CSCHOLAR
Publishing INC

Volume 1 Number 3 2025

iEducation

ISSN:3068-3769

https://ie.cscholar.com

iEducation

Volume 1, Issue 3, 2025

Quarterly (Issue No. 3)

Cover Design: ConnectSix Scholar Publishing INC

Publishing Unit: ConnectSix Scholar Publishing INC

Publisher's website: http://www.cscholar.com/

Publisher's address:

6547 N Academy Blvd #2265

Colorado Springs CO 80918

US

Website of the *iEducation*:

https://ie.cscholar.com/

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iEducation, 2025, 1(3), 1-15
https://doi.org/10.71204/w0b60n19

Reflection and Creativity of Preservice English Teachers: An Empirical Study

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Received: 18 October 2025 / Accepted: 24 November 2025 / Published online: 29 November 2025

Abstract

Reflection and creativity are important quality for preservice English teachers and they are of great significance for the preservice English teachers to both become professional teachers and foster creative intellectuals. They are the focus of educational concerns and have attracted the attention of researchers. However, reflection and creativity of preservice English teachers are underexplored. The present research aimed to investigate preservice English teachers' status quo of reflection and creativity, detecting the relationship between them. Self-reflection and Insight Scale (SRIS) and Creativity Scale (CS) were employed as the research instruments. 293 preservice English teachers were sampled as the research subjects. The research found that the preservice English teachers enjoyed medium-high level of reflection and creativity, and that reflection positively correlated with creativity at low degree. Measures could be adopted to promote preservice English teachers' reflection and creativity.

Keywords: Preservice English Teachers; Reflection; Creativity; Empirical Study

1. Introduction

Education in the 21st century attaches great importance to the cultivation of core competencies, which reshapes the role of English teachers. Their responsibilities exceed merely imparting language knowledge and they need to become guides who can stimulate students' critical thinking and innovative abilities. Against this backdrop, reflection and creativity have been established as two indispensable core competencies in teachers' professional qualities (Baran-Łucarz & Klimas, 2020; De Leon-Pineda & Prudente, 2022). Reflection skills are necessary for teachers to be reflective practitioners (Demirel et al., 2015). Creativity is of great significance for teachers to both become professional teachers and foster creative intellectuals (Zhong et al., 2023). Preservice English teachers are no exception. For pre-service English teachers, who are in the

critical period of forming and solidifying their professional identities, the collaborative cultivation of these two capabilities is a cornerstone for the future vitality of education.

Despite the wide acknowledgement of the importance of reflection and creativity in teacher education, significant empirical gaps remain in the understanding of these fundamental issues concerning preservice English teachers. For one thing, there is a lack of systematic investigation into the actual status of preservice English teachers' reflection and creativity. For another, while it is commonly theorized that profound reflection can foster more creative teaching practices (Flavell, 1979), this crucial hypothesis within the preservice education context still lacks robust validation from empirical data. The ambiguity of the current state and the unverified relationship hinder the refinement of teacher education programs by obscuring precise targets for intervention.

This study aims to systematically delineate the landscape of reflection and creativity among preservice English teachers through an empirical investigation and to explore the relationship between them. Theoretically, this study could provide empirical evidence for the correlation between reflection and creativity in the pre-service stage, supplementing the theoretical system of teacher education. Practically, the research findings could illuminate targeted suggestions for optimizing preservice English teacher training programs.

2. Literature Review

The reflection of preservice teachers is the focus of educational concerns and it has attracted the attention of researchers. Some studies are concerned with investigating the reflection level of preservice teachers. With undergraduates as research subjects, Costa et al. (2020) surveyed the levels and nature of reflection of 13 preservice Chemistry teachers in Brazil. Based on the data collected by questionnaires and the autoscopies of their microteachings, Costa et al. (2020) found that the reflection in which the preservice Chemistry teachers were involved was of three distinct levels and six categories. Employing reflection reports and interviews as the research instruments, Turhan and Kirkgöz (2023) analyzed the qualitative data of 10 preservice English teachers in Turkish. The subjects were found to have been involved in lower level of reflection. Other studies are interested in the themes or cultivation of preservice teachers' reflection. For example, Bowling et al. (2022) revealed five themes of reflective observation based on the data analysis of a collective case study. In order to identify preservice teachers' self-efficacy for reflection, Hußner et al. (2023) investigated 248 preservice teachers who mainly majored in German, Sports and English. After a semester of systematic reflection on their micro-teaching experiences, the preservice teachers were found to have significantly improved their self-efficacy for reflection. Another study, Wang and Ko (2025), focused on the reflective journals of preservice teachers in China. The majors of the preservice teachers mainly consisted of math, language studies, science studies and primary education studies. Data analysis revealed that reflection tasks contributed to the reflection depth of the preservice teachers by promoting professional identity and pedagogical knowledge. Previous studies have investigated the reflection of preservice teachers in various majors. It is agreed that training facilitates to improve preservice teachers' reflection. However,

mix results are yielded when it is concerned with their levels of reflection. In addition, inadequate studies focused on pre-service English teachers' reflection.

Studies concerning preservice teachers' creativity are conducted. Some focus on preservice teachers' perspective on creativity. For example, Keiner et al. (2020) conducted the qualitative research to inspect 83 German chemistry preservice teachers' perspective on creativity. The results yielded positive attitudes to creativity and the significance of integrating it in Chemistry classroom. Conducting a qualitative research, Michaelidou and Pitri (2022) interviewed 15 early childhood preservice teachers to examine their perspectives on creativity. It was concluded that creativity was positively related to several qualities of thinking and to instructional design and application. Similarly, Hua and Yang (2024) performed a qualitative study to investigate preservice teachers' beliefs on creativity, creative individuals and creative learning environments. The subjects were 13 early childhood preservice teachers in China. The data of interviews revealed that the preservice teachers knew little about creativity and creative individuals but they valued the cultivation of creativity without constructing creativity-supportive environments in their actual pedagogical practice. More studies focus on the development of preservice teachers' creativity. For instance, Sánchez et al. (2022) adopted 198 preservice teachers in a masters' program as the research subjects. The preservice teachers' comments on creativity in the masters' final project were employed as the research corpus. Conclusions were drawn that their creativity was indirectly developed from the tasks of problem posing, argumentation, modelling, cooperative work and the employment of manipulatives. A study in 2023 by Park tested the effect of the Theory of Inventive Problem Solving on boosting South Korean preservice teachers' creativity and their creativity beliefs. The results proved the effectiveness of the instruction. With a quasi-experimental design, Novak et al. (2024) attempted to improve preservice elementary teachers' creativity in computer education. 76 subjects were divided into the experimental group and the control group, and the experimental group were instructed with a creativity-enhancement intervention. The research findings indicated that the intervention did work and that the experimental group outperformed the control group concerning person-, process-, and Scratch product-related creativity. Utilizing questionnaires as the research instruments, Zhong et al. (2024) quantitatively explored the factors influencing preservice teachers' creativity development. The subjects were 349 preservice teachers majoring in teacher education. According to the results, the factors having effect on the preservice teachers' creativity development included intrinsic motivation, teaching models, learner traits and teacher influence. Findings of previous studies confirmed the importance of creativity for preservice teachers and the boosting effect of instruction to creativity enhancement. However, the status quo of preservice teachers' creativity has been neglected, let alone that of preservice English teachers.

In summary, previous studies have explored the reflection and creativity of preservice teachers of various disciplines, depicting a general picture of their reflection and creativity. It has also been testified that preservice teachers' reflection and creativity could be cultivated and enhanced. However, conflicting results concerning the status quo of reflection are yielded by previous studies. In addition, previous studies seldom pay attention to the current situation of preservice

teachers' creativity. What's more, very little is known about preservice English teachers' reflection and creativity, let alone the relationship between them.

3. Research Design

3.1. Research Questions

In order to detect the status quo of Preservice English teachers' reflection, creativity and the relationship between them, three research questions were posed. They were as follows:

RQ1: What is the status quo of reflection of Preservice English teachers?

RQ2: What is the status quo of creativity of Preservice English teachers?

RQ3: What is the relationship between the status quo of reflection and that of creativity of Preservice English teachers?

3.2. Research Subjects

The research subjects involved 293 English major students in a Normal University in the North of China. They were preservice English teachers, covering freshmen (N=110), sophomores (N=135) and juniors (N=48). As was seen in Table 1, the average age of the research subjects was 22.7 years old, and there were more females (N=262) than males (N=31).

Table 1. Research Subjects

	Number	**Percentage (%)**	**Mean Age**	**Gender**	
				Female	**Male**
Freshman	110	37.5	19.08	105	5
Sophomore	135	46.1	20.14	124	11
Junior	48	16.4	19.42	33	15
Total	293	100.0	19.62	262	31

3.3. Research Instruments

Quantitative research, which is characterized by structured and objective methodology, is conducive to generalizable conclusions. The present research employed a quantitative research method and questionnaires were adopted to detect the status quo of reflection and creativity of the preservice English teachers.

3.3.1. Self-reflection and Insight Scale (SRIS)

In order to investigate the preservice English teachers' status quo of reflection, Self-reflection and Insight Scale (SRIS) was adopted as one of the research instruments. The Self-reflection and Insight Scale (SRIS) was developed by Grant et al. in 2002. Having 20 items, it consists of 3 dimensions (subscales), which are Engagement in Self-reflection (ESR), Need for Self-reflection

(NSR) and Insight (I). It was adopted in the research as a 7-point Likert scale. According to reliability analysis results, the overall reliability of SRIS was 0.814, the reliability of the sub-scale of Engagement in Self-reflection (ESR) was 0.637, that of Need for Self-reflection (NSR) was 0.772 and that of Insight (I) was 0.592 (Table 2). Cronbach's Alpha Value higher than 0.8 signifies high reliability, that between 0.7and 0.8 indicates good reliability and that close to 0.6 is marginally accepted reliability. The reliability analysis results illustrated that Self-reflection and Insight Scale (SRIS) and its sub-scales generally enjoyed good reliability, which means that SRIS could be used for the present study.

Table 2. Reliability Analysis of SRIS

Scales		**Alpha**
SRIS	ESR	0.637
	NSR	0.772
	I	0.592
	Total	0.814

Confirmatory factor analysis (CFA) was conducted to test the construct validity of the questionnaire SRIS. For good construct validity, it is generally required that X^2/Df does not exceed 3, that RMSEA and SRMR are both lower than 0.1, and that TLI and CFI are both higher than 0.9. According to the results, the value of X^2/Df equaled 2.446, that of RMSEA was 0.056, that of SRMR was 0.049, that of TLI was 0.912, and that of CFI was 0.907 (Table 3). The results indicated good validity of the questionnaire.

Table 3. Validity Analysis of SRIS

Indices	**Threshold Criteria**	**Current Value**	**Result**
χ^2	-	357.137	-
Df	-	146	-
χ^2/df	<3	2.446	Pass
RMSEA	<0.1	0.056	Pass
SRMR	<0.1	0.049	Pass
TLI	>0.9	0.912	Pass
CFI	>0.9	0.907	Pass

3.3.2. Creativity Scale (CS)

Creativity Scale was employed to investigate the preservice English teachers' status quo of creativity. The Creativity Scale was designed by the author. It is a 7-point-Likert Scale, which

consists of 19 items. It is made up of 4 dimensions (sub-scales), which are Creativity Behavior (CB), Self-efficacy of Creativity (SC), Creative Thoughts and Creativity Awareness (CTCA), and Creativity Intention (CI).

According to reliability analysis results, the overall reliability of the Creativity Scale (CS) was 0.963, the reliability of the sub-scale of Creativity Behavior (CB) was 0.902, that of Self-efficacy of Creativity (SC) was 0.923, that of Creative Thoughts and Creativity Awareness (CTCA) was 0.842 and that of Creativity Intention (CI) was 0.897 (Table 4). Cronbach's Alpha Value higher than 0.8 signifies high reliability, that between 0.7and 0.8 indicates good reliability and that close to 0.6 is marginally accepted reliability. The results illustrated that both CS and its sub-scales enjoyed high reliability, which means the Creativity Scale (CS) could be used for the present study.

Table 4. Reliability Analysis of CS

Scales		**Alpha**
	CB	0.902
	SC	0.923
CS	CTCA	0.842
	CI	0.897
	Total	0.963

Table 5. Validity Analysis of CS

Indices	**Threshold Criteria**	**Current Value**	**Result**
χ^2	-	394.679	-
Df	-	146	-
χ^2/df	<3	2.703	Pass
RMSEA	<0.1	0.063	Pass
SRMR	<0.1	0.047	Pass
TLI	>0.9	0.917	Pass
CFI	>0.9	0.903	Pass

Confirmatory factor analysis (CFA) was conducted to test the construct validity of the questionnaire CS. For good construct validity, it is generally required that X^2/Df does not exceed 3, that RMSEA and SRMR are both lower than 0.1, and that TLI and CFI are both higher than 0.9. As was shown in Table 5, the value of X^2/Df equaled 2.703, that of RMSEA was 0.063, that of

SRMR was 0.047, that of TLI was 0.917, and that of CFI was 0.903. The results indicated that the questionnaire CS was of good validity.

3.4. Ethical Issues of the Study

Before data collection, the preservice English teachers were asked for consent. Those who volunteered to answer the questionnaires were informed of the purpose of the investigation, their rights, the manipulation of the data and data privacy issues. They were also informed that they would answer the questionnaires anonymously and they were free to opt out during the data collection and that their answers would not be related to their grades. Informed consent was given by all the subjects.

3.5. Data Collection and Analysis

To obtain the research subjects' responses about their status quo of reflection and creativity, questionnaires were employed to enable the collection of data. Before the administration of the questionnaire, the reliability and validity of the questionnaires were tested. Then, they were distributed to the research subjects in March, 2024. The questionnaires were in digital form and the subjects were required to answer the questionnaire online within a week. 297 questionnaires were collected, among which 293 questionnaires were valid.

After the data were collected, quantitative analyses were statistically computed with the software of SPSS 26 so as to inspect the status quo of the preservice English teachers' reflection and creativity and the relationship between them. Firstly, descriptive analyses were employed to examine the status quo of the preservice English teachers' reflection, namely, the mean obtained by the general scale and those obtained by the sub-scales of reflection. The Self-reflection and Insight Scale (SRIS) is a 7-likert scale. The higher a preservice teacher scores on the scale, the higher level of reflection the preservice teacher illustrates. Secondly, the preservice English teachers' status quo of creativity, which were represented by the mean of the general scale and those of the sub-scales, were detected by making use of descriptive analyses. The Creativity Scale (CS) is also a 7-likert scale. The higher score a preservice teacher achieves, the higher level of creativity the preservice teacher possesses. Lastly, bivariate correlations analyses were conducted to examine the relationship between the subjects' reflection and their creativity. The correlation coefficient of reflection and creativity was calculated, and so did those of the dimensions of reflection and creativity. The correlation coefficient varies between "-1" and "+1". "+1" means perfectly positive correlation and "-1" denotes perfectly negative correlation. The larger the absolute value of correlation coefficient is, the higher level of correlation is demonstrated.

4. Results

4.1. Preservice English Teachers' Status Quo of Reflection

The first research question was what was the status quo of reflection of preservice English teachers. In order to answer this question, Self-reflection and Insight Scale (SRIS) was employed and 293 preservice English teachers were sampled as the research subjects. They were informed in advance the purposes of the questionnaires. The results were shown in Table 6.

Table 6. Descriptive Analysis of Reflection

Scales		Number	Minimum	Maximum	Mean	Standard Deviation
SRIS	ESR	293	2.17	7.00	4.6320	0.84255
	NSR	293	2.00	7.00	4.9192	0.84147
	I	293	2.00	6.75	4.1020	0.66668
	Total	293	2.79	6.79	4.5511	0.63556

As was shown in Table 6, the preservice English teachers enjoyed medium-high level of reflection. The mean of the general scale of SRIS was 4.5511, which was higher than the mid-point of the 7-point Likert scale, and so were the means of the three sub-scales. Among the three sub-scales, Need for Self-reflection (NSR) reported the highest mean (M=4.9192; SD=0.84225) and Insight (I) revealed the lowest mean (M=4.1020; SD=0.63556).

4.2. Preservice English Teachers' Status Quo of Creativity

The second research question was "What is the status quo of creativity of preservice English teachers?" The 293 preservice English teachers were surveyed with the questionnaire Creativity Scale (CS) to answer this research question. They were informed in advance the purposes of the questionnaires. The results were shown in Table 7.

Table 7. Descriptive Analysis of Creativity

		Number	Minimum	Maximum	Mean	Standard Deviation
CS	CB	293	1.60	7.00	4.9311	1.01578
	SC	293	1.00	7.00	4.8404	1.10723
	CTCA	293	1.75	7.00	5.0111	0.99446
	CI	293	2.00	7.00	5.1086	0.95167
	Total	293	1.94	7.00	4.9728	0.93473

As was illustrated in Table 7, the preservice English teachers reported medium-high level of creativity. The mean of the overall scale--Creativity Scale--was 4.9728 (SD=0.93473), which was higher than the mid-point of the 7-point Likert Scale of Creation Scale (CS). The mean of Creativity Behavior (CB) (M=4.9311; SD=1.01578), that of Self-efficacy of Creativity (SC) (M=4.8404; SD=1.10723), that of Creative Thoughts and Creativity Awareness (CTCA) (M=5.0111; SD=0.99446) and that of Creativity Intention (CI) (M=5.1086; SD=0.95167) were all higher than 3.5, the mid-point of the scale. Among the four dimensions, Creativity Intention (CI) reported the highest mean and Self-efficacy of Creativity (SC) the lowest mean.

4.3. The Relationship Between the Preservice English Teachers' Reflection and Creativity

The third research question was: "What is the relationship between the status quo of reflection and that of creativity of the preservice English teachers?" Correlation analyses were conducted to answer the question. The results were shown in Table 8.

Table 8. Correlation Analysis

		CB	SC	CTCA	CI	CS
ESR	Pearson Correlation	.174**	.069	.185**	.214**	.180**
	Sig.(2-tailed)	.003	.241	.002	.000	.002
NSR	Pearson Correlation	.345**	.285**	.387**	.419**	.402**
	Sig.(2-tailed)	.000	.000	.000	.000	.000
I	Pearson Correlation	.109	.041	.150*	.148*	.142*
	Sig.(2-tailed)	.062	.486	.010	.011	.015
SRIS	Pearson Correlation	.267**	.170**	.305**	.331**	.307**
	Sig.(2-tailed)	.000	.003	.000	.000	.000

**Correlation is significant at the level 0.01 level (2-tailed).

* Correlation is significant at the level 0.05 level (2-tailed).

The correlation analyses results revealed that the preservice English teachers' reflection positively correlated with creativity. As was shown in Table 8, low correlation was found between the mean of Self-reflection and Insight (SRIS) and that of Creativity Scale (CS) because correlation coefficient was .307. As for the four sub-scales, low correlation was found between Need for Self-reflection (NSR) and Creative Thoughts and Creativity Awareness (CTCA) (correlation coefficient = .387), and moderate correlation was revealed between Need for Self-reflection (NSR) and Creativity Intention (CI) (correlation coefficient = .419).

5. Discussion

This study explored the status quo of Preservice English teachers' reflection, creativity and the relationship between them. Results showed that the preservice English teachers enjoyed medium-

high level of reflection and medium-high level of creativity respectively. Low degree of positive correlation was detected between the teachers' reflection and creativity.

The preservice English teachers reported medium-high level of reflection (M=4.5511; SD=0.63556) and the highest mean of Need for Self-reflection (NSR) (M=4.9192; SD=0.84225) among the three subscales. According to Deci and Ryan (2012), intrinsic motivation could promote individual's personal growth. The preservice English teachers usually have intrinsic motivation to develop English proficiency, which contributes to foster deeper self-reflection. Besides, collaborative learning is generally encouraged in the university of the preservice English teachers. The preservice English teachers were encouraged to engage in self-assessment and reflection, which could account for the research finding that the highest mean was yielded by the sub-scale of Need for Self-reflection (NSR). Intrinsic motivation and collaborative learning are proposed as possible explanatory variables for the research findings concerning reflection. However, since these variables were not empirically measured in the current study, their role could be tentative and hypothesized. Hypotheses could be developed that intrinsic motivation is a key predictor for preservice English teachers' reflection and that positive correlation exists between collaborative learning and Need for Self-reflection (NSR) of the preservice English teachers. Future research could empirically test these hypotheses so as to provide more robust causal evidence for the findings of this study.

The preservice English teachers reported medium-high level of creativity (M=4.9728; SD=0.93473) and the highest mean of Creativity Intention (CI) (M=5.1086; SD=0.93473) among the four subscales. The preservice English teachers have the opportunity to contact with multiple languages and cultures. Diverse ideas originating from different cultures could enhance the preservice English teachers' creativity thinking (Earley & Ang, 2003). Aiming at achieving language proficiency and personal goals, the preservice English teachers might strive to seek various opportunities for creative expression. Therefore, multilingual and multicultural contact and achievement-oriented pursuit could be postulated as the reasons why the preservice English teachers illustrated medium-high creativity and the highest creativity intention among the four dimensions. However, since these variables were not empirically measured in the current study, their role could be tentative and hypothesized. Hypotheses could be developed that the multilingual and multicultural contact is positively correlated with the creativity of the preservice English teachers, and that their achievement-oriented pursuit of language proficiency and personal development is positively correlated with their creativity intention. Future research could empirically test these hypotheses to provide supporting evidence for the research findings.

The preservice English teachers' reflection was revealed to be positively correlated with creativity at low degree (r=.307). Reflection and creativity are correlated (Flavell, 1979). When preservice English teachers reflectively assessed their learning experiences, creativity could be enhanced by reflection. However, the context where preservice English teachers reflected might hinder creative thinking, leading to low correlation between them. In the university of the preservice English teachers, reflection and creativity are cultivated independently. Activities aimed at cultivating reflection are often segregated from those designed to foster creativity; the levels and types of reflection fail to effectively lead to innovation. It is worthwhile to notice that

moderate correlation was revealed between Need for Self-reflection (NSR) and Creativity Intention (CI). When preservice English teachers felt the need for self-reflection, they might be more open to experimentation and growth, and then greater intention might be motivated to be more creative (Dweck, 2006).

6. Pedagogical Implications for Future Teacher Training

Pedagogical implications for teacher training could be developed based on the findings of the present research.

Firstly, it is necessary to take measures to enhance preservice English teachers' reflection. According to the results of the present research, the reflection of the preservice English teachers was of medium-high level. Future teacher training could adopt different strategies to reinforce preservice English teachers' reflection. To begin with, reflection practice could be incorporated into the teacher education programs. Structured reflective tasks, including reflective journals and discussions guided by reflection scaffolding, contribute to strengthen preservice teachers' reflection (Larrivee, 2000). Besides, future teacher training could cultivate reflection-supportive environment. Providing opportunities for preservice teachers to self-assess and set goals helps to construct reflective environment (Fendler, 2003). For example, cooperative learning is an environment conducive to self-assessment, goal setting, questioning and discussion, which is beneficial for reflection development. What's more, Contradictory Case Analysis Method could be introduced into preservice English teachers' education programs. Research findings illustrate that the preservice English teachers scored the lowest in the subscale of Insight, which indicates that the curriculum was insufficient in cultivating students' ability to deeply identify the essence of problems and establish cross-disciplinary connections. Contradictory Case Analysis Method could compel preservice teachers to examine teaching issues from opposing perspectives, thereby training their ability to discover underlying connections.

Secondly, it is obligatory to adopt strategies to strengthen preservice English teachers' creativity. Teacher training courses should be directed at enhancing preservice teachers' creativity (Baran-Łucarz & Klimas, 2020). Research findings reveal that the preservice English teachers illustrated creativity of medium-high level. In the process of future teacher training, creativity-facilitating tactics could be employed to enhance preservice teachers' creativity. "TRIZ" (teoriya reshniya izobretatelskikh zadatch) (Shih et al., 2013), a technique for creative problem-solving, could be integrated into teacher education program. It helps to achieve innovative solutions by identifying and then overcoming the contradictions impeding the realization of ideal solutions (Kaliteevskii et al., 2022; Park, 2023). It has been verified as an effective tactic to improve preservice teachers' creativity beliefs and creativity (Park, 2023). Besides, inter-disciplinary knowledge could be integrated into the teacher education program. Inter-disciplinary learning is more engaging than traditional lessons (Baillat & Niclot, 2010). It will enable preservice teachers to make connections between different subjects, which requires them to think critically and creatively, inspiring creativity and innovation among the preservice English teachers. In addition, it is advised to systematically incorporate "micro-teaching innovation labs" into the teacher

training curriculum. The lowest score of Self-efficacy of Creativity (SC) among the four subscales signifies that the preservice English teachers lack experience in translating creative ideas into practice and obtaining successful validation. “Micro-teaching innovation labs” could allow students to implement their innovative lesson plans in a controlled environment and build their creative confidence through immediate, positive feedback.

Lastly, it is vital to integrate the cultivation of reflection with that of creativity. The research findings indicate that the preservice English teachers’ reflection was positively correlated with creativity at low degree. Future curriculum design could go beyond treating reflection cultivation and creativity cultivation as separate parallel objectives and actively build scaffolds to connect the two. For one thing, innovative directives could be embedded in reflective activities. When required to reflect on teaching practices, preservice teachers could to be urged to not stop at “what happened” and “why,” but could be compelled to advance to the “how to innovate” stage. For example, “Based on this reflection, how will you redesign this teaching segment to stimulate greater creativity in students?” For another, reflective components could be integrated into creative practices. After preservice English teachers complete a creative task, they should be guided through “meta-creative” reflection. For example, “Looking back on the entire design process, which key reflection helped you break through the initial cognitive fixedness?”

7. Conclusions

The present research aimed to investigate the preservice English teachers’ status quo of reflection and creativity, detecting the relationship between them. Self-reflection and Insight Scale (SRIS) and Creativity Scale (CS) were employed as the research instruments. The research findings were yielded that the preservice English teachers enjoyed medium-high level of reflection and creativity, and that reflection positively correlated with creativity at low degree.

Measures could be adopted to promote preservice English teachers’ reflection and creativity in future teacher training. Above all, future teacher training could incorporate regular reflective activities, construct reflection-supportive environment and introduce Contradictory Case Analysis Method to enhance preservice English teachers’ reflection skills. In addition, “TRIZ”, inter-disciplinary knowledge and “micro-teaching innovation labs” could be integrated into future teacher training program so as to promote preservice teachers’ creativity. What’s more, future teacher training program could integrate the cultivation of reflection with that of creativity.

Author Contributions:

Conceptualization, Jiangtao Ma; methodology, Jiangtao Ma; software, Yifei Du; validation, Jiangtao Ma; formal analysis, Jiangtao Ma; investigation, Jiangtao Ma; resources, Jiangtao Ma; data curation, Yifei Du; writing—original draft preparation, Jiangtao Ma; writing—review and editing, Jiangtao Ma; visualization, Jiangtao Ma; supervision, Jiangtao Ma; project administration, Jiangtao Ma; funding acquisition, Jiangtao Ma. All authors have read and agreed to the published version of the manuscript.

Funding:

This research was funded by Research and Practice Project on Foreign Language Teaching Reform in Universities in Hebei Province (grant number: 2025WYJG042). This research was funded by the Research Projects of the 14th Five-Year Plan for Educational Science in Hebei Province (grant number: 2502018). This research was funded by Hebei Normal University of Science & Technology (Grant Number: YJSJG202406; 2024YB005; 2025JK022).

Institutional Review Board Statement:

Ethical review and approval were waived for this study due to its nature as an educational, non-interventional study conducted in accordance with local regulations in China. No personal or sensitive data were collected, and all participants provided informed consent voluntarily.

Informed Consent Statement:

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement:

The datasets presented in this article are not readily available because the data are part of an ongoing study.

Conflict of Interest:

The authors declare no conflict of interest.

References

Baillat, G., & Niclot, D. (2010). In search of interdisciplinarity in schools in France: From curriculum to practice. Issues in Integrative Studies, 28, 170–207.

Baran-Łucarz, M., & Klimas, A. (2020). Developing 21st century skills in a foreign language classroom: EFL student teachers' beliefs and self-awareness. Academic Journal of Modern Philology, 10, 23–38.

Bowling, A., Giorgi, A., Filson, C., & Kitchel, T. (2022). Agricultural education preservice teachers' metacognitive processes and reflective observations during a reflection-in-action activity. Teaching and Teacher Education, 114, 103695.

Costa, S., Broietti, F., & Passos, M. (2020). The levels and nature of pre-service Chemistry teachers' reflections in a public university in Southern Brazil. Problems of Education in the 21st Century, 78(2), 147–166.

De Leon-Pineda, J., & Prudente, M. (2022). Using online journals to improve the teaching of reflection among preservice math teachers. Reflective Practice, 23(3), 369–381.

Deci, E. L., & Ryan, R. M. (2012). Self-determination theory. Handbook of Theories of Social Psychology, 1(20), 416–436.

Demirel, M., Derman, I., & Karagedik, E. (2015). A study on the relationship between reflective thinking skills towards problem solving and attitudes towards mathematics. 7th World Conference on Educational Sciences, Athens, GREECE.

Dweck, C. S. (2006). Mindset: The new psychology of success. Random House.

Earley, P. C., & Ang, S. (2003). Cultural intelligence: Individual interactions across cultures. Stanford University Press.

Fendler, L. (2003). Teacher reflection in a hall of mirrors: Historical influences and political reverberations. Educational Researcher, 32(3), 16–25.

Flavell, J. H. (1979). Metacognition and cognitive monitoring: A new area of cognitive–developmental inquiry. American Psychologist, 34(10), 906–911.

Hua, Y., & Yang, Y. (2024). Early childhood preservice teachers' beliefs of creativity, creative individuals and creative environment: Perspectives from China. Thinking Skills and Creativity, 51, 101441.

Hußner, I., Lazarides, R., Symes, W., Richter, E., & Westphal, A. (2023). Reflect on your teaching experience: systematic reflection of teaching behaviour and changes in student teachers' self-efficacy for reflection. Zeitschrift für Erziehungswissenschaft, 26(5), 1301–1320.

Kaliteevskii, V., Bryksin, M., & Chechurin, L. (2022). Integration of TRIZ Methodologies into the digital product development process. 22nd International TRIZ Future Conference on Automated Invention for Smart Industries (TFC), Warsaw, POLAND.

Keiner, L., Graulich, N., Göttlich, R., & Pietzner, V. (2020). Comparison of beginner and advanced chemistry student teachers' perspective on creativity – does it play a role in the chemistry classroom? Chemistry Education Research and Practice, 21(2), 608–621.

Larrivee, B. (2000). Transforming teaching practice: Becoming the critically reflective teacher. Reflective Practice, 1(3), 293–307.

Michaelidou, A., & Pitri, E. (2022). Early childhood student-teachers' perspectives on creativity. Frontiers in Education, 7, 1042598.

Novak, E., Kuo, C.-L., Tassell, J. L., & Morris, G. (2024). Effects of a creativity-enhancement intervention on preservice elementary teachers' creativity in computing education. TechTrends, 68(6), 1095–1106.

Park, S. J. (2023). Testing the effects of a TRIZ invention instruction program on creativity beliefs, creativity, and invention teaching self-efficacy. Education and Information Technologies, 28(10), 12883–12902.

Sánchez, A., Font, V., & Breda, A. (2022). Significance of creativity and its development in mathematics classes for preservice teachers who are not trained to develop students' creativity. Mathematics Education Research Journal, 34(4), 863–885.

Shih, B., Chen, C., & Li, C. (2013). The exploration of the mobile Mandarin learning system by the application of TRIZ theory. Computer Applications in Engineering Education, 21(2), 343–348.

Turhan, B., & Kirkgöz, Y. (2023). A critical and collaborative stance towards retrospective reflection in language teacher education. European Journal of Teacher Education, 46(2), 222–240.

Wang, Y., & Ko, J. (2025). How does online training with reflection tasks affect the depth of reflection of preservice teachers in China? Teacher Development, 29(1), 127–147.

Zhong, B., Liu, X., & Chen, L. (2023). The framework and practice of cultivating normal students' interdisciplinary innovative ability in the context of "New Teacher Education". e-Education Research, 44(07), 114–120+128.

Zhong, X., Qu, K., & Zhang, D. (2024). Examining influencing factors of teacher education students' creativity in Chongqing Municipality. Cogent Education, 11(1), 2351268.

iEducation, 2025, 1(3), 16-29
https://doi.org/10.71204/3sh53m08

Research on the Reconstruction of the "Chinese Paradigm" for the Deep Integration of New Liberal Arts and Economics and Management Majors Education

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Received: 5 December 2025 /Accepted: 15 December 2025/Published online: 16 December 2025

Abstract

This paper discusses the reconstruction of the deep integration model for Economics and Management Majors under the background of the new liberal arts in China. The study analyzes the connotation and characteristics of the new liberal arts, as well as the current situation and challenges of the integration of new liberal arts with Economics and Management Majors. Based on this, the paper proposes a deep integration model that includes curriculum system reform, the deepening of industry-education integration, and innovation in science-education integration. The article also explores implementation strategies and safeguard measures, including top-level design, the construction of teaching staff, clear positioning of participating entities, and the establishment of a quality evaluation system for the integration of new liberal arts. The research indicates that the deep integration of new liberal arts with Economics and Management Majors is of great significance for cultivating compound talents and promoting disciplinary innovation and development.

Keywords: New Liberal Arts; Economics and Management Majors; Deep Integration; Industry-Education Integration; Science-Education Integration

1. Introduction

The fourth industrial revolution is reshaping the global knowledge production system with a disruptive momentum (Lee et al., 2018). The exponential development of technologies such as artificial intelligence, big data, and blockchain is placing unprecedented pressure on the deconstruction of traditional talent cultivation models in Economics and Management Majors (George, 2024). Against this backdrop, the core dilemma faced by current business management

education is that the pace of disciplinary knowledge iteration lags behind the cycle of technological change, standardized talent cultivation is difficult to match the needs of industrial digital transformation, and the cognitive barriers formed by the traditional disciplinary system hinder the systematic resolution of complex economic issues (Balmer, 2006); the structural contradictions such as rigid disciplinary barriers, outdated technical tools, and virtualization of practical fields in Economics and Management disciplines, along with the traditional teaching model centered on the transmission of disciplinary knowledge, are no longer able to meet the urgent demand of the digital economy era for compound and innovative talents (Bobkova, Korobejnikova, Nelyubina, & Likhman, 2015).

In recent years, the curriculum reform of the world's top business schools has shown a significant turn towards the philosophy of technology (Lewis, 2018). The MIT Sloan School of Management has embedded machine learning into its corporate finance courses, and London Business School has introduced complex system simulations into its strategic management teaching (Sterman, 2014). These practices reveal that business management education is undergoing a paradigm shift from "technology application" to "technology cognition." The interdisciplinary "Climate Finance" project conducted by the Harvard Kennedy School, which successfully integrates environmental science, financial engineering, and public policy research methods, provides a referable paradigm for the integration of new liberal arts and business management (Andonova,2022). The dissolution of disciplinary barriers is giving birth to new knowledge growth points. The Nobel Prize in Economics' recent continuous tilt towards behavioral science and complex science reflects a profound shift towards interdisciplinary integration in the research paradigm of economic management (Ren & Liu, 2024). The "big issue-oriented" research paradigm advocated by the new liberal arts is highly compatible with the complex issues facing the business management field, such as sustainable development and digital economy governance. In an algorithm-driven decision-making environment, business management talents not only need to master data analysis tools but also need to have the ability to make ethical judgments about algorithms and to anticipate technical risks.

In this revolution of educational paradigm, the introduction of the concept of new liberal arts has pointed out the direction for the reform of liberal arts education in China, and has also provided strategic opportunities for the innovative development and transformation of Economics and Management Majors (Zha, 2022). The deep integration of new liberal arts with Economics and Management Majors is, at its essence, a fundamental reconstruction of the mode of knowledge production, aiming to build a new cognitive framework and capability system that adapts to the digital civilization era (Li & Hu, 2024). As a field of study with strong practical application, business management faces the important task of achieving deep integration under the background of new liberal arts, and cultivating compound talents with interdisciplinary perspectives and innovative capabilities. This study aims to explore the models and paths for the deep integration of new liberal arts with Economics and Management Majors, providing theoretical references and practical guidance for promoting the innovative development of Economics and Management Majors.

2. The Connotation and Characteristics of the New Liberal Arts

2.1. The Connotation of the New Liberal Arts

The concept of the new liberal arts was first proposed by the United States' Hiram College in 2017, with the aim of integrating new technologies into humanities and social science courses through disciplinary reorganization and the intersection of arts and sciences, to meet the demands of the global new technological revolution and economic development(Lu & Hu, 2020). In 2018, China officially introduced the concept of "new liberal arts" and explicitly proposed to develop new engineering, new medical, new agricultural, and new liberal arts, to enhance the service capacity and contribution level of education (Chen & Li ,2024). The new liberal arts represent both the continuation and innovation of traditional humanities disciplines, with its core focusing on the deep integration of humanities with social sciences, natural sciences, engineering technology, and other fields, forming a more inclusive and practical knowledge system. The new liberal arts not only pay attention to traditional humanities issues (such as culture, ethics, history, etc.) but also devote themselves to solving complex contemporary social problems (such as environmental crises, technological ethics, globalization, etc.). The proposal of the new liberal arts is a reflection and reconstruction of traditional humanities disciplines, aiming to break through disciplinary boundaries and promote the integration and innovation of knowledge (Geiger& Rothblatt,2015).

2.2. The Core Characteristics of the New Liberal Arts

The core characteristics of the new liberal arts include: (1) Disciplinary reorganization and the intersection of arts and sciences. Integrating new technologies into traditional liberal arts courses to promote interdisciplinary crossover and deep integration. (2) Comprehensive interdisciplinary learning. Providing students with comprehensive interdisciplinary learning opportunities to cultivate applied and compound liberal arts talents. (3) Cultivation of innovative talents. Focusing on developing students' innovative thinking and practical abilities to meet the development needs of the new era (Li, & Hong, 2022).

3. The Current Status of the Integration and Development of New Liberal Arts and Economics and Management Majors

3.1. Preliminary Exploration of Interdisciplinary Integration

The deep integration of new liberal arts with Economics and Management Majors is an important trend in the current field of higher education. In the preliminary exploration of interdisciplinary integration, Chinese universities have made various attempts in curriculum systems, research directions, and talent cultivation models (Liu, 2024), as follows: (1) The construction of an interdisciplinary curriculum system. Universities have begun to break down traditional disciplinary barriers and design curriculum systems that integrate the characteristics of both fields: a fusion module of interdisciplinary core courses with elective courses. For example, Economics and Management Majors are attempting to integrate with data science, artificial intelligence, and other science and technology fields (Johnson,2021). (2) The exploration of

interdisciplinary research directions. Universities have started to establish interdisciplinary research institutions, and through interdisciplinary academic salons, forums, and other activities, they promote the exchange between scholars of new liberal arts and business management, driving the integration of academic research (Newman, 2024). (3) The innovation of interdisciplinary talent cultivation models, such as dual degrees or joint training programs, interdisciplinary mentor teams, and personalized cultivation plans (Gao, Ji, Wang, & Yu, 2025). The combination of interdisciplinary practice and application, including the construction of interdisciplinary practice bases, interdisciplinary solutions to social problems, and interdisciplinary competitions and activities. Some universities have attempted to build a practical teaching system that integrates "curriculum crossover" with "disciplinary crossover," achieving a "multi-dimensional Synergy" model, and integrating resources from universities, enterprises, and industry associations (Fu et al., 2025).

3.2. Attempts at Reforming the Practical Teaching System

Under the context of deep integration between new liberal arts and Economics and Management Majors, attempts at reforming the practical teaching system have become an important trend (Riabovolyk,2023). Management in the education system: global tendencies, reforming and innovations. This reform is not only to meet society's demand for compound and innovative talents but also to break down traditional disciplinary barriers and cultivate students' practical abilities and comprehensive qualities. Some universities have reconstructed their practical teaching systems through a "multi-dimensional Synergy" model (school-enterprise cooperation, integration of competition and teaching, etc.), proposing a practical framework of "course crossover + industry-education integration"(Guo, 2023). Some universities have reconstructed talent cultivation paths through the integration of competition and teaching, and industry-education integration, introducing lecture-based teaching, corporate thematic lectures, and other forms to enhance participation. Most institutions have strengthened practical orientation, improving students' application abilities through case teaching, corporate internships, and disciplinary competitions (Lu, 2021). At the same time, the promotion of project-based learning (PBL) is an important direction in current practical teaching reforms. By designing real, complex interdisciplinary projects and real corporate projects, students can combine new liberal arts and business management knowledge, or provide real business cases or projects to solve practical problems (Almulla,2020). Some universities have also opened up "digital intelligence" courses, integrating data analysis tools with business practices.

3.3. The Rise of Multi-party Collaborative Education Models

Chinese universities are strengthening their cooperation with governments and enterprises, such as establishing practice bases and carrying out school-enterprise joint projects. Some higher education institutions promote the cultivation of students' comprehensive abilities by completing innovation and entrepreneurship projects through interdisciplinary team collaboration (Lin,2023). The multi-party collaborative education model is particularly prominent in the integration of new liberal arts and Economics and Management Majors: (1) School-enterprise cooperation: Universities and enterprises jointly design courses, conduct project research, or engage in practical teaching. For example, students in new liberal arts majors can participate in corporate

branding, cultural communication projects, while students in Economics and Management Majors can provide support to enterprises through data analysis, market research, and other means (Bian & Wang, 2021). (2) Government support: The government encourages in-depth cooperation between universities and enterprises to promote the integration of production, learning, and research through policy guidance and financial support. For instance, many local governments have set up special funds to support universities and local enterprises in carrying out research and practice in cultural industries, digital economy, and other fields (MA et al., 2022). (3) Participation of social organizations: Industry associations, non-profit organizations, and others have also begun to participate in talent cultivation, providing internship opportunities, lectures, or competitions and other resources to help students better understand social needs (Lee et al., 2025).

4. Problems in the Deep Integration of New Liberal Arts and Economics and Management Majors

4.1. Unclear Integration Paths and Lagging Curriculum Systems

Currently, the integration path between new liberal arts and Economics and Management Majors remains unclear. Most institutions are still at the stage of "course module patchwork," failing to achieve organic integration of knowledge and not forming a clear path for interdisciplinary talent cultivation (Sarina & Wardiah, 2019). The curriculum system lags behind industrial changes, with traditional courses still dominating and a lack of content in emerging fields such as blockchain economics and ESG management. The curriculum design lacks comprehensive interdisciplinary planning, resulting in insufficient understanding of interdisciplinary courses among teachers and students, which leads to repeated or disjointed course content. For example, courses that integrate arts and sciences often only combine economics with basic programming without achieving methodological penetration, thus, such integration often remains at the level of content superposition, lacking systematic design.

4.2. Imbalance in Interdisciplinary Teaching Staff

Teachers generally lack interdisciplinary backgrounds and industry practical experience, making it difficult to support the needs of deep integration. The teaching staff commonly faces the issue of "disciplinary singularity," with insufficient teaching abilities across fields. A survey shows that only 37% of business management teachers at a certain university have experience in data analysis or digital technology applications, leading to superficial case teaching and the application of new technologies (Huang ,2024). The reason for this is the lack of interdisciplinary learning, training, and support, which limits teachers' guidance capabilities in interdisciplinary teaching.

4.3. The "Shallow" Dilemma of Industry-Education Integration

In the current “School-enterprise cooperation” models for Economics and Management Majors in colleges and universities, many are limited to the construction of internship bases. The proportion of enterprises participating in curriculum design and sharing of teaching staff is insufficient, and the distribution of school resources is uneven. Practical projects often focus on

case analysis and simulated operations, which have a gap with real business scenarios, and the problem of uneven resource allocation is prominent. Some industry-education projects are actually "visiting-type practices," failing to establish a long-term collaborative mechanism. Issues such as the lagging update of experimental software and the superficiality of enterprise cooperation projects are prominent (Wang, et al., 2017). Interdisciplinary practical teaching requires abundant resource support, but some universities invest insufficiently in school-enterprise cooperation and the construction of practice bases, leading to limited practical opportunities for students. There is also an imperfect cooperation mechanism between universities and enterprises, low efficiency in resource integration, and a lack of awareness among some enterprises of the needs for interdisciplinary talents (Liu, 2024).

4.4. Homogenization and Ambiguity in Positioning

The construction of Economics and Management Majors in local colleges and universities tends to be homogenized and lacks regional characteristics (Zha, 2009). Some institutions have attempted to construct professional groups by leveraging regional industrial features (such as cultural tourism economy, digital trade), but the depth of characteristic integration is insufficient, and long-term planning is lacking. There is also a lack of positioning: (1) School positioning: For example, in the professional settings of most colleges and universities in China, Economics and Management Majors still focus on traditional business administration, failing to form differentiated positioning by combining regional industrial advantages, which puts local colleges' majors under the pressure of homogenized competition (Hou & Chen, 2014). (2)Students' cognition and adaptability issues: Students lack a clear understanding of the value of interdisciplinary integration and its impact on career development prospects. Some students have insufficient awareness of interdisciplinary integration, believing that the combination of new liberal arts and Economics and Management Majors is unnecessary or lacks prospects, leading to a lack of motivation to learn (Horn & Zweekhorst, 2022). (3) Social cognition and adaptability issues in the job market (Wu & Zhang, 2024). The model of interdisciplinary integration is still in the exploratory stage, and some employers have insufficient awareness of talents with interdisciplinary integration, leading to unclear demand in the job market for such talents. The social cognition and acceptance of these talents need to be improved.

4.5. Lack of Evaluation Mechanisms and Incentives

The existing evaluation system still primarily focuses on theoretical examination scores, with a low proportion of indicators for interdisciplinary project outcomes and innovation capabilities, which suppresses the enthusiasm for integration reforms (Deng, & You, 2025). On one hand, the teaching evaluation system does not fully incorporate interdisciplinary integration indicators, leading to insufficient motivation for teachers to participate in curriculum reforms. On the other hand, the traditional evaluation system pays more attention to students' mastery of theoretical knowledge, with theoretical examinations still being the main form of student assessment, neglecting the cultivation of practical abilities and interdisciplinary comprehensive capabilities. In the process of integration with new liberal arts, the evaluation system lacks a design that targets interdisciplinary integration, making it difficult to comprehensively measure students' comprehensive abilities.

5. Reconstruction of the Deep Integration Model of New Liberal Arts and Business Management Disciplines

Under the background of new liberal arts, the deep integration of Economics and Management Majors has made phased progress, but it still faces core challenges such as curriculum integration, faculty optimization, resource matching, and lack of incentives. Combined with the three core characteristics of new liberal arts: disciplinary reorganization and the intersection of arts and sciences, comprehensive interdisciplinary learning, and the cultivation of innovative talents, future breakthroughs need to be achieved through dynamic curriculum system reconstruction (such as modular crossover course design), deepening industry-education integration (school-enterprise joint training), and innovative science-education integration (industry-academia-research collaborative education). The framework for the deep integration reconstruction of new liberal arts and Economics and Management Majors is shown in Figure 1.

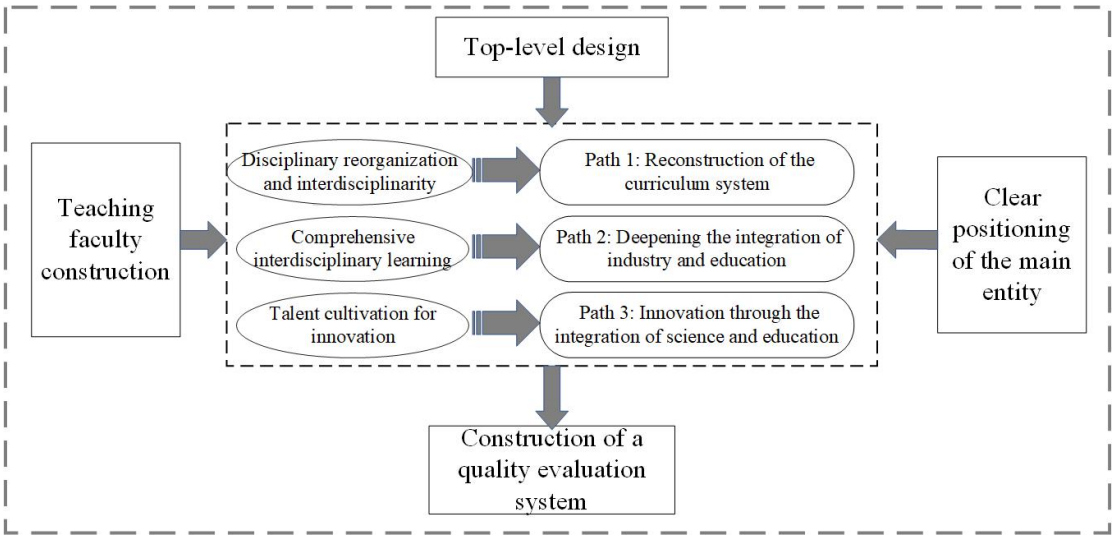

Figure 1. Reconstruction Plan for Deep Integration of the New Liberal Arts and Management and Economics Majors

5.1. Premise of Integration: Strengthening Top-level Design and Policy Support

Universities should formulate plans for the construction of new liberal arts, clarify the goals and paths for the deep integration of Economics and Management Majors, and provide necessary policy support and resource guarantees. At the same time, it is necessary to establish and improve the incentive mechanisms for interdisciplinary teaching and research, encouraging teachers to participate in interdisciplinary teaching and research activities. Universities should integrate internal and external resources, establish a platform for the sharing of interdisciplinary resources, and provide necessary resource support for deep integration. This can be achieved by establishing interdisciplinary laboratories, shared databases, and other means to promote the effective use and sharing of resources.

5.2. Path of Integration: The "Three-Dimensional Reconstruction" Chinese Paradigm

5.2.1. Course System Reconstruction

(1) Curriculum System Reform. Business management programs should universally incorporate technology courses such as Python, big data analysis, machine learning, and blockchain. For instance, the Financial Technology major at the Central University of Finance and Economics integrates programming with finance, while the School of Economics and Management at Tsinghua University offers a course in "Business Data Analysis." Some universities have launched dual-degree programs that combine economics with computer science and management with artificial intelligence, or established interdisciplinary directions such as "Digital Economics" and "Intelligent Supply Chain Management" to engage in interdisciplinary modular design.

(2) Innovation in Teaching Methods. Utilizing technology-driven teaching models that employ virtual simulations (such as financial trading simulation platforms) and case databases (like Wind and CSMAR) for empirical teaching, with some courses incorporating natural language processing tools to assist in business decision analysis. Engaging in project-based learning (PBL) in collaboration with enterprises for digital transformation projects, such as optimizing the supply chain for JD.com and designing financial risk control models for Ant Group.

(3) Expansion of Research Fields. Firstly, there is a rise in computational social science. Business and management research extensively adopts methods such as big data analysis (e.g., using social media sentiment indices to predict stock markets), Agent-Based Modeling (ABM) simulations (e.g., simulating supply chain disruptions during a pandemic), and natural language processing (NLP analysis of policy texts). Secondly, there are emerging interdisciplinary fields. These include the integration of behavioral economics with neuroscience (neuromarketing), the application of blockchain in supply chain finance, and ESG data analysis.

5.2.2. Deepening Industry-Education Integration

In the process of implementation, industry-education integration needs to be deepened in multiple aspects such as joint training, practical teaching, and organizational models (Feng, 2025, April). (1) School-enterprise joint education mechanism. Universities and enterprises should jointly develop training programs and carry out activities such as customized training and on-the-job internships. The curriculum system needs to be redesigned based on industrial needs, with a modular approach that integrates basic courses, specialized courses, and practical courses. Promote blended teaching, strengthen practical teaching, integrate innovation and entrepreneurship education with comprehensive quality education. (2) Optimization of the practical teaching system. Practical teaching is an important carrier of industry-education integration, and a multi-level practical platform needs to be constructed, including on-campus training bases, school-enterprise joint laboratories, and enterprise internships. For example, the "school-enterprise co-construction of practice bases" model can be used to implement real project teaching by introducing real projects from enterprises into the teaching process. Examples include "Cultural and Creative Product Design and Market Promotion" and "Cultural IP Operation and

Commercialization," which help students learn and practice in real scenarios. (3) Innovation in the organizational model of industry-education integration. This can be achieved through the establishment of a "dual mentorship" system (campus mentors + enterprise mentors) and "project-based learning" to provide students with comprehensive guidance and support. (4) Resource support. This includes teacher resources, practical facilities, and financial guarantees. It is necessary to strengthen school-enterprise collaboration, integrate enterprise educational resources, and provide support for the educational process. Through industry-education integration, students can grasp real industry needs and vocational skills.

5.2.3. Innovation in Science-Education Integration

One of the core features of new liberal arts is the cultivation of innovative talents, and therefore, innovation in science-education integration should be achieved in the deep integration of new liberal arts with business management disciplines. The main measures include: (1) Development of cutting-edge courses. Integrating the latest scientific research findings and technological advancements into the content of business management courses to ensure the frontier and innovativeness of teaching content. For example, the latest research findings in fields such as artificial intelligence and quantum computing can be integrated into relevant courses. Develop interdisciplinary courses based on the latest scientific research findings to cultivate students' comprehensive qualities. (2) Student participation in scientific research projects. Encourage students to participate in scientific research projects led by teachers or enterprises, provide special funding support, and cultivate their scientific research capabilities and innovative awareness. The integration of production, learning, and research promotes the transformation of scientific and technological achievements and applies research findings to teaching practice, promoting the deep integration of education and science and technology. (3) Openness and sharing of research platforms. Establish interdisciplinary research centers and disciplinary teams to promote cooperation and exchanges between different disciplines and drive the in-depth development of scientific research (Reuver & Zuiderwijk, 2022). Open university laboratories to students and teachers, providing advanced research equipment and technical support to promote the conduct of scientific research activities.

5.3. Foundation for Integration: Strengthening the Cultivation of Teachers' Interdisciplinary Capabilities

Advancing the construction of teaching staff and enhancing their capabilities is key to deep integration (Zhao & Shi, 2024). Universities should strengthen the construction of interdisciplinary teaching staff, recruit outstanding talents with interdisciplinary backgrounds, and at the same time, strengthen the training of existing teachers to improve their interdisciplinary teaching and research abilities. (1) Constructing an Interdisciplinary Knowledge System. Teachers need to master the core knowledge and research methods of new liberal arts and business management disciplines through systematic study. This can be achieved through the following means: conducting interdisciplinary course training to help teachers understand the basic theories and practical methods of other disciplines; establishing a "dual-discipline" teaching staff training mechanism to encourage teachers to pursue interdisciplinary further education or joint training; developing interdisciplinary teaching materials and resources to provide references

for teachers' learning and teaching. (2) Enhancing Interdisciplinary Teaching Abilities. Teachers' interdisciplinary teaching abilities directly affect the effectiveness of disciplinary integration. Specific measures include: conducting case-based interdisciplinary teaching training to help teachers master the methods of interdisciplinary course design; holding interdisciplinary teaching observation and discussion activities to promote experience exchange among teachers. (3) Strengthening Practical and Application Abilities. Teachers need to enhance their interdisciplinary teaching abilities through practical activities. Specific measures include: organizing teachers to participate in interdisciplinary research projects to improve their practical abilities; establishing school-enterprise cooperation platforms to promote collaboration between teachers and enterprises and understand industrial needs; conducting interdisciplinary teaching practice activities, such as interdisciplinary course design competitions and teaching achievement exhibitions. (4) Establishing incentive mechanisms for interdisciplinary teaching, such as incorporating interdisciplinary teaching achievements into the teacher evaluation system, holding interdisciplinary teaching practice activities like interdisciplinary course design competitions and teaching achievement exhibitions, and encouraging teachers to participate in interdisciplinary course design and teaching.

5.4. Support for Integration: Clear Positioning of Participating Entities

(1) Enhancing Students' Interdisciplinary Cognition and Adaptability. Universities should strengthen interdisciplinary cognition education for students, helping them recognize the value and career development prospects of interdisciplinary integration through lectures, promotional materials, and other forms. Through career planning courses or counseling, help students clarify their career development directions in interdisciplinary integration. By showcasing successful cases of interdisciplinary integration talents, stimulate students' interest and confidence in learning. Design interesting and challenging interdisciplinary courses to enhance the learning experience and participation of students.

(2) Promoting Social Cognition and Adaptability in the Job Market. Universities should strengthen communication with society, promoting the cognition and acceptance of interdisciplinary integration talents through publicity, forums, and other forms. Through research on fields such as cultural industries and the digital economy, clarify the market demand for interdisciplinary integration talents. Share the successful experiences of alumni with society to demonstrate the value of interdisciplinary integration talents. Collaborate with employers in the job market promotion, promoting the employment prospects and competitive advantages of interdisciplinary integration talents.

5.5. Guarantee for Integration: Building a Multi-dimensional Evaluation System

(1) Evaluation of Students' Interdisciplinary Abilities. Universities should design a multi-dimensional fusion quality evaluation system to comprehensively measure students' interdisciplinary abilities, including theoretical knowledge, practical skills, teamwork abilities (Carmichael, 2024). In the process of formative assessment during the implementation of courses, students are dynamically evaluated through various forms such as classroom performance and project progress. Multi-party evaluation methods are introduced, including assessments from

teachers, enterprise mentors, and student self-evaluations, to ensure the comprehensiveness and objectivity of the evaluation. Students' practical achievements, such as project reports and practical works, serve as important bases for evaluation, examining the practical application of their interdisciplinary abilities.

(2) Evaluation of the Effectiveness and Quality of Deep Integration Models. Universities should establish a scientific quality evaluation system, incorporating interdisciplinary teaching and research achievements into the evaluation indicators to encourage teachers and students to participate in interdisciplinary activities. At the same time, an effective feedback mechanism should be established to timely adjust and optimize the strategies and measures of deep integration.

6. Conclusion

The deep integration of new liberal arts with Economics and Management Majors is a significant direction for the reform of higher education in China in the new era. It is a complex systematic project that not only requires comprehensive reforms in curriculum systems, industry-education integration, and science-education integration by universities but also necessitates supportive measures such as strengthening top-level design, promoting the construction of teaching staff, building quality evaluation systems, enhancing student cognition, and advancing social cognition to effectively promote the in-depth development of interdisciplinary integration in Economics and Management Majors. This will not only help cultivate business management professionals with greater innovation and practical abilities but also provide stronger talent support for social and economic development. In the future, as the interdisciplinary integration model continues to improve and expand, the reform of new liberal arts integration models will play an even greater role in the field of higher education.

Author Contributions:

Conceptualization, L. G. and C. J.; methodology, L. G.; validation, L. G.; investigation, L. G.; resources, L. G.; writing—original draft preparation, L. G; writing—review and editing, L. G. and C. J.; supervision, L. G.; project administration, L. G.; funding acquisition, L. G.. All authors have read and agreed to the published version of the manuscript.

Funding:

This work was supported by the 2024 Annual Provincial-Level Quality Engineering Projects for Institutions of Higher Education in Anhui Province(2024jyxm0187).

Conflict of interest

The authors declare no conflict of interest.

References

Almulla, M. A. (2020). The effectiveness of the project-based learning (PBL) approach as a way to engage students in learning. Sage Open, 10(3), 2158244020938702.

Andonova, L. B., Faul, M. V., & Piselli, D. (2022). Partnerships for sustainability in contemporary global governance: Pathways to effectiveness (p. 308). Taylor & Francis

Balmer, R. T. 2006. Converging Technologies in Higher Education. Annals of the New York Academy of Sciences, 1093(1): 74–83.

Bian, F., & Wang, X. (2021). School enterprise cooperation mechanism based on improveddecision tree algorithm. Journal of Intelligent & Fuzzy Systems, 40(4), 5995-6005.

Bobkova, E. Yu., Korobejnikova, E. V., Nelyubina, E. G., & Likhman, V. A. (2015). Pedagogical Problems of Effective Training of Specialists in International Virtualization of Economic Industry. Mediterranean Journal of Social Sciences, 6(3), 17-24.

Carmichael, T. S. (2024). Evaluating interdisciplinary education. In Handbook of Interdisciplinary Teaching and Administration (pp. 227-244). Edward Elgar Publishing.

Chen, Y., & Li, H. (2024). Exploring the Construction Ideas for a First-Class Undergraduate Major in Finance Under the Background of New Liberal Arts. Education, 3(4), 86-92.

De Reuver, M., Ofe, H., Agahari, W., Abbas, A. E., & Zuiderwijk, A. (2022, December).The openness of data platforms: A research agenda. In Proceedings of the 1st International Workshop on Data Economy (pp. 34-41).

Deng, D., Sun, F., Liu, Y., & You, S. (2025, September). Research on the Optimization ofIndustry-Education Integration Curriculum System for Landscape Architecture under the Background of New Engineering. In Proceedings of the 2025 9th International Seminar on Education, Management and Social Sciences (ISEMSS 2025) (p. 352). Springer Nature.

Feng, L. (2025, April). Design and Reform of Industry-Education Integration in. In Proceedings of the 2024 3rd International Conference on Educational Science and Social Culture (ESSC 2024) (Vol. 914, p. 132). Springer Nature.

Fu, S., Dong, F., Chen, R., Shen, D., Zhang, J., et al. 2025. Multi-Dimensional Training Optimization for Efficient Federated Synergy Learning. IEEE Transactions on Mobile Computing, 24(7), 6243–6258.

Full article: Reform and practice of the interdisciplinary competency cultivation model based on the German economic engineering talent training. n.d. https://www.tandfonline.com/doi/full/10.1080/2331186X.2025.2580073, December 1, 2025.

Gao, X., Ji, X., Wang, R., & Yu, J. 2025. The effect of artificial intelligence on energy transition: Evidence from China. Energy Economics, 147, 108568.

Geiger, R. L., Rothblatt, S., Melin, C., Kleinman, D. L., Moses, Y., Woodward, K., ... & Williams, J. J. (2015). A new deal for the humanities: Liberal arts and the future of public higher education. Rutgers University Press.

George, A. S. (2024). The evolution of economic models: From knowledge to intuition and optimization. Partners Universal Multidisciplinary Research Journal, 1(2), 1-25.

Guo, Z. (2023). Evaluation on the Prospects of School Enterprise Cooperation and the Integration of Industry and Education in Vocational Education in the 5G Era. The Frontiers of Society, Science and Technology, 5(13), 63-70.

Horn, A., Urias, E., & Zweekhorst, M. B. M. (2022). Epistemic stability and epistemic adaptability: interdisciplinary knowledge integration competencies for complex sustainability issues. Sustainability Science, 17(5), 1959-1976.

Hou, J., Michaud, C., Li, Z., Dong, Z., Sun, B., Zhang, J., ... & Chen, L. (2014). Transformation of the education of health professionals in China: progress and challenges. The Lancet, 384(9945), 819-827.

Huang Xinning. Research on the Integration Strategy of Artificial Intelligence and College Foreign Language Teaching from an Interdisciplinary Perspective[J]. Journal of Taiyuan City Vocational and Technical College, 2024, (11): 86-88.

Jiajing, F., Zhiwei, Y., & Qin, D. (2025). Reform and practice of the interdisciplinary competency cultivation model based on the German economic engineering talent training. Cogent Education, 12(1), 2580073.

Johnson, M., Jain, R., Brennan-Tonetta, P., Swartz, E., Silver, D., Paolini, J., ... & Hill, C. (2021). Impact of big data and artificial intelligence on industry: developing a workforce roadmap for a data driven economy. Global Journal of Flexible Systems Management, 22(3), 197-217.

Lee, C. W., Liu, P. T., Thy, Y. H., & Peng, C. L. (2025). Sustainable Open Innovation Model for Cultivating Global Talent: The Case of Non-Profit Organizations and University Alliances. Sustainability, 17(11), 5094.

Lee, M., Yun, J. J., Pyka, A., Won, D., Kodama, F., et al. 2018. How to Respond to the Fourth Industrial Revolution, or the Second Information Technology Revolution? Dynamic New Combinations between Technology, Market, and Society through Open Innovation. Journal of Open Innovation: Technology, Market, and Complexity, 4(3), 21.

Li, X., & Hu, Y. (2024). Research on Top-Level Drivers and Grassroots Practices in the Construction of New Liberal Arts in China. Frontiers in Educational Research, 7(11), 156-163.

Li, C. J., & Hong, L. X. (2022). The new era of liberal arts: Tailoring practical education for international economics and trade. Research Journal of Education and Allied Studies, 10(3), 11-20.

Lin, M. (2023). Research on Higher Education Management and the Cultivation of Innovation and Entrepreneurship Abilities in University Students. Academic Journal of Management and Social Sciences, 5(3), 63-66.

Liu, Y. (2024). Research on the Talent Cultivation Model of Interdisciplinary Integration in Art and Design. The Educational Review, USA, 8(4), 506-510.

Lu, H., & Hu, T. (2020). The Reconstruction of Higher Law Education Curriculum System in the Context of New Liberal Arts*, 765–770. Presented at the 4th International Conference on Culture, Education and Economic Development of Modern Society (ICCESE 2020), Atlantis Press.

Lu, H. F. (2021). Enhancing university student employability through practical experiential learning in the sport industry: An industry-academia cooperation case from Taiwan region. Journal of Hospitality, Leisure, Sport & Tourism Education, 28, 100301.

Ma, S., Huo, P., Li, W., Li, Y., Li, L., & Su, C. (2022). Study on the Integration of Industry and Education through Deep Cooperation between Government, Industry, Universities and Enterprises. Integration, 1(1), 1-7.

Newman, J. (2024). Promoting interdisciplinary research collaboration: A systematic review,a critical literature review, and a pathway forward. Social Epistemology, 38(2), 135-151.

Ren, X., & Liu, L. (2024). Research on Art and Design Education in the Context of New Liberal Arts. Journal of Arts and Cultural Studies, 3(1): 1-13.

Riabovolyk, T. (2023). Management in the education system: global tendencies, reforming and innovations. Zenodo, 518-530.

Sarina, M. K., & Wardiah, D. (2019). Module Development The Utilization Of Patchwork Fabric As Teaching Materials Crafts On The Subjects Of Craft And Entrepreneurship For High School Students. International Journal Of Scientific & Technology Research, 8(5):124-130.

Sterman, J. (2014). Interactive web-based simulations for strategy and sustainability: the MIT Sloan LearningEdge management flight simulators, Part I. System Dynamics Review, 30(1-2), 89-121.

Sustainable Open Innovation Model for Cultivating Global Talent: The Case of Non-Profit Organizations and University Alliances. n.d. https://www.mdpi.com/2071-1050/17/11/5094, December 1, 2025.

Wang, S., Shen, G., Jiang, S., Xu, H., Li, M., Wang, Z., ... & Yu, Y. (2017). Nutrient status of vitamin D among Chinese children. Nutrients, 9(4), 319.

Wu, C., & Zhang, L. (2024). The Relationship Between College Students' Employment Psychology and Social Adaptability. Journal of Modern Education and Culture, 1(4), 1-7.

Zha, Q. (2022). How should liberal arts education evolve in the twenty first century? An exploration of universities in China and beyond1. Educational Philosophy and Theory, 54(12), 2082-2096.

Zha, Q. (2009). Diversification or homogenization: How governments and markets have combined to (re) shape Chinese higher education in its recent massification process. Higher education, 58(1), 41-58.

Zhao, Y., Zhao, M., & Shi, F. (2024). Integrating moral education and educational information technology: A strategic approach to enhance rural teacher training in universities. Journal of the Knowledge Economy, 15(3), 15053-15093.

iEducation, 2025, 1(3), 30-45
https://doi.org/10.71204/h2hvmn60

Driving Mechanisms and Competency Modeling for Cultivating Business–Engineering Integrated Talent in Inland Open-Economy Hubs

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Received: 15 December 2025 / Accepted: 17 December 2025/ Published online: 18 December 2025

Abstract

Inland regions are becoming critical areas in China's open strategy, urgently needing international talents with skills in business, engineering, and digital technology. This study takes Chongqing as a case to propose a restructured model of international business education to support the construction of inland open-economy hubs. Utilizing a multi-level analytical framework, the research reveals the demand-driven mechanism for business – engineering integrated talents within technology-intensive global value chains and introduces a "dual-core, three-tier" competency model. This model, through the integration of curriculum modules, provides a practical guide for educational reform in inland regions to integrate into the global economy.

Keywords: Inland open-economy hubs; Business – engineering integration; International business education; Competency modeling; Curriculum reform

1. Introduction

The reform of New Liberal Arts programs and related professional curricula originates in the necessity for higher education systems to respond proactively to profound structural transformations in the external environment (Ministry of Education of the PRC, 2020). China’s pattern of external opening is currently undergoing a fundamental transition—from a predominantly coastal-led model toward a dual system characterized by coordinated inland–coastal interaction. National strategies such as the Belt and Road Initiative and the development of the Western Land–Sea New Corridor have progressively extended the spatial depth of opening-

up, reshaping the geography of global circulation across the country's interior (National Development and Reform Commission [NDRC], 2019; NDRC, 2021).

In 2023, rail–sea intermodal services along the Western Land–Sea New Corridor exceeded 9300 trips, generating cargo flows valued at more than RMB 280 billion (Western Land–Sea New Corridor Logistics and Operations Organization Center, 2024). This rapid scaling has begun to fundamentally alter the organization of inland industries and the structure of talent demand, with implications extending well beyond logistics efficiency. Within this strategic context, national planning frameworks designate Chongqing as both the Logistics and Operations Organization Center of the Western Land–Sea New Corridor and a strategic linkage node within China's dual-circulation development paradigm (The Central Committee of the CPC & State Council, 2021). This positioning signals a structural shift in the city's development logic—from a traditional transit hub toward a strategic platform aggregating high-end factors such as logistics, trade, finance, and data, thereby accelerating the transition from transfer-based growth to value creation.

Against this backdrop, inland open-economy hubs represented by Chongqing exhibit an increasingly pronounced demand for deep business–engineering integration. As a globally significant electronic information manufacturing base, Chongqing accounts for approximately one-third of global laptop production, with exports from the Xiyong Comprehensive Bonded Zone alone exceeding 38 million units in 2024 (Chongqing Customs, 2024; Chongqing Municipal Bureau of Statistics, 2024). However, the sustainability of such world-class industrial clusters increasingly depends not on scale or efficiency alone, but on capabilities in digitalized cross-border supply-chain governance, the agile application of high-standard trade rules such as the Regional Comprehensive Economic Partnership (RCEP), and the effective navigation of complex technical trade barriers (State Administration for Market Regulation, 2023).

The rapid expansion of high-technology and high–value-added exports has fundamentally redefined talent requirements. Industrial upgrading increasingly necessitates a shift away from single-function "trade executors" or "technical engineers" toward cross-boundary integrators capable of aligning international business rules and market strategies with industrial processes, intelligent manufacturing systems, and digital tools for data analysis and platform operation (Commercial Industry Committee of CCPIT, 2024). This transformation in talent demand closely aligns with the objectives articulated in China's New Liberal Arts initiative, which emphasizes the deep integration of humanities and social sciences with science, engineering, and emerging technologies (Xu and Wang, 2025; Xiao, 2025).

Systematically exploring and constructing a business‑engineering integrated talent cultivation paradigm is therefore not merely an internal imperative for disciplinary development within universities. Rather, it constitutes a critical educational response that supports inland open-economy hubs in moving from corridor-based growth toward high-value port economies and value-chain-oriented development (OECD, 2018). Situated at the intersection of national strategy, industrial transformation, and educational reform, this study systematically examines what types of international business talent should be cultivated in inland open-economy hubs.

2. Driving Mechanisms of Business–Engineering Integrated Talent Cultivation in Inland Open-Economy Hubs

The logical starting point of New Liberal Arts reform and professional curriculum restructuring lies in a systematic response to profound external transformations in the political economy and technological environment of higher education (Ministry of Education of the PRC, 2020). The transition of international business talent cultivation toward a business–engineering integrated paradigm in inland open-economy hubs is not the result of isolated educational experimentation. Instead, it is driven by a multi-level and interlocking mechanism shaped by national strategies at the macro level, industrial restructuring at the meso level, and labor-market evolution at the micro level.Together, these forces form a systemic and path-dependent driver that compels higher education institutions to recalibrate their talent supply structures in response to evolving development needs.

2.1. Macro-Level Strategic Drivers: National and Regional Policy Architecture

At the macro-level, national development strategies provide an authoritative policy framework that exerts a directional and normative influence on educational reform. The Master Plan for the Western Land–Sea New Corridor explicitly emphasizes the deep integration of transportation corridors with industry, trade, and the digital economy, signaling a strategic shift from infrastructure expansion toward system-level value creation (National Development and Reform Commission [NDRC], 2019) .This repositioning transcends traditional logistics functions and generates demand for talent capable of simultaneously navigating international commercial rules, industrial operations, and digital technologies.

Policy initiatives such as the promotion of “single bill of lading” multimodal transport systems further illustrate this transformation. Their effective implementation relies not only on legal and commercial expertise, but also on professionals who can integrate data standards across rail, maritime, customs, and platform-based systems (Office of the China (Chongqing) Pilot Free Trade Zone, 2023). The Implementation Plan for Promoting the High-Quality Development of the Western Land–Sea New Corridor during the 14th Five-Year Plan Period reinforces this orientation by prioritizing the construction of “smart corridors” and explicitly embedding big data and blockchain technologies into corridor governance. At the strategic level, digital technology application is thus institutionalized as a core competency requirement for international business professionals (NDRC, 2021).

At the regional level, the Outline Plan for the Construction of the Chengdu–Chongqing Twin-City Economic Circle assigns Chongqing a dual role as both an international comprehensive transportation hub and a national center for advanced manufacturing (The Central Committee of the CPC & State Council, 2021). This dual mandate inherently challenges the traditional separation between logistics-oriented engineering education and international trade–oriented business education. Complementary municipal policies further emphasize the integration of manufacturing and services and the acceleration of digital trade development, accompanied by targeted talent support measures (Chongqing Municipal People’s Government, 2021). Taken together, these policy signals delineate a clear “capability frontier” for talent cultivation, within

which business–engineering integration becomes a structural requirement rather than an optional enhancement.

2.2. Meso-Level Industrial Drivers: Pressure Transmission from Industrial Upgrading

At the meso-level, regional industrial upgrading translates strategic intent into concrete enterprise-level capability demands, thereby exerting direct pressure on educational systems. Chongqing's electronic information industry exemplifies this mechanism. As the sector extends upstream into research and development, testing, and supply-chain coordination, firms increasingly require international business professionals who can participate in supplier technical evaluation, assess the compliance implications of key component specifications, and collaborate with engineers to address overseas technical disputes (Chongqing Municipal Bureau of Statistics, 2024).

Empirical evidence indicates that insufficient familiarity with foreign technical standards imposes substantial losses on exporting firms, underscoring the emergence of "technical communication capability" as a critical occupational threshold (State Administration for Market Regulation, 2023). Similarly, traditional export-oriented industries such as motorcycles and general machinery frequently encounter technical trade barriers related to emissions, safety, and energy efficiency when entering overseas markets. Effective responses require business personnel who can interpret detailed technical standards, coordinate product adaptation with engineering teams, and prepare compliance documentation—tasks for which graduates of conventional international business programs are often underprepared.

Digital transformation further intensifies this pressure. Cross-border e-commerce has become a standard pathway for firms' global expansion, while supply-chain digitalization increasingly binds commercial decision-making to technological platforms (Chongqing Municipal Commission of Commerce, 2024). From Internet of Things–enabled logistics tracking to blockchain-based certificates of origin, business processes are now deeply embedded within digital infrastructures (Office of the China (Chongqing) Pilot Free Trade Zone, 2024). As a result, data-driven decision-making and platform-based operations have become non-negotiable competencies, reinforcing the necessity for integrated business–engineering skill sets.

2.3. Micro-level Job Drivers: Emerging Occupational Profiles and Competency Decomposition

Macro and meso-level drivers ultimately crystallize into concrete competency requirements through labor-market dynamics. Analysis of recruitment practices and emerging job descriptions in Chongqing reveals the rapid emergence of business–engineering integrated positions with distinctive capability profiles (Commercial Industry Committee of the China Council for the Promotion of International Trade, 2024).

Positions such as intelligent customs and trade compliance specialists require proficiency in customs regulations alongside the ability to extract and process data from enterprise resource planning systems, operate single-window platforms, and understand technical classification rules. Cross-border supply-chain data analysts combine supply-chain management knowledge with advanced data analytics skills to translate quantitative insights into operational decisions. Digital

overseas marketing managers must integrate cross-cultural understanding with platform analytics, content management systems, and collaboration with technical teams for website optimization.

Across these occupations, a common competency structure is evident. These roles occupy the intersection of commercial value creation processes and technological support systems. Their competency architecture resembles a layered configuration: a foundation of general international business knowledge, a top layer of industry- or market-specific expertise, and a central core composed of digital technology application capability, technical comprehension, and the integration of technical value into commercial decision-making. This micro-level evolution provides the most precise specification for educational output standards.

2.4. An Integrated Framework: The Strategic–Industrial–Occupational Tri-Level Mech anism

Synthesizing the above analysis, the driving mechanism for cultivating business–engineering integrated talent in inland open-economy hubs can be conceptualized as a tri-level interactive system encompassing the macro (strategy), meso (industry), and micro (occupation) levels (Figure 1).

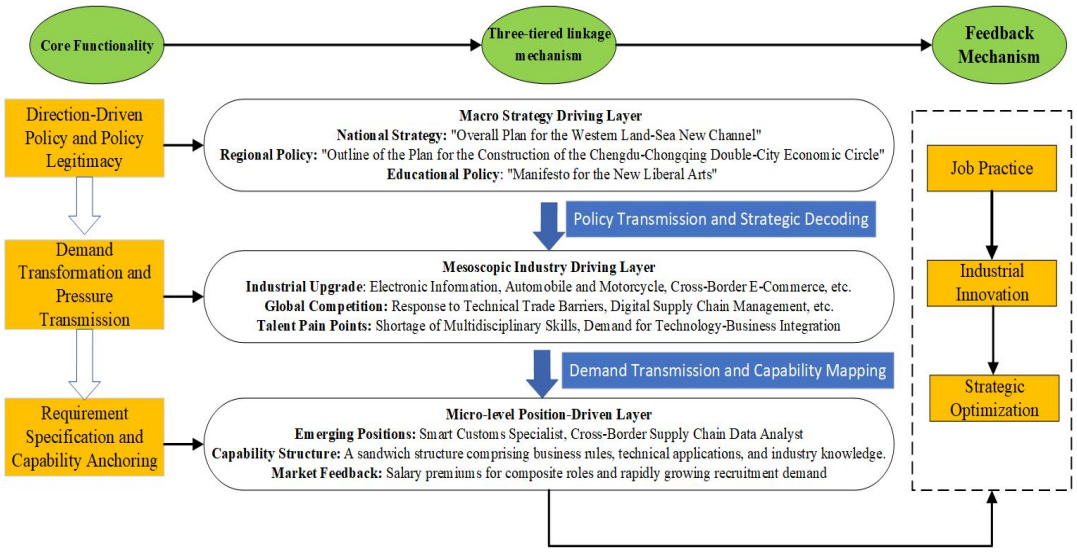

Figure 1. Three-Tier Driving Mechanism Model for Business–Engineering Integrated Talent Cultivation in Inland Open-Economy Hubs

The macro-level establishes strategic orientation and policy legitimacy; the meso-level translates strategic intent into concrete demand pressures; and the micro-level anchors these demands in observable competency requirements (NDRC, 2019; NDRC, 2021).

Importantly, this mechanism is not a linear transmission chain but a dynamic feedback system. Successful practices at the occupational level stimulate enterprise innovation and industrial upgrading, which in turn refine and reinforce regional strategic objectives. Within this recursive process, the traditional discipline-centered talent supply model emerges as a structural bottleneck. Business–engineering integrated education reform thus represents a necessary and endogenous response to this tri-level driving mechanism.

2.5. Supplementary Evidence from Enterprise Consultation and Teaching Practice

To enhance empirical grounding, the conceptual model is further informed by exploratory enterprise consultations and preliminary teaching-practice observations conducted in Chongqing. Between 2022 and 2024, semi-structured interviews were conducted with managers and HR specialists from export-oriented manufacturing enterprises, logistics platform operators, and cross-border e-commerce firms located in the Western Land–Sea New Corridor region. Interviewees consistently emphasized difficulties in recruiting professionals capable of simultaneously understanding international trade rules, digital platforms, and basic industrial processes.

In parallel, pilot teaching practices were carried out within an international business program at a local university, where integrated modules incorporating supply-chain digitalization, technical compliance cases, and scenario-based projects were introduced on a trial basis. Feedback from students and enterprise mentors indicated improved capability in cross-disciplinary communication, data-informed decision-making, and rule-based problem analysis, compared with traditional course arrangements.

Although these observations do not constitute large-scale quantitative validation, they provide contextualized, practice-based evidence supporting the necessity and feasibility of the proposed business–engineering integrated competency model.

3. Theoretical Construction and Conceptual Elaboration of the “Dual-Core, Three-Tier” Competency Model

Building on the systematic decomposition of the driving mechanisms discussed above, the focus of talent cultivation reform shifts from explaining why transformation is necessary to clarifying what objectives such transformation should pursue. Existing discipline-centered competency frameworks in international business education are increasingly inadequate for addressing the strategic demands of inland open-economy hubs. In these contexts, commercial activities are deeply intertwined with industrial systems, digital infrastructures, and evolving regulatory regimes. In response, this study develops a structured, dynamic, and application-oriented “dual-core, three-tier” competency model to articulate, with conceptual precision, the capability architecture required for business–engineering integrated talent cultivation, thereby providing a clearly specified target framework for subsequent curriculum and pedagogical reform.

3.1. Theoretical Foundation and Logical Premises of Model Construction

The “dual-core, three-tier” competency model is theoretically grounded in competency-based education and constructivist learning theory, while being empirically anchored in the developmental practice of inland open-economy hubs. Competency-based education emphasizes that educational outcomes should be defined in terms of observable and assessable professional capabilities rather than abstract knowledge accumulation (Spady, 1994). This outcome-oriented perspective has been widely adopted in higher education reform to enhance alignment between educational provision and labor-market demand (Mulder, 2014).

In this study, “engineering” is used in a broad and functional sense to encompass not only conventional engineering knowledge, but also industrial processes, digital technologies, and applied technical systems that directly support business operations and value creation.

Constructivist learning theory further complements this perspective by positing that knowledge is actively constructed by learners through engagement with authentic and complex problem contexts rather than passively transmitted through instruction (Vygotsky, 1978). From this standpoint, business competence and technical competence do not exist as isolated domains; instead, they are integrated through situated learning processes in which learners resolve real-world, cross-boundary problems. Representative examples include coordinating tariff compliance and logistics optimization for intelligent manufacturing exports or integrating data governance with multimodal transport operations in corridor economies (Kolb, 1984).

Accordingly, the core premise of the model is that business–engineering integration does not emerge from the mechanical juxtaposition of heterogeneous knowledge domains, but from their “ chemical synthesis ” within scenario-driven tasks requiring coordinated application. This premise requires the competency model to exhibit interactivity, structural coherence, and generative capacity, enabling the progressive transformation of knowledge inputs into integrated problem-solving capabilities (Biggs & Tang, 2011).

3.2. The Dual-core of Competency: Open-Rule Practice and Technology-Integrated In novation

The “dual core” constitutes the foundational pillars of the model, representing two interdependent clusters of competencies essential for business–engineering integrated talent cultivation.

Core I: Open-Rule Practice Capability

Open-rule practice capability refers to the capacity to conduct cross-border commercial activities efficiently, compliantly, and strategically within global and regional regulatory frameworks. Under conditions of accelerated rule evolution and deepened opening-up, this capability extends beyond traditional trade execution to encompass strategic rule interpretation and operational application (WTO, 2020).

First, global and regional rule application capability emphasizes operational proficiency in applying high-standard trade agreements such as the Regional Comprehensive Economic Partnership (RCEP), including rules of origin accumulation, tariff differentials, and institutional coordination across regional economies (Urata, 2018). Second, cross-border operation and compliance execution capability covers end-to-end processes such as market entry, international logistics coordination, export controls, and cross-border data governance. The increasing prevalence of technical trade measures faced by exporting firms underscores the importance of this capability for sustaining market access (OECD, 2023). Third, cross-cultural business negotiation capability involves effective communication and relationship management across institutional and professional cultures, particularly when commercial objectives must be translated into technical or contractual parameters.

Core II: Technology-Integrated Innovation Capability

Technology-integrated innovation capability represents the distinctive value-added dimension of business–engineering integration. Data-driven decision-making capability involves the systematic collection and analysis of international market and supply-chain data to support strategic and operational decisions (McAfee & Brynjolfsson, 2012). Intelligent tool application capability requires not only operational familiarity but also conceptual understanding of digital technologies such as blockchain, the Internet of Things, and artificial intelligence, enabling informed application and governance-aware use. Process-level technological comprehension further enables business professionals to coordinate effectively with engineering teams by understanding key production processes, quality systems, and technical constraints.

The two competency cores interact through a reinforcing feedback loop in which technological capability enhances rule implementation efficiency, while regulatory understanding constrains and guides technological application. Together, they form an integrated competency system oriented toward value creation in open-economy environments.

3.3. The Three-Tier Knowledge Architecture: From Integrative Cognition to Capability Generation

To support the progressive formation of dual-core competencies, the model incorporates a three-tier knowledge architecture aligned with established theories of cognitive development and competency formation (Bloom et al., 2001). Rather than constituting a static classification of courses, the three-tiers form a cumulative learning pathway in which competencies are generated through sequential cognitive integration, functional coupling, and scenario-based application. Each tier functions simultaneously as the learning outcome of the preceding stage and as the enabling condition for subsequent competency development.

Tier I: General Integrative Layer (Foundations of Integrative Cognition)

This tier establishes a shared cognitive foundation by dismantling disciplinary silos at the conceptual level. Courses emphasize inland open-economy systems, digital transformation, and global governance, enabling learners to recognize the structural interdependence between technological systems and commercial value creation. By cultivating integrative cognition and systems awareness, this layer provides the necessary conceptual prerequisites for students to meaningfully engage in cross-disciplinary knowledge coupling in subsequent learning stages.

Tier II: Foundational Coupling Layer (Cross-Disciplinary Knowledge Integration)

Building upon the integrative cognitive framework developed in Tier I, this tier facilitates the transition from conceptual understanding to functional coupling. Core international business courses are restructured to embed technological content, while analytical methods, data tools, and information systems are introduced to support applied learning. Through shared analytical frameworks and tool-based learning, students begin to connect business logic with technological processes, thereby transforming abstract integrative awareness into operational cross-disciplinary competence.

Tier III: Professional Generation Layer (Scenario-Driven Capability Synthesis)

Based on the coupled knowledge structures formed in Tier II, this tier focuses on transforming integrated knowledge into actionable professional capabilities. Teaching is organized around authentic scenarios characteristic of inland open-economy hubs and implemented through project-based learning and industry collaboration. Learners synthesize regulatory knowledge, technological tools, and industry-specific expertise to deliver integrated solutions, thereby internalizing dual-core competencies through practice and experiential learning (Kolb, 1984). In this stage, competency generation is completed through repeated engagement with complex, real-world tasks that mirror actual occupational contexts.

3.4. Structural Characteristics and Analytical Value of the Model

Analytically, the "dual-core, three-tier" model represents a dynamic, three-dimensional ar chitecture in which open-rule practice capability and technology-integrated innovation capa bility function as vertical pillars spanning the horizontal tiers of knowledge formation. The ir convergence at the professional generation layer yields graduates equipped with integrati ve capabilities for complex problem-solving.

The model exhibits three defining characteristics: dynamic adaptability to technological and regulatory change, regional embeddedness allowing scenario localization, and explicit capability orientation with assessable learning outcomes. Collectively, these features reflect a shift from discipline-centered education toward a competency-centered paradigm, consistent with the broader objectives of New Liberal Arts reform (Ministry of Education of the PRC, 2020).

4. Knowledge Architecture and Curriculum Mapping Based on the "Dual-Core, Three-Tier" Model

The practical value of a competency model ultimately lies in its capacity to guide curriculum reconstruction and instructional design. The "dual-core, three-tier" competency model developed in the preceding section defines a clear target state for international business talent cultivation in inland open-economy hubs. The key challenge, however, is to translate this abstract capability framework into an operational and coherent curriculum system. This requires not incremental course adjustment, but a capability-oriented reengineering of the existing knowledge architecture to ensure systematic alignment between educational inputs and competency outputs (Biggs & Tang, 2011).

4.1. Structural Constraints of Traditional International Business Curricula

Most traditional international business curricula remain embedded in a discipline-centered structure shaped by the industrial economy. When confronted with the integrated competency requirements of inland open-economy hubs, this structure exhibits several systemic limitations.

First, curricular objectives are fragmented and knowledge is compartmentalized. Core courses such as international trade theory, international finance, and international business law are typically organized as parallel and self-contained units, each emphasizing internal theoretical

completeness. Weak horizontal linkages prevent the formation of problem-oriented learning trajectories capable of integrating dispersed knowledge around complex real-world tasks, such as digitalized corridor logistics or intelligent product compliance. As a result, students accumulate isolated cognitive components rather than functional integrative capabilities (Barnett, 2006).

Second, curricular content is increasingly decoupled from contemporary practice. Slow textbook revision cycles have generated a widening gap between academic instruction and the rapid evolution of digital trade, supply-chain technologies, and platform-based business models. Traditional emphases on documentary credits and conventional trade procedures persist, while emerging issues such as cross-border e-commerce autonomy, cross-border data governance, and smart contract applications remain marginal within the curriculum. This temporal mismatch weakens graduates' immediate applicability in technologically dynamic environments (OECD, 2018).

Third, technological elements are structurally peripheralized. Information systems, data analytics, or e-commerce-related courses are often positioned as general electives rather than integrated components of the professional core. Their content is frequently generic and detached from core business decision-making contexts, limiting students' ability to establish meaningful cognitive connections between technological tools and commercial strategy (McAfee & Brynjolfsson, 2012).

Finally, practical training remains superficial and weakly coupled with capability formation. Experimental teaching is often confined to closed-system simulations or short-term observational internships, which rarely expose students to authentic data, real decision constraints, or complex task environments. Consequently, practice modules fail to function as effective mechanisms for integrative competency generation (Kolb, 1984).

These limitations underscore the necessity of reconstructing international business curricula around occupational capability logic rather than disciplinary completeness.

4.2. Core Principles for Curriculum Reconstruction Aligned with the Model

To ensure structural alignment with the "dual-core, three-tier" competency framework, curriculum reconstruction should adhere to three interrelated principles.

The first is the principle of deep integration. Curriculum design must move beyond the mechanical aggregation of business – engineering courses toward genuinely integrated courses whose learning objectives explicitly encompass both commercial and technological dimensions. Assessment should prioritize students' capacity to synthesize heterogeneous knowledge within complex scenarios rather than evaluate isolated knowledge recall.

The second is the principle of scenario anchoring. Representative real-world scenarios drawn from inland open-economy hubs—such as digitalized multimodal transport coordination, cross-border e-commerce expansion, or compliance challenges in high-end manufacturing exports—should serve as organizing anchors for course content. Within these scenarios, theoretical knowledge, regulatory frameworks, and technological tools are embedded into coherent task sequences, enabling capability formation through situated learning (Lave & Wenger, 1991).

The third is the principle of dynamic balance between frontier orientation and regional embeddedness. Curriculum content must integrate frontier developments in digital trade, intelligent logistics, and data analytics while embedding region-specific strategies, corridor economies, and industrial structures. This balance ensures graduates possess both global competence and localized applicability. The operationalization of these principles is illustrated through the integrated curriculum modules presented in the following section and summarized in Table 1.

Table 1. Credit and Hour Allocation for Core Integrated Curriculum Modules

Module	Credits	Total Hours	Lecture (%)	Practical / Project (%)
Intelligent Cross-Border Supply Chain Management and Data Analytics	4	64	40%	60%
Global Digital Trade Operations and Compliance	3	48	45%	55%
Advanced Manufacturing and International Technical Trade Compliance	3	48	50%	50%

4.3. Core Integrated Course Modules Supporting Dual-Core Capability Formation

Based on these principles, the curriculum system can be modularly reconstructed around a set of integrated course clusters that primarily support the foundational coupling and professional generation tiers of the competency model.

Module I: Intelligent Cross-Border Supply Chain Management and Data Analytics

This module supports cross-border operational capability and data-driven decision-making. Students engage with IoT-enabled logistics visualization, demand forecasting, multimodal transport optimization, and digital traceability for compliance risk monitoring. Evaluation emphasizes analytical rigor and solution feasibility.

Module II: Global Digital Trade Operations and Compliance

Anchored in full-cycle cross-border e-commerce operations, this module integrates market-entry analytics, platform-based operations, digital marketing optimization, cross-border payment systems, taxation fundamentals, and data compliance. Project-based learning structures require students to synthesize commercial strategy, technological tools, and regulatory requirements within a unified operational framework (OECD, 2023).

Module III: Advanced Manufacturing and International Technical Trade Compliance.

Focusing on export-oriented manufacturing industries, this module integrates technical standard interpretation, export control compliance, technology contract governance, and foundational industrial process cognition. Through simulated negotiation and case analysis, students develop the ability to coordinate technical and commercial considerations in international

market entry. Together, these modules constitute the curricular backbone supporting dual-core competency formation.

Each module is designed as a medium-sized integrated course emphasizing the balance between conceptual instruction and scenario-based practice. A higher proportion of practical hours is allocated to ensure capability formation through project work, data analysis, and simulated decision-making tasks. The modular design allows flexible adaptation to different institutional credit systems.

4.4. Implementation Pathways for Cross-Disciplinary Curriculum Integration

Effective implementation of integrated curriculum modules requires institutional mechanisms capable of overcoming organizational and disciplinary barriers.

First, engineering-oriented courses should be adapted for business application through modular redesign and micro-credentialing, enabling business students to acquire essential technological tools without excessive technical abstraction. Second, cross-disciplinary teaching teams and dual-instructor mechanisms should be institutionalized to ensure instructional coherence, supported by corresponding adjustments in workload recognition and incentive structures. Third, scenario-based project platforms should be developed through collaboration with local governments, industrial parks, and leading enterprises, providing access to authentic data, realistic problem contexts, and sustainable practice environments (Etzkowitz & Leydesdorff, 2000).

Through these mechanisms, the curriculum system becomes a functional carrier of the “dual-core, three-tier” competency model, translating theoretical objectives into concrete educational processes.

In practice, interdisciplinary curriculum implementation faces institutional barriers, particularly in faculty collaboration and resource integration. Differences in disciplinary language, evaluation standards, and workload recognition often constrain sustained cooperation between business–engineering faculty. To address these challenges, universities should institutionalize cross-disciplinary teaching teams supported by joint workload accounting, co-teaching incentives, and shared curriculum development platforms.

In addition, modular teaching materials and shared case repositories jointly developed with enterprises can reduce coordination costs and enhance teaching consistency. These institutional arrangements are critical for ensuring the scalability and sustainability of business–engineering integrated curriculum reform.

5. Conclusions and Implications

Situated at the intersection of China’s deepening inland opening-up strategy and the digital transformation of regional industries, this study addresses the growing structural misalignment between traditional international business education and emerging talent demands. Following a coherent analytical trajectory — from problem diagnosis and driver decomposition to objective reconstruction and pathway design — this study responds to the core question of what type of

international business talent should be cultivated in inland open-economy hubs. By constructing and operationalizing the "dual-core, three-tier" competency model and its curriculum mapping framework, the research offers a conceptually grounded and practically actionable blueprint for advancing New Liberal Arts–oriented business education reform.

5.1. Conclusions

First, the demand for business–engineering integrated talent in inland open-economy hubs represents an irreversible, system-level educational transformation driven by the interaction of strategy, industry, and labor markets. At the macro-level, national and regional development strategies—such as the Western Land–Sea New Corridor and the Chengdu–Chongqing Dual-City Economic Circle—have redefined inland regions from peripheral spaces of openness to strategic platforms of value creation. At the meso-level, industrial upgrading in export-oriented manufacturing sectors has translated these strategic orientations into concrete enterprise-level capability gaps, particularly in digital supply-chain governance and technical trade compliance. At the micro-level, emerging occupational profiles articulate explicit competency requirements that integrate commercial rules, industrial knowledge, and digital technologies. These three layers form a dynamic feedback mechanism in which traditional discipline-centered education structures have become a critical bottleneck, rendering systemic educational reform both necessary and urgent.

Second, although the competency model and curriculum modules are developed based on the case of Chongqing, their applicability may vary across inland regions with different industrial structures and openness levels. Regions dominated by resource-based industries or with limited participation in global value chains may require contextual adjustment of scenario design, technological depth, and industry focus.

Nevertheless, the underlying logic of the "dual-core, three-tier" model—integrating open-rule practice capability with technology-integrated innovation capability through scenario-based learning—possesses strong transferability. Future research should explore localized adaptations of the model across diverse inland regions to refine its scalability and contextual responsiveness.

Third, translating the competency model into educational outcomes requires a capability-oriented restructuring of the curriculum system rather than incremental course adjustments. Guided by the principles of deep integration, scenario anchoring, and frontier–regional balance, the study demonstrates how integrated course modules can embed technological elements into core business processes. Through engagement with high-fidelity inland open-economy scenarios, students are enabled to develop and integrate dual-core competencies in the process of solving complex, real-world problems.

5.2. Educational Reform and Policy Practice

The findings of this study carry implications for educational reform and policy practice at multiple levels. Rather than offering general normative recommendations, this section delineates differentiated and actionable implications for key stakeholders involved in business–engineering integrated talent cultivation.

At the policy level, education authorities are encouraged to incorporate business–engineering integration into competency standards and evaluation frameworks for international business programs, particularly in inland regions undergoing open-economy transformation. This includes supporting flexible curriculum accreditation mechanisms, encouraging cross-disciplinary faculty collaboration, and aligning talent cultivation objectives with regional industrial upgrading and digital transformation strategies. By embedding educational reform within broader systems of industrial and innovation governance, policy frameworks can enhance the strategic responsiveness of higher education.

At the institutional level, universities and colleges should shift from discipline-centered curriculum design toward competency-oriented program structuring. This may involve reorganizing course modules around integrated learning outcomes, establishing cross-school teaching teams that bridge business‐engineering domains, and introducing scenario-based and project-oriented courses aligned with regional economic practices. Such institutional arrangements enable universities in inland regions to translate abstract reform principles into operational teaching models.

At the practice level, enterprises and industry partners can participate as co-educators by providing authentic application scenarios, data resources, and project mentorship. Through structured collaboration with universities, enterprises contribute to the co-construction of learning contexts that reflect real-world regulatory, technological, and operational complexity, while simultaneously cultivating talent aligned with their own development needs. This form of engagement supports the formation of a sustainable university–industry collaboration ecosystem.

Collectively, these multi-level implications reinforce the role of New Liberal Arts reform as a systemic transformation that connects competency modeling, curriculum innovation, and regional development practice, rather than as an isolated adjustment within individual disciplines.

Funding:

This research was funded by the Major Project of Chongqing Higher Education Teaching Reform and Innovation Program, grant number 251033.

Institutional Review Board Statement:

Not applicable.

Informed Consent Statement:

Not applicable.

Data Availability Statement:

Not applicable.

Conflict of Interest:

The authors declare no conflict of interest.

References

Autor, D. H. (2015). Why are there still so many jobs? The history and future of workplace automation. Journal of Economic Perspectives, 29(3), 3–30.

Barnett, R. (2006). Graduate attributes in an age of uncertainty. Springer.

Biggs, J., & Tang, C. (2011). Teaching for quality learning at university (4th ed.). Open University Press.

Chongqing Customs. (2024). Press conference materials on Chongqing's foreign trade import and export performance in 2023. Chongqing Customs.

Chongqing Municipal Bureau of Statistics. (2024). Statistical bulletin on Chongqing's national economic and social development in 2023. Chongqing Municipal Bureau of Statistics.

Chongqing Municipal Commission of Commerce. (2024). Report on Chongqing's commercial operations in 2023. Chongqing Municipal Commission of Commerce.

Chongqing Municipal People's Government. (2021). High-quality development plan for the manufacturing sector during the 14th Five-Year Plan period [Policy document]. Chongqing Municipal People's Government.

Commercial Industry Committee of the China Council for the Promotion of International Trade. (2024). Research report on China's cross-border e-commerce talent (2023). CCPIT.

Etzkowitz, H., & Leydesdorff, L. (2000). The dynamics of innovation: From national systems and "Mode 2" to a triple helix of university–industry–government relations. Research Policy, 29(2), 109–123.

Kolb, D. A. (1984). Experiential learning: Experience as the source of learning and development. Prentice Hall.

Ministry of Education of the People's Republic of China. (2020). Declaration on the development of New Liberal Arts [Policy document]. Ministry of Education of the PRC.

National Development and Reform Commission. (2019). Master plan for the Western Land–Sea New Corridor [Policy document]. National Development and Reform Commission.

National Development and Reform Commission. (2021). Implementation plan for promoting the high-quality development of the Western Land–Sea New Corridor during the 14th Five-Year Plan period [Policy document]. National Development and Reform Commission.

OECD. (2018). Future of education and skills 2030. OECD Publishing.

OECD. (2023). International regulatory co-operation and trade. OECD Publishing.

Office of the China (Chongqing) Pilot Free Trade Zone. (2023). Blockchain-based "single bill of lading" innovation practice for the Western Land–Sea New Corridor. China (Chongqing) Pilot Free Trade Zone Office.

Office of the China (Chongqing) Pilot Free Trade Zone. (2024). Annual report on institutional innovation of the China (Chongqing) Pilot Free Trade Zone. China (Chongqing) Pilot Free Trade Zone Office.

Perkmann, M., Salter, A., Tartari, V., McKelvey, M., Autio, E., Broström, A., D'Este, P., Fini, R., Geuna, A., Grimaldi, R., Hughes, A., Krabel, S., Kitson, M., Llerena, P., Lissoni, F., Mauri, C., & Sobrero, M. (2013). Academic engagement and commercialisation: A review of the literature on university–industry relations. Research Policy, 42(2), 423–442.

Spady, W. G. (1994). Outcome-based education: Critical issues and answers. American Association of School Administrators.

State Administration for Market Regulation. (2023). Survey report on the impact of technical trade measures in 2022. SAMR.

The Central Committee of the Communist Party of China & State Council. (2021). Outline plan for the construction of the Chengdu – Chongqing Twin-City Economic Circle [Policy document]. People's Publishing House.

Western Land–Sea New Corridor Logistics and Operations Organization Center. (2024). Report on the operation of the Western Land–Sea New Corridor in 2023. WLSS Corridor Logistics and Operations Organization Center.

World Trade Organization. (2020). World trade report 2020: Government policies to promote innovation in the digital age. WTO.

Xiao, L. (2025). Business – engineering integration and innovative talent cultivation. Modern Business Trade Industry, 46(6), 112–116.

Xu, Y., & Wang, B. (2025). Construction of New Liberal Arts and educational development pathways. Jiangsu Higher Education, (1), 15–22.

iEducation, 2025, 1(3), 46-64
https://doi.org/10.71204/2683ef14

Revisiting Knowles' "Self-Directed Learning" Theory in the Age of AIGC: A Conceptual Reconstruction Based on the Relationship Between "Technological Dependence" and "Learner Autonomy" in Adult Learners with Disabilities

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Received: 12 December 2025 / Accepted: 29 December 2025/ Published online: 31 December 2025

Abstract

The deep integration of AIGC technology into adult education for persons with disabilities raises a fundamental question: can technological dependence and learner autonomy coexist? This study examines the explanatory power of Knowles' self-directed learning theory for adult learning among persons with disabilities through proposition deduction and conceptual reconstruction. Findings indicate that the core logic of Knowles' theory - learner-centered agency - remains valid despite technological intervention. This is because psychological maturity and experiential accumulation, the prerequisites for self-directed learning, function independently of physical ability. However, the implementation pathway requires modification: from unmediated autonomy to technology-mediated autonomy. For persons with disabilities, reliance on AIGC tools constitutes functional dependence. This mechanism empowers learners to transcend physical limitations and secures their right to participate, forming a synergistic rather than antagonistic relationship with learner autonomy. Technology enables learning access while learners determine what to learn, how to learn, and how to evaluate outcomes. Accordingly, this study constructs a three-tier analytical framework: the functional tier addresses participation access, the mechanism tier ensures technology serves learner goals, and the value tier orients toward the integration of inclusive learning and self-actualization. This study transcends the historical limitations of Knowles' technology-absent theoretical context, resolves scholarly debates regarding whether technological dependence undermines learner autonomy through a typological distinction between functional and alienating dependence, and provides theoretical guidance for technology design and educational practice in AIGC-era adult education for persons with disabilities.

Keywords: Self-Directed Learning; AIGC; Adult Learners With Disabilities; Technological Dependence; Learner Autonomy

1. Introduction

Malcolm Knowles' theory of self-directed learning posits that adult learners possess the psychological maturity to transition from teacher-directed to self-directed learning (Knowles, 1975). According to Knowles, self-directed learning is the process by which individuals proactively diagnose their learning needs, set learning goals, identify learning resources, select and implement appropriate strategies, and evaluate learning outcomes - with or without external support from teachers, experts, peers, and learning materials (Ling, 2017; Zhu & Xu, 2020). By establishing learner ownership of this complete cycle as the essential characteristic distinguishing adult learning from child learning, Knowles created the theoretical cornerstone of the learner-centered paradigm in adult education. However, when applied to adult education for persons with disabilities, Knowles' theory encounters explanatory limitations. Persons with disabilities face distinct physical limitations: visually impaired individuals may not access text directly, hearing impaired learners may face barriers in discussions, and physically impaired learners may struggle to operate equipment. Consequently, they must use assistive technologies to participate in learning. In the era of Artificial Intelligence Generated Content (AIGC), intelligent tools such as screen readers, real-time captions, and voice input have achieved a qualitative leap in accuracy, interactivity, and scenario adaptability by leveraging generative AI technology, providing unprecedented technological support for people with disabilities to overcome physical barriers. This technological mediation raises a fundamental theoretical question: does the dependence of persons with disabilities on AIGC tools erode learner autonomy, or does it constitute a necessary condition for learner autonomy to be realized? Knowles'theory, developed in a pre-digital context, assumed learners possessed unmediated access to learning materials - an assumption that does not hold for persons with disabilities who require assistive technology to access text, participate in discussions, or manipulate learning tools. Knowles' developmental model posits a linear progression from dependence to autonomy. However, this model struggles to explain how technological dependence and learner autonomy can coexist in disability education.

Existing scholarship offers contradictory positions on technology's role in learner autonomy. Technology empowerment theorists argue that AIGC tools strengthen autonomy by lowering participation barriers (Dai & Wang, 2025). In contrast, alienation theorists worry that algorithmic mediation replaces learner judgment, creating technology-directed rather than self-directed learning (Liu, 2024). However, both positions overlook a crucial distinction: for persons with disabilities, technological dependence is not a choice but a structural necessity arising from physiological constraints. This oversight reveals a fundamental gap in existing scholarship. The central theoretical question therefore becomes: does technology-mediated access undermine or enable learner autonomy? This study argues that the answer depends on the type of technological dependence involved. When AIGC tools function as access mechanisms that preserve learner control over goal-setting, resource evaluation, and outcome assessment, they constitute functional dependence that enables rather than erodes autonomy. This distinction resolves the apparent contradiction between technological dependence and learner autonomy in disability education. The study thus makes two contributions: theoretically, it extends Knowles' framework to technology-mediated learning contexts by distinguishing functional from alienating dependence;

practically, it provides design principles for AIGC accessibility tools that prioritize learner agency over algorithmic efficiency. By resolving the apparent tension between technological dependence and learner autonomy, this framework enables educators and designers to support genuine self-directed learning while acknowledging the structural necessity of technological mediation for persons with disabilities.

2. The Theoretical Foundations and Conceptual Boundaries of Knowles' Self-Directed Learning Theory

2.1. Theoretical Origins and Evolution Trajectory

Self-directed learning originated in early 20th-century adult education thought (Shen, 2017). Lindeman (1926) first positioned learner agency at the center of the field, emphasizing that adult learning should be rooted in life experience and guided by problem-solving. While Houle (1961) formally introduced the term into academic discourse, it was Tough's (1979) empirical research on "learning projects" that revealed adults actively plan and implement learning in daily life, providing the empirical foundation for Knowles' theoretical constructs. Knowles systematized this theory in Self-Directed Learning: A Guide for Learners and Teachers (1975), though he later refined his views in 1980 to view adult and child education as a continuous spectrum rather than a binary opposition (He & He, 2022).

Philosophically, research has evolved through three paradigms: progressivism, humanism, and constructivism.

a. The Progressivist approach focuses on observable behavior. Knowles' process model exemplifies this, defining self-directed learning as a linear sequence of steps (diagnosing, planning, evaluating) (Zhu & Xu, 2020).

b. The Humanistic approach emphasizes self-actualization, positing that individuals possess innate drives toward self-responsibility. However, this view often isolates the learner from their environment.

c. The Constructivist approach examines learning within a social context, viewing it as an interactive construction between learners and their environment.

This evolution reflects a deepening understanding of learner agency: shifting from behavioral description (progressivism), to internal motivation (humanism), and finally to socially situated agency (constructivism).

2.2. Conceptual Meanings and Underlying Assumptions

Knowles defined self-directed learning as a process in which individuals take the initiative - with or without the help of others - to diagnose their learning needs, formulate goals, identify resources, select strategies, and evaluate outcomes (Zhang, 2017). This definition encompasses three levels of meaning: first, the initiative to initiate learning belongs to the learner; it is the learner, not the teacher, who decides what to learn, why to learn it, and how to learn it; second, the control over the learning process belongs to the learner, with the learner having complete control over resource selection, strategy adjustments, and progress monitoring; and third, the authority to evaluate learning outcomes belongs to the learner, who assesses the effectiveness of

their learning based on their own set goals. It is essential to clarify that self-directed learning is not a solitary endeavor devoid of external support. Effective self-directed learning involves the learner's process of acquiring and processing information from teachers, experts, peers, learning materials, and various resources, which is a form of conditional learning. This clarification holds dual theoretical significance. First, it corrects the narrow understanding of self-directed learning as equivalent to independent learning. Second, it establishes technology as a legitimate external resource in self-directed learning - a point particularly relevant to AIGC tools, which function as novel learning resources that learners actively integrate rather than passively consume.

Knowles' theory rests on five fundamental assumptions distinguishing adult learners from children:

a. Self-concept evolution: Adult learners possess a distinct self-concept that enables them to guide their own learning. As individuals mature, their self-concept evolves from dependence to autonomy, creating the psychological foundation for self-directed learning.

b. Experiential resource base: Adult learners have accumulated extensive life experiences that serve as both a repository of learning resources and a framework that shapes their learning styles and cognitive schemas. This experiential base distinguishes adult learning from the relatively limited experience foundation of childhood education.

c. Role-based readiness: An adult learner's readiness for learning is closely tied to their social roles. Career development, family responsibilities, and social involvement trigger learning motivation in ways that differ fundamentally from the externally imposed curricula of childhood education.

d. Problem-centered orientation: Adult learners approach learning with a problem-centered rather than discipline-centered mindset, focusing on immediate application of knowledge rather than deferred application. This pragmatic orientation reflects their need to address real-world challenges in their professional and personal lives.

e. Internal motivation primacy: The primary driving force behind adult learning stems from internal factors such as self-esteem enhancement, quality of life improvement, career fulfillment, and self-actualization, rather than external rewards or punishments that typically motivate child learners.

Collectively, these assumptions posit that psychological maturity and accumulated experience - rather than physical capacity - provide the internal basis for self-directed learning.

Here, a clarification of a viewpoint is required: in the field of self-directed learning research, the academic community has long held the view that learner autonomy is best realized through the minimization of external mediation, with this view assuming that reduced reliance on external agents strengthens' self-regulatory capacity. However, such an assumption presupposes unimpeded access to learning environments.

For adult learners with disabilities, this presupposition does not hold. In contexts where access to texts, interaction, and learning tools depends on assistive technologies, technological mediation is not a contingent pedagogical choice but a structural precondition for participation. The absence of mediation does not signify autonomy but exclusion. Consequently, technological mediation

does not undermine self-directed learning in disability contexts; it constitutes the condition through which learner agency can be enacted.

2.3. Theoretical Expansion and Academic Inquiry

Subsequent scholarship has expanded Knowles' framework in three directions: operationalizing self-directed learning through practical tools, incorporating metacognitive dimensions absent in Knowles' behavioral focus, and recognizing developmental variability in self-directed capacity. Allen Tough introduced the concept of a learning contract, defining it as a bilateral agreement between students and educators to achieve certain standards during the learning process. This acknowledges students' ability to be self-reliant and manage their own performance, providing a practical tool for self-directed learning. Garrison (1997) constructed a comprehensive model comprising self-management, self-monitoring, and motivation as three dimensions, arguing that meaningful and valuable learning must view external task control and cognitive responsibility issues as a unified whole. This overcomes Knowles' limitations in focusing solely on explicit process descriptions by incorporating the meta-cognitive dimension into the analytical framework. Grow (1991) proposed a four-stage development model: dependent, interested, participatory, and autonomous, emphasizing that self-directed abilities are not static traits but rather developing tendencies. This gradual development is a synthesis of personality traits and situational responses, offering a tool for understanding the diverse needs of learners at different stages of development. More recent research has further introduced the concept of deep self-directed learning, which refers to the process of learners critically incorporating new knowledge and ideas into their existing cognitive structures while understanding the knowledge, applying it in new problem-solving contexts, and thereby elevating self-directed learning from superficial information acquisition to deep meaning construction. Recent research within the Chinese context has also analyzed ability structures, breaking down self-directed learning abilities into dimensions such as learning motivation and attitude, formulating and executing learning plans, self-regulation, and interpersonal communication and cooperation. This provides an operational framework for measuring and cultivating self-directed learning abilities. However, none of these expansions address how technological mediation fundamentally alters the premises of self-directed learning - particularly for learners whose access to learning materials requires assistive technology as a structural precondition rather than an optional resource.

Despite these expansions, three persistent critiques challenge Knowles' framework. Firstly, cultural bias critiques argue that Knowles' assumptions about adult education may reflect the learning preferences and value orientations of the Western middle class, and their cross-cultural applicability is questionable. Adult learners in collectivist cultures may prioritize group harmony and authoritative guidance over individual autonomy (He, 2013). Secondly, the developmental stage critique challenges the stark distinction between adults and children, arguing that not all adults possess self-directed capabilities, while some children exhibit strong self-directed tendencies. While Knowles'1980 revision addressed this criticism, his theoretical framework still assumes adults as the primary subject. Thirdly, the narrow concept critique points out that contemporary research tends to equate self-direction with independent learning, deviating from Knowles'original idea that learners can actively integrate external resources. This narrow

understanding is particularly inadequate in responding to the reality where technology has become a structured learning resource in the AIGC era (Yin, 2014). These three critiques - cultural bias, developmental oversimplification, and conceptual narrowing - collectively reveal Knowles' theory emerged in a pre-digital educational context. Its understanding of autonomy presupposes that learners possess the ability to engage in learning without intermediaries, without anticipating how technology, as a structural element, reshapes the learner's agency. Most critically, Knowles' framework fails to account for learners with disabilities, for whom technological intermediaries are not optional enhancements but structural prerequisites for participation. This gap necessitates a conceptual reconstruction that distinguishes between types of technological dependence and their relationship to learner autonomy.

3. The Special Context of Adult Learners with Disabilities in the AIGC Era: Identifying Technological Dependence

Having established the theoretical foundations and limitations of Knowles' framework, this study now turns to examining the specific context where these limitations become most apparent: adult learning for persons with disabilities in the AIGC era. The following analysis proceeds in three stages: first, identifying the structural constraints that distinguish disability learning from Knowles' assumed learning context; second, examining how AIGC technology addresses these constraints; third, developing a typological distinction that resolves the tension between technological dependence and learner autonomy.

3.1. Structural Constraints on Adult Learners with Disabilities

Adults with disabilities face structural constraints that distinguish them from typical adult learners, arising from the fundamental barriers posed by physical limitations to participation in learning (Clark, 2006). Physical limitations create fundamental barriers to participation. As noted, visual impairments prevent direct access to text, hearing impairments disrupt auditory engagement, and motor disabilities hinder the operation of standard interfaces. These barriers do not reflect cognitive limitations but rather the absence of accessible learning conditions. Disabled learners may possess sufficient psychological maturity and motivation for learning, but they lose the practical foundation for self-directed learning due to their inability to access learning environments. In the absence of assistive technologies, even if disabled individuals possess the skills emphasized by Knowles, such as ability to diagnose needs, set goals, and evaluate effectiveness, they are unable to translate these skills into actual learning actions. The fundamental challenge facing learners with disabilities differs categorically from typical adult learning challenges: not how to optimize learning strategies, but whether basic participation is possible.

Knowles' framework fails to account for these structural barriers. His concept of self-directed learning rests on an implicit assumption: that learners possess unmediated physical access to learning environments - they can read texts, hear lectures, operate tools, and engage in face-to-face communication. For typical adult learners, this assumption may hold true; however, for learners with disabilities, it constitutes a theoretical blind spot. Knowles' model of the transition

from dependence to autonomy describes a psychological shift (from external to internal drive), not a physical transformation (from inability to ability). When learners with disabilities are excluded from learning environments due to physical limitations, the stages of needs diagnosis, goal setting, resource selection, strategy adjustment, and outcome evaluation outlined in Knowles' theory become irrelevant. The theory fails to account for situations where learners must rely on technological intermediaries to participate in learning, and its linear assumption of a transition from dependence to autonomy cannot explain the coexistence of reliance on technology and maintaining autonomy in the context of disability-related learning The advancements in intelligent assistance technology during the AIGC era offer unprecedented possibilities for overcoming these structural constraints, but also present new challenges for evaluating the explanatory power of Knowles' theory.

3.2. The Empowering Mechanism of AIGC Technology for Adult Learners with Disabilities

AI technology provides support for individuals with disabilities to overcome physical barriers and engage in learning environments through various pathways. At the level of accessible participation, screen readers convert text into speech, enabling individuals with visual impairments to access written information. Real-time subtitle systems translate speech into text, allowing individuals with hearing impairments to participate in lectures and discussions. Voice input technology replaces keyboard operation, enabling individuals with physical disabilities to control learning devices. These technologies form the foundational channels for disabled individuals to participate in learning and address the fundamental question of whether they can learn (Guo, 2020). At the level of personalized resource generation, AIGC can create tailored content based on the specific needs, cognitive preferences, and physiological characteristics of learners. For instance, in the case of visually impaired learners learning massage techniques, learners can request AI to generate audio resources that combine theoretical knowledge of meridians with practical examples, and specify a slower speaking pace to suit their individual comprehension rhythm. This enables them to access customized learning materials that are difficult to obtain in traditional learning environments. In terms of immediate feedback, intelligent tutor systems and dialogue agents provide real-time guidance for disabled learners, helping to compensate for their inability to receive face-to-face instruction due to physical limitations, thereby supporting the continuous progression of the learning process. This empowerment mechanism preserves rather than displaces learner agency. While AIGC tools mediate access to learning content, they do not predetermine learning goals, strategies, or evaluation criteria - these remain under learner control. This distinction becomes clear when examining concrete learning scenarios. Knowles emphasizes that self-directed learning is not isolated self-study but rather the integration and utilization of diverse resources under the guidance of the learner. AIGC tools can be viewed as a new type of learning resource, and the selection, utilization, and integration of this resource by individuals with disabilities represent the contemporary manifestation of self-directed learning in a technological context.

Consider a hypothetical scenario that illustrates this principle: a visually impaired adult learning massage techniques. The learner first reflects on their own needs, identifies knowledge gaps in current basic techniques that cannot meet customer demands for traditional Chinese

medicine treatments; then sets goals, plans to master key meridian massage techniques within a specified timeframe; subsequently, actively uses AI-generated audio resources on meridian theory and chooses content formats that incorporate massage practice cases based on professional needs; during the learning process, the learner discusses meridian locations with peers in online communities to adjust their learning strategies; ultimately, they assess their learning outcomes through customer feedback. Throughout this process, technology provides the conditions for participation in learning, while the decision-making authority regarding what to learn, how to learn, and how well one learns remains with the learner. AIGC's personalized generation capabilities particularly reinforce the learner's sense of autonomy: customized resources enable learners to move beyond passive acceptance of generic content, as these resources are no longer predetermined or unadjustable but rather responsive to the learner's needs and tailored to serve their goals.

3.3. Taxonomic Distinctions Between Types of Technological Dependence: Functional Dependence and Alienating Dependence

The dependence of persons with disabilities on AIGC tools is of a nature distinct from general technical dependence, and requires typological differentiation. Functional dependence occurs when persons with disabilities rely on technology to compensate for physical limitations, thereby gaining access to learning opportunities. The essence of this dependence is empowerment: technology enables the learner to act, rather than acting for the learner. In this relationship, the learner acts as the subject and technology as the tool; the learner determines the purpose and method, while technology remains subordinate to the learner's pursuit of meaning. The choices made by visually impaired individuals, such as opting for screen readers instead of magnifying glasses, adjusting audio playback speed to suit their comprehension rhythm, and specifying the format of AI-generated content based on case examples, all demonstrate the learner's dominance over technology. Functional dependence does not undermine the autonomy of the subject; rather, it is a necessary condition for the realization of subject autonomy. Without the functional support of technology, the autonomous consciousness of learners with disabilities cannot be translated into autonomous actions (Guo et al., 2019). From a perspective of value orientation, functional dependence points to the inclusivity of learning, enabling persons with disabilities to participate equally in learning environments that would otherwise be inaccessible due to physical limitations.

In contrast, alienating dependence occurs when technology supplants the learner's autonomous judgment. Here, the learner becomes a mere executor of the technology's logic. In this type of dependence, the relationship between the learner and technology is reversed - technology transforms from a tool into a dominant force, and the authority over the learning process shifts from the learner to the technological system. Typical manifestations of alienation-based dependence include: algorithm-driven recommendations creating a path dependency, where learners are unable to deviate from predetermined tracks to choose their learning content; the replication of biased generated content, solidifying stereotypes about individuals with disabilities; excessive and intensive feedback provision, which diminishes the learner's space for autonomous judgment; and commercial logic dominating the delivery of resources, forcing learners to accept irrelevant content. For instance, if an AI tool used by a visually impaired learner forcibly pushes

commercial advertisements instead of requested instructional content, the relationship transitions from functional to alienating dependence. The learner loses control over both the content and the process (Liu, 2024). The typological distinction between functional dependence and alienating dependence holds dual theoretical significance: on one hand, it addresses concerns about technological alienation, demonstrating that the technological dependence of persons with disabilities differs fundamentally from technological alienation in general terms; on the other hand, it provides conceptual tools for subsequent propositional deduction, clarifying the explanatory efficacy of Knowles' theory within the context of AIGC, with functional dependence serving as the applicable boundary.

This functional-alienating distinction intersects with developmental stages in self-directed learning. Recall that Grow proposed a four-stage model of learner development: dependent, interested, participatory, and autonomous. For learners with disabilities, technological relationships vary across these stages. Learners in earlier developmental stages (dependent, interested) may require structured technological support to maintain functional dependence. Learners in advanced stages (participatory, autonomous) can independently evaluate and deploy AIGC tools to serve their learning goals. Crucially, at all developmental stages, technological dependence remains functional rather than alienating when learners retain authority over learning objectives, resource evaluation, and outcome assessment. The functional or alienating orientation of technological dependence thus depends on both the design of AIGC tools and the learner's developmental stage.

4. Theoretical Exposition and Conceptual Reconfiguration of the Explanatory Power of Knowles' Theory for the Learning of Adults with Disabilities

Having established the distinction between functional and alienating dependence, this section examines the explanatory power of Knowles' theory in this new context of technology-mediated disability learning. Five interrelated propositions reconstruct the theory's applicability while preserving its core logic.

The five propositions presented in this section are not independent claims but constitute a logically progressive framework. The foundational proposition establishes the continued validity of Knowles' core psychological assumptions regarding adult learners. Building on this premise, the revised proposition extends the original theory by redefining the pathway through which self-directed learning is realized under technological mediation.

The dialectical proposition addresses the tension that emerges from this extension by demonstrating how functional technological dependence and learner autonomy can coexist rather than conflict. The boundary proposition then delineates the conditions under which this coexistence holds, specifying the point at which technological dependence becomes alienating and undermines autonomy. Finally, the conceptual reconstruction proposition integrates these preceding arguments into a revised definition of self-directed learning for adults with disabilities in the AIGC era. Together, these propositions form a coherent theoretical progression from validation, extension, and resolution to reconstruction.

These propositions demonstrate how the functional-alienating distinction resolves the theoretical tension between dependence and autonomy. When technological dependence remains functional - serving learner goals rather than supplanting learner judgment - Knowles' framework retains explanatory power. The boundary between functional and alienating dependence thus determines the theory's applicability.

4.1. Foundational Proposition: Validating the Original Theory's Core Logic

As established in Section II, Knowles' theory rests on five assumptions about adult learners, particularly psychological maturity and experiential accumulation as prerequisites for self-directed capacity. Adults develop the ability to identify their own learning needs, plan learning strategies, and evaluate outcomes through accumulated life experiences addressing career challenges and personal issues. This psychological maturity, rather than physical ability, provides the internal foundation for self-directed learning. This section demonstrates that these prerequisites hold regardless of physical ability.

As adult learners, the psychological maturity and experience of individuals with disabilities do not change due to their physical limitations. Although physical limitations may prevent conventional participation, they do not diminish the adult capacity to reflect on their learning needs, plan paths, and evaluate learning effectiveness. As demonstrated in the massage learning scenario discussed previously, visually impaired learners retain the capacity to identify knowledge gaps, set professional goals, and evaluate outcomes through client feedback - capacities rooted in metacognitive development rather than physical ability (Guo & Gao, 2025). AIGC tools can provide resource support and process assistance, but they cannot replace the learner's reflection on their own needs, the setting of learning goals, and the evaluation of learning outcomes. These aspects rely on the learner's meta-cognitive abilities, which are traits that belong to the psychological rather than the physical realm. Therefore, the fundamental logic of the Knowles theory, which posits that the learner's agency plays a dominant role, remains valid for adult learning by persons with disabilities: While these individuals may require technical support, they still need to possess the psychological maturity to identify their needs, plan their path, as an intrinsic basis for self-directed learning. Regarding the concern that not all adults possess self-directed abilities, Grow's stage model offers an answer: self-direction is a developable ability rather than a static trait, and learners can transition from dependence to autonomy with appropriate support. For persons with disabilities, AIGC tools, when designed properly, can serve as scaffolding to facilitate their transition from dependence to autonomy.

4.2. Revised Proposition: From Unmediated Autonomy to Technologically Mediated Self-Direction

While the core psychological prerequisites for self-directed learning remain constant regardless of physical ability, the pathway to implementing self-directed learning must be revised to account for technological mediation. Knowles' original theory implicitly assumes learners possess the ability to engage in learning without intermediaries. However, physical limitations undermine this assumption: visually impaired learners may not read standard text, hearing-impaired learners may not access auditory content, and motor-impaired learners may struggle with standard equipment.

For these individuals, AIGC technology serves as an essential intermediary to overcome physical boundaries, utilizing tools such as screen readers, real-time captioning, and voice input systems. This technology does not rely on passive dependence but rather on active functional choices - where learners with disabilities use technology to compensate for their physical limitations and gain access to learning opportunities - a prerequisite for learner agency. AIGC interventions do not negate Knowles' original proposition; rather, they reconstruct the pathway to realizing autonomy through the functional premise of technological dependence: transitioning from unmediated autonomy to autonomy under technological mediation.

Recall the massage learning scenario: technology enables access (audio resources), while the learner controls the purpose (skill development), method (playback speed), and evaluation (client feedback). Throughout this process, technology enables learners to learn, while the learners themselves decide what to learn, how to learn, and how well they learn. To illustrate this, we can refer to Garrison's three-dimensional model: the autonomous entity's behavior is manifested through the coordinated operation of self-management, self-monitoring, and motivation-driven decision-making. The learner's selection and control of technological tools belong to self-management, their meta-cognitive reflection of the learning process belongs to self-monitoring, and their internal grasp of the learning significance belongs to motivation-driven decision-making (Wu & Yang, 2018). Although persons with disabilities rely on technology to access learning opportunities, they remain in control of the fundamental decisions regarding what to learn, how to learn, and how well to learn. Thus, the logic of shifting pathways while maintaining learner control remains consistent.

4.3. Dialectical Proposition: The Synergistic Relationship Between Functional Technological Dependence and Learner Autonomy

The academic community's concerns about technological dependence stem largely from theoretical assumptions about the dehumanization of technology - where technology transforms from a tool into a dominant force, and learners become subservient to it. However, in the context of adult learning for persons with disabilities, the essence of technological dependence is functional empowerment: the role of technology is to compensate for physical limitations and enable learners to participate in learning, rather than to replace their own choices. Functional empowerment does not oppose learner agency; rather, it creates a synergy between tools and values. Technology serves as the means, while learner agency remains the ultimate purpose. Take the learning of sign language translation skills by individuals with hearing impairments as an example: the learner uses an AI subtitle tool to watch sign language translation videos, which represents technological dependence; the choice to opt for sign language translation over text subtitles, as sign language better aligns with their communication habits, reflects learner agency; adjusting font size and color represents self-management; and applying sign language skills to enhance vocational abilities represents value-driven learning (Wang & Wang, 2025). Throughout the entire process, AI subtitles serve as a tool. The needs and goals of the learners are the primary drivers of value – technology serves the value, not the other way around. Functional dependence is a means, while the autonomy of the subject is the ultimate goal. These two elements together constitute the complete logic of self-directed learning for persons with disabilities in the era of

AIGC. The personalized generation capabilities of AIGC technology can further enhance rather than diminish the autonomy and agency of learners with disabilities. Knowles has pointed out that the key to self-directed learning lies in the ability of learners to find resources that meet their individual needs. In traditional learning environments, individuals with disabilities often struggle to access customized resources. For instance, visually impaired individuals may find it difficult to locate audio versions of massage instructional materials with case studies. The personalized generation capabilities of AIGC can address this challenge by generating customized resources tailored to the needs, learning styles, and physical characteristics of individual learner (Mou, 2017). Students with visual impairments can request audio generated by AI with a slower speaking pace and features that simulate a massage on the bladder meridian to alleviate back pain. This enables them to access learning materials that are perfectly tailored to their individual needs. Customized resources empower disabled learners to take greater control over the content of their learning. Instead of being generic and unsuitable, these resources are personalized to meet their specific needs. This mechanism not only enhances the learning outcomes but also reinforces the learner's sense of agency: learning is about fulfilling one's own needs, and technology serves as a tool to facilitate this fulfillment. Drawing on the concept of deep self-directed learning, when disabled learners are able to critically integrate new knowledge into their existing cognitive structures and apply it in new problem-solving contexts, their self-directed learning transitions from superficial to deep levels. The personalized support provided by technology creates conditions for deep self-directed learning rather than acting as a hindrance.

4.4. Boundary Proposition: Conditions Limiting the Explanatory Power of the Theory

The validity of the above proposition is contingent upon the context in which technology serves as a facilitator of learner needs. In this scenario, technology acts as a functional intermediary, and learners dictate the purposes and methods for using technology. If technology becomes an agent of alienation, the proposition loses its validity. Specific instances of alienation include: algorithmic recommendations creating path dependence, where learners are unable to deviate from predetermined tracks to choose their learning content; generated content exhibiting replication bias, solidifying stereotypes about individuals with disabilities; data collection infringing on privacy and commercializing the use of learners' learning behaviors; feedback provision becoming overly dense, diminishing learners' space for autonomous judgment; commercial logic dominating resource dissemination, forcing learners to accept unrelated content. For example, if an AI tool forces commercial advertisements instead of requested content, dependence transitions from functional to alienating. In this state, the learner loses control over the process, rendering learner agency impossible (Fan et al., 2025).

Practically, this boundary proposition implies that the design of AIGC educational tools must prioritize learner goals as the fundamental principle. The algorithmic logic of technology should be guided by the needs of the learners rather than by considerations of traffic or commercial interests; resource delivery should respond to explicit requests from learners rather than making forced recommendations based on predetermined preferences; feedback mechanisms should support learners' autonomous judgment rather than replacing their independent thinking with excessive and immediate feedback. Only when technology serves learner needs can the synergy

between functional dependence and learner autonomy be achieved, and the explanatory power Knowles' theory in the era of AIGC can be upheld. This boundary setting also addresses concerns about technological alienation: the dependence on technology is not inherently problematic; the issue lies in whether technology serves the needs of learners. There is a fundamental difference between the technological dependence of persons with disabilities and the general phenomenon of technological alienation; the former serves as a support for autonomy, while the latter erodes autonomy.

4.5. Conceptual Reconstruction: Defining Self-Directed Learning Under Technological Mediation

Based on this logical deduction, we propose a revised definition of self-directed learning for adults with disabilities: Under the mediation of AIGC and other assistive technologies, adults with disabilities take the lead in diagnosing their learning needs, setting learning goals, selecting and integrating technical resources, monitoring and adapting learning strategies, and reflecting on learning outcomes. This process ultimately leads to self-development and social participation. The revised definition encompasses three modifications: (1) Path modification (shifting from unmediated to technology-mediated learning); (2) Method modification (transitioning from solitary effort to active resource integration); and (3) Goal modification (shifting from mere knowledge acquisition to broader self-development and social participation) (Liu et al., 2024).

This concept reconstruction has a dual relationship of inheritance and development with Knowles' original theory. On the inheritance level, the reconstructed concept retains the fundamental logic of Knowles' theory, which emphasizes the learner's centrality in terms of the meaning, path, and effects of learning. The setups for needs diagnosis, goal setting, resource selection, strategy regulation, and effect evaluation continue to use Knowles' process model framework. On the development level, the reconstructed concept breaks away from the historical limitation of Knowles' theory without a technological context, incorporating technological mediation into the analytical framework of self-directed learning. It revises the understanding of autonomy, moving from unmediated autonomy to autonomy under technological mediation. It addresses the academic debate on whether technology dependence erodes autonomy by demonstrating that technological dependence of individuals with disabilities can coexist with their autonomy. Theoretically, this reconstruction is neither a negation nor a simple application of Knowles' theory. Rather, it represents a critical inheritance and creative development of Knowles' theory within the technological context of the AIGC era, allowing classic theories to regain their explanatory power in new historical contexts.

In addition, the reconstruction of self-directed learning also requires cultural contextualization. Knowles' conception of autonomy reflects an individualistic orientation that emphasizes independence from external support. In the Chinese context, however, autonomy is more commonly understood as the capacity to act effectively within relational and institutional support structures.

Adult learners with disabilities in China typically engage in learning within family, community, and public service systems. Self-directed learning therefore manifests not as the withdrawal of

support, but as learners' capacity to define goals and regulate learning within mediated arrangements. Under such conditions, reliance on technology aligns with culturally situated forms of agency rather than contradicting them.

5. Theoretical Integration & Practical Implications

Having reconstructed Knowles' theory for technology-mediated disability education contexts, this section integrates the theoretical propositions into a unified operational framework, articulates practical implications for AIGC tool design and educational practice.

5.1. Mechanisms of Operation of Self-Directed Learning Under Technology Intermediation

The proposed Three-Tier Analytical Framework clarifies the synergy between technological dependence and learner autonomy. It consists of the Functional Tier (access), the Mechanism Tier (control), and the Value Tier (meaning). At the functional layer, AI technology compensates for physiological limitations through accessibility features (screen readers, real-time captions, voice input), addressing the prerequisite question of learning participation rights. At the mechanism layer, learners exercise autonomous control over technology use through self-management (selecting and regulating technical tools), self-monitoring (metacognitive reflection on learning processes), and motivation-driven decision-making (determining learning purpose and significance). At the value layer, technology-mediated learning enables persons with disabilities to achieve self-development and social participation, returning self-directed learning to its essential purpose of human flourishing rather than mere knowledge acquisition. These three layers operate recursively: functional accessibility enables mechanism-layer autonomy, autonomous regulation realizes value-layer goals, and value orientation provides meaning to functional and mechanism processes.

5.2. Synergy between Technology Empowerment and Subject Autonomy: The Implementation Path of Self-directed Learning for the Disabled in the AIGC Era

Psychological maturity and experience accumulation in adults are prerequisites for self-directed learning, independent of physical health. Although learners with disabilities rely on technology for learning due to their physical limitations, they still need metacognitive ability to identify needs, plan pathways, and evaluate effectiveness as an intrinsic basis for self-directed learning. Knowles' theory requires a pathway correction: shifting from the assumption of unmediated autonomy to a recognition of autonomy under technological mediation. AIGC tools become a structural element of learning for people with disabilities, but leadership remains with learners - the technology helps people with disability learn, and they decide what to learn, how to learn and how to learn. The dependence of disabled people on AIGC tools belongs to functional dependence. In essence, it is an enabling mechanism to break through the physiological boundary, and forming a cooperative rather than antagonistic relationship. The tension between empowerment and alienation resolves when we distinguish functional dependence (autonomous support) from alienating dependence (autonomy dissolution). When technology serves the needs of learners, dependence is autonomous support. When technology becomes the dominant player in the learning process, dependency constitutes the dissolution of autonomy. This distinction provides a

conceptual tool for judging the reasonable boundary of technical intervention, and also provides a theoretical basis for the technical design and practice of adult education for the disabled in the age of AIGC.

Regarding technical design, accessible AIGC tools must adhere to learner-centered principles across three levels:

(1) Accessibility Interaction: Adaptable modules must address specific physiological characteristics. For visually impaired learners, tools should optimize speech synthesis quality, support rapid audio positioning (e.g., chapter marking), and integrate tactile feedback systems. For hearing-impaired learners, tools require improved real-time caption accuracy, customized technical vocabulary expansion, and two-way sign language translation capabilities. For physically impaired learners, systems should enhance voice command recognition and support alternative inputs like eye-tracking and head-movement sensors.

(2) Personalized Resource Generation: Learners must be supported in tailoring content formats - such as requesting audio with practical examples (for visual impairment) or visually illustrated explanations (for hearing impairment). Furthermore, learners should control presentation parameters (e.g., playback speed, font size) and organizational structure (e.g., case-oriented vs. systematic).

(3) Algorithmic Logic: Resource delivery must respond to explicit learner requests rather than forced recommendations based on preset preferences. Algorithms should be oriented toward learning goals rather than commercial interests, strictly avoiding path dependency, bias replication, and privacy infringement (Wei et al., 2025).

Regarding educational practice, programs must cultivate the learner's ability to maintain autonomy while using technical intermediaries. Interventions should align with the stages of self-directed learning:

(1) Needs Diagnosis: Educators should help learners distinguish between immediate and long-term needs, converting vague intent into clear learning problems. Tools like career development counseling and peer experience sharing can help identify intrinsic drivers.

(2) Goal SettingLearners should be guided to translate broad directions into assessable, phased goals. Learning contracts and progress visualization tools help establish logical links between goals and actions.

(3) Strategic Regulation: Emphasis should be placed on metacognitive monitoring - such as adjusting learning rhythms or replacing technical tools based on adaptability. Peer evaluation mechanisms can further strengthen reflection awareness.

(4) Effectiveness Evaluation: Evaluation criteria must be diverse, covering knowledge mastery, skill upgrading, and practical application. Educators should facilitate objective indicators through practical task testing and professional qualification certification.

(5) Community Building: Online and offline platforms should be established to promote experience sharing and remedy the lack of social presence in AIGC tools, encouraging learners to

deepen their self-directed capacity through collaboration (Zhuang & Goggin, 2024). The common orientation of these practice pathways is to ensure that learners with disabilities continue to take the lead in fundamental decisions about what, how and how to learn under technical intermediation, thereby achieving the integration of inclusive learning and self-actualization, returning self-directed learning to its essential purpose within adult education: human flourishing and development.

Within the Chinese policy framework, adult education for persons with disabilities is explicitly oriented toward educational equity and social participation. Learning is framed not only as individual development but as a means of reducing structural exclusion and enabling participation in social and vocational life.

In this context, technological mediation assumes normative significance. It functions as an institutional mechanism that secures learning access and supports participation under conditions of structural disadvantage. Accordingly, the reconstructed model of self-directed learning evaluates autonomy not by the absence of dependence, but by learners' capacity to act meaningfully in society through mediated learning.

6. Conclusion & Future Direction

This study makes three theoretical contributions to adult education scholarship and disability studies. First, it extends Knowles' self-directed learning theory beyond its original pre-digital context by demonstrating that psychological prerequisites for self-directed learning remain valid under technological mediation, while implementation pathways require revision from unmediated to technology-mediated autonomy. Second, it resolves longstanding scholarly debates about whether technological dependence erodes learner autonomy by introducing a typological distinction between functional and alienating dependence, showing these represent qualitatively different relationships between learners and technology. Third, it provides a three-tier analytical framework - functional, mechanism, and value - that clarifies how AIGC tools can enable rather than undermine self-directed learning for persons with disabilities when designed to serve learner goals.

This study has several limitations that should be acknowledged. First, as a conceptual reconstruction, the analysis relies on theoretical deduction rather than empirical validation. While this approach allows for clarifying conceptual boundaries and theoretical logic, the proposed distinctions - particularly between functional and alienating technological dependence - require empirical examination in diverse learning contexts.

Second, although the typology of technological dependence provides analytical clarity, its operationalization remains underdeveloped. The criteria for identifying functional versus alienating dependence need to be translated into observable indicators to support future empirical research. Addressing these limitations will enable subsequent studies to test, refine, and extend the reconstructed framework.

Future research should investigate how the functional-alienating distinction manifests across different disability types, learning contexts, and cultural settings. Longitudinal studies could examine how learners with disabilities progress through Grow's developmental stages under technological mediation, and whether AIGC scaffolding effectively facilitates transitions toward greater autonomy. Additionally, the framework developed here focuses on individual learners; future work should explore how technology-mediated self-directed learning operates in collaborative learning communities for persons with disabilities. Finally, as AIGC technologies continue evolving, ongoing theoretical work must examine emerging forms of technological mediation and their implications for learner autonomy.

The integration of AIGC technology into adult education for persons with disabilities represents both opportunity and challenge. By distinguishing functional from alienating dependence, this study provides conceptual tools for ensuring that technological advancement serves inclusive education rather than creating new barriers to autonomy. The revised understanding of self-directed learning under technological mediation allows Knowles' foundational theory to regain explanatory power in contemporary contexts while addressing the specific structural constraints facing learners with disabilities.

Author Contributions:

Conceptualization, W. D.; methodology, W. D.; validation, W. D.; investigation, W. D.; resources, W. D.; writing—original draft preparation, W. D; writing—review and editing, W. D.; supervision, W. D.; project administration, W. D.; funding acquisition, W. D. All authors have read and agreed to the published version of the manuscript.

Funding:

This research was supported by Shenzhen Open University， in connection with the project entitled "Exploration and Research on the Practice of Distance and Open Education and the Vocational Development of Persons with Disabilities in the Context of the Guangdong-Hong Kong-Macao Greater Bay Area (GBA): A Case Study of Disability Education at Shenzhen Open University (Project No.: SD20-009).

Data Availability Statement:

Not applicable.

Acknowledgments:

I am grateful to my colleagues and students at the National Open University's College of Education for Persons with Disabilities. The insights derived from my teaching and observations within their context have been crucial in shaping both the arguments presented in this paper and in stimulating my deeper reflections on this subject. Shenzhen Open University provided project funding.

Conflict of Interest:

The authors declare no conflict of interest.

References

Clark, M. A. (2006). Adult education and disability studies, an interdisciplinary relationship: Research implications for adult education. Adult Education Quarterly, 56(4), 308-322.

Dai, T., & Wang, J. (2025). The value, predicaments and solution paths of artificial intelligence empowering special education. Continuing Education Research, (10), 88-93.

Fan, W., Shi, C., Li, K., & Yang, J. (2025). The application logic and practical paths of artificial intelligence empowering the development of special education students. Modern Distance Education, (1), 34-47.

Garrison, D. R. (1997). Self-directed learning: Toward a comprehensive model. Adult Education Quarterly, 48(1), 18-33.

Grow, G. O. (1991). Teaching learners to be self-directed. Adult Education Quarterly, 41(3), 125-149.

Guo, J., & Gao, M. (2025). Crossing the body crack: The impact of assistive technology on older adults with disabilities. Studies in Intelligent Society, 4(5), 102-121, 256-257.

Guo, L., Yang, X., Duan, X., & Xing, B. (2019). Integrated design of artificial intelligence and special education. Distance Education in China, (8), 10-19.

Guo, Y. (2020). AI empowers information accessibility: Patterns, problems and prospects. Information Studies: Theory & Application, 43(8), 57-63, 69.

He, G. (2013). Debate and significance of andragogy. Open Education Research, 19(3), 63-70.

He, S., & He, G. (2022). Malcolm Knowles: Apostle of andragogy. Lifelong Education Research, 33(2), 74-81.

Houle, C. O. (1961). The inquiring mind: A study of the adult who continues to learn. University of Wisconsin Press.

Knowles, M.S. (1975). Self-directed learning: A guide for learners and teachers. Association Press.

Lindeman, E. C. (1926). The meaning of adult education. New Republic.

Ling, L. (2017). The resume of Knowles' andragogy theory. Adult Education, 37(8), 11-14.

Liu, B., Liu, M., Yu, J., Wu, Y., & Li, W. (2024). Construction and validation of self-directed learning behavioral framework from the perspective of process. Distance Education in China, 44(1), 68-79.

Liu, Y. (2024). From technology dependence to platform isolation: The formation of loneliness among young people in the digital age. Journal of Jishou University (Social Sciences Edition), 45(5), 110-121.

Mou, Z. (2017). The reconsideration and solution of personalized learning theory in the era of "artificial intelligence plus". Journal of Distance Education, 35(3), 22-30.

Shen, K. (2017). On the application of self-directed learning theory in adult learning. China Adult Education, (23), 29-32.

Tough, A. (1979). The adult's learning projects: A fresh approach to theory and practice in adult learning. Ontario Institute for Studies in Education. https://eric.ed.gov/?id=ED054428

Wang, H., & Wang, Y. (2025). Intelligent presence and the recurrence of subjectivity: A historical materialist examination of human subjectivity restoration in the age of artificial intelligence. Zhejiang Social Sciences, (9), 97-107, 158-159.

Wei, S., Liu, X., Du, Y., & Sun, Y. (2025). Innovative practices and international experiences of artificial intelligence empowering special education: Case analysis based on open-source big data. Chinese Journal of Special Education, (9), 88-96.

Wu, P., & Yang, L. (2018). The development and change of digital accessibility learning from the perspective of learning theory. China Educational Technology, (12), 136-141.

Yin, Y. (2014). Interpretation, cognition and practical verification of Knowles' self-directed learning model. Adult Education, 34(1), 4-8, 18.

Zhang, B. (2017). Enlightenment of Knowles' adult learning theory on teacher education and training in China. China Adult Education, (13), 135-137.

Zhu, D., & Xu, J. (2020). The realistic dilemma and reconstruction of the era of Knowles' self-directed learning model. Adult Education, 40(9), 13-18.

Zhuang, K. V., & Goggin, G. (2024). New possibilities or problems for disability and inclusion? The case of AI and ADMs across work. Telematics and Informatics, 92, 102156.

iEducation, 2025, 1(3), 65-76
https://doi.org/10.71204/bsgvdd58

Chinese Language and Culture Learning in Belt and Road Contexts: A Post-Pandemic Study of Russia and Uzbekistan

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Received: 17 February 2025/ Accepted: 7 January 2026 / Published online: 17 January 2026

Abstract

Against the backdrop of the continued advancement of the Belt and Road Initiative (BRI), the dissemination of the Chinese language and Chinese culture has increasingly become a crucial component of "soft connectivity" in transnational cooperation. Taking Russia and Uzbekistan as comparative cases, this study draws on questionnaire survey data supplemented by follow-up interviews to examine the strategies, challenges, and social impacts of Chinese language and culture dissemination in BRI-participating countries. The findings reveal four key patterns. First, the dissemination of the Chinese language and culture has developed into a multi-pathway configuration jointly shaped by institutional platforms and everyday social contact spaces, significantly enhancing social visibility. Second, although young people generally hold positive attitudes toward learning Chinese, learning trajectories are often short-lived, with a clear pattern of "many beginners but few long-term learners," reflecting structural challenges related to learning sustainability and advanced support. Third, cultural understanding tends to remain at the level of observable differences, while deeper cultural interpretation requires sustained interaction and systematic learning. Fourth, while the COVID-19 pandemic expanded access to learning through online modalities, it also intensified inequalities in interaction quality and learning support. From a comparative perspective, Russia and Uzbekistan differ significantly in motivational structures, frequency of contact, and awareness of policy support, indicating that the effectiveness of Chinese language and culture dissemination is highly contingent on national contexts. This study argues that the key to effective dissemination in BRI-participating countries lies in the systematic integration of diverse dissemination pathways, enabling a meaningful transition from initial exposure to be sustained learning and deeper cultural understanding.

Keywords: Chinese as a Foreign Language; Learning Motivation; Learning Persistence; Intercultural Competence

1. Introduction

Since the Belt and Road Initiative (BRI) was proposed by China in 2013, it has aimed to promote cross-regional infrastructure development, economic cooperation, and policy coordination. As the initiative has evolved, the BRI has gradually expanded from an economically oriented framework into a comprehensive platform encompassing mobility, institutional alignment, and socio-cultural interaction (Dunford, Liu, & Society, 2019; Johnston & Studies, 2019; Rolland, 2017; Summers, 2016). Within this process, language and cultural exchange has increasingly been recognized as a key dimension of "soft connectivity" supporting the long-term sustainability of the BRI (Costa, 2020; Y. J. S. Gao, 2020; Gu & Schweisfurth, 2015; Xu, 2021)

As BRI-related cooperation deepens, large-scale infrastructure projects, corporate investments, and cross-border collaborations are often accompanied by sustained interactions between Chinese actors and host societies. These interactions not only facilitate the flow of capital and technology but also increase the social visibility of the Chinese language and culture, creating practical conditions for language learning, cultural activities, and everyday intercultural contact. Previous research has emphasized that language and culture dissemination is not a one-way transmission but a process that must be locally embedded within specific national contexts, with outcomes highly dependent on institutional environments, social acceptance, and interaction mechanisms (Gu & Schweisfurth, 2015; Hartig, 2015)

Within the field of international Chinese language dissemination, Confucius Institutes and related educational exchange mechanisms are widely regarded as key institutional platforms. On the one hand, studies have acknowledged their contributions to curriculum provision, teacher training, and cultural programming (Gil, 2017; Zhao, Huang, & Practice, 2010); On the other hand, scholars have also highlighted the institutional controversies and divergent public perceptions they encounter across national contexts (Hubbert & review, 2014; Paradise, 2009). Meanwhile, an emerging body of research has drawn attention to the fact that the dissemination of the Chinese language and culture increasingly occurs beyond formal classrooms, extending into everyday spaces such as corporate activities, consumption sites, and community interactions (Gil, 2017; Hartig, 2015). However, existing studies tend to examine institutional platforms and everyday contact spaces separately, with limited systematic analysis of how these pathways interact within specific national contexts.

From the learner perspective, second language acquisition research suggests that instrumental motivations—such as economic returns and employment prospects—are effective in attracting learners at the entry stage but do not necessarily ensure sustained learning engagement. Long-term learning persistence often depends on stable learning pathways, high-quality advanced support, and continuous opportunities for meaningful interaction (Dörnyei & self, 2009; Gardner, 1985). Within

the BRI context, the instrumental value of learning Chinese has increased substantially, yet tensions between initial interest and long-term commitment remain widely observed(X. Gao, Zheng, & Development, 2019)

The outbreak of COVID-19 further reshaped the structural conditions of cross-border education and cultural exchange. While border restrictions and reduced mobility weakened face-to-face interaction and immersive learning environments, the pandemic also accelerated the development of online instruction and digital resources. In the post-pandemic context, Chinese language and culture dissemination has exhibited a dual pattern of enhanced accessibility alongside increasingly differentiated learning experiences, the long-term implications of which remain underexplored at the national level (Ghosh & Jing, 2020; Giacometti & Wøien Meijer, 2021; Kurowska-Pysz; Wang, Zhan, & Liu, 2022).

In summary, existing research reveals three main gaps. First, studies on BRI-participating countries often focus on single national or institutional cases, with limited cross-national comparison (Rolland, 2017); Second, the internal connections among dissemination strategies, structural challenges, and social impacts remain insufficiently theorized. Third, the lived experiences and perceptions of young people in the post-pandemic context lack systematic empirical examination. To address these gaps, this study adopts Russia and Uzbekistan as comparative cases and employs questionnaire surveys supplemented by interviews to analyze the strategies, challenges, and impacts of Chinese language and culture dissemination in BRI-participating countries.

Specifically, the study examines: (1) the institutional and social pathways through which the Chinese language and culture enter the everyday lives of young people; (2) the structural constraints related to learning sustainability, resource provision, and cultural understanding; and (3) the ways in which dissemination practices shape young people’s attitudes, motivations, and perceptions in the post-pandemic context. By comparing Russia and Uzbekistan in terms of geopolitical positioning, language education ecologies, and resource distribution, this study aims to deepen understanding of dissemination mechanisms under the BRI framework and to provide empirical insights for international Chinese education and cultural exchange.

2. Research Methodology

2.1. Sample Selection

This study adopts a purposive sampling strategy, selecting Russia and Uzbekistan as comparative cases. Purposive sampling is commonly used in exploratory and cross-cultural research, as it allows researchers to obtain information-rich cases within specific contexts (Creswell & Clark, 2017; Patton, 2014).The selection is not merely based on their shared participation in the Belt and Road Initiative, but on their representation of two structurally distinct modes of Chinese language and culture dissemination.

In Russia, Chinese learning has increasingly been embedded within existing foreign language education systems and employment-oriented frameworks. Chinese courses are institutionally integrated into higher education curricula and linked to professional development and labor market demands, resulting in relatively stable learning pathways. In this context, learning Chinese is often driven by instrumental motivations related to career advancement.

In contrast, Chinese language learning in Uzbekistan remains in an expansionary and developmental phase. Although regional cooperation and BRI-related exchanges have increased social interest in Chinese language and culture, institutionalization remains limited. Learning opportunities are more frequently shaped by cultural interest, symbolic value, and informal or semi-formal channels, with fewer clearly articulated long-term learning pathways.

This structural contrast enables the study to examine how different configurations of institutional support and motivational orientation shape learning participation, persistence, and depth of cultural understanding, offering a more analytically grounded comparison than single-country studies.

The survey targeted host-country citizens aged 18–22, a group typically enrolled in higher education and significantly affected by educational disruptions during the COVID-19 pandemic. Moreover, as a future labor force cohort, their attitudes toward language learning and educational choices provide insight into the long-term sustainability of Chinese language learning, especially the structural tension between initial interest and sustained engagement(Dörnyei & self, 2009).

A total of 160 questionnaires were distributed, and 150 valid responses were collected (75 from each country), yielding an effective response rate of 93.75%. In addition, semi-structured interviews were conducted with 20 respondents (10 in each country), including both learners and non-learners.

2.2. Research Design and Data Collection

A mixed-methods research design was employed, combining online questionnaires with follow-up interviews. Mixed-methods approaches allow researchers to identify overall trends while contextualizing quantitative findings through qualitative data, making them particularly suitable for exploratory and cross-cultural studies (Creswell & Clark, 2017; Valsiner, 2000; Wilkinson, Ferraro, & Kemp, 2017).

The questionnaire was developed based on established research on second language motivation, learning persistence, and intercultural contact (Dörnyei & self, 2009; Gardner, 1985), with items adapted and contextualized for the BRI and post-pandemic setting. Additional items were self-designed to capture everyday exposure to Chinese language and culture and perceptions of institutional support.

Representative items included questions on learning duration, learning motivation, frequency of contact with Chinese language or interlocutors, and perceived accessibility of learning resources. The questionnaire was distributed through online and offline channels, including social media platforms and direct contacts. Interviews focused on learning trajectories, perceived barriers to sustained

learning, experiences during and after the pandemic, and expectations regarding advanced courses and learning pathways.

2.3. Reliability, Validity, and Data Analysis

Internal consistency reliability was assessed using Cronbach's alpha. The overall scale demonstrated good reliability ($\alpha = 0.82$), with subscale values ranging from 0.74 to 0.85. Content validity was ensured through reference to established theoretical frameworks and expert review.

Descriptive statistics were used to illustrate overall trends. Independent-samples t-tests were conducted to examine cross-national differences in learning duration, motivation, contact frequency, and resource awareness ($p < .05$). Interview data were analyzed using inductive thematic analysis to support interpretation. Given the modest sample size, the analysis emphasizes pattern identification and cross-national comparison, providing directions for future large-scale and inferential research (Creswell & Clark, 2017).

3. Results

3.1. Current Status of Chinese Learning and Learning Duration

Survey results indicate clear cross-national variation in respondents' engagement with Chinese learning. Among Russian respondents, both learners and non-learners were represented, with 45.3% reporting no systematic study of Chinese. Regarding learning duration, the largest proportion consisted of learners with less than one year of experience (33.3%), followed by those with one to three years (17.3%), while only a small minority reported more than eight years of study (4%). Overall, the distribution suggests relatively broad entry-level participation but limited persistence at advanced stages.

In Uzbekistan, non-participation in systematic Chinese learning was even more pronounced, with 68.9% reporting no formal learning experience. Moreover, the proportion of learners with one to three years of experience was lower than that in Russia, indicating a steeper drop-off beyond the beginner stage. Independent-samples t-tests reveal a statistically significant difference between the two countries in reported learning duration ($p < 0.05$), confirming that Russian respondents are more likely to have sustained exposure to Chinese than their Uzbek counterparts.

Across both contexts, the results point to a consistent empirical pattern: Chinese learning is often characterized by short learning trajectories rather than long-term progression. While initial access to Chinese learning opportunities appears relatively available, the transition from initial engagement to sustained learning remains structurally weak.

3.2. Learning Interest and Motivation

Respondents in both countries expressed generally positive attitudes toward learning Chinese, though motivational structures differed. In Russia, 69.3% reported interest in learning Chinese, while

12% expressed a lack of interest. A high proportion of Russian respondents reported multilingual backgrounds (87.32% speaking two or more languages), which may correspond to broader openness toward additional language learning. In Uzbekistan, approximately 60% also reported interest in learning Chinese, indicating favorable attitudes despite lower participation rates.

Employment prospects emerged as the most frequently cited motivation in both samples, though the strength of endorsement differed significantly between the two countries (Russia: 68.57%; Uzbekistan: 55.56%; $p < 0.05$). In contrast, cultural motivation—specifically interest in understanding Chinese culture—was more prominent among Uzbek respondents (48.15%) than among Russian respondents (31.43%), a difference that was also statistically significant ($p < 0.05$).

These findings suggest that instrumental and cultural motivations coexist rather than function as mutually exclusive categories. However, positive motivation alone does not guarantee sustained learning. Even among respondents with strong interest, learning trajectories often remained short, indicating a potential gap between motivational orientation and the availability of structured learning pathways capable of supporting long-term engagement.

3.3. Visibility of Chinese Enterprises and Cultural Presence

Respondents in both countries reported increased visibility of Chinese-related presence in daily life, though perceived levels differed. In Russia, only 17.6% reported no noticeable increase in Chinese enterprise visibility, whereas in Uzbekistan approximately 35% reported no such change, reflecting fewer or less salient exposure opportunities. This difference between the two samples was statistically significant ($p < 0.05$).

When asked to identify concrete forms of Chinese presence, respondents most frequently mentioned Chinese restaurants and cafés, educational and training institutions, and Chinese grocery stores. These findings indicate that Chinese language and culture are increasingly encountered through everyday social and commercial spaces rather than solely through formal educational channels.

The results further suggest that visibility operates across multiple low-threshold contact domains—such as food consumption, commerce, and informal learning markets—which may stimulate awareness and curiosity even among non-learners. However, increased visibility does not necessarily translate into sustained learning or deeper cultural understanding, highlighting the distinction between exposure and educational engagement.

3.4. Contact Frequency, Resource Awareness, and Pandemic Effects

Most respondents reported some degree of contact with Chinese people or the Chinese language, but contact frequency varied significantly between the two contexts. In Russia, only 16.4% reported no such contact, compared to approximately 36% in Uzbekistan ($p < 0.05$). This suggests that Russian respondents are more likely to encounter Chinese language or interlocutors through daily routines, potentially due to differences in urban internationalization and mobility patterns.

Perceptions of policy support and resource accessibility further illuminate structural conditions for learning. In Uzbekistan, 40% of respondents perceived support for Chinese as weaker than that for other foreign languages, whereas approximately 40% of Russian respondents perceived Chinese as receiving relatively stronger support. Across both samples, "moderate accessibility" of learning resources was the most frequently selected category, indicating neither acute scarcity nor easy abundance.

Open-ended responses and interview data repeatedly referenced shortages of qualified teachers and limited access to advanced-level resources. Importantly, several respondents explicitly noted that while online learning opportunities expanded during the COVID-19 pandemic, reduced face-to-face interaction weakened opportunities for sustained engagement and meaningful cultural exchange. Thus, the pandemic appears to have simultaneously increased access while intensifying differentiation in learning quality and support.

3.5. Cultural Difference and Similarity Perceptions

Open-ended responses indicate that respondents more readily articulated cultural differences than similarities. Frequently cited differences included food preferences, social etiquette, and interaction styles. Some respondents relied on observable behaviors, such as speaking volume in public spaces, or broad cultural labels, such as collectivism, to describe perceived contrasts.

In contrast, similarities were mentioned less frequently and with greater hesitation, though recurring themes included tea-drinking practices, respect for tradition, and diligence as a shared value. This imbalance suggests that respondents are more confident in describing salient and visible differences than in articulating shared cultural logic or deeper interpretive understanding.

This finding does not aim to establish a novel claim but empirically confirms patterns widely observed in second language learning literature within the specific BRI post-pandemic context. Overall, the results suggest that increased exposure has not yet been systematically translated into stable interpretive frameworks supporting deeper intercultural understanding.

4. Discussion

Drawing on comparative data from Russia and Uzbekistan, this study examines the strategies, challenges, and impacts of Chinese language and culture dissemination in BRI-participating countries within the post-pandemic context.

First, the persistent pattern of "many beginners but few long-term learners" reflects a structural tension between instrumental motivation and learning sustainability. While employment prospects and economic cooperation effectively attract initial learners, sustained engagement requires stable learning pathways, advanced-level support, and alignment with learners' longer-term educational and professional identities (Dörnyei & self, 2009; Gardner, 1985). In both contexts, entry-level access is

relatively widespread, whereas advanced courses and progression mechanisms remain limited, constraining long-term commitment.

Second, the findings demonstrate that dissemination operates through multiple parallel pathways combining institutional platforms and everyday social contact spaces. Formal institutions provide foundational instruction, while enterprises, restaurants, and community spaces enhance social visibility. However, increased visibility alone does not automatically produce deeper cultural understanding. Without structured learning support, contact risks remaining episodic and superficial, yielding limited long-term educational impact.

Third, the predominance of difference-oriented cultural narratives highlights a gap between cultural display and cultural interpretation. Intercultural competence research emphasizes that deeper understanding emerges through sustained interaction, guided reflection, and meaning making rather than through sporadic exposure (Deardorff, 2006). The findings suggest that existing dissemination practices have expanded awareness but have not consistently facilitated these deeper processes.

The COVID-19 pandemic further intensified these dynamics. While online instruction expanded access and lowered entry barriers, reduced face-to-face interaction and immersive environments made it easier for learners to remain at short-term participation levels. This dual effect aligns with broader findings in pandemic-era language education research, in which accessibility increased alongside differentiation in learning quality (Wang et al., 2022).

Finally, cross-national differences between Russia and Uzbekistan underscore the importance of national context. Russia's stronger integration of Chinese into foreign language education systems and employment frameworks amplifies instrumental motivation, whereas Uzbekistan exhibits relatively stronger cultural interest amid constraints in institutional support. These contrasts caution against treating BRI-participating countries as a homogeneous group and highlight the value of comparative approaches in understanding dissemination outcomes.

Overall, while diverse dissemination strategies are in place, their impact remains largely confined to enhanced visibility and positive attitudes. Transforming exposure into sustained learning and deeper cultural understanding requires systematic integration of pathways, stronger progression mechanisms, and expanded opportunities for meaningful interaction.

5. Conclusion

Focusing on BRI-participating countries, this study adopts Russia and Uzbekistan as comparative cases and based on questionnaire surveys supplemented by interviews, systematically examines the strategies, challenges, and social impacts of Chinese language and culture dissemination in the post-pandemic context. Despite significant differences in political environments, language ecologies, and education systems, several shared structural features emerge.

At the strategic level, dissemination has expanded beyond formal education systems to form a multi-pathway configuration combining institutional platforms, economic activities, and everyday social contact spaces. This diversification enhances social visibility and lowers barriers to initial exposure among young people. However, the findings indicate that visibility alone is insufficient to support sustained learning or deeper cultural understanding unless these pathways are meaningfully connected.

At the level of challenges, the study reveals a structural tension between increased interest and limited long-term persistence. While instrumental motivations linked to employment prospects and economic cooperation effectively strengthen initial attraction, insufficient advanced courses, the absence of clearly articulated learning pathways, and limited opportunities for sustained and meaningful interaction often confine learning to the introductory stage. As a result, cultural understanding remains largely concentrated on observable differences, reflecting constraints on the depth of intercultural engagement.

At the level of impact, dissemination practices have contributed to more positive attitudes toward Chinese language and culture and heightened initial interest among young people, yet these effects remain uneven. Social visibility and contact frequency tend to increase more rapidly than learning sustainability and cultural depth. The COVID-19 pandemic has acted as an amplifier in this process, simultaneously expanding access through digitalization while intensifying inequalities in learning experiences and support.

From a comparative perspective, Russia and Uzbekistan demonstrate that there is no single model for effective dissemination. Outcomes depend heavily on geopolitical positioning, language education traditions, and resource allocation. Russia tends to integrate Chinese into existing foreign language education systems and employment-oriented frameworks, whereas Uzbekistan exhibits relatively stronger cultural interest alongside developmental constraints in institutional and curricular support.

Building on these findings, the study suggests that improving dissemination effectiveness requires moving beyond fragmented exposure toward more coherent and sustainable learning structures. This entails designing advanced courses that integrate language proficiency development with cultural and professional content, establishing clearer progression pathways linking introductory and advanced stages, and expanding opportunities for in-depth interaction through project-based learning, community engagement, and sustained exchange initiatives.

In conclusion, this study argues that the effectiveness of Chinese language and culture dissemination in BRI-participating countries depends less on the number of strategies employed than on whether diverse pathways can be systematically connected. Only by transforming initial exposure into coherent learning trajectories and deeper cultural understanding can long-term dissemination outcomes be meaningfully enhanced in the post-pandemic context.

Author Contributions:

Lianyun pang: designing, writing—original draft preparation, writing—review and editing. Miriam Leah Ivanenko: investigation and do some basic data analysis. Shakhrizoda Abdujabborova: investigation and do some basic data analysis.

Funding:

Not applicable.

Institutional Review Board Statement:

Ethical review and approval were waived for this study due to its minimal risk nature. The research involved anonymous questionnaire surveys and voluntary follow-up interviews with adult participants, without the collection of identifiable personal or sensitive information. The study did not involve any intervention or manipulation, and all participants provided informed consent prior to participation.

Informed Consent Statement:

Informed consent was obtained from all subjects involved in the study.

Data Availability Statement:

Not applicable.

Acknowledgments:

The authors would like to thank the Duke Kunshan University Student Research Scholars (SRS) Program for its support of this research.

Conflict of Interest:

The authors declare no conflict of interest.

Reference

Costa, C. M. (2020). The words of the belt and road initiative: A Chinese discourse for the world? In The Belt and Road Initiative: An old archetype of a new development model (pp. 23-44): Springer.

Creswell, J. W., & Clark, V. L. P. (2017). Designing and conducting mixed methods research: Sage publications.

Deardorff, D. K. (2006). Identification and assessment of intercultural competence as a student outcome of internationalization. Journal of studies in international education, 10(3), 241-266.

Dörnyei, Z. J. M., language identity, & self, t. L. (2009). The L2 motivational self system, 36(3), 9-11.

Dunford, M., Liu, W. J. C. J. o. R., Economy, & Society. (2019). Chinese perspectives on the Belt and Road Initiative,12(1), 145-167.

Gao, X., Zheng, Y. J. J. o. M., & Development, M. (2019). Multilingualism and higher education in Greater China. In (Vol. 40, pp. 555-561): Taylor & Francis.

Gao, Y. (2020). How the Belt and Road Initiative informs language planning policies in China and among the countries along the road. Sustainability, 12(14), 5506.

Gardner, R. C. J. (1985). Social psychology and second language learning: The role of attitudes and motivation.

Ghosh, R., & Jing, X. (2020). Fostering global citizenship through student mobility: COVID-19 and the 4th wave in internationalization of education. Beijing Intrnational Review of Education, 2(4), 553-570.

Giacometti, A., & Wøien Meijer, M. (2021). Closed borders and divided communities: Status report and lessons from Covid-19 in cross-border areas. Nordregio.

Gil, J. (2017). Soft power and the worldwide promotion of Chinese language learning: The Confucius Institute project (Vol. 167). Multilingual Matters.

Gu, Q., & Schweisfurth, M. (2015). Transnational connections, competences and identities: Experiences of Chinese international students after their return 'home'. British Educational Research Journal, 41(6), 947-970.

Hartig, F. (2015). Chinese public diplomacy: The rise of the Confucius Institute. Routledge.

Hubbert, J. (2014). Ambiguous states: Confucius Institutes and Chinese soft power in the US classroom. PoLAR: political and legal anthropology review, 37(2), 329-349.

Johnston, L. A. (2019). The Belt and Road Initiative: what is in it for China?. Asia & the Pacific Policy Studies, 6(1), 40-58.

Kurowska-Pysz, J. (2021). Analysis of changes in the barriers to cross-border educational projects–the COVID-19 pandemic effect.https://d-nb.info/126517315X/34

Paradise, J. F. (2009). China and international harmony: The role of Confucius Institutes in bolstering Beijing's soft power. Asian survey, 49(4), 647-669.

Patton, M. Q. (2014). Qualitative research & evaluation methods: Integrating theory and practice. Sage publications.

Rolland, N. (2017). China's Eurasian century?: Political and strategic implications of the belt and road initiative. National Bureau of Asian Research.

Summers, T. (2016). China's 'New Silk Roads': sub-national regions and networks of global political economy. Third World Quarterly, 37(9), 1628-1643.

Valsiner, J. (2000). Data as representations: Contextualizing qualitative and quantitative research strategies. Social science information, 39(1), 99-113.

Wang, Y., Zhan, H., & Liu, S. (2022). A comparative study of perceptions and experiences of online Chinese language learners in China and the United States during the COVID-19 pandemic. Journal of China Computer-Assisted Language Learning, 2(1), 69-99.

Wilkinson, L. R., Ferraro, K. F., & Kemp, B. R. (2017). Contextualization of survey data: What do we gain and does it matter?. Research in human development, 14(3), 234-252.

Xu, C. (2021). Research on the Soft Power of Cross-border Language and Culture in the Core Area of the Belt and Road Initiative. Paper presented at the 7th International Conference on Humanities and Social Science Research (ICHSSR 2021).

Zhao, H., & Huang, J. (2010). China's policy of Chinese as a foreign language and the use of overseas Confucius Institutes. Educational Research for Policy and Practice, 9(2), 127-142.

iEducation, 2025, 1(3), 77-104
https://doi.org/10.71204/4ekse740

A Study on Medical Management Students' Attitudes Towards the Elderly and Their Willingness to Pursue Careers in Geriatrics

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Received: 8 January 2026 / Accepted: 31 January 2026 / Published online: 7 February 2026

Abstract

Against the backdrop of rapid population ageing, this study examined whether geriatric medicine education can cultivate ageing-competent healthcare managers by focusing on medical management students. A total of 205 third-year students who completed a virtual simulation course on community hospital service optimization in ageing contexts were surveyed. Attitudes towards older adults, willingness to pursue careers in geriatric health management, and their influencing factors were analysed. The results showed that 70.7% of students demonstrated positive attitudes towards older adults, and 67.3% expressed willingness to work in geriatric health management. Female students, those reporting good relationships with older adults, greater attention to ageing-related information, and prior exposure to geriatric coursework scored significantly higher on both attitude and career intention measures. Evaluation scores of the virtual simulation course were positively associated with both outcomes, indicating that immersive, ageing-oriented simulation teaching can simultaneously enhance students' emotional attitudes and professional willingness. However, further analysis revealed a partial masking effect: increased career willingness was associated with heightened perceptions of responsibility and stress, which offset approximately 26% of the positive impact of the simulation course on attitudes towards older adults. This "high willingness–high pressure" mechanism suggests that while geriatric simulation education strengthens professional identification, it may also activate emotional strain related to perceived occupational burden. These findings indicate that geriatric medicine education for medical management students should extend beyond technical training and empathy induction to incorporate career guidance and stress-management components. Such integrated curricular design may better translate positive attitudes into sustainable career commitment, providing scalable, evidence-based strategies for cultivating compassionate and resilient healthcare managers in ageing societies.

Keywords: Ageing Contexts; Medical Management Students; Geriatric Medicine Education; Attitudes Towards Older Adults

1. Introduction

As China's population continues to age, healthcare professionals will increasingly be required to deliver services to a rapidly expanding elderly population. Medical students constitute the future healthcare workforce, and their attitudes toward older adults, as well as their willingness to pursue careers related to ageing, will play a critical role in determining the quality and efficiency of healthcare services for older adults.

Despite the growing demand for geriatric care, little is known about the attitudes and career intentions of medical management students—those who will plan, coordinate and evaluate older-adult services rather than deliver direct bedside care. Understanding and shaping their outlook is therefore essential for building an ageing-competent health-management workforce.

In response to these challenges, the present study designs a virtual simulation experimental course that optimizes community hospital services within the context of an ageing society. Focusing on medical management students who participate in this course, the study examines their attitudes toward older adults, their willingness to pursue careers in geriatric health management, and the factors influencing these outcomes. Furthermore, it explores the formative role of ageing-related virtual simulation practice courses in shaping students' attitudes and career intentions (Taylor, 2020), thereby providing evidence-based support for medical schools to refine teaching strategies and cultivate healthcare management professionals equipped with geriatric humanistic care competencies.

Against this background, the present study set out to answer four straightforward questions: (1) After finishing the virtual-simulation course, how positive are medical management students toward older adults and how willing are they to work in geriatric health management? (2) Which factors—such as gender, having taken gerontology classes, getting along well with older people, or paying attention to ageing news—make their attitudes or career willingness notably higher? (3) Does a better course rating boost attitudes directly and also indirectly by increasing career intention, and can this indirect path be "masked" when students suddenly feel the heavy responsibility of caring for older adults? (4) How big is this responsibility-pressure effect, and what does it imply for adding stress-management and career-support content to future geriatric courses?

2. Literature Review

Existing research has primarily focused on attitudes toward older adults and career intentions among medical students from clinical or caregiving perspectives. For example, Gendron (2016) examined attitudes toward older adults and related career aspirations, while Brown (1987) and Kim(2020) concentrated on medical students with specialized clinical competencies. Studies by

Yeom (2021), Zhang (2016), Jang (2019), and Lima-Silva (2021) mainly addressed geriatric healthcare and care services (Pang, 2025). However, comparatively little attention has been paid to medical management students—such as those majoring in health services administration or health services and management—particularly regarding their attitudes toward older adults and their willingness to pursue careers in geriatric health management (Liu, 2020).

In international research, Jung (2020) and Gunderson (2005) explored attitudes toward older adults and career intentions in health management–related fields, with a focus on nutrition and pharmacy students. Nevertheless, such studies remain limited in scope and depth. As China's ageing strategy shifts toward healthy and active ageing, disease-centered management alone is no longer sufficient to meet the complex health needs of older adults. The role of health management has therefore become increasingly prominent, suggesting that medical management students entering this field will play an essential role in providing health management services to an ageing population. As noted by Kang (2022), understanding this group's attitudes toward older adults and their willingness to engage in the geriatric health management industry has important practical implications for improving older adults' health outcomes and quality of life.

Both domestic and international studies have confirmed that geriatric education significantly influences attitudes toward older adults (Shao, 2021). Educational interventions that integrate knowledge acquisition with empathy cultivation have been shown to effectively and holistically improve attitudes among medical and medical-related students (Chen, 2021). In China, current intervention approaches primarily rely on community service–based models to implement blended educational interventions. However, these approaches are constrained by time and space, limiting their scalability and broader application.

To date, no study has simultaneously assessed Chinese medical management students' attitudes toward older adults and their willingness to enter geriatric health management after completing a geriatric-focused virtual-simulation course, identified the key predictors of these outcomes within this population, or tested whether stronger career intention might paradoxically weaken positive attitudes through responsibility-pressure concerns as predicted by occupational-stress theory; closing these gaps will furnish much-needed evidence for integrating stress-management and career-support modules into geriatric curricula and for scaling simulation-based training across health-management programmes nationwide.

3. Subjects and Methods

3.1. Subjects

In April 2024, third-year students majoring in Public Affairs Management at a medical university were selected via convenience sampling to participate in the course "Simulation Experiments for Optimising Community Hospital Services in an Ageing Context." All students voluntarily

participated in this survey. The questionnaire included introductory guidance, and all participants anonymously completed the survey after understanding its purpose and significance.

This survey distributed 220 questionnaires during classes in April 2024, with 214 recovered on-site, achieving a 97.3% response rate. After excluding 9 invalid questionnaires (those with ≥10% missing items, 80% consecutive identical scores, or logical contradictions), 205 valid questionnaires remained, achieving a 93.2% response rate that met the sample size requirements for subsequent regression analysis.

Invalid questionnaires were excluded based on the following criteria: 1. ≥10% missing items in the entire scale; 2. ≥80% consecutive items assigned the same score (classified as "straight-line response"); 3. Logical inconsistencies (e.g., selecting "never lived with elderly" while reporting "daily care for the elderly"); 4. Response times exceeding 120 seconds or deviating beyond 2 standard deviations.

3.2. Method

The survey comprised two sections: a self-designed questionnaire and an elderly attitudes survey questionnaire.

3.2.1. General Background Information

General background information encompassed basic demographic characteristics, educational background, life experiences,and career aspirations.Basic demographic characteristics encompass gender,household registration status,and whether the respondent is an only child. Educational background includes whether the respondent has studied geriatric courses and whether they have undertaken internships related to elderly health management. Life experiences cover family attitudes towards the elderly, whether the respondent has lived with elderly individuals,their personal relationship with the elderly,whether they have experience caring for the elderly,whether they follow information related to the elderly,and whether they have participated in elderly-related voluntary activities.Employment intention refers to whether the respondent is willing to engage in elderly health management work after graduation.

3.2.2. Effectiveness Evaluation of Management Virtual Simulation Experiments Set Against an Ageing Society Context

Banos (2012) and Castilla (2013) conducted effectiveness Evaluation of management-oriented virtual simulation experiment courses. Assessment of such courses set against an ageing society context encompasses: stimulating interest in the discipline; enhancing specialised health management knowledge; improving health management techniques for older adults; strengthening care for the elderly; bolstering interpersonal skills with older adults; and increasing aspirations to pursue careers in health management.The evaluation employs a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). The minimum total score is 6, the maximum is 30, with 18 as the midpoint. Scores above the midpoint indicate a positive evaluation of the virtual simulation course,

scores below the midpoint indicate a negative evaluation, and scores at the midpoint indicate a neutral evaluation.

3.2.3. Attitudes Towards Older Adults

The Attitude Towards Older Persons Questionnaire employed the University of California, Los Angeles (UCLA) Attitude Towards Older Persons Scale Ying (2013). This 14-item scale utilised a 5-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree). Negative items were reverse-scored, yielding a total score ranging from 14 to 70 points, with 42 points as the midpoint. Scores above the midpoint indicated a more positive attitude towards older persons,Scores below the midpoint indicate a negative attitude towards the elderly, while scores at the midpoint indicate a neutral attitude. The Cronbach's alpha coefficient for this scale is 0.76, a level consistent with the α = 0.74–0.78 previously reported among Chinese university samples.

To further verify the structural validity of this published instrument, we conducted confirmatory factor analysis (CFA) on the 14-item Chinese UCLA-GAS within the same sample. Maximum-likelihood estimation in AMOS 26 yielded an acceptable four-factor solution (social, sympathy, medical, resource): $\chi^2/df = 1.96$, CFI = 0.93, TLI = 0.91, RMSEA = 0.049 (90 % CI 0.032–0.065), SRMR = 0.042, with all standardized loadings above 0.45 ($p < 0.001$). These results align with the preceding Cronbach's α evidence and jointly support the scale's reliability and factorial validity for use in the present study.

External validity is further supported by Cheng et al. (2017), who found the Chinese UCLA-GAS to correlate positively with the Kogan Attitudes Toward Older People scale (KAOP) ($r = 0.30–0.63$, $P < 0.01$) and to load on four factors (social, sympathy, medical, resource) explaining 64 % of the variance (KMO = 0.76). In the same study the total score yielded a Cronbach's α of 0.754 and a 3-week test-retest reliability of 0.75–0.97, indicating that the Chinese version possesses satisfactory reliability and validity for the present study.

3.2.4. Statistical Methods

To address the three research questions, we applied a sequential set of statistical techniques.First, drawing on Altman's (1990) and Cumming's (2013) emphasis on summary metrics and precision, we computed descriptive statistics (means, standard deviations and 95 % CIs) for the UCLA Attitude Towards Older Persons total score and for the binary career-intention item to establish baseline levels.

Second, following Cohen's (1988) power framework and Kelley's (2012) effect-size guidelines, independent-samples t-tests, one-way ANOVA and Pearson correlations (with Cohen's d, η^2 or r) were used to identify significant predictors of these outcomes.

Third, hierarchical multiple regression—with VIF and tolerance diagnostics recommended by Hair et al. (2019)and O'brien (2007)—modelled the direct and masked effects of the virtual-simulation course on attitudes, while binary logistic regression employing the Hosmer-Lemeshow test and

Nagelkerke R^2 (Hosmer et al., 2013; Nagelkerke, 1991) estimated the probability of geriatric-health-management career willingness.

Finally, consistent with Preacher's (2008) and Hayes's (2018) mediation procedures, bias-corrected bootstrapping (5,000 samples) quantified the indirect pathway to determine whether the "high-willingness–high-pressure" mechanism significantly counteracts the course's positive influence.

3.2.5. Regression Variable Explanation

Hierarchical regression analysis of medical management students' attitudes toward the elderly, with elderly attitudes as the dependent variable, incorporated statistically significant variables from univariate analysis into the hierarchical regression method. The assigned values are shown in table 1.

Table1. Attitude Scores Towards Elderly Individuals Among Medical Management Students

Variable		Attribution and Value Range
Dependent Variable	Attitude Towards the Elderly	14–70 (higher values indicate more positive attitudes towards the elderly)
Independent Variable	Gender	1=Male, 2=Female
	Relationship with the Elderly	1=Good, 2=Average, 3=Poor
	Have you participated in volunteer activities related to the elderly?	1=Yes, 2=No
	Do you follow information related to the elderly?	1=Yes, 2=No
	Virtual Simulation Course Evaluation	Enter original value
	Intention to pursue a career in elderly health management	0=Unwilling, 1=Willing

Multivariate analysis of medical management students 'career intentions. The dependent variable was medical management students' willingness to engage in geriatric health management. Variables with statistical significance from univariate analysis were included in the binary logistic regression equation, with assigned values as shown in table 2.

Table2. Assignment Table for Medical Management Students' Willingness to Pursue Careers in Elderly Health Management

Variable		Assignment and Range of Values
Dependent Variable	Willingness to Pursue a Career in Elderly Health Management	0 = Unwilling, 1 = Willing
Independent Variable	Whether Enrolled in Gerontology Course	1=Yes, 2=No
	Relationship with the Elderly	1=Good, 2=Fair, 3=Poor
	Participation in elderly-related voluntary activities	1=Yes, 2=No
	Have you participated in volunteer activities related to the elderly?	1=Yes, 2=No
	Do you follow information related to the elderly?	1=Yes, 2=No
	Virtual simulation course evaluation	Enter original value
	Attitudes towards the elderly	Enter original value

4. Results

4.1. General Characteristics of Study Participants

The basic demographic characteristics of the subjects were as follows: 82 males (40%) and 123 females (60%); 69 subjects (33.7%) held urban household registration, while 136 subjects (66.3%) held rural household registration; 88 subjects (42.9%) were only children,and 117 subjects (57.1%) were non-only children.Regarding educational background, only 27 participants (13.2%) had taken courses on gerontology, and merely 34 (16.6%) possessed relevant practical experience in elderly health management. In terms of life experiences, the majority of respondents (184, 89.8%) reported that their families held favourable attitudes towards the elderly,178 (86.8%) had cohabited with elderly individuals, 168 (82%) maintained good relationships with them, 122 (59.5%) had caregiving experience, 112 (54.6%) participated in elderly-related volunteering, and 147 (71.7%) followed elderly-related information (Table 3).

Table3. General Background Information of Survey Participants

Basic Demographic Characteristics	Frequency	Relative Frequency
Gender		
Male	82	40
Female	123	60
Registered residence		
Urban	69	33.7
Rural	136	66.3
Only child status		
Yes	88	42.9
No	117	57.1
Whether Studied Gerontology Courses		
Yes	27	13.2
No	178	86.8
Do you have relevant internship experience in elderly health management?		
Yes	34	16.6
No	171	83.4
Life experiences		
Family Attitudes Towards the Elderly		
Good	184	89.8
Average	21	10.2
Poor	0	0
Have you ever lived with elderly people?		
Yes	178	86.8

No	27	13.2
Relationship with the elderly		
Good	168	82
Average	37	18
Poor	0	0
Do you have experience caring for the elderly?		
Yes	122	59.5
No	83	40.5
Have you participated in elderly volunteer activities?		
Yes	112	54.6
No	93	45.4
Do you follow information related to the elderly?		
Yes	147	71.7
No	58	28.3

4.2. Univariate Analysis of Medical Management Students' Evaluations of Virtual Simulation Courses, Attitudes Towards the Elderly, and Career Intentions

4.2.1. Evaluation of Virtual Simulation Courses Among Different Categories of Medical Management Students

Univariate analysis revealed significant differences ($P < 0.05$) in medical management students' evaluation scores across five variables: "family members' attitudes towards the elderly,""personal relationships with the elderly," "participation in elderly volunteer activities," "attention to elderly-related information," and "willingness to pursue geriatric health management after graduation."Specifically, students reporting a "positive" family attitude towards the elderly scored markedly higher than those with an "average" attitude; students with a "positive" personal relationship with the elderly scored higher than those with an "average" relationship; students who had participated in elderly volunteering scored significantly higher than non-participants; students who followed elderly-related information scored higher than those who did not; and students willing to pursue elderly health management careers scored markedly higher than those unwilling.The

findings indicate that the teaching effectiveness of virtual simulation courses is influenced not only by the technology itself but also by family environment, intergenerational interaction, practical experience, information engagement, and career motivation. The more positive these factors, the higher the students' evaluation of the virtual simulation course .

4.2.2. Attitude Scores Towards Older People Among Medical Management Students of Different Categories

Univariate analysis demonstrated significant differences in elderly attitude scores among medical management students according to gender, personal relationships with the elderly, participation in elderly-related volunteer activities, and engagement with elderly-related information. Specifically, female students exhibited higher attitude scores than their male counterparts. In terms of personal relationships with the elderly, students reporting good relationships achieved significantly higher scores than those reporting average relationships. Additionally, students who had participated in elderly-related volunteer activities scored significantly higher than those who had not participated (Table 4).

Table 4. Elderly Attitude Scores Among Medical Management Students by Category

Variable	Virtual Simulation Course Evaluation Score	F/t Value	P-value	Attitude towards the elderly score	F/t value	P-value
Gender						
Male	24.82 ± 4.815	-2.281	0.779	45.39 ± 7.303	-3.078	0.002
Female	25±4.149			48.67 ± 7.573	-3.078	0.002
Registered residence						
Urban	25.19±4.647	0.603	0.547	47.51±8.350	0.202	0.840
Rural	24.79±4.307			47.28±7.253		
Whether an only child						
Yes	24.48±4.331	-1.266	0.207	47.28±7.366	-0.117	0.907
No	25.26±4.469			47.41±7.837		
Whether studying geriatric courses						
Yes	25.67±4.540	0.934	0.352	48.78±7.87	1.041	0.299

No	24.81 ± 4.400			47.14±7.593		
Do you have relevant internship experience in elderly health management?						
Yes	25.47±4.581	0.785	0.433	46.26±9.093	-0.914	0.362
No	24.82±4.389			47.57±7.303		
Family Attitude Towards the Elderly						
Good	25.29±4.319	13.112	0.000	47.61±7.807	2.070	0.152
Average	21.71±4.027			45.10±5.347		
Poor	0			0		
Have you ever lived with elderly people?						
Yes	25.10±4.369	1.407	0.161	47.45 ± 7.933	0.611	0.544
No	23.81±4.650			46.74±5.171		
Relationship with the elderly						
Good	25.56±4.152	20.968	0.000	48.11±7.945	9.572	0.002
Average	22.05±4.497			43.92±4.621		
Poor	0			0		
Experience in caring for the elderly						
Yes	24.94±4.476	0.062	0.951	46.89 ± 7.823	-1.054	0.293
No	24.90±4.355			48.04±7.304		
Participation in elderly volunteer activities						
Yes	25.63±4.189	2.549	0.012	48.40±8.192	2.176	0.031
No	24.08±4.555			46.10±6.697		
Attention to elderly-related information						
Yes	25.56±4.286	3.336	0.001	48.10±8.246	2.671	0.008
No	23.33 ± 4.375			45.48±5.352		

Willingness to engage in elderly health management after graduation						
Yes	25.86 ± 4.108	4.558	0.000	46.96 ± 8.292	1.204	0.230
No	23.00±4.435			48.18 ± 5.977		

4.2.3. Correlation Analysis between Virtual Simulation Course Evaluation and Elderly Attitudes

A Pearson product-moment correlation analysis was conducted to examine the linear relationship between "virtual simulation course evaluation" and "attitudes toward the elderly" as continuous variables. The results showed a correlation coefficient of r = 0.180 (P = 0.010, <0.05), indicating a statistically significant positive correlation, albeit with a relatively weak strength. Specifically, higher course scores were associated with more positive attitudes toward the elderly among students, preliminarily confirming that virtual simulation teaching has a statistically significant positive effect on improving attitudes toward the elderly.

Since r = 0.18 only accounts for approximately 3.2% of the common variance ($r^2 = 0.032$), this suggests that while course experience can enhance attitudes, there are still numerous other factors requiring further investigation. This finding provides preliminary linear evidence for subsequent causal path analysis of "course → attitude".

Confirmatory Factor Analysis To examine factorial validity, a CFA was performed on the 14-item Chinese UCLA-GAS. The four-factor solution (social, sympathy, medical, resource) yielded adequate fit indices (Table 10). Factor loadings ranged 0.46–0.79 and were statistically significant ($p < 0.01$), indicating that the theoretical dimensionality held in our medical-management student sample. Composite reliability for each factor exceeded 0.70, and AVE values were above 0.50, demonstrating convergent validity (Table5). CFA Fit Indices and Standardised Factor Loadings for the Chinese UCLA-GAS (n = 205)

Our CFA (Table 5) corroborated the four-factor structure reported by Cheng et al. (2017), but used confirmatory rather than exploratory methods, thereby providing stronger evidence that the Chinese UCLA-GAS retains its theoretical structure when administered to medical-management students.

Table 5. Elderly Attitude Scores Among Medical Management Students by Category

Fit Index / Factor	Value / Range
χ^2/df	1.96
CFI	0.93
TLI	0.91
RMSEA (90 % CI)	0.049 (0.032–0.065)
SRMR	0.042
Standardised loadings	0.46 – 0.79*
Composite reliability	0.73 – 0.78
Average variance extracted (AVE	0.51 – 0.55

*All factor loadings significant at $p < 0.001$.

4.2.4. Career Intentions Among Different Categories of Medical Management Students

Univariate analysis revealed significant differences in career aspirations among medical management students based on whether they had taken geriatric courses, their relationship with older adults, prior experience caring for older adults, participation in geriatric volunteer activities, and engagement with geriatric-related information. Students who had taken geriatric courses, maintained better relationships with older adults, possessed experience caring for older adults, participated in geriatric volunteer activities, and followed geriatric-related information demonstrated greater willingness to pursue careers in geriatric health management post-graduation (Table 6).

Table 6. Career Intentions Among Medical Management Students by Category

Variable	Unwilling	Willing	χ^2	P-value
Gender				
Male	26	56	0.059	0.880
Female	41	82		
Registered residence				
Urban	23	46	0.020	0.876

Rural	44	92		
Only child status				
Yes	32	56	-	-
No	35	82		
Whether studying geriatric courses				
Yes	2	25	9.029	0.002
No	65	113		
Do you have relevant internship experience in elderly health management?				
Yes	8	26	1.552	0.237
No	59	112		
Family Attitudes Towards the Elderly				
Good	56	128	4.126	0.051
Average	11	10		
Poor	-	-		
Have you ever lived with elderly people?				
Yes	55	123	1.955	0.188
No	12	15		
Relationship with the elderly				
Good	48	120	7.152	0.011
General	19	18		
Poor	-	-		
Do you have experience caring for the elderly?				
Yes	32	90	5.704	0.023
No	35	48		

Have you participated in elderly volunteer activities?				
Yes	29	83	5.174	0.026
No	38	55		
Do you follow information related to the elderly?				
Yes	34	113	21.555	0.000
No	33	25		

5. Multivariate Analysis of Medical Management Students' Attitudes Towards the Elderly and Their Willingness to Work in the Field

5.1. Hierarchical Regression Analysis of Medical Management Students' Attitudes Towards the Elderly

With attitudes towards the elderly as the dependent variable, statistically significant variables from the univariate analysis were incorporated into a hierarchical regression model. Assignments are detailed in Table 1 at and Table 2, with results presented in Table 7 at and Table 8 .Model 1 represents the basic model incorporating control variables. Models 2–6 sequentially added participation in elderly-related voluntary activities, attention to elderly-related information, virtual simulation course evaluation, and willingness to pursue geriatric health management careers. Results from Models 1–3 indicate that gender and personal relationship with the elderly significantly influence medical management students' attitudes towards the elderly: female students and those with better personal relationships towards the elderly exhibit more favourable attitudes.Results from Models 4–6 indicate that when willingness to pursue geriatric health management careers is excluded from the model, virtual simulation course evaluations exert no significant influence on attitudes towards the elderly. However, when this willingness is included, virtual simulation course evaluations yield a significant positive impact on attitudes towards the elderly.This may occur because career intention suppresses the influence of virtual simulation course evaluation on attitudes towards the elderly. When career intention is uncontrolled, its negative impact masks the positive effect of course evaluation. Controlling for career intention allows the positive influence of course evaluation to manifest.

To further validate the masking effect of employment intention between virtual simulation course evaluation and elderly attitudes, a mediation analysis was conducted. This analysis controlled for gender and relationship with the elderly as independent variables, with virtual simulation course evaluation as the dependent variable, employment intention as the mediating variable, and elderly attitudes as the outcome variable. Results indicated:

Direct effect: The standardised regression coefficient of virtual simulation course evaluation on elderly attitudes decreased from 0.146 ($P < 0.05$) to 0.108 ($P < 0.05$) after introducing employment intention, remaining significant. This indicates partial masking rather than complete mediation.

Partial Mediation Effect: The path coefficient for employment intention on attitudes towards the elderly was −0.192 ($P < 0.01$), with Bootstrap 95% CI [−0.268, −0.118] excluded zero, confirming a significant negative indirect effect along the pathway "course evaluation→willingness to engage→attitudes towards the elderly". This implies that higher course ratings→increased student willingness to pursue elderly health management→heightened concerns about responsibility and pressure → a slight decrease in emotional ratings towards the elderly.

Effect size: The masking effect accounted for 26.0% of the total effect, indicating that approximately one-quarter of the positive impact of the virtual simulation course on attitudes was offset by the "perception of heightened pressure accompanying high willingness".

Given that univariate analysis revealed only "attention to elderly-related information," "enrolment in geriatric courses," "personal relationships with the elderly," "caregiving experience,"and "volunteering participation" significantly correlated with career intent ($P < 0.05$), while variables such as gender, household registration, and internship experience showed no statistical differences ($P > 0.05$), subsequent models incorporated only these five significant variables as control covariates to purify the masking effect estimation.Bootstrap sampling (n=5000) revealed: - Virtual simulation course evaluation → employment intention pathway: positive ($\beta=0.159$, SE=0.045, $P<0.001$)while the path from employment intention to attitudes towards the elderly was negative ($\beta= -0.192$, SE = 0.062, $P < 0.01$). The 95% CI for the indirect effect [-0.051, -0.012] excluded zero, confirming the existence of a negative masking effect.The direct effect remained significant ($\beta = 0.108$, SE = 0.051, $P < 0.05$), accounting for 73.8% of the total effect. This suggests that the positive influence of the course on attitudes was partially offset by the "high responsibility pressure accompanying high willingness," consistent with the single-factor screening results (Table 7).

The “high-willingness–high-pressure” pattern is consistent with occupational-stress theory: geriatric health management embodies high “decision responsibility” and “task significance,” which are core job demands (Karasek and Robert, 1979). When the course immerses students in high-consequence scenarios (e.g., resource allocation, care planning), their professional identity strengthens, yet they also appraise the heavy responsibility (“I will be accountable”). If coping resources (stress-management skills, supervisory coaching) are insufficient—as is common in undergraduate training—the resulting emotional strain can slightly lower affective ratings toward older adults (Lazarus, 1984). The present 26 % masking effect thus reflects a demand–resource imbalance rather than a genuine attitude reversal. Embedding stress-inoculation and role-modelling components within future simulation modules could buffer this strain and fully unlock the course’s attitudinal benefits.

In summary, career aspirations exert a partially negative masking effect along the 'curriculum→attitude' pathway. Whilst the curriculum enhances students' professional interest, it simultaneously activates perceptions of pressure stemming from the 'significant responsibilities of elderly care', thereby slightly inhibiting further growth in emotional attitudes.Teaching practice must concurrently embed "career support, role modelling, and stress management" content within virtual simulation modules to overcome the psychological bottleneck of "the more willing, the more hesitant," thereby fully unleashing the course's dual impact on technical skills and emotional engagement.

Table 7. Analysis of Mediation Effect

Effect path	Standardized coefficient	SE	95% CI	Effect size
Total effect (Course→Attitude)	0.146*	0.059	[0.029,0.262]	100%
Direct effect	0.108*	0.051	[0.008,0.208]	73.8%
Indirect effect (Curriculum → Willingness → Attitude)	−0.038**	0.015	[−0.068,−0.010]	−26.0%

Table 8. Analysis Results of Attitude Model Towards Elderly Population Among Medical Management Students

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
Gender	0.222**	0.215**	0.214**	0.211**	0.210**	0.206**
Relationship with the elderly	-0.223**	-0.207**	-0.191**	-0.165*	-0.203**	-0.169*
Whether one has participated in volunteer activities related to the elderly		-0.111	-0.097	-0.086	-0.106	-0.093
Whether one follows information related to			-0.053	-0.042	-0.097	-0.091

the elderly						
Virtual simulation course evaluation				0.101		0.146*
Intention to Pursue a Career in Geriatric Health Management					-0.158*	-0.192**
F	10.479	7.956	6.077	5.289	5.973	5.742

Note: *p<0.05, **p<0.01, ***p<0.001

5.2. Multivariate Analysis of Career Intentions Among Medical Management Students

Using medical management students' employment intentions in geriatric health management as the dependent variable, statistically significant variables from univariate analysis were incorporated into a binary logistic regression equation. Assigned values are detailed in Table 8 of . The regression equation yielded P < 0.001, indicating statistical significance of the model; the Hosmer-Lemeshow test P-value was 0.649, demonstrating good model fit.

Results indicate that "whether one follows elderly-related information," "whether one has taken gerontology courses," "virtual simulation course evaluations,"and "attitude towards the elderly" as influencing factors for career intent (P < 0.05). The regression coefficients were 1.437, 2.419, 0.159, and -0.081 respectively, indicating that "attention to elderly-related information," "enrolment in geriatric courses," and "virtual simulation course evaluation" positively influence career intent, while "attitude towards the elderly" negatively impacts it.

The OR value for "whether one follows information related to the elderly" was 4.209, indicating that medical management students who follow such information have 4.209 times the willingness to pursue careers in geriatric health management compared to those who do not. The OR value for "whether one has taken geriatric courses" was 11.235, indicating that students who have taken such courses have 11.235 times the willingness to pursue careers compared to those who have not.The OR value for "virtual simulation course evaluation" was 1.173, indicating that for each unit increase in students' evaluation scores for virtual simulation courses, their willingness to pursue careers in this field increased by 17.3%; The OR value for "attitude towards the elderly" was 0.922, indicating that for each unit increase in students' attitude scores towards the elderly, their willingness to pursue careers in this field was 0.922 times that of the baseline. Results are presented in Table 8.

Table 10 summarizes the multicollinearity diagnostic results for the stratified regression model and logistic regression model. All VIF values are <2.0, significantly lower than the commonly used

thresholds of 5 or 10, with tolerances all> 0.40, indicating no significant multicollinearity among independent variables and reliable regression coefficient estimatesHair et al. (2019).The highest VIF (1.339) was observed for the item “Do you pay attention to information related to the elderly?”, suggesting minimal overlap with other predictive variables. Therefore, the regression coefficients reported in the attitude model (Table 8) and the occupational intention model for elderly health management (Table 9) do not exhibit concerning multicollinearity issues and can be interpreted with confidence.

Table 9. Analysis of Medical Management Students' Intentions Regarding Employment in Geriatric Health Management

Independent Variables	Regression Coefficient	Standard Error	P-value	*Odds* Ratio
Relationship with the elderly	0.440	0.474	0.353	1.552
Experience in caring for the elderly	0.530	0.357	0.138	1.699
Have you ever participated in volunteer activities related to the elderly?	0.194	0.370	0.599	1.215
Do you follow information related to the elderly?	1.437	0.407	0.000	4.209
Whether taking courses on ageing	2.419	0.809	0.003	11.235
Virtual Simulation Course Evaluation	0.159	0.045	0.000	1.173
Elderly Attitude	-0.081	0.028	0.004	0.922
Constant	-1.207	1.374	0.380	0.299

Note: Cox-Snell $R^2 = 0.251$, Nagelkerke $R^2 = 0.350$, $P = 0.000$

Table 10. Regression Analysis of Attitude towards the Elderly and Multiple Linear Analysis of the Willingness to Work in Medical Management

Project	Nonstandardized Coefficient		Standardized Regression Coefficient Beta	T-value	P-value	Collinearity Statistics	
	regression coefficient	standard error				Tolerance	VIF
Constant	46.021	4.623		9.955	0.000		
Gender	3.196	1.022	0.206	3.128	0.002	0.992	1.008
Relationship with the elderly	-3.331	1.433	-0.169	-2.325	0.021	0.818	1.222
Have you ever participated in volunteer activities related to the elderly?	-1.416	1.066	-0.093	-1.329	0.185	0.883	1.132
Do you follow information related to the elderly?	-1.537	1.281	-0.091	-1.200	0.232	0.747	1.339
Virtual Simulation Course Evaluation	0.252	0.124	0.146	2.029	0.044	0.830	1.204
Intention to Pursue a Career in Geriatric Health Management	-3.115	1.162	-0.192	-2.680	0.008	0.837	1.195

6. Discussion

6.1. Attitudes of Medical Management Students Towards the Elderly and Influencing Factors

This study found that medical management students' attitude towards the elderly scored 47.36 ± 7.620. Among them, 145 individuals (70.7%) scored above the median of 42 points, 29 individuals (14.1%) scored exactly 42 points, and 31 individuals (15.2%) scored below 42 points, indicating an overall positive attitude .

Influential factors included gender and personal relationships with older adults. Previous research confirming gender's impact on medical students' attitudes towards older adults was replicated here, with female students exhibiting more positive attitudes than their male counterparts .

Among life experiences, the relationship with older people significantly influenced medical management students' attitudes towards them. Students with better relationships with older people held more positive attitudes. However, factors such as "whether they pay attention to information related to older people" and "whether they have participated in volunteer activities related to older people" did not affect students' attitudes towards older people. Previous research has confirmed that participation in volunteer activities related to older people positively influences medical students' attitudes towards them .However, this conclusion was not confirmed among medical management students, potentially due to the lower quality of their participation in elderly-related volunteering.

Regarding educational background, taking geriatric courses does not influence students' attitudes towards the elderly. Conversely, virtual simulation course evaluation scores do affect these attitudes: higher scores correlate with more favourable attitudes.Extensive domestic research confirms that exposure to geriatric medicine education significantly influences medical students' attitudes towards older adults Ross (2020). However, the impact of differing curricula and content on these attitudes remains to be fully established. In this study, the geriatrics courses undertaken by medical management students were not tailored to their disciplinary characteristics, whereas the virtual simulation course developed specifically for this programme did influence their attitudes towards older adults.

The virtual simulation course influences attitudes towards the elderly through career aspirations, with medical management students' career intentions serving as a predictor of these attitudes.It is generally assumed that students willing to pursue careers in geriatric health management should exhibit more positive attitudes towards the elderly. Specifically, the virtual simulation course produces a significant positive effect on attitudes through a three-stage pathway: "immersive experience – role empathy–professional identification". Students complete tasks such as functional impairment assessments and home visits from a "caregiver's" first-person perspective within VR scenarios, where high interactivity activates emotional resonance.

However, career aspirations exert a partial negative masking effect within the 'course→attitude' pathway. This may stem from the fact that information about older adults and geriatric medicine education received by these medical management students often centres on negative scenarios,

leaving them without systematic, comprehensive geriatric medicine training.The masking effect indicates that approximately 26% of the positive impact of virtual simulation courses on attitudes towards older adults is offset by "willingness to practise": the higher the course evaluation, the greater the students' willingness to engage in geriatric health management. However, this "willingness" simultaneously evokes psychological pressure stemming from a sense of "significant responsibility," leading to a slight decline in emotional scores.This cognitive dynamic may result in medical management students expressing a willingness to work in geriatric health management from a professional perspective, yet maintaining negative attitudes towards older adults.Therefore, while maintaining immersion and motivation, courses should incorporate stress-reduction and support components to mitigate the emotional attrition caused by "high willingness-high pressure," thereby fully unlocking their potential to enhance attitudes towards the elderly.

6.2. Career Intentions and Influencing Factors Among Medical Management Students

The majority (138 students, 67.3%) of medical management students expressed willingness to pursue careers in elderly health management post-graduation, indicating relatively positive career aspirations.Among life experiences, only "whether one pays attention to information related to the elderly" can predict career intentions among medical management students. Those who pay attention to such information are 4.209 times more likely to pursue geriatric health management careers than those who do not. This indicates that guiding students to proactively engage with elderly-related information in daily life can enhance their willingness to work in this field.

Regarding educational background, "whether they have taken geriatric courses" predicts students' willingness to pursue careers in geriatric health management. Students who have taken such courses are 11.235 times more likely to express such willingness than those who have not. This demonstrates that taking geriatric courses significantly increases students' desire to work in geriatric health management.

Evaluations of virtual simulation courses influence medical management students' career aspirations. Each unit increase in students' evaluation scores for virtual simulation courses elevates their career aspirations by 17.3%. This demonstrates that virtual simulation courses related to ageing can also significantly enhance students' willingness to pursue careers in geriatric health management. Evidently, diverse forms of medical education courses related to the elderly can collectively enhance professional competence and strengthen medical management students' aspirations for careers in geriatric health management.

Attitudes towards older adults can influence medical management students' willingness to pursue careers in geriatric health management. Existing research largely confirms that positive attitudes towards older adults among clinical medicine and nursing students positively predict their willingness to work in geriatric medicine and nursing (Sivarajan, 2025). Furthermore, studies have demonstrated that positive attitudes towards older adults among students in other medical-related fields, such as nutrition, are significant predictors of their willingness to collaborate with older adults.However, in

this study, each unit increase in medical management students' attitude scores towards older adults reduced their career intention by 0.922 times. This indicates that attitudes towards older adults inhibit career intention among these students, contradicting existing research findings.This may relate to medical management students' perception of responsibility: those with more favourable attitudes towards older adults tend to have better relationships with them. They may recognise that working in elderly health management entails greater responsibility, and this awareness of occupational pressure and duty may deter them from pursuing careers in this field. Guiding medical management students with positive attitudes towards older adults to consider and enter the health management sector, while enhancing their professional understanding and identification with the field, holds significant importance for improving the quality of health management for older adults.

6.3 Limitations of the Study The following limitations should be noted when interpreting the results

6.3.1 Insufficient sample representativeness

The data were collected through convenience sampling from third-year students majoring in Public Administration at a single medical university, resulting in a highly concentrated sample in terms of geographic location, institutional type, and academic year. This may introduce selection bias. Consequently, the study's conclusions may not be generalizable to other universities, academic years, or medical management students with different educational systems.

6.3.2 Cross-sectional Design

All variables were measured immediately after the completion of the virtual simulation experiment. Long-term effects could not be inferred, nor could it be determined whether students' attitudes and career intentions changed over time or with subsequent clinical-management internship experiences.

6.3.3 Uncontrolled Potential Factors

Variables potentially influencing attitudes, such as family socioeconomic status, prior virtual simulation experience, and personality traits, were not included in the model. Additionally, environmental factors like teaching styles of instructors and concurrent interventions in other courses were not separated, which may lead to estimation bias.

7. Conclusion

As China's population continues to age, single-disease management can no longer meet the health needs of older adults. Healthy ageing and active ageing have become development priorities, with health management gaining increasing prominence (Hao, 2019). Medical management students, as a vital reserve force for geriatric health management services, directly influence the quality and efficiency of healthcare services for older adults through their attitudes and willingness to work in this field.Regarding research status, existing domestic studies predominantly focus on medical students in clinical medicine, nursing, and other specialisations requiring professional medical skills,

concentrating on geriatric medical services and care domains. Research involving medical management students remains scarce. While studies confirm that geriatric medicine education can influence students' attitudes towards the elderly, their implementation methods face temporal and spatial constraints, hindering large-scale replication and promotion. Overseas research primarily targets students in nutrition,pharmacy, and other medical-related disciplines (James, 2024).These studies explored their attitudes towards the elderly and willingness to pursue careers in health management (Vitman-Schorr, 2025).

Consequently, this study engaged 205 third-year students from a public health management programme at a medical university in April 2024, all voluntarily participating in an anonymous survey (having completed a virtual simulation course on optimising community hospital services in an ageing society context). Utilising a self-designed questionnaire (covering general background information and career aspirations) alongside the UCLA Attitudes Towards the Elderly Scale,Employing a five-point Likert scale, the study evaluated the virtual simulation course's effectiveness and students' attitudes towards older adults. SPSS 26.3 was used to conduct univariate analysis, hierarchical regression analysis, and binary logistic regression analysis to investigate students' attitudes towards older adults, their willingness to pursue careers in elderly health management, and the influencing factors. Results indicate that gender and relationships with older adults influence students' attitudes towards older adults, while taking geriatric courses and following information related to older adults influence career willingness.

Concurrently, this study explored the role of the virtual simulation practice course in shaping students' relevant attitudes and career aspirations (Beverly, 2025).Findings indicate that students' attitudes towards the elderly and their willingness to pursue careers in this field generally exhibit a positive trend. It was confirmed that a medical management virtual simulation course set against the backdrop of an ageing society can simultaneously enhance medical management students' attitudes towards the elderly and their willingness to work in this field. However, this "dual enhancement" effect is not linear but follows a psychological pattern characterised by a "high willingness-high stress" dynamic:When students developed strong professional interest through the course, their emotional ratings towards the elderly slightly declined due to concerns about caregiving responsibilities and occupational burdens (masking effect accounted for 26%).

Based on these findings, course design must extend beyond technical and emotional experiences to concurrently integrate modules on "career support, role modelling, and stress management." This helps highly empathetic students translate positive attitudes into tangible career commitment. For future implementation, it is recommended to bundle virtual simulation experiments with compulsory geriatrics courses and high-quality volunteer programmes into a "trinity" teaching package. Concurrently, establish joint university-industry-government internship bases.to continuously monitor students' long-term career choices, thereby validating the intervention's sustainability and transferability (Rashidi, 2022). This will provide empirical evidence and replicable, scalable models for medical schools to adjust teaching strategies, cultivate healthcare management personnel with

geriatric care competencies, and optimise management talent development pathways in an ageing society.

Author Contributions:

Luyao Pan contributed to the conceptualization, methodology, and data analysis of the study. Wanting Lin provided guidance on theoretical framing and critical revisions of the manuscript. Xiangyu Chen supervised the overall project and coordinated the research process. All authors have read and agreed to the published version of the manuscript.

Funding:

This research received external funding. This research was funded by Rational Nurturing for Longevity–A New Resource-Regulation Model Integrating Community Will and Social Organizations, grant number 2024R413A046 and the project Elderly Care Intelligent Control–A New AI-Enabled Community Elderly Care Resource Regulation Solution, grant number 2025R413A058. The APC was funded by Zhejiang Province Undergraduate Student Innovation and Technology Activity Programme.

Institutional Review Board Statement:

Not applicable.

Informed Consent Statement:

Not applicable.

Data Availability Statement:

Not applicable.

Acknowledgments:

The authors would like to express their sincere gratitude to the funding agency for its financial support, to all colleagues and partner institutions for their valuable guidance and assistance throughout this study, and to the editors for their thoughtful comments and professional handling of the manuscript.

Conflict of Interest:

The authors declare no conflict of interest.

References

Altman, D. G. (1990). Practical statistics for medical research. Chapman and Hall/CRC.

Baños, R. M., Etchemendy, E., Castilla, D., García-Palacios, A., Quero, S. & Botella, C. (2012). Positive mood induction procedures for virtual environments designed for elderly people. Interact. Comput., 24(3), 131–138.

Beverly, E. A., Miller, S., Love, M. & Love, C. (2025). Feasibility of a Cinematic-Virtual Reality Program Educating Health Professional Students About the Complexity of Geriatric Care: Pilot Pre-Post Study. JMIR Aging, 8, e64633.

Castilla, D., Garcia-Palacios, A., Bretón-López, J., Miralles, I., Baños, R. M., Etchemendy, E., Farfallini, L. & Botella, C. (2013). Process of design and usability evaluation of a telepsychology web and virtual reality system for the elderly: Butler. Int. J. Hum.-Comput. Stud., 71(3), 350–362.

Chen R., Zheng X., Cheng J., Chen G., Bai Z. l. & Hu Z.. (2021). Research progress on medical students' attitudes towards older adults. Journal of PLA Nursing, 38(01), 61-64.

Cheng, L., Zhang, H. J., Li, G., & Liu, T. (2017). Reliability and validity of the Chinese version of the UCLA Attitude Toward Older Persons Scale. Chinese Journal of Gerontology, 37(18), 4641-4643.

Cohen, J. (1988). Statistical power analysis for the behavioral sciences. New York: Routledge.

Cumming, G. (2013). Understanding the new statistics: Effect sizes, confidence intervals, and meta-analysis. Routledge.

Gendron, T., Welleford, E. A., Pelco, L. & Myers, B. J. (2016). Who is likely to commit to a career with older adults? Gerontology & geriatrics education, 37(2), 208-228.

Gunderson, A., Tomkowiak, J., Menachemi, N. & Brooks, R. (2005). Rural physicians' attitudes toward the elderly: evidence of ageism? Quality Management in Healthcare, 14(3), 167-176.

Hair, J. F., Babin, B. J., Anderson, R. E., & Black, W. C. (2019). Multivariate Data Analysis (8th ed.). England: Pearson Prentice.

Hao, X., Yang, Y., Gao, X. & Dai, T. (2019). Evaluating the Effectiveness of the Health Management Program for the Elderly on Health-Related Quality of Life among Elderly People in China: Findings from the China Health and Retirement Longitudinal Study. Int J Environ Res Public Health, 16(1).

Hayes, A. F. (2018). Introduction to Mediation, Moderation, and Conditional Process Analysis: A Regression-Based Approach (Methodology in the Social Sciences) (2nd ed.). New York: The Guilford Press.

Hosmer, J. D. W., Lemeshow, S., & Sturdivant, R. X. (2013). Applied logistic regression. Hoboken: John Wiley & Sons.

James, E., Butler, T., Nichols, S., Goodall, S. & O'doherty, A. F. (2024). Provision of dietary education in UK-based cardiac rehabilitation: a cross-sectional survey conducted in conjunction with the British Association for Cardiovascular Prevention and Rehabilitation. British Journal of Nutrition, 131(5), 880-893.

Jang, I., Oh, D. & Kim, Y. S. (2019). Factors associated with nursing students' willingness to care for older adults in Korea and the United States. International journal of nursing sciences, 6(4), 426-431.

Jung, S. E., Lawrence, J., Hermann, J. & Mcmahon, A. (2020). Application of the theory of planned behavior to predict nutrition students' intention to work with older adults. Journal of Nutrition in Gerontology and Geriatrics, 39(1), 44-55.

Kang, H.-J. (2022). Influence of attitude toward the elderly on job satisfaction among social welfare officials: Focused on the moderating effect of compassion competence. Journal of the Korea Convergence Society., 13(10), 313-323.

Karasek, J., & Robert, A. (1979). Job demands, job decision latitude, and mental strain: Implications for job redesign. Administrative science quarterly, 285-308.

Ken, K., & J, P. K. (2012). On effect size. Psychological methods, 17(2), 137.

Kim, S. Y. (2020). A Study on the elderly oral health and elderly health attitudes of dental hygiene student. Journal of Digital Convergence, 18(12), 153-157.

Lazarus, R. S. (1984). Stress, appraisal, and coping. New York: Springer.

Lima-Silva, T. B., Almeida, E. B. D., Borges, F. S. P. S., Ordonez, T. N. & Domingues, M. a. R. (2021). Extramural gerontology management devising an integrating record for a geriatric care service, an experience report. Dementia & Neuropsychologia, 15, 112-120.

Liu, C., Bartram, T. & Leggat, S. G. (2020). Link of patient care outcome to occupational differences in response to human resource management: a cross-sectional comparative study on hospital doctors and nurses in China. International Journal of Environmental Research and Public Health, 17(12), 4379.

Nagelkerke, N. J. D. (1991). A note on a general definition of the coefficient of determination. biometrika, 78(3), 691-692.

O'brien, R. M. (2007). A caution regarding rules of thumb for variance inflation factors. Quality & quantity, 41(5), 673-690.

Pang, R., Liu, F. & Li, T. (2025). Professional values, ageism, attitudes and willingness towards geriatric care among nursing students in China: a multiple path analysis. BMC Nursing, 24(1), 162.

Preacher, K. J., & Hayes, A. F. (2008). Asymptotic and resampling strategies for assessing and comparing indirect effects in multiple mediator models. Behavior Research Methods, 40(3), 879-891.

Rashidi, F. & Azadi, A. (2022). Attitudes toward and willingness to work with older people and its predicting factor among medical science students in Iran. Working with Older People, 26(4), 397-406.

Ross, L., Jennings, P. & Williams, B. (2020). Improving health care student attitudes toward older adults through educational interventions: A systematic review. Clinical Education in Geriatrics, 74-94.

Shao, Y. T., & Xu, Y. (2021). Research progress on medical students' attitudes towards older adults. Journal of PLA Nursing, 38(01), 61-64.

Sivarajan, R. & Varma, A. M. (2025). Beyond the call of duty: exploring early career nurses' mobility ambitions and commitment in the face of workplace challenges. Career Development International, 30(4), 443-460.

Taylor, W. C., Das, B. M., Paxton, R. J., Shegog, R., Suminski, R. R., Johnson, S. R., Akintola, O. A., Hammad, A. & Guidry, M. K. (2020). Development and implementation of a logic model: Occupational stress, physical activity, and sedentary behavior in the workplace. Work, 67(1), 203-213.

Vitman-Schorr, A. & Rozani, V. (2025). Examining final-year healthcare students' willingness to work with older adults: a mediator-moderator analysis of knowledge, ageism, and grandparental relationships. BMC Medical Education, 25(1), 769.

Yeom, E. Y. (2021). The influence of dementia knowledge, ageism and humanism on attitude toward the elderly with dementia in nursing students. The Journal of the Korea Contents Association, 21(8), 629-639.

Ying, Y. & Bi-Hua, Z. (2013). Reliability and Validity of the Chinese Version of the University Mattering Scale. Journal of West Anhui University.

Zhang, S., Liu, Y. H., Zhang, H. F., Meng, L. N. & Liu, P. X. (2016). Determinants of undergraduate nursing students' care willingness towards the elderly in China: Attitudes, gratitude and knowledge. Nurse Education Today, 43, 28-33.