Teacher Conceptions of Applying Educational Technology in Course Teaching: A Grounded Theory Study

Yanjing Ma
Jilin International Studies University, Changchun, Jilin, China

Abstract: This study explores higher-education teachers' conceptions of educational technology, factors influencing its application, self-perceived competency, and views of training programs. Adopting systematic grounded theory, semi-structured interviews were conducted with 20 teachers at a Chinese university. Findings reveal that teachers view educational technology as supportive tools and instructional processes, guided by educational beliefs and driven by professional responsibility and social development. Four layers of influencing factors were identified: teacher-level factors, student-level factors, technology-level factors, and environmental-level factors. Teachers' motivation for improvement comes from both internal professional responsibility and external institutional and peer pressure. They prefer practical, pedagogically integrated training with flexible, interactive, and classified delivery modes. This study provides a grounded framework to understand teachers' real needs and offers implications for optimizing institutional support and training systems to promote deep integration of educational technology in higher education.

***Keywords*:** educational technology, teacher conception, grounded theory, technology integration, teacher training

1. Introduction

Digital transformation has profoundly restructured the landscape of global education, bringing new opportunities and imperatives for instructional innovation. As noted by UNESCO, the rapid evolution of societal and educational demands requires continuous redefinition of teachers' professional identities and responsibilities in technology-rich contexts. In China, national strategic documents including the Education Informatization 2.0 Action Plan and China's Education Modernization 2035 have elevated the deep integration of information technology into teaching as a core policy direction, with a strong emphasis on enhancing teachers' digital competence as a key pillar of educational modernization. Empirical studies have consistently demonstrated that appropriate integration of educational technology enriches pedagogical practices, expands teachers' professional roles, and strengthens the cultivation of innovative and applied talents.

The global pandemic has further accelerated the institutionalization of online and blended learning models. In response to public health requirements, the Ministry of Education of China mandated large-scale emergency online instruction across higher education institutions to sustain educational continuity. For university teachers, educational technology ceased to be an optional instructional choice and evolved into an indispensable professional competency. Against this dual backdrop of policy promotion and practical necessity, scholarly attention to teachers' technology integration has grown substantially [1].

Despite widespread advocacy and policy support, real-world implementation remains constrained by persistent challenges. Research indicates that many university teachers remain at a superficial level of technology use, and high-level, pedagogically sound integration remains limited [2]. Technology-supported instructional designs frequently fail to align with students' cognitive rules and learning characteristics. Meanwhile, the effectiveness of institutional educational technology training remains suboptimal. Many training programs overemphasize technical operation while neglecting pedagogical reasoning and authentic instructional application, resulting in weak transfer to actual teaching. Internal administrative data from X university reveals that the average attendance rate of educational technology training was merely 10.73%, indicating low intrinsic motivation and low perceived value among teachers.

1.1 Research significance

Existing literature tends to focus on competency measurement, factor identification, or technical training design, with limited qualitative inquiry into teachers' lived experiences, implicit conceptions, and deep-seated barriers regarding educational technology. Teachers' subjective perceptions and underlying beliefs serve as critical precursors to behavioral intention and sustained technology use. To fill this research gap, the present study adopts systematic grounded theory to explore teachers' conceptions of educational technology, perceived competence, multi-level influencing factors, and evaluative perceptions of professional training. The findings aim to provide empirically grounded insights for optimizing institutional support systems,

refining training mechanisms, and facilitating sustainable, high-quality integration of technology into university teaching.

1.2 Research assumptions

This study was guided by three foundational assumptions:

(1) Challenges and facilitators of educational technology integration are contextually embedded; thus, context-specific investigations yield more practical and actionable implications for local institutional improvement.

(2) Current organizational training systems and delivery models are insufficiently responsive to teachers' authentic needs, resulting in low engagement and limited instructional impact.

(3) Teachers' pre-academic career experience and teaching seniority shape their digital competence, learning preferences, and motivational orientation toward educational technology training.

1.3 Research questions

To achieve the research objectives, this study addressed four interrelated questions:

(1) How do university teachers conceptualize and understand educational technology in instructional practice?

(2) What multi-level factors influence teachers' application of educational technology in regular course teaching?

(3) How do teachers perceive and evaluate their own educational technology competency?

(4) What are teachers' experiences and evaluative perceptions of formal educational technology training programs?

2. Methodology

2.1 Research design

This study employed a qualitative methodological framework grounded in systematic grounded theory. Developed by Strauss and Corbin, grounded theory is a rigorous, inductive approach that constructs abstract, contextually grounded theoretical models through systematic data collection, comparative analysis, and progressive coding. It is particularly suitable for exploring dynamic processes, complex behavioral mechanisms, and emergent themes that are inadequately explained by existing structural frameworks such as TPACK or SAMR [3]. By prioritizing participants' lived experiences, grounded theory enables a holistic, data-driven understanding of teachers' real-world struggles and needs [4]. Accordingly, this design is highly appropriate for exploring the conceptions, experiences, and decision-making processes of teachers engaged in technology-enhanced teaching.

2.2 Participants

Twenty teachers from X University were recruited using convenience sampling. The sample was intentionally diversified to ensure variation across gender, age, teaching seniority, disciplinary background, and career trajectory. Among the participants, 17 were female and 3 male; 10 held multi-career experiences prior to entering academia; 7 combined teaching with administrative responsibilities. All participants provided voluntary informed consent and were assured full anonymity, confidential data management, and the right to withdraw at any stage of the research. Pseudonyms were used in all data reporting to protect privacy.

Table 1. Participant Demographics

Participant	Gender	Age	Teaching years	Multiple working experiences
Xin	F	44	17	Yes
Ziming	F	43	23	Yes
Jianhui	F	38	16	No
Mei	F	44	23	No
Wei	F	39	19	No
Zhu	F	35	10	No
Chang	F	28	3	No
Hui	M	46	14	Yes
Ye	F	45	6	Yes
Hua	F	49	26	No
Jie	M	44	20	Yes
Jing	F	39	17	No
Xia	F	38	12	No
Tong	F	33	4.5	Yes

Participant	Gender	Age	Teaching years	Multiple working experiences
Lin	F	42	20	No
Rui	F	36	14	No
Jun	F	39	10	Yes
Di	F	46	22	Yes
Yueyou	F	26	2	Yes
Ming	M	41	3	Yes

Twenty teachers were interviewed in this qualitative study between October 1st, 2022 and November 5th, 2018. The twenty participants worked in 10 different departments at X university, including some teachers (n=7) who also did some administration as well as being a teacher. The majority of the participants (n=17) were females, and half of the participants (n=10) had multiple working experiences. Table 2 presents the participants demographics.

Table 2. Participant Demographics.

Category		N
Gender	Male	3
	Female	17
Multiple Working Experience	Yes	10
	No	10
Position	Teacher	13
	Teacher and administrator	7

2.3 Data collection

Empirical data were collected through semi-structured online interviews conducted via Tencent Meeting. Each interview was audio-recorded with explicit participant consent, and complementary field notes were documented simultaneously. Recordings were transcribed verbatim using professional transcription software, followed by meticulous manual proofreading and member checking to enhance accuracy and credibility. Data saturation was achieved after 16 interviews; four additional interviews were conducted to confirm that no new categories, themes, or theoretical insights emerged, thereby validating the saturation of the dataset.

2.4 Research instrument

A semi-structured interview protocol was developed based on a systematic review of relevant literature and the study's core research questions. The protocol comprised four thematic sections: teachers' conceptual understanding of educational technology; perceived barriers and facilitators of technology integration; self-evaluation of educational technology competence; and experiences with and attitudes toward institutional training. The protocol underwent ethical review and received approval. During data collection, one question was removed due to the absence of a standardized evaluation rubric, which rendered responses inconsistent and analytically invalid.

Table 3. List of Semi-structured Interview Questions

Items	Semi-structured Interview Questions
General Information	Information such as teaching age, gender, teaching period, subject and working background of the interviewees
1. How do higher-education teachers understand educational technology?	1. What educational technology are you applying in your course teaching?
	2. What kind of educational technology are you interested in or planning to learn and apply in your course teaching?
	3. How do you understand the effects of educational technology on students' learning?
2. What are the factors that will affect higher-education teachers' applying educational technology in course teaching?	1. What are the greatest difficulties in applying educational technology in course teaching?
	2. What kind of school support are you looking for?

Items	Semi-structured Interview Questions
3. How do higher-education teachers perceive their educational technology competency?	1. What do you think of your educational technology competency?
	2. If the maximum score is 10, how do you think of your educational technology competency? Why is that?
	3. What do you think can be your highest score on educational technology competency after being trained or self-learning? Why?
4. How do higher-education teachers perceive educational technology training programs?	1. What was the effect of the teacher technical training you attended?
	2. What was your favorite training session? What's the reason?
	3. What was your least favorite aspect of training?

2.5 Data analysis

Data analysis followed the three-stage coding procedure of systematic grounded theory, supported by ATLAS.ti qualitative data analysis software:

Open coding: Line-by-line coding of raw transcripts to generate initial concepts and provisional categories.

Axial coding: Systematic linking of categories and subcategories to identify logical relationships, hierarchical structures, and causal connections.

Selective coding: Integration and refinement around a core category to construct a coherent, parsimonious theoretical framework.

3. Findings

3.1 Teachers' understanding of educational technology

Teachers' conceptions of educational technology clustered into four interlocking thematic dimensions: content and process, educational beliefs, functional orientation, and motivational drivers.

Table 4. Research Question #1- How do higher-education teachers understand educational technology?

Themes	Subthemes
Content & Process	Technological Tools Hardware & Software Online Resources Teaching Processes
Educational Concepts	Teachers' Consciousness Goal-Orientation Teachers' Digital Literacy
Functions	Supporting Role Improving Efficiency and Effects
Reasons or Driving Forces	Fast-developing World Responsibility of Being a Teacher

3.1.1 Content and process

The majority of teachers defined educational technology as a composite system of supportive tools including hardware, software, digital platforms, multimedia resources, and online learning materials. Many extended this definition to cover the full instructional cycle: instructional design, in-class implementation, interactive engagement, and formative assessment. Consistently, participants framed educational technology as an auxiliary rather than dominant component of teaching. Several participants explicitly recognized open educational resources such as MOOCs and digital teaching repositories as integral components of contemporary educational technology.

3.1.2 Educational beliefs

A substantial proportion of teachers emphasized that sustainable technology integration depends fundamentally on teachers' internal educational beliefs, including professional awareness, goal orientation, and digital literacy. Teachers highlighted that genuine behavioral change requires internalized recognition of technology's pedagogical value, not merely external compliance. Technology was viewed as meaningful only when aligned with core teaching objectives, thereby avoiding superficial or decorative use. Teachers' digital literacy—including operational proficiency, design capacity, ethical awareness, and critical evaluation—was regarded as a foundational prerequisite for quality integration.

3.1.3 Functional orientation

Participants widely acknowledged the instrumental functions of educational technology in boosting instructional

efficiency, diversifying representation modes, increasing student engagement, and providing adaptive learning support. Many teachers noted that technology enables structured scaffolding, helps mitigate individual differences among students, and improves overall teaching effectiveness. Despite these positive perceptions, most teachers continued to situate technology as a supplementary enhancement to traditional face-to-face instruction.

3.1.4 Motivational drivers

Two prominent motivational forces emerged. The first was professional responsibility: teachers expressed strong intrinsic motivation to use technology to improve learning quality and support student development. The second was normative pressure from digital transformation: teachers recognized that keeping pace with technological advancement was essential to maintain professional relevance and effectively connect with digital-native students.

3.2 Factors influencing technology integration

Analysis identified four overarching layers of influencing factors: teacher-level factors, student-level factors, technology-level factors, and environmental-level factors. Teacher and environmental factors were most frequently and emphatically reported.

Table 5. Research Question #2- What are the factors that will affect higher-education teachers' applying educational technology in course teaching?

Themes	Subthemes
Teacher Factors	Teachers' Educational Concepts Teachers' Physical & Mental Conditions Teachers' Vision (Teacher's Familiarity with Technology) Teachers' Learning Ability Low Priority of Educational Technology Teachers' Inertia in Teaching (Related to Age and Teaching Years) Teachers' Uncertainty about Applying ET in Teaching
Student Factors	Students' Attitudes towards Educational Technology Students' Digital Literacy Students' Equipment Conditions
Technology Factors	Low ROI of Applying ET Inner Flaws of Technology Digital Ethics Issues
Environment Factors	Hardware and Software Support System Incentive System Atmosphere at the School

3.2.1 Teacher-level factors

Teacher-related factors were the most salient and multifaceted. Key subthemes included:

Educational beliefs and cognitive orientation: Internal perceptions directly determined willingness and depth of adoption.

Time and energy constraints: Heavy teaching loads, administrative responsibilities, family obligations, and promotion-related pressures severely limited capacity for technology learning.

Limited technological vision: Many teachers lacked awareness of advanced tools, innovative applications, or discipline-specific use cases.

Variable learning ability: Age-related differences in digital adaptability and high learning thresholds created barriers for senior teachers.

Low instructional priority: Teachers prioritized content accuracy and pedagogical design over technological innovation.

Teaching inertia: Established routines and comfort zones reduced openness to innovative change.

Unclear purpose: Many teachers lacked a clear rationale for why and how to integrate technology meaningfully into specific learning objectives.

3.2.2 Student-level factors

Student characteristics significantly shaped teachers' instructional decisions. Positive student attitudes and engagement reinforced teachers' willingness to innovate. Conversely, low student digital literacy, insufficient personal devices, and weak self-regulated learning often hindered effective technology implementation. At the same time, students' advanced digital proficiency created both motivational pressure and collaborative opportunities for teachers to upgrade their skills.

3.2.3 Technology-level factors

Teachers expressed consistent concerns about practicality and cost-effectiveness. Prominent issues included high time investment with uncertain pedagogical returns; overly complex interfaces; rapid, discontinuous tool updates; reduced

emotional rapport in virtual environments; systemic instability; and ethical risks related to data privacy, copyright, and digital safety. These practical constraints directly reduced willingness to adopt advanced or novel technologies.

3.2.4 Environmental-level factors

Environmental conditions were widely perceived as decisive for systemic and sustainable technology integration. Teachers emphasized four urgent institutional needs:

Stable, high-quality hardware, software, and network infrastructure.

Responsive, professional technical support and timely troubleshooting services.

Clear, consistent incentive structures linked to performance evaluation, professional promotion, and recognition.

A supportive campus culture that encourages innovation, peer sharing, and reflective practice.

3.3 Teachers' self-perceived technology competency

Teachers' motivation to enhance educational technology competency originated from a combination of internal and external drivers.

Table 6. Research Question #3- How do higher-education teachers perceive their educational technology competency?

Themes	Subthemes
Internal Factors	Profession Responsibility Sense of Satisfaction
External Factors	Developments in the External Environment Pressure from Teaching Competitions and Projects Peer Pressure

3.3.1 Internal drivers

Internal motivators were particularly influential, especially among mid-career and senior teachers. The dominant internal driver was professional responsibility to improve instructional quality, optimize learning efficiency, and support personalized student development. Many teachers derived strong professional satisfaction and intrinsic fulfillment from successful technology-enhanced lessons and positive student feedback. Personal curiosity, interest in digital tools, and a desire to maintain rapport with digital-native students further encouraged continuous learning.

3.3.2 External drivers

External motivators included rapid technological and social change; formal requirements embedded in teaching competitions, curriculum projects, and institutional evaluation policies; and peer influence. Peer modeling and successful case sharing were especially powerful: teachers frequently reported increased motivation when colleagues demonstrated practical, contextually appropriate applications.

3.4 Teachers' perceptions of educational technology training

Teachers' evaluative feedback focused on two core dimensions: training content and delivery formats.

Table 7. Research Question #4: How do higher-education teachers perceive educational technology training programs?

Themes	Subthemes
Training Content	Usefulness
	Widening Vision
	Pedagogy
Training Ways	24-Hour Support System
	Successful Case Sharing
	Interactions Classifications

3.4.1 Training content

Teachers strongly preferred content that was practically relevant, immediately applicable, and pedagogically integrated. They emphasized that effective training should expand technological awareness by showcasing cutting-edge tools, award-winning cases, and discipline-specific scenarios. Many teachers insisted that training must connect technology with pedagogical principles to avoid "technology for technology's sake" and strengthen capacity for principled, objective-aligned instructional design.

3.4.2 Training methods

Teachers provided specific, actionable recommendations for improving training design:

Establish a 24/7 online Q&A support system and develop modular, topic-based micro-video tutorials for self-paced learning.

Expand peer-led successful case sharing to enhance authenticity, relevance, and replicability.

Increase hands-on practice, interactive demonstration, and collaborative problem-solving to strengthen experiential learning.

Implement differentiated, targeted training based on discipline, age, seniority, and skill level to replace ineffective one-size-fits-all models.

4. Implications and Recommendations

4.1 Interpretation of the Findings

The findings reveal that teachers' consciousness is the core determinant of educational technology integration. Most teachers still regard technology as a supplementary tool rather than a transformative force, remaining at the low-level enhancement stage of the SAMR model. Few teachers have reached the transformation stage that supports students' advanced cognitive development. In addition, teachers' psychological factors—including self-satisfaction, sense of achievement, and self-value—are prominent motivating forces that have been insufficiently addressed in previous domestic research. Student feedback, campus support systems, and professional learning communities also significantly affect teachers' practices. Most teachers are dissatisfied with traditional training and prefer practical, interactive, on-demand, and classified support mechanisms.

4.2 Recommendations for Universities

Based on the findings, five practical recommendations are proposed.

First, universities should conduct top-level integrated design, improve incentive and evaluation systems, and link technology integration practice with performance and promotion. The teaching development center should innovate training modes by combining expert lectures, peer case sharing, micro-learning, and flipped training. Student affairs departments should guide students to improve digital literacy and learning attitudes to form a supportive classroom atmosphere.

Second, universities must enhance teachers' awareness of technology integration. Teachers should recognize the trend of educational digitalization, understand that technology helps develop students' future-oriented competencies, and take the initiative to update their professional beliefs.

Third, universities should establish a full-time technology coordinator position to bridge teaching needs and technical tools, provide on-demand support, optimize tool selection, and help teachers solve operational and ethical problems.

Fourth, universities should develop professional learning communities (PLCs) with shared vision, collaborative culture, reflective practice, and institutional support. Both offline teaching-research groups and online virtual communities should be strengthened to promote peer learning and resource sharing.

Fifth, universities should strengthen educational technology research focusing on advanced knowledge construction, high-level cognition, and deep integration rather than merely technical operation, so as to guide sustainable teaching innovation.

5. Conclusion

This grounded theory study explores university teachers' conceptions, perceived competence, influencing factors, and training needs regarding educational technology integration. The findings show that teachers view educational technology as auxiliary tools and instructional processes supported by professional consciousness. Major barriers include limited time and energy, uneven learning ability, teaching inertia, low return on investment, inadequate infrastructure, and insufficient incentives. Teachers' motivation stems from professional responsibility, peer influence, and institutional requirements. They prefer practical, case-based, interactive, and flexible training support.

This study enriches the qualitative understanding of teachers' real experiences in educational technology application and supplements the literature by highlighting the role of teachers' psychological needs and professional learning communities. Theoretically, it constructs a multi-level factor model based on empirical data. Practically, it provides actionable suggestions for institutional support, training reform, and culture construction.

The study also has limitations, including a relatively homogeneous sample and single institutional context. Future research may adopt mixed methods, expand cross-institutional samples, and explore long-term intervention effects of

support systems. With the continuous advancement of educational digitalization, promoting deep integration of technology and teaching requires joint efforts from policies, institutions, and teachers to truly enhance teaching quality and student learning outcomes.

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