

Research on the Current Status, Acceptance Level, and Digital Competence of AI Integration in Interior Design Programs at Vocational Colleges in Heilongjiang

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Abstract

To explore the effect of AI integration in interior design courses at vocational colleges in Heilongjiang, a mixed-methods study was conducted with 380 students (via questionnaire) and 10 teachers/enterprise practitioners (via interviews). Results showed that: 1) AI integration was generally at a "low-level partial penetration" stage, with senior students (third-year and above) and private colleges performing significantly better in content integration than junior students and public colleges ($\text{sig} < 0.001$); 2) Students' acceptance of AI improved in a grade-based stepped manner, and "teachers' AI application" was the key influencing factor; 3) Digital competence was relatively low (with weak advanced abilities) and showed a significantly positive correlation with both AI integration level ($r = 0.643^{**}$) and acceptance level ($r = 0.667^{**}$); 4) Core needs included hardware supplementation (graphics workstations), localized courses, and hierarchical teacher training. This study provides empirical references for AI education reform in vocational design programs.

Keywords: Vocational Colleges, Interior Design, AI Integration, Acceptance Level, Digital Competence, Heilongjiang

Introduction

Research Background

Against the backdrop of China's national strategy of "AI + Education" and the deep digital transformation of the creative industry, artificial intelligence technology is reshaping the ecosystem of interior design—generative design engines, intelligent material selection systems, and other tools have not only optimized design workflows but also raised new requirements for the professional competence of design talents (Liu Y, 2024). In line with the requirements of the *Guidelines for the Application of Artificial Intelligence in Vocational Colleges*, vocational education must take industrial needs as the core, promote the in-depth integration of AI technology with teaching, and cultivate technical and skilled talents with AI

literacy and professional capabilities through curriculum restructuring and school-enterprise collaboration (Kendrick Jim et al., 2025). Global research on technical and vocational education and training (TVET) has confirmed that AI integration is no longer an optional upgrade but a core requirement for aligning talent cultivation with future workforce demands, especially in creative and technical fields. As a core link connecting industrial demands and skill development, vocational education must integrate AI competencies into curriculum systems in line with the principles of vocational education curriculum integration theory, to bridge the gap between graduate skills and industry needs.

Heilongjiang Province, as a key region in China's northeast old industrial base transformation, is vigorously advancing the digital transformation of traditional industries and developing new quality productive forces by leveraging AI technology (Zhang X, 2025). The local decoration, old house renovation, and cold-region characteristic design industries are in urgent need of design talents who can combine AI technology with regional industrial characteristics (Jiang Y, 2025). However, the province's traditional industries face dilemmas such as weak innovation capacity and outdated management concepts, making the cultivation of AI-integrated design talents an important support for breaking through development bottlenecks. Currently, the integration of AI into interior design programs at local vocational colleges is still in the exploratory stage. Preliminary observations indicate fragmented AI content in courses, inconsistent digital competence among teachers, and divided acceptance levels among students—all of which may undermine the competitiveness of graduates in adapting to regional industrial upgrading (Mehrnaz Fahimirad, 2018).

Research Questions and Significance

Existing studies on AI integration in education mainly concentrate on STEM fields (Quan, G. 2020) or colleges in economically developed eastern regions, with scarce empirical research targeting design-related programs at vocational colleges in northern China, especially Heilongjiang. BHUVA PRASHANT (2018) noted resource shortages as a bottleneck for AI education, but failed to address the regional adaptation issues of AI integration in design programs—such as aligning AI applications with local needs like old house renovation and cold-region storage design in Heilongjiang. Based on this research gap, the core research questions of this study are proposed as follows:

- 1) What is the current status of AI integration in interior design programs at vocational colleges in Heilongjiang, and are there differences across grades or college types?
- 2) What are the characteristics of students' acceptance of AI and its key influencing factors?
- 3) What is the level of digital competence required for AI integration, and what is the correlation mechanism between digital competence, the current status of integration, and acceptance level?
- 4) What are the practical paths to effectively promote AI integration?

The significance of this study is twofold: theoretically, it supplements empirical data on AI education in the specific context of "regional vocational colleges + design programs" and enriches the application of vocational education curriculum integration theory in digital transformation; practically, it provides targeted solutions for Heilongjiang's vocational education digital reform, helping local interior design programs cultivate talents adaptable to both regional industry needs and digital trends.

Research Methods

Research Objects

Using stratified cluster random sampling, public (209 students, 55.0%) and private (171 students, 45.0%) vocational colleges in Heilongjiang offering interior design programs were selected. The sample covered freshmen (141 students, 37.1%), sophomores (169 students, 44.6%), and junior students and above (70 students, 18.3%). A total of 380 valid questionnaires were collected, which was consistent with the distribution of students majoring in interior design at vocational colleges in the province.

Research Instruments

Structured Questionnaire include 20 items across 4 dimensions:

Current status of AI integration (5 items, covering content penetration, teacher application, etc.);

AI acceptance level (5 items, covering perceived usefulness, perceived ease of use, and usage attitude);

Digital competence (5 items, covering tool operation, critical evaluation, and application ability);

Integration needs (5 items, covering hardware, curriculum, and teacher training needs).

A 5-point Likert scale was used for the questionnaire, and the reliability and validity tests showed good results: the overall Cronbach's $\alpha=0.842$, and the α values of each dimension ranged from 0.716 to 0.839; KMO = 0.734, and Bartlett's Test of Sphericity yielded $\chi^2=2264.238$ (df=190, $p<0.001$), indicating suitability for factor analysis.

Semi-structured Interviews: Conducted with 2 teachers, 3 teaching managers, and 5 enterprise practitioners (including technical directors and design managers of decoration companies), focusing on "pain points of AI integration" and "region-specific adaptation needs". Each interview lasted an average of 27 minutes, resulting in 105 pages of transcribed text.

Data Processing

SPSS 26.0 was used for descriptive statistics, one-way Analysis of Variance (ANOVA), and Pearson correlation analysis. The interview data were analyzed using thematic analysis, with two researchers independently coding (consistency Kappa = 0.82) and resolving discrepancies through discussion.

Research Results

Current Status of AI Integration: Low-level Partial Penetration with Significant Group Differences

Overall Characteristics

The mean values of all dimensions of AI integration ranged from 2.12 to 2.39 (on a 5-point scale), all below the medium level (3 points), showing the characteristic of "relatively better content integration but weakest model integration":

Course content penetration (mean = 2.39, SD = 0.896): Some courses included knowledge of AI applications (e.g., tool principles), but the coverage was limited;

Teacher tool application (mean = 2.13, SD = 0.777): Teachers rarely used AI to assist in case explanation, and traditional teaching methods still dominated;

Teaching model integration (mean = 2.12, SD = 0.724): The "AI practical operation + traditional design" model was not popularized, and there was no systematic arrangement for AI practical training;

Student project support (mean = 2.25, SD = 0.754): AI was used in a small number of projects to optimize layouts, but it had not become a regular tool;

Full-process integration (mean = 2.16, SD = 0.749): AI was only used sporadically in the design phase and not throughout the entire process from "conception to evaluation".

Group Difference Analysis

Grade Differences(Table 1): The level of AI integration among senior students was significantly higher than that of junior students (sig < 0.05), with no significant difference only in "full-process integration" (sig = 0.204). Junior students and above showed significant improvements in content penetration (mean = 2.79) and teacher application (mean = 2.53) compared to freshmen (mean = 1.84, 1.89), which may be due to the fact that senior courses are more closely aligned with industrial practice.

Tab.1

Grade-based Difference Analysis

Test Variable		Group statistics			Significance statistics	
		Grade	Mean	Standard Deviation	F	Sig.
Course Penetration	Content	Grade One	1.84	0.669	32.880	0.000
		Grade Two	2.52	0.410		
		Grade Three and Above	2.79	0.754		
Teacher Tool Application		Grade One	1.89	0.896	21.211	0.000
		Grade Two	1.97	0.827		
		Grade Three and Above	2.53	0.589		
Teaching Model Integration	Model	Grade One	1.93	0.737	4.774	0.009
		Grade Two	2.23	0.777		
		Grade Three and Above	2.20	0.761		
Student Project Support		Grade One	2.16	0.750	7.682	0.001
		Grade Two	2.24	0.622		
		Grade Three and Above	2.36	0.724		
Full-process Integration		Grade One	1.93	0.763	1.597	0.204
		Grade Two	2.20	0.724		
		Grade Three and Above	2.36	0.769		

College Type Differences(Table 2): Significant differences were only found in "course content penetration" (sig = 0.000), with private colleges (mean = 2.62) performing better than public colleges (mean = 2.15). This may be because private colleges pay more attention to market demands and prioritize integrating AI knowledge to enhance students' employability.

There were no significant differences in other dimensions (teacher application, model integration, etc.) ($\text{sig} > 0.05$), and all were at low levels.

Tab.2

School-type-based Difference Analysis

Test Variable	Group statistics			Significance statistics	
	School Type	Mean	Standard Deviation	F	Sig.
Course Content Penetration	Public	2.15	0.729	19.425	0.000
	Private	2.62	0.987		
Teacher Tool Application	Public	2.39	0.896	0.003	0.954
	Private	2.13	0.815		
Teaching Model Integration	Public	2.13	0.740	1.992	0.159
	Private	2.13	0.777		
Student Project Support	Public	2.18	0.680	2.003	0.158
	Private	2.06	0.763		
Full-process Integration	Public	2.12	0.724	2.229	0.137
	Private	2.32	0.747		

Students' AI Acceptance Level: Grade-based Stepped Improvement with Teachers' AI Application as the Key

Dimensional Characteristics

All three dimensions of acceptance level increased with grade, showing the characteristic of "most significant improvement in perceived usefulness and stabilization of perceived ease of use after the sophomore year"(Table 3):

Perceived usefulness: The mean value of junior students and above (3.222) was 1.016 points higher than that of freshmen (2.206), as senior students experienced the value of AI in "improving efficiency and promoting innovation" through projects;

Perceived ease of use: There was no significant difference between sophomores (2.710) and juniors and above (2.770), as AI practical training was integrated into sophomore courses, and familiarity with operations stabilized after reaching a certain level;

Usage attitude: The mean value of juniors and above (2.978) increased steadily compared to freshmen (2.189), as students' willingness to use AI grew with the demonstration of its practical value.

Tab.3

Descriptive Statistics on AI Acceptance Level

Dimension	Grade	Mean	Standard Deviation
Perceived Usefulness	Grade One	2.206	0.608
	Grade Two	2.561	0.333
	Grade Three and Above	3.222	0.486
Perceived Ease of Use	Grade One	2.180	0.869
	Grade Two	2.710	0.658
	Grade Three and Above	2.770	0.688
Usage Attitude	Grade One	2.189	0.597
	Grade Two	2.617	0.389
	Grade Three and Above	2.978	0.502

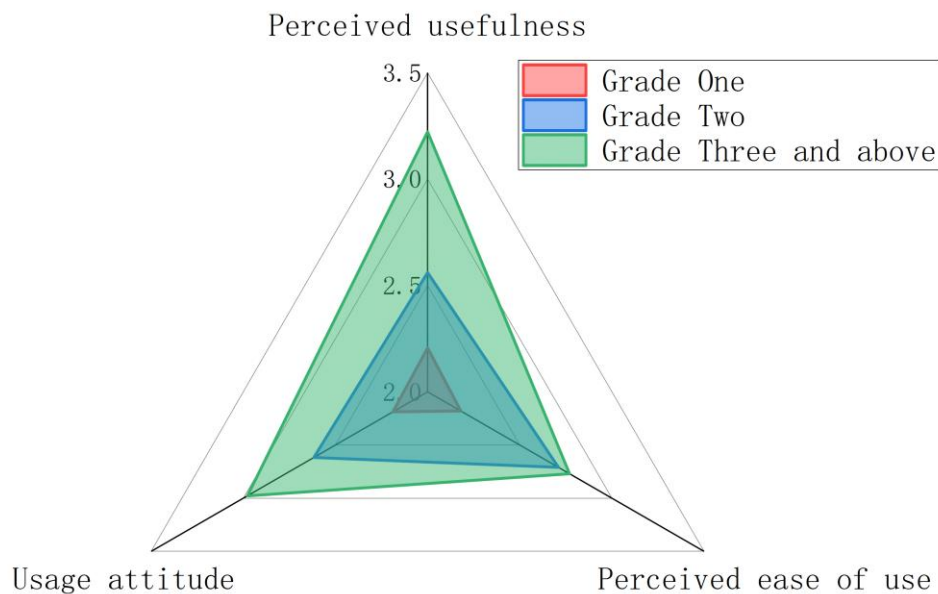


Fig.1 Radar chart of the acceptance level of AI

College Type and Correlation Analysis

College Type: Private colleges showed slightly higher perceived usefulness (2.7388) and usage attitude (2.7007) compared to public colleges (2.5882, 2.4882), but the differences did not reach a significant level ($\text{sig} = 0.055\text{--}0.059$); there was no difference in perceived ease of use ($\text{sig} = 0.864$), indicating that tool operation thresholds were a common obstacle for both types of colleges.

Correlation with the Current Status of Integration (Table 4): "Teachers' AI application" had a significantly positive correlation with all three dimensions of acceptance level ($r =$

0.332**,-0.406**), serving as the core connecting link; content penetration and model integration mainly affected perceived usefulness and usage attitude ($r = 0.256^{**}$ -0.399**); full-process integration was only correlated with perceived ease of use ($r = 0.263^{**}$).

Tab.4

Correlation Analysis between AI Acceptance Level and Integration Level

Dimensions of Integration		Perceived Usefulness (r)	Perceived Ease of Use (r)	Usage Attitude (r)
Course Penetration	Content	0.399**	0.077	0.380**
Teacher Application	Tool	0.332**	0.393**	0.406**
Teaching Integration	Model	0.256**	0.116	0.343**
Student Support	Project	0.141*	0.235*	0.141*
Full-process Integration		0.137*	0.263**	0.123*

Note: ** $p < 0.05$, * $p < 0.10$

Digital Competence Required for AI Integration: Strong Basic Skills but Weak Advanced Abilities, with Positive Correlation to Core Variables

Overall Level

The mean values of all dimensions of digital competence ranged from 2.14 to 2.47, showing the characteristic of "best tool operation ability but worst application ability":

Tool operation ability (2.47, SD = 0.812): Only some students could initially operate AI design tools (e.g., Kujiale AI);

Critical evaluation ability (2.18-2.20, SD = 0.764-0.808): 45% of students could not judge the spatial logic of AI-generated solutions, lacking the ability to screen AI outputs;

Application ability (2.14-2.18, SD = 0.700-0.770): Only 30% of students could combine AI with core content such as "spatial layout", and they were unable to independently solve AI tool malfunctions (e.g., format compatibility issues).

Correlation Analysis

Digital competence had a significantly positive correlation with both the current status of AI integration ($r = 0.643^{**}$) and acceptance level ($r = 0.667^{**}$) (Table 5), forming a positive cycle of "competence improvement → enhanced acceptance → deeper integration": tool operation ability improved perceived ease of use, while critical evaluation and application abilities directly promoted the in-depth integration of AI with courses.

Tab.5

Correlation Analysis of the Three Core Dimensions

Core Variables	Digital Competence (r)	Current Status of Integration (r)	Acceptance Level (r)
Digital Competence	1	0.643**	0.667**
Current Status of Integration	-	1	0.649**
Acceptance Level	-	-	1

Note: **p < 0.05

Needs and Suggestions for AI Integration: A Five-dimensional Closed Loop with Regional Adaptation

Based on interviews, core needs were summarized, and five-dimensional suggestions covering "hardware-curriculum-teachers-practice-resources" were formed (Table 6), all combined with the regional characteristics of Heilongjiang (e.g., old house renovation, winter storage needs in Northeast China):

Tab.6

Needs and Suggestions for AI Integration

Dimensions	Core Needs	Practical Suggestions
Hardware Support	Shortage of graphics workstations and insufficient VR equipment	1) Prioritize supplementing 10-20 graphics workstations (e.g., Lenovo P620); 2) Deploy VR equipment in phases for junior project training; 3) Low-cost solutions: Alibaba Cloud Design Desktop, enterprise donation of old equipment
Curriculum Integration	Balancing AI and traditional teaching, lacking localized content	1) Offer "AI + Interior Design" as an elective (initial stage) → compulsory course (later stage); 2) Integrate Northeast-specific cases: AI solutions for old house renovation, storage design for small apartments; 3) Assessment requirement: AI solutions + 30% manual modification + reflection report
Teacher Training	Young teachers lack cases, senior teachers lack operational skills	1) Hierarchical training: Young teachers learn AI classroom case design, senior teachers learn basic operations; 2) School-enterprise co-training: Cooperate with Harbin decoration enterprises (e.g., Dongyi Risheng) for 1-month on-site teacher internships

Tab.6

Needs and Suggestions for AI Integration

Dimensions	Core Needs	Practical Suggestions
Practical Projects	Lack of regional projects, preventing technical dependence	1) Introduce local projects in Harbin: Old house renovation, milk tea shop design; 2) School-enterprise dual-tutor system: Enterprises provide demands, schools manage teaching; 3) Requirement: AI solutions must include at least 3 manual modifications with reasons
Resource Library Construction	Lack of local cases and tool manuals	1) Build a Heilongjiang-specific resource library: Local house plans, old house renovation cases, AI solution evaluation forms; 2) Update monthly with joint maintenance by teachers, students, and enterprises; 3) Realize inter-college sharing via the provincial vocational education platform

Discussion*Current Status of AI Integration: Common Pain Points and Regional Characteristics*

The finding of "low-level partial penetration" in this study is consistent with Quan, G.(2020)'s discovery of "fragmented AI application in vocational education". However, it further reveals the regional characteristics of Heilongjiang: most existing AI cases are from first-tier cities (e.g., high-end apartment design), which are disconnected from Heilongjiang's local needs such as "old house renovation" and "winter storage", leading to "insufficient integration adaptability". This supplements the research gap identified by BHUVA PRASHANT(2018), who only mentioned "resource shortage", and clarifies that "lack of localized resources" is the core bottleneck.

The advantage of private colleges in content integration (sig = 0.000) confirms Zhang X(2025)'s view that "private colleges have a stronger market orientation". The absence of differences between public and private colleges in "teacher application and model integration" indicates that both types of colleges are constrained by common factors such as "insufficient teacher digital competence" and "limited AI training resources", which aligns with Mehdaoui A.(2024)'s conclusion that "AI integration in vocational education needs to overcome bottlenecks in teachers and resources".

Acceptance Level and Digital Competence: Theoretical Verification and Practical Implications

Grade Differences in Acceptance Level: Consistent with the assumption of the UTAUT2 theory (Yusuf Kalinkara. (2023) that "practice scenarios moderate technology acceptance"—senior students show significantly higher perceived usefulness due to their participation in AI-assisted projects (e.g., graduation project optimization). The finding that "teachers' AI application is the key influencing factor" supplements Holmes et al (2022)'s research perspective which "focuses on students' individual characteristics" and confirms Ma S (2024)'s view that "teachers' technical demonstration in design education has a greater impact on students' acceptance willingness than the tools themselves". This is because the

"creative imitativeness" of design courses requires teachers to first become "effective AI users".

"Strong Basic Skills but Weak Advanced Abilities" in Digital Competence: In line with the DigComp 2.0 framework (Riina V, 2016) which states that "digital competence develops progressively from basic to advanced levels". However, this study further finds that vocational college design programs face more prominent shortcomings in advanced abilities (critical evaluation and application). Cultivating tool operation skills alone is insufficient for in-depth integration, and it is necessary to strengthen abilities such as "AI solution screening" and "combination with teaching content".

Research Innovations and Limitations

Innovations: 1) Focusing on design programs at vocational colleges in Heilongjiang, supplementing empirical data on regional AI education; 2) Proposing adaptive strategies such as "localized projects and hierarchical training" to avoid one-size-fits-all suggestions.

Limitations: 1) The sample only covers Heilongjiang, so the conclusions may not be generalized to other regions; 2) AI technology updates rapidly (e.g., functional iterations of generative AI), and some suggestions on tool operation may become outdated over time; 3) The questionnaire relies on self-reports, which may be subject to social desirability bias, and the interview sample size (n = 10) is relatively small.

Conclusions and Recommendations

Core Conclusions

The integration of AI into interior design programs at vocational colleges in Heilongjiang is at a stage of "low-level partial penetration". Full-process integration and teaching model innovation are common shortcomings, while senior students and private colleges have advantages in content integration; 2) Students' acceptance of AI shows a grade-based stepped improvement, with teachers' AI application as the key influencing factor; 3) The overall level of digital competence is relatively low, with insufficient advanced abilities (critical evaluation and application), and it has a significantly positive correlation with both the integration status and acceptance level; 4) Effective integration requires forming a closed loop around "hardware supplementation, curriculum localization, hierarchical teacher training, regionalized practice, and resource sharing".

Practical Recommendations

College Level: 1) Configure hardware in phases, prioritizing solving the shortage of graphics workstations; 2) Restructure the curriculum system by integrating Heilongjiang-specific cases (e.g., AI solutions for old house renovation) and balancing AI with traditional content such as hand-drawing and construction technology; 3) Establish an "AI teaching points system", linking points to teacher professional title evaluation to encourage teachers to apply AI.

Teacher Level: 1) Young teachers participate in school-enterprise AI case workshops, while senior teachers receive "one-on-one simplified operation training"; 2) Form an "AI teaching studio" to regularly discuss AI classroom cases (e.g., using AI to generate multiple solutions for comparative explanation).

Policy Level: 1) Include AI integration in the scope of support from Heilongjiang's special funds for vocational education reform, encouraging colleges to jointly build AI training laboratories with local decoration enterprises; 2) Promote inter-college sharing of the "Interior Design AI Resource Library" via the provincial vocational education resource platform to address the shortage of localized cases.

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