

Developing a Skill-Oriented Teaching Model for Fashion Design Education: A Fuzzy Delphi Approach

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Abstract: As fashion design education transitions from knowledge transmission to skill development, establishing a systematic skills-oriented teaching model has become pivotal to enhancing students' professional capabilities. Addressing practical challenges in higher vocational fashion design education, this study employs the Fuzzy Delphi Method (FDM) to construct and validate a skills-oriented teaching model. The model comprises five core components—teaching objectives, teaching strategies, teaching links, teaching resources, and evaluation and feedback—further refined into twenty key elements. Experts were invited to rate the importance and feasibility of each component and element. Fuzzy computation was employed to determine weights and consensus levels. Results demonstrated high expert consensus ($S_B \leq 0.20$) across all components, with fuzzy scores exceeding 0.80. This confirms the model's sound structure and high practical applicability.

Keywords: Skill-oriented; Fuzzy Delphi Method; Teaching model; Professional skills development

1. Introduction

Driven by the dual forces of Industry 4.0 and digital transformation, the global fashion industry is undergoing an unprecedented paradigm shift. The role of the contemporary fashion designer is no longer confined to traditional aesthetic conception but has evolved into a comprehensive professional role requiring mastery of creative expression, technological integration, and market value judgement (Zhang Yiling, Jin Ying & Liu Yangyang, 2025). Industry demand for talent has shifted from a singular 'portfolio-driven' approach towards a 'comprehensive skills-driven' orientation (Liu Xiaoling, 2025). Leading international fashion education institutions are actively exploring how curriculum reform (Cardoso & Spagnoli 2022) can equip students to navigate the rapidly evolving demands of global value chains.

Despite the growing recognition of the importance of fashion education, a pronounced phenomenon of 'single-skilled training' persists within contemporary fashion design curricula (Tang Ruichang & Zhang Zhaopeng, 2024). On the one hand, traditional practical training models often place excessive emphasis on imparting artistic aesthetics, neglecting the rigour of technical implementation and the practical effectiveness of market conversion (Li Shuai, 2024); On the other hand, teaching processes frequently exhibit linear characteristics, lacking collaborative cultivation of interdisciplinary skills (Bian Xiangyang & Zhou Honglei, 2020). Existing pedagogical models are predominantly empirically based, lacking scientifically validated standardised frameworks capable of systematically enhancing students' professional skills (Fu Lina, 2024). This gap between educational outcomes and industry competency requirements has become a bottleneck constraining the quality enhancement of fashion design talent.

Therefore, this study aims to address the current gaps in higher vocational fashion design education, specifically the insufficient integration of theory and practice, as well as the inadequacies in the skills development framework (Zhong Jufang, 2021). Based on the Design and Development Research (DDR) methodology, an 'Enhancing Students' Professional Skills (ESPS)' teaching model has been constructed. Centred on Competence - Based Education (CBE), this model incorporates the CDIM (Conceive-Design-Implement-Market) teaching logic. This logic, drawing upon the CDIO (Conceive-Design-Implement-Operate) engineering education framework, incorporates Project-Based Learning (PBL) methodology. It emphasises the cultivation of student competencies through authentic tasks and practical projects, systematically identifying and establishing key skill elements within vocational fashion design training. This provides structured guidance for curriculum design, teaching implementation, and assessment. By clarifying teaching objectives, optimising teaching strategies and teaching links, and integrating teaching resources and evaluation mechanisms, this model not only provides a practical pathway for enhancing students' innovation capabilities, design skills, craftsmanship execution abilities, and commercialisation capabilities but also offers theoretical support and practical reference for fashion design education reform. It drives the transformation of educational models from knowledge transmission to skills cultivation.

We believe that this research holds both theoretical and practical importance. Theoretically, it enriches the theoretical framework of skills-oriented teaching within the context of fashion design education. Practically, the skills-oriented teaching model validated through FDM will provide educators with an actionable, quantifiable teaching guide. This will effectively assist students in making the capability leap from “design students” to “preprofessional designers” during their studies, thereby significantly enhancing their professional adaptability and market competitiveness.

2. Research Methodology

This study aims to develop a skill-oriented teaching model for fashion design based on expert consensus, addressing current issues in higher vocational fashion design education, including ambiguous course objectives, insufficient practical components, and monolithic assessment mechanisms (Zhang, 2023). The research employs the Design and Development Research (DDR) methodology, integrated with the Fuzzy Delphi Method (FDM), to systematically construct the teaching model. This chapter outlines the methodology of research design, the expert selection process, the questionnaire design, and the data analysis.

2.1 Model Validation Methods

To ensure the scientific, systematic, and practical feasibility of the "Enhancing Students' Professional Skills (ESPS)" teaching model in terms of structure and element selection, this study employed the Fuzzy Delphi Method (FDM) for expert consensus building during the DDR model design and development phase. Compared to the traditional Delphi method, which primarily relies on deterministic statistical results, FDM integrates fuzzy set theory, effectively addressing the uncertainty and linguistic ambiguity in expert judgment. It transforms subjective experience into quantifiable data, thereby reducing biases caused by cognitive differences and improving the consistency and stability of group decision-making.

2.2 Methodological Advantages

The Fuzzy Delphi method is widely used in educational and teaching model construction research because it can integrate the subjective opinions of multiple experts. On the one hand, the traditional Delphi method itself is an effective way to reduce cognitive bias and improve consensus through multiple rounds of anonymous expert feedback. The Fuzzy Delphi method further enhances its ability to handle the ambiguity of expert language by introducing fuzzy set theory (Abdul Rahman et al., 2021). This method can transform experts' uncertain judgments on complex concepts into quantifiable fuzzy numbers, thereby maintaining the original meaning of expert opinions and reducing subjective bias, improving the consistency and reliability of judgments (Othman et al., 2024). Other studies have pointed out that the Fuzzy Delphi method (FDM) has significant advantages in constructing educational evaluation indicator systems, curriculum module verification, and instructional framework design. Its multi-round expert integration process can effectively promote the formation of expert consensus and provide an empirical basis, making the constructed model more scientific in structure and more closely aligned with practical needs in content (Ciptono et al., 2019). Therefore, the use of FDM in this study not only ensures the scientific basis for selecting elements and the structural design of the ESPS teaching model but also considers the operability and feasibility of educational practice, providing solid theoretical and empirical support for the practical application and promotion of the model.

2.3 Expert Selection

Guided by the principles of authority and representativeness in expert selection under the Delphi method, the study assembled an evaluation group comprising eight specialists. Members encompassed lecturers from higher vocational institutions specialising in fashion design alongside industry mentors. All experts possessed either a background in fashion design education or practical industry experience, demonstrating strong professional judgement across both pedagogical theory and industrial application dimensions. This enabled them to evaluate the model from dual perspectives: educational appropriateness and vocational skill requirements.

2.4 Questionnaire Design and Scoring Methodology

Based on the first-stage requirements analysis utilising the DDR research methodology, and following the confirmation of the preliminary structure of the ESPS teaching model through semistructured questionnaires in the second stage, a structured evaluation questionnaire comprising five core components and 20 key elements was developed. The five components include:

Teaching Objectives
Teaching Strategies
Teaching Links

Teaching Resources Evaluation and Feedback

Each element addresses professional skill dimensions including innovative thinking, design skills, craft implementation capabilities, and commercialisation competencies. Experts rated the importance of each element using a 7-point Likert scale (1 = Strongly Disagree, 7 = Strongly Agree).

To facilitate subsequent fuzzy operations, this study further maps the numerical ratings from the 7-point Likert scale into corresponding fuzzy linguistic variables during the data processing stage. Specifically, different rating levels correspond to varying linguistic judgement intensities: 7 denotes Strongly Agree (SA), 6 denotes Agree (A), 5 denotes Moderately Agree (MA), 4 denotes General (G), 3 denotes Moderately Disagree (MD), 2 denotes Disagree (D), and 1 denotes Strongly Disagree (SD). This conversion process aims to transform experts' subjective judgements from discrete numerical forms into linguistic intervals suitable for triangular fuzzy number representation. This preserves the uncertainty and fuzziness inherent in expert evaluations while establishing a foundation for subsequent fuzzy aggregation and defuzzification calculations. Through this mapping relationship, the rating scale system and the fuzzy Delphi analysis framework achieve methodological unification. This enables expert opinions to possess quantifiable characteristics without losing their original semantic information.

2.5 Fuzzy Number Conversion and Group Consensus Analysis

Expert ratings are first converted into triangular fuzzy numbers (A, B, C), representing the minimum, most probable, and maximum values respectively. Subsequently, fuzzy aggregation is performed on all expert opinions to form group triangular fuzzy numbers (A_G, B_G, C_G). To assess the degree of expert consensus, the standard deviation (S_B) of the median value B is calculated. When $S_B \leq 0.20$, expert opinions are deemed to be converging; if exceeding this threshold, relevant factors require revision and proceed to the next evaluation round.

Defuzzification and Weight Determination: Defuzzification is applied to the group triangular fuzzy numbers to obtain the final fuzzy score A, which determines the importance level of each factor. Factors with $A \geq 0.50$ are retained and incorporated into the final model structure (Ishikawa, A., Amagasa, M., Shiga, et al., 1993). Based on the defuzzification results, the priority and structural hierarchy of each component and factor within the ESPS model can be further determined, thereby providing a quantitative basis for subsequent teaching implementation.

2.6 Data Analysis and Weight Determination

Following questionnaire collection, the research team subjected expert ratings to fuzzy processing, calculated the fuzzy average for each factor, and performed defuzzification to determine final weights. These weighting results clarified the priority and hierarchical structure of factors within the model, thereby providing a guiding framework for subsequent teaching practice. This methodology ensured both the scientific rigour of the model and its practical applicability within educational contexts.

3. Results and Discussion

Based on the data processing results derived from the Fuzzy Delphi method, the expert group's evaluation of the five core components of the ESPS teaching model and their subordinate elements demonstrated a high degree of consensus. Overall, the dispersion indices for each component remained at relatively low levels, while the fuzzy scores occupied a higher range. This indicates that the model structure has gained broad recognition among experts, exhibiting strong theoretical rationality and practical applicability.

Regarding the overall evaluation outcomes for the five core components, the dispersion indices (SB) for all components were significantly below the consensus threshold, indicating concentrated expert opinion and stable judgements. Concurrently, the fuzzy scores for each component fell within high-value ranges, signifying unanimous recognition of their importance within skills-oriented fashion design education. This implies that the ESPS model's overall structure has been fully validated at the expert level, requiring no structural reduction or reorganisation, and that the model framework possesses stability.

3.1 Consensus Findings on Model Components and Elements

Researchers submitted the five core components of the ESPS teaching model to an expert panel for evaluation, subsequently conducting calculations and analyses in accordance with the FDM core assessment principles. The specific results are as follows:

Table 1: Fuzzy Delphi Expert Opinions

Component	Original Score (B Value Distribution)	Collective Fuzzy Numbers (A _G , B _G , C _G)	Dispersion S _B	Consensus Threshold S _B ≤ 0.20	Fuzzy Score A	Final Determination
Evaluation And Feedback	6 SA (1.0), 2 A (0.9)	(0.7,0.975, 1.0)	0.043	Reach a consensus	0.913	Retain
Teaching Objectives	4 SA (1.0), 4 A (0.9)	(0.7,0.950, 1.0)	0.054	Reach a consensus	0.900	Retain
Teaching Links	3 SA (1.0), 5 A (0.9)	(0.7,0.938, 1.0)	0.048	Reach a consensus	0.894	Retain
Teaching Strategies	2 SA (1.0), 3 A (0.9), 3 MA (0.7)	(0.5,0.850, 1.0)	0.131	Reach a consensus	0.800	Retain
Teaching Resources	2 SA (1.0), 3 A (0.9), 3 MA (0.7)	(0.5,0.850, 1.0)	0.131	Reach a consensus	0.800	Retain

The table indicates that the dispersion index S_B for all five core components falls below the set threshold of 0.20, whilst the fuzzy scores A exceed 0.800 across the board, substantially surpassing the retention criterion of 0.50. This fully demonstrates that the expert panel has reached a high degree of consensus on all components of the ESPS teaching model and considers all components to be of paramount importance. Consequently, all components have been effectively validated and retained within the final model structure.

Teaching Evaluation: This component received the highest recognition, with a dispersion S_B ≈ 0.043 and a fuzzy score A = 0.913.

Teaching Objectives and Teaching Links:

Expert ratings predominantly clustered between SA and A. Dispersion values S_B ≈ 0.054 and S_B ≈ 0.048, substantially below the 0.20 threshold, indicate high consensus. Final fuzzy scores: A = 0.900 and A = 0.894.

Teaching Strategies and Teaching Resources:

Ratings showed slight dispersion, encompassing SA, A, and MA. Dispersion S_B ≈ 0.131, yet still substantially below the 0.20 threshold, establishing consensus. Fuzzy score A = 0.800.

Overall, the five core components demonstrate high stability across both consensus and importance dimensions, indicating the ESPS teaching model's overall structure possesses a robust foundation of expert recognition.

Having validated the structural soundness of the five core components within the ESPS teaching model, the FDM methodology was subsequently employed to further validate the 20 key elements contained within these components. This phase established the definitive set of elements to be incorporated into the final model by quantifying the degree of consensus among expert opinions (dispersion S_B) and their relative importance (fuzziness score A).

Based on the original scoring data from eight experts, the validation results for the 20 elements are presented in the table below:

Table 2: Expert Consensus of Components

N0.	Element	Original Score (B Value Distribution)	Dispersion S _B	Consensus Threshold S _B ≤ 0.20	Fuzzy Score A	Final Determination
A1	Innovative Thinking Objectives	4 SA, 3 A, 1 MA	0.104	Reach a consensus	0.838	Retain
A2	Design Skills Objectives	5 SA, 3 A	0.052	Reach a consensus	0.906	Retain
A3	Craftsmanship and Execution Skills Objectives	2 SA, 4 A, 2 MA	0.116	Reach a consensus	0.813	Retain
A4	Commercialization Skills Objectives	4 SA, 3 A, 1 MA	0.104	Reach a consensus	0.838	Retain
B1	Real-world Project- Based Teaching	3 SA, 3 A, 2 MA	0.125	Reach a consensus	0.819	Retain

B2	Simulated Workplace scenarios	1 SA, 2 A, 4 MA, 1 G	0.16	Reach a consensus	0.706	Retain
B3	Role assignment and responsibility definition	1 A, 5 MA, 2 G	0.128	Reach a consensus	0.663	Retain
B4	Coach-led Guidance	3 SA, 3 A, 2 MA	0.125	Reach a consensus	0.819	Retain
C1	Conceive stage	3 SA, 4 A, 1 G	0.164	Reach a consensus	0.769	Retain
C2	Design stage	5 SA, 3 A	0.052	Reach a consensus	0.906	Retain
C3	Implement stage	2 SA, 3 A, 2 MA, 1 G	0.175	Reach a consensus	0.738	Retain
C4	Market Stage	6 SA, 2 A	0.046	Reach a consensus	0.913	Retain
D1	Corporate case studies, industry reports on fashion design trends	4 SA, 3 A, 1 MA	0.104	Reach a consensus	0.838	Retain
D2	Professional design software	5 SA, 3 A	0.052	Reach a consensus	0.906	Retain
D3	Micro-lesson Videos	2 SA, 5 A, 1MA	0.093	Reach a consensus	0.825	Retain
D4	Virtual Simulation System. etc	5 SA, 3 A	0.052	Reach a consensus	0.906	Retain
E1	Business Valuation	2 SA, 3 A, 3MA	0.131	Reach a consensus	0.8	Retain
E2	Social media feedback from potential customers	2 SA, 4 A, 2MA	0.116	Reach a consensus	0.813	Retain
E3	Teacher Evaluations	6 SA, 2 A	0.046	Reach a consensus	0.913	Retain
E4	Student Peer Reviews	2 A, 4 MA, 2 G	0.151	Reach a consensus	0.675	Retain

Consensus Analysis: The computational results indicate that the standard deviation (S_B) values for all 20 factors fall within the range of 0.046 to 0.175. The S_B values for all factors are strictly below the established threshold of 0.20.

3.2 Analysis of Element Weighting Order

Through standardisation of defuzzification values, relative weights for each element within the model were established. Results indicate:

Very High Consensus ($S_B < 0.10$): Elements C4, E3, A2, C2, D2, D4, etc., exhibited highly concentrated opinions, with expert ratings predominantly SA or A.

Moderate Consensus ($0.10 \leq S_B \leq 0.20$): Factors such as C3 (Implementation Phase, $S_B=0.175$) and B2 (Simulated Scenarios, $S_B=0.160$) exhibited isolated 'General (G)' evaluations, leading to a slight increase in dispersion. However, these remained within an acceptable consensus range, indicating the expert panel's overall recognition of their necessity.

Importance Screening: Based on fuzzy score A ranking analysis:

Core Elements ($A \geq 0.900$): C4 Marketisation Promotion Phase (0.913), E3 Teacher Guidance and Final Assessment (0.913), A2 Designing Skill Objectives (0.906), C2 Design Phase (0.906), D2 Online Learning Platform (0.906), and D4. These six elements achieved the highest scores and were deemed by the expert panel as the critical pillars within the ESPS model.

Key Elements ($0.700 \leq A < 0.900$): Many elements (such as A1, B1, B4, D1, E1, etc.) fall within this range, forming the core framework of the model. Notably, the C3 Implement stage (0.738) maintains a high overall weighted score despite reservations from some experts, demonstrating its practical value.

Auxiliary Elements ($0.500 \leq A < 0.700$): B2 Simulated workplace scenarios (0.706, approaching medium), E4 Peer Student Evaluation (0.675), and B3 Role Assignment and Responsibility Definition (0.663). These three elements scored relatively low, reflecting experts' views that they present greater operational challenges or lower priority in actual teaching implementation. However, their scores remain well above the 0.50 retention threshold.

In summary, all 20 ESPS teaching model elements proposed during the DDR design phase met the retention criteria ($S_B \leq 0.20$ and $A \geq 0.50$) after rigorous FDM data validation. This indicates that the expert group unanimously agreed that these 20 elements are necessary and reasonable for developing a teaching model that enhances students' professional skills at Shandong universities. The final model comprises 5 core components and 20 validated key elements.

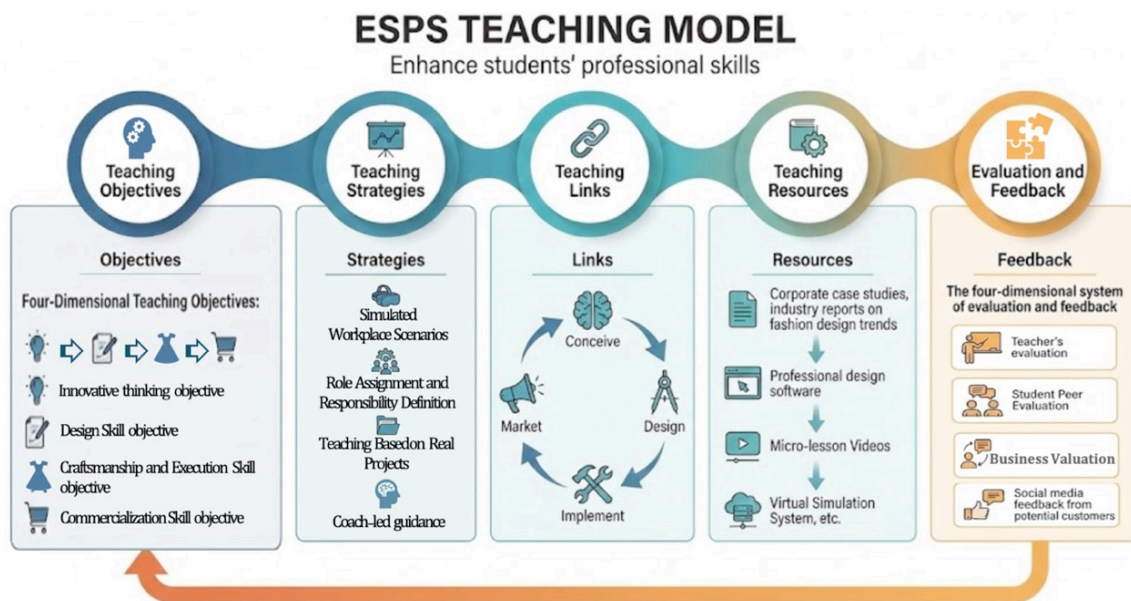


Figure 1: ESPS Teaching Model

3.3 Discussion on Structural Characteristics of the ESPS Teaching Model

Based on the weight distribution results, the ESPS teaching model exhibits a closed-loop system in its overall structure, comprising 'goal-led—process-driven—resource-supported—evaluation feedback'. Teaching objectives not only emphasise knowledge acquisition but also highlight competency-oriented development, fostering the simultaneous advancement of multiple abilities. Teaching activities are structured around project workflows, reinforcing students' integrated application capabilities within authentic contexts.

Compared to traditional content-centred teaching approaches, the ESPS model places greater emphasis on competency orientation and learning outcomes, reflecting a shift from 'what is taught' to 'what is learned and what can be done'. This structural characteristic aligns closely with skills-based education theory and outcomes-oriented teaching philosophy, providing theoretical underpinnings for the model's practical feasibility.

3.4 Comparative Analysis with Existing Research

Previous studies predominantly explored pathways for enhancing fashion design education through singular approaches such as curriculum reform or teaching strategies (Hong Ting, 2023). In contrast, this research employs the FDM framework to construct a systematic teaching model incorporating multiple components and elements, thereby integrating teaching objectives, processes, resources, and evaluation into an organic whole. Compared to prior research, this model demonstrates greater systemic advantages in terms of structural integrity and implementation logic.

Furthermore, establishing model weights through expert consensus effectively mitigates biases arising from individual researchers' subjective judgements, thereby enhancing the scientific rigour and credibility of the model's construction.

3.5 Summary

This study systematically validated the components and elements of the ESPS teaching model using the fuzzy Delphi method. Results indicate that the model received high recognition from experts in terms of

structural rationality, practice orientation, and targeted competency development. The findings not only provide empirical support for the final formulation of the ESPS teaching model but also offer an operational structural paradigm for optimising fashion design education and teaching methodologies.

4. Conclusions

This study employed the fuzzy Delphi method to develop and validate a competency-oriented teaching model for fashion design education. Based on expert consensus, the ESPS teaching model was constructed around five core elements: teaching objectives, teaching strategies, teaching links, teaching resources, and evaluation and feedback, supplemented by twenty supporting elements. Findings indicate that experts reached high consensus on the importance and feasibility of all components, confirming the model's structural validity and practical relevance.

Key research insights emphasise that assessment feedback, teaching objectives, and instructional sequencing play pivotal roles in skills-oriented fashion design education. This demonstrates that effective skills cultivation relies not only on content delivery but also on systematic process design and sustained feedback mechanisms. The hierarchical structure based on fuzzy weights provides clear guidance for prioritising instructional design in fashion design curricula.

This study bridges the gap between theoretical educational models and practical curriculum implementation by providing a skills-oriented teaching framework validated through quantitative expert consensus, thereby contributing to fashion design education research. At the teaching practice level, the ESPS model offers a structured and transferable paradigm for enhancing students' professional skills, learning engagement, and industry adaptability. However, the study is constrained by the size of the expert sample and its regional context. Subsequent research may expand this model through large-scale, cross-institutional empirical validation, while exploring its long-term impact on students' career development and learning outcomes. Overall, the ESPS teaching model offers a systematic, feasible, and replicable solution for advancing skills-oriented reform within fashion design education.

References

- [1]. Abdul Rahman, F. B., Mustafa, Z., & Kharuddin, A. F. (2021). Employing the fuzzy Delphi technique to validate a multiple intelligence-based instructional teaching module for preschool children. *Southeast Asia Early Childhood Journal*.
- [2]. Bian, X. Y., & Zhou, H. L. (2020). Rethinking fashion design education in China. *Art Observation*, (7), 13–15.
- [3]. Cardoso, G. F., & Spagnoli, A. (2022). Redesigning fashion design in higher education programs: The student's role in improving didactic approaches. In *EDULEARN22 Proceedings* (pp. 4749–4756). IATED.
- [4]. Fu, L. N. (2024). Practice research on integrating Xiangyunsha intangible cultural heritage into university fashion education under the ADDIE model. *West Leather*, 46(11), 68–70.
- [5]. Li, S. (2024). Innovation of talent cultivation models for fashion majors under the strategy of rejuvenating the country through science and education. *Chemical Fiber & Textile Technology*, 53(6), 219–221.
- [6]. Liu, X. L. (2025). Current situation and development direction of vocational undergraduate fashion design education. *Art Education Research*, (1), 151–153.
- [7]. Othman, M. K. H., Yaakob, M. F. M., Fauzee, M. S. O., Zakaria, N., & Abdullah, S. (2024). Language of expert consensus: Indicators of student outcomes according to Ibn Miskawayh's theory using the fuzzy Delphi technique. *Journal of Language and Linguistic Studies*.
- [8]. Tang, R. C., & Zhang, Z. P. (2024). Curriculum reform of fashion majors in vocational colleges under the background of new quality productive forces. *Textile Report*, 43(8), 80–82.
- [9]. Ciptono, A., Setiyono, S., Nurhidayati, F., & Vikaliana, R. (2019, October). Fuzzy Delphi method in education: A mapping. In *Journal of Physics: Conference Series* (Vol. 1360, No. 1, p. 012029). IOP Publishing.
- [10]. Zhang, Q. Y. (2023). Research on talent cultivation pathways in university fashion education based on the development needs of fashion enterprises. *Chemical Fiber & Textile Technology*, 52(3), 189–191.
- [11]. Zhang, Y. L., Jin, Y., & Liu, Y. Y. (2025). Advocating virtue and competence: Local knowledge empowering reform of art majors in universities—A case study of fashion design. *Progress in Textile Science & Technology*, 47(10), 78–80, 88.
- [12]. Zhong, J. F. (2021). Exploring teaching reform and innovation in fashion education based on industry-education integration and school-enterprise cooperation platforms. *West Leather*, 43(7), 45–46.