective during the conception and modeling phases, while post-production is limited by process limitations. Participants with a metalworking background were better able to integrate AI with implementation, indicating that professional knowledge is a moderating variable. This is consistent with Koehler and Mishra's (2009) TPACK model, which states that effective technology integration requires a balance between technical knowledge (TK), pedagogical knowledge (PK), and content knowledge (CK).

4.4.4 Comprehensive Analysis and Theoretical Interpretation

Combining quantitative and qualitative results, AI APIs demonstrate three educational values in teaching:

(1) Improving learning effectiveness and self-direction: AI's instant feedback promotes independent exploration, echoing the strengthening effect of "action mastery experience" in Bandura's 1997 self-efficacy theory cited by Klassen (2025).

(2) Promoting creativity and the development of design thinking: AI assists in rapid prototyping and concept revision, consistent with Brown's (2008) design thinking cycle model.

(3) Revealing the structural limitations of craft education: AI is highly effective in the conceptual and modeling stages, but still relies on manual technology in the later stages, echoing Bertacchini et al.'s (2021) view of AI as an assistive medium.

4.4.5 Summary

Overall, AI in jewelry design education should be positioned as a tool for generating creativity and supporting learning. It can improve learning efficiency and inspire inspiration, but it still needs to be combined with craft expertise and teacher guidance to form an integrated "creativity-technology-craftsmanship" education model.

4.5 Chapter Summary

This chapter, drawing on the results of questionnaires, interviews, and triangulation, explores the teaching effectiveness and learning experiences of incorporating AI API technology into jewelry design and 3D printing courses. Overall, AI has a significant positive impact on students' learning outcomes, creative thinking, and operational efficiency. However, the practical production phase remains limited by process and technology, requiring human-machine collaboration and teacher guidance.

The survey results show that overall satisfaction with AI-assisted learning is relatively high (average rating of 3.70 to 4.38), with "Learning Effectiveness" and "Creative Thinking" scoring the highest, demonstrating that AI can effectively enhance learning motivation and creativity. Regarding operational processes, AI tools (Leonardo.ai, Vizcom, and Rodin) simplify modeling and lower the learning threshold. However, regarding "Production Accuracy," some students still need to manually modify the generated models, indicating that the benefits of AI are primarily concentrated in the design phase.

Qualitative interviews revealed five key themes: (1) AI lowers the learning threshold and boosts confidence; (2) promotes creative thinking and style exploration; (3) optimizes operations and provides instant feedback; (4) improves accuracy but is limited by process; and (5) the effects vary across different learning stages. Overall, AI provides the most significant assistance in the conception and modeling stages, while printing and post-production still rely on teachers and hands-on experience.

Triangulation results show consistent trends across quantitative and qualitative data. AI performs well in the dimensions of "learning outcomes, creative thinking, and operational processes," but also presents challenges such as information overload and difficulty in making choices. Those with a background in metalworking or design are more effective in transforming AI findings into practical applications.

The comprehensive results show that AI API has three major educational implications in jewelry education: (1) promoting individualized and adaptive learning, with AI providing real-time feedback to help students adjust their progress according to their abilities; (2) strengthening creative thinking and design integration capabilities, with AI becoming a creative assistant; and (3) improving digital skills and learning confidence, reducing technological anxiety, and enabling students to focus on creation. However, AI is still difficult to fully meet the needs of 3D printing and metalworking. Its best position is as a "creative generation and learning assistance tool" rather than replacing professional judgment. The results of this chapter verify the feasibility of the AI API teaching module and provide empirical evidence for the introduction of AI into vocational education.

5. CONCLUSION AND RECOMMENDATIONS

This chapter summarizes the key findings from the integration of AI API technology into jewelry design and 3D printing courses, and offers theoretical and practical recommendations. This study aims to explore how AI APIs can help students from diverse backgrounds improve their learning outcomes, operational efficiency, creative thinking, and project accuracy, and to validate their feasibility in vocational training education.

5.1 Research Conclusions

The study adopted a mixed method approach, integrating the results of questionnaires, interviews and triangulation, and summarized the following conclusions:

1. AI API effectively improves learning outcomes and self-efficacy: AI lowers the learning threshold, enabling those without a design background to quickly master modeling skills, and instant feedback promotes the connection between theory and practice (Klassen, 2025).

2. AI promotes creative thinking and style exploration: Generative technology stimulates inspiration and helps students extend their design concepts, echoing Brown's (2008) design thinking cycle of "idea-prototype-reflection".

3. AI optimizes learning processes and operational efficiency: Instant prompts and error corrections improve self-learning ability, partially replacing the instant guidance function in traditional teaching.

4. AI improves the accuracy of artwork but is subject to technical limitations: While it can assist with proportion and structural analysis, printing and metalworking still require manual correction, highlighting the importance of human-machine collaboration.

5. AI benefits are highest at the beginning and decline later in the process: It is most effective in the conception and modeling stages, with declining effectiveness in printing and post-production, making

it suitable for assisting in the early stages of design.

6. AI supports individualized and adaptive learning: It can dynamically adjust the learning process based on student feedback, demonstrating the potential of vocational education to support diverse learners.

In summary, AI API has achieved remarkable results in generating ideas and optimizing operations, but it still requires teacher guidance and professional craftsmanship to establish a teaching model that is both innovative and practical.

5.2 Study Limitations

(1) Sample limitations: Only 23 questionnaires and 8 interviews were conducted, which is a pilot study with limited representativeness.

(2) Technical limitations: The study used Leonardo.ai, Vizcom, Rodin, etc., and did not cover all AI modeling systems.

(3) Learning differences: Students have different levels of familiarity with the software, which affects learning outcomes.

(4) Researcher role bias: Researchers are also teaching teachers, and although anonymous, they may still be influenced by social expectations.

(5) AI generation uncertainty: AI content is random and biased, and its stability and reproducibility are limited.

5.3 Research Recommendations

1. Suggestions for Educational Practice

(1) Initial course introduction: Use AI as an inspirational tool in the conception and modeling stages.

(2) Strengthen the integration of AI and technology: Combine AI design with physical production to establish a hybrid model of "AI design-human refinement".

(3) Cultivate AI literacy and critical thinking: Teachers should guide students to understand the principles and limitations of generation and strengthen their judgment and correction capabilities.

(4) Develop an AI adaptive learning platform: Integrate AI feedback mechanisms with course management systems to achieve individualized teaching.

2. Suggestions for Future Research

(1) Expand the sample and conduct cross-disciplinary comparisons: Extend to fields such as product, clothing, and architectural design.

(2) Construct an AI learning process model: Combine learning analytics to explore the impact of AI on creativity and problem solving.

(3) Explore AI ethics and human-machine co-creation: Study how to maintain students' originality and creative subjectivity.

(4) Establish a localized AI teaching module: Integrate Taiwanese culture and craftsmanship to develop AI educational resources with local value.

5.4 Summary

AI API technology demonstrates significant pedagogical potential in jewelry design education, not only enhancing learning outcomes and design thinking but also fostering cross-technology integration and personalized learning. AI has evolved from a tool into an "intelligent learning partner," assisting students in exploration, correction, and innovation throughout the creative process.

The future requires a balance between "human creativity" and "intelligent assistance" to promote intelligent, innovative, and personalized design education. This research finding serves as an important reference for the digital transformation of vocational education and the application of AI in teaching.

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