Journal of Contemporary Educational Research, 2026, Volume 10, Issue 1
http://ojs.bbwpublisher.com/index.php/JCER
ISSN Online: 2208-8474
ISSN Print: 2208-8466

The Impact of Digital Transformation of Education on the Quality of Talent Training in Colleges and Universities: A Case Study of the Statistical Test of Mediating Effect and Moderating Effect

Linjia Li

School of Science, Shandong Jianzhu University, Jinan 250101, Shandong, China

Abstract: To demonstrate the intrinsic mechanism linking educational digital transformation with higher education quality, this study investigates 1,200 teachers and students from four universities in City A. We construct a mediation effect model examining "digital transformation → pedagogical innovation → learning experience optimization → talent development quality," along with a moderating effect model where "digital literacy" acts as a mediator. Statistical validation is conducted using structural equation modeling and hierarchical regression analysis. The findings demonstrate that educational digital transformation significantly enhances the quality of talent cultivation in higher education institutions. Both pedagogical innovation and optimized learning experiences partially mediate this relationship. The digital literacy of both teachers and students positively moderates the impact of digital transformation on talent development quality, with particularly pronounced effects observed among those with higher digital literacy. These insights provide practical pathways and quantitative evidence for universities to leverage digital transformation in improving talent cultivation outcomes.

Keywords: Digital transformation in education; Quality of talent cultivation in higher education institutions; Mediating effect; Moderating effect; Statistical testing

Online publication: February 4, 2026

1. Introduction

In the era of rapid digital economy development, the digital transformation of education has become the core driving force for promoting high-quality development in higher education. It is also a key approach for universities to address the homogenization of talent cultivation and enhance the precision of talent development. As the primary arena for talent cultivation, the quality of talent development in universities directly impacts the implementation effectiveness of the national innovation-driven development strategy. Currently, universities

across China are actively advancing digital campus initiatives and adopting intelligent teaching platforms. However, the extent to which digital transformation enhances the quality of talent cultivation and its underlying mechanisms still requires in-depth exploration [1]. Existing research primarily focuses on practical approaches to educational digital transformation or evaluation systems for talent cultivation quality, while lacking quantitative analysis of their interconnections. Notably, studies often overlook the mediating role of intermediate variables and the boundary effects of moderating variables.

2. The core influence mechanism of educational digital transformation on the quality of talent training in colleges and universities

2.1. The core dimensions and characteristics of educational digital transformation

The digital transformation of education is not only the application of technology, but also a systematic reconstruction of all elements and processes of teaching and education in colleges and universities supported by digital technology. Based on research data and practical observations, this study defines the digital transformation of education through three core dimensions: First, digital resources, where universities leverage digital platforms to build extensive and diverse online teaching repositories, enabling the sharing and reuse of high-quality educational resources; Second, digitalized teaching processes, which utilize intelligent teaching systems to digitally empower interactive learning, process monitoring, and student performance analysis; Third, digitalized management services, which employ big data technology to optimize talent development planning, teaching evaluation, and career guidance workflows. These interconnected and progressively layered dimensions collectively form a comprehensive framework for digital transformation in higher education, laying the foundation for enhancing the quality of talent cultivation [2].

2.2. The core evaluation dimensions of the quality of higher education talents

Based on the core goal of higher education talent training, this study defines the quality of talent training from three dimensions: knowledge mastery, ability enhancement, and quality cultivation. The knowledge mastery dimension evaluates students' comprehension and application of core disciplinary knowledge; the competency enhancement dimension assesses the development of key skills, including innovative thinking, practical abilities, and teamwork; while the literacy cultivation dimension focuses on fostering students' lifelong learning awareness and digital ethics literacy [3]. In the process of the research, the comprehensive and accurate evaluation of the quality of talent training is ensured by combining the evaluation from the perspective of teachers and students with the verification of objective results, which provides a reliable measurement foundation for the subsequent effect test.

2.3. The direct positive impact of educational digital transformation on the quality of talent training

The statistical analysis reveals that the standardized regression coefficient of educational digital transformation on talent cultivation quality in higher education institutions is 0.42 ($P < 0.001$), indicating a significant positive correlation between the two. From a practical standpoint, digital transformation of educational resources transcends the temporal and spatial constraints of traditional classrooms. Through online platforms, students can access high-quality learning materials anytime and anywhere, thereby broadening their knowledge acquisition channels and enhancing learning outcomes. The digitization of teaching processes enables "tailored instruction" via intelligent learning analytics, allowing educators to adjust teaching strategies based on students' performance

data, effectively boosting practical and innovative skills. Meanwhile, digitalized management services optimize training workflows and align with employment demands, ensuring the cultivation of students' comprehensive competencies. This direct effect reflects the basic effect of digital transformation on the quality of talent training in colleges and universities.

3. Mediating effect: The mediating effect of teaching mode innovation and learning experience optimization

3.1. Test results of the mediation effect

This study employs structural equation modeling to examine the mediating effects of teaching model innovation and learning experience optimization. The results indicate that the mediating effects of both variables are statistically significant, and they both represent partial mediation (see **Table 1**). Specifically, the indirect effect of educational digital transformation on talent cultivation quality through teaching model innovation is 0.18 ($P < 0.01$), accounting for 30.5% of the total effect. Meanwhile, the indirect effect of learning experience optimization is 0.15 ($P < 0.01$), contributing 25.4% of the total effect. These findings demonstrate that teaching model innovation and learning experience optimization serve as key transmission pathways through which educational digital transformation influences talent cultivation quality.

Table 1. Results of mediation effect testing

Ways and means	Standardized regression coefficient	Standard error	*P* value	Indirect effect size	Proportion of total effect
Digital transformation of education → innovation of teaching mode → quality of talent training	0.32	0.04	< 0.01	0.18	30.5%
Digital transformation of education → optimization of learning experience → quality of talent training	0.29	0.05	< 0.01	0.15	25.4%
Digital transformation of education → quality of talent training (direct path)	0.26	0.04	< 0.001	-	44.1%
Ensemble	0.59	0.03	< 0.001	0.59	100%

3.2. The mediating mechanism of teaching mode innovation

The digital transformation of education provides technological support and pathways for innovating teaching models, which in turn directly enhances the quality of talent cultivation. Against the backdrop of digital transformation, the traditional teaching model where teachers play a dominant role and students passively accept knowledge has been disrupted. Innovative approaches such as flipped classrooms, blended learning, and project-based learning have gained widespread adoption. For instance, through online teaching platforms, educators can pre-release preview videos and learning task sheets, enabling students to acquire foundational knowledge before class. The classroom then focuses on explaining key and challenging concepts, facilitating group discussions, and conducting practical explorations, thereby enhancing the interactivity and relevance of instruction [4]. This mode of innovation not only improves the students' learning initiative, but also cultivates their ability of cooperation and innovative thinking, thus achieving the improvement of the quality of talent training. The statistical data show that the professional ability scores of students in classes adopting innovative teaching models are, on average, 15.3% higher than those in traditional classes, which validates the transmission effect of teaching model innovation.

3.3. The mediating mechanism of learning experience optimization

The optimization of learning experience serves as another critical pathway through which educational digital transformation impacts the quality of talent cultivation. By leveraging technological capabilities, digital transformation enhances students' learning experience across three dimensions: learning environment, interactive learning, and feedback mechanisms. In terms of learning environments, digital resources such as virtual simulation labs and immersive learning platforms provide students with intuitive and engaging learning scenarios, reducing the difficulty of understanding complex knowledge. Regarding interactive learning, tools like intelligent Q&A systems and online discussion communities break down barriers between teachers and students, as well as among students, enabling timely and efficient communication. For learning feedback, intelligent learning analytics systems can track students' progress and knowledge mastery in real time, offering personalized learning suggestions to help students pinpoint their weak areas. The optimized learning experience has enhanced students' satisfaction and engagement in learning, thereby contributing to the improvement of talent cultivation quality. Survey results indicate that students with higher learning experience scores significantly outperformed those with lower scores in dimensions such as knowledge mastery and skill enhancement ($P < 0.05$).

4. Moderating effect: The boundary role of digital literacy of teachers and students

4.1. Test results of the adjustment effect

This study employed hierarchical regression analysis to examine the moderating role of digital literacy among teachers and students. The results demonstrated that the interaction term between educational digital transformation and digital literacy exhibited significant regression coefficients ($\beta = 0.16$, $P < 0.01$) in relation to talent cultivation quality, indicating a pronounced positive moderating effect of digital literacy on educational outcomes. Further subgroup analysis revealed that among individuals with higher digital literacy, the positive impact of educational digital transformation on talent development quality was more pronounced ($\beta = 0.58$, $P < 0.001$). In contrast, while the positive effect remained significant, its coefficient markedly decreased ($\beta = 0.23$, $P < 0.05$) in groups with lower digital literacy (see **Table 2**).

Table 2. Results of the adjustment effect group test

Group types	Standardized regression coefficient	Standard error	*P* value	R^2
High digital literacy group	0.58	0.04	< 0.001	0.34
Low digital literacy group	0.23	0.06	< 0.05	0.05

4.2. Mechanism of moderating effects

The role of teachers' and students' digital literacy at the essential level shows the matching degree of "technology gives energy" and "subject has ability," which brings the effect to the quality of talent training. Teachers with high digital literacy can skillfully utilize digital teaching tools to design innovative lesson plans, explore and integrate digital resources, and fully leverage the educational empowerment potential of digital technologies. Moreover, such teachers can provide effective guidance, enabling students to engage in self-directed learning and hands-on exploratory activities using digital tools, thereby significantly enhancing the effectiveness of teaching. Students with high digital literacy can swiftly adapt to digital learning environments. By skillfully using online resources and tools, they engage in self-directed learning and participate in interactive online

activities. They actively explore the educational value of digital technologies, thereby enhancing their knowledge absorption and achieving personal growth goals. In contrast, when both teachers and students demonstrate low digital literacy, they struggle to fully leverage the advantages of digital technologies. Teachers may find themselves constrained in applying digital teaching tools due to technical unfamiliarity, while students might fail to effectively utilize digital learning resources because of insufficient digital literacy skills. This creates a vicious cycle that ultimately undermines the positive impact of educational digital transformation on enhancing talent development quality. The effect of this regulation suggests that universities should prioritize the cultivation of digital literacy among faculty and students during the synchronized advancement of digital transformation.

5. Conclusion

This study systematically reveals the impact mechanism of educational digital transformation on the quality of talent cultivation in higher education institutions by employing statistical testing methods based on mediation and moderation effect models. The research findings demonstrate that educational digital transformation significantly enhances talent cultivation quality in higher education institutions through synergistic digitalization across three dimensions: resource integration, instructional processes, and administrative services. The innovative transformation of teaching models and optimization of learning experiences partially mediate this effect, collectively forming a core transmission pathway system. Furthermore, digital literacy among faculty and students positively moderates this relationship, with individuals possessing higher digital literacy levels more effectively realizing the empowering value of digital transformation.

Disclosure statement

The author declares no conflict of interest.

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