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University Foreign Language Teachers' Roles in the Age of AI: A Systematic Review

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Abstract. The integration of artificial intelligence (AI) into foreign language education is fundamentally altering the professional responsibilities of university Foreign Language Teachers (FLTs). Contemporary research, however, is devoid of a theoretical framework to elucidate the fundamental mechanics of this transformation. This study used Activity Theory (AT) as a conceptual framework to conduct a comprehensive literature review of the empirical research published from 2020 to 2025. Following PRISMA guidelines, 18 studies were chosen from an initial pool of 115 entries sourced from Web of Science and Scopus. The results reveal that the field predominantly relies on qualitative studies that exhibit a deficiency in reflexivity, while quantitative and mixed-methods research is marked by insufficient statistical power and the unsatisfactory synthesis of quantitative and qualitative data. An analysis employing the AT paradigm reveals that EFTs have obstacles due to structural misalignments, such as the absence of explicit restrictions, community dysfunction, and ambiguous divisions of labor. This study advocates a shift from individual "self-rescue" to systemic assistance. Educational institutions must rectify policy deficiency by formulating

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explicit AI regulations, cultivating extensive community networks, and openly integrating emotional support into professional growth frameworks.

Keywords: Artificial Intelligence (AI); Foreign Language Teachers (FLTs); Activity Theory; Teacher Role Transformation; Higher Education

1. Introduction

The advancement of artificial intelligence is profoundly reshaping the landscape of higher education, exerting a particularly disruptive impact on university foreign language education (Chan & Hu, 2023; Crompton & Burke, 2023). Nevertheless, there is an academic consensus that AI cannot replace the role of teachers (Jeon & Lee, 2023; Li et al., 2025; Ma & Chen, 2025; Tutton & Cohen, 2025). The irreplaceable value of FLTs has been confirmed. They provide emotional connections that AI struggles to simulate, thereby stimulating students' deep learning motivation by satisfying the three basic psychological needs of belonging, autonomy, and competence (Tutton & Cohen, 2025). Teachers' "situated scaffolding" also compensates for the rigidity of algorithms, guiding students to transform from passive recipients into self-regulated learners (Ma & Chen, 2025).

Moreover, the teachers' interpersonal interactions (e.g., eye contact) remain core predictors of student engagement in AI-mediated classrooms (Li et al., 2025). These findings align with the theory of scaffolding (Vygotsky, 1978), reaffirming the indispensable role of teachers as "more knowledgeable others" in facilitating meaningful learning processes. Against this backdrop, although some scholars have attempted to identify and define emerging roles for FLTs, such as "critical guides," "emotional connectors," "ethical guardians," "resource integrators," "inquiry stimulators," and "standard setters" (Jeon & Lee, 2023; Moorhouse, 2024; Sawangwan, 2024; Ulla et al., 2023), these studies largely remain descriptive. In other words, they define the new roles of foreign language teachers but fail to explain how these roles are formed, under what conditions they transform, and what systemic forces drive such changes.

Several empirical studies have investigated the intricate emotions associated with the role of reconfiguration of foreign language teachers in relation to artificial intelligence. For example, learner-driven AI autonomy has resulted in emotional vulnerability and professional identity conflict among educators, revealing a loop of declining respect, ethical challenges, and restricted autonomy amid role transformation (Karimi & Keshvari, 2026). A 10-month longitudinal study of 10 Chinese university foreign language teachers' emotional transitions revealed that

positive emotions facilitate the teachers' adaptation to AI, improving their role-related adaptive competencies (Liu & Chang, 2024). A separate study suggests that the "EFL teachers' Epistemic Agency" perceives the reconfiguration of the foreign language teachers' roles as a cognitive result of two stimulus phases. Initially, the rapid adoption of AI breaks the instructional balance and engenders motivational discord. Subsequently, educators employ collaborative pedagogical research and critical analysis to address these conflicts. The favorable ideas of teachers regarding AI, their contact with peers, the educational environment, and sociocultural factors impact this process (Chu & Wang, 2025).

Although the aforementioned empirical research has demonstrated how FLT are evolving in the AI era from specific angles (such as emotional and cognitive dimensions), it has not yet been incorporated into a cohesive theoretical framework (Chu & Wang, 2025; Karimi & Keshvari, 2026; Liu & Chang, 2024). More critically, the existing review studies primarily concentrate on the technology itself, analyzing the advantages and disadvantages of AI tools (Meniado, 2023; Farrokhnia et al., 2024), or the teachers' decision-making behaviors regarding AI use (Eedelouei, 2026).

They continue to concentrate on technology-related "first-order barriers," yet neglect to elucidate "second-order barriers" such as teacher roles and identity formation (Ertmer, 1999). A systematic review of 32 empirical studies on AI-assisted learning (Punar Özçelik, 2025), revealed that the majority of the literature focuses on AI functionalities, with more than half of the studies failing to elucidate the role of educators. Another assessment identified this bias: only two out of 25 empirical studies examined teachers in AI interaction (H. Yang & Kyun, 2022). These statistics indicate the oversight of teachers in studies on AI-enabled foreign language instruction.

Activity Theory is grounded in Hegelian and Marxist dialectical materialism (Jonassen & Rohrer-Murphy, 1999). Vygotsky' s (1978) triadic mediation framework of "subject—tool—object," which underscores mediation, was succeeded by Leont'ev (1982), who differentiated between individual and collective activities (Daniels, 2016). Engeström (1987) developed a six-element activity system model by incorporating rules, community, and the division of labor into the triadic model. He also delineated four subsystems—production, distribution, exchange, and consumption—whose functions are contingent upon component relationships (Figure 1).

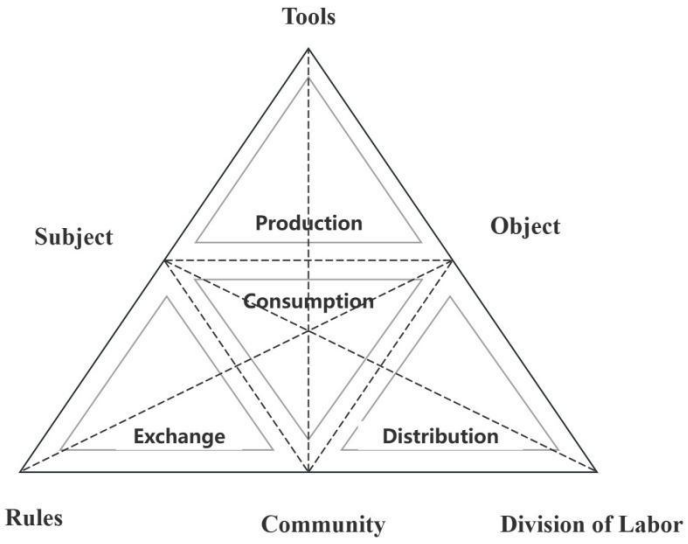

Figure 1: AT system (Adopted from Engeström, 1987)

AT offers a comprehensive analytical framework illustrating the interplay of the internal components within foreign language teaching (Engeström, 1987). For instance, Li (2022) utilized the six parts as mediating variables to discern the variability in blended language learning outcomes, whereas Yang and Kyun (2022) employed the same AT framework to examine AI-assisted language learning interactions. The idea is extensively applied in education and considers contradictions as the primary catalyst for system innovation and growth (Cliff et al., 2022; Murphy & Rodriguez-Manzanares, 2008). Murphy and Rodriguez-Manzanares (2008) elucidated the contradictions encountered by educators in virtual classrooms, whereas Yan and Yang (2019) delineated the complex contradictions experienced by foreign language teachers in their attempts to integrate into professional learning communities.

Moreover, AT has been extensively utilized in teacher development research because of its capacity for cross-elemental analysis, systemic investigation, and the exploration of person-situation interactions and power dynamics (Cliff et al., 2022), such as professional challenges (Yan & Yang, 2019), factors influencing well-being (Nazari & Karimpour, 2024), and identity formation (Nguyen & Ngo, 2025). However, to date, no review study has systematically applied this theoretical framework to specifically examine the issue of university FLT's role reshaping in the context of AI. Based on the above research gap, this study adopts Activity Theory to conduct a review of university FLTs in the context of AI, addressing the following research questions:

1. What are the current trends in research methods and objectives?
2. What are the main methodological limitations in existing literature?

3. How does Activity Theory systematically explain the role reconfiguration of university FLTs in the context of AI technology?

2. Methodology

The systematic literature review adhered to PRISMA standards (Page et al., 2021), and was comprised of four stages: identification, screening, eligibility assessment, and inclusion (Figure 2). AT was employed to synthesize and evaluate the data to address the research inquiries.

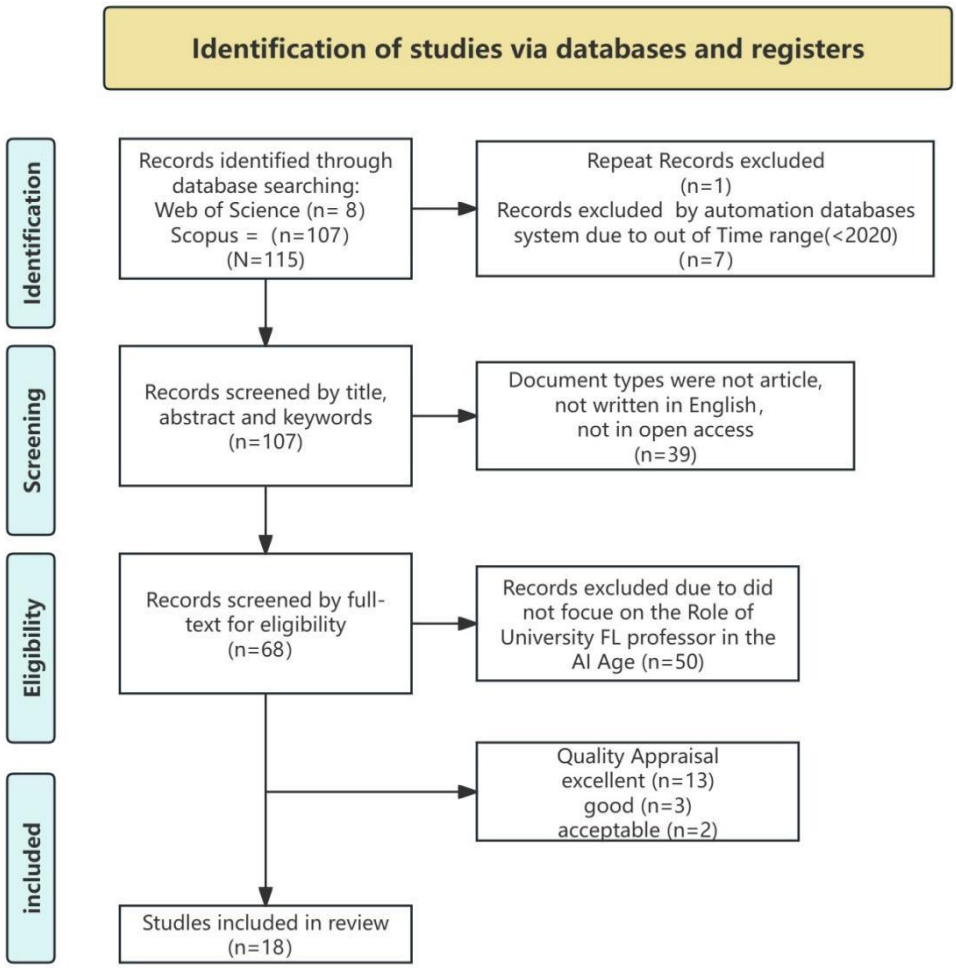

Figure 2: PRISMA flow diagram (according to the PRISMA checklist 2020)

2.1 Identification Phase

To address the research questions, keywords, synonyms, and related terms were identified and refined according to four domains: foreign language teachers, roles, artificial intelligence, and higher education. Boolean operators (AND, OR) and truncation symbols (*) were used. The complete search strings and screening criteria are presented in Table 1. The search strings were entered into the Web of

Science (WoS) and Scopus databases, yielding a total of 115 articles. Both WoS and Scopus have extensive disciplinary coverage (Leydesdorff et al., 2016) and are widely recognized as core tools for journal screening, bibliometric analysis, and research evaluation (Pranckutė, 2021; Zhu & Liu, 2020). Specifically, WoS has long been regarded as the "gold standard" for citation analysis, while Scopus has a more prominent coverage advantage in the humanities and social sciences (Leydesdorff et al., 2016), particularly in education research (Tosun, 2022). Therefore, employing both WoS and Scopus ensures rigor in both citation tracking and broad discipline-appropriate literature coverage, which aligns with the purpose of this study.

Table 1: Search string keywords used in this study

Database	Search String
Web of Science (WoS)	TS=(("language teacher*" OR "foreign language teacher*") AND ("professional identity" OR "teacher identity" OR "role perception" OR "role change" OR "role transition") AND ("artificial intelligence" OR AI OR "generative AI" OR ChatGPT OR "large language model*") AND ("higher education" OR university* OR college OR "tertiary education"))
Scopus	TITLE-ABS-KEY (("language teacher*" OR "foreign language teacher*") AND ("role" OR "professional identity" OR "teacher identity" OR "role perception" OR "role change" OR "role transition") AND ("artificial intelligence" OR AI OR "generative AI" OR ChatGPT OR "large language model*") AND ("higher education" OR university* OR college OR "tertiary education"))

2.2 Screening Phase

Initially, duplicate records were removed from both databases, resulting in 114 items available for screening. Seven items published prior to 2020 were eliminated utilizing built-in system functions, resulting in a total of 107 articles. To maintain data integrity, we eliminated non-article document formats and non-English publications, retaining solely Open Access papers for full-text access. Following the screening process, 39 records were discarded, and 68 items were chosen for additional examination. Table 2 delineates the criteria for inclusion and exclusion.

Table 2: Inclusion and exclusion criteria

Inclusion Criteria	Exclusion Criteria
Between 2020 and 2025	Before 2020
Empirical Articles	Book, Review, Book chapter, Conference paper, Report
Open Access	Without Open Access
Written in English	Not written in English
Related to the role of foreign language teachers, artificial intelligence, and higher education	Not related to the role of foreign language teachers, artificial intelligence, and higher education

Table 3: Overview of Study Characteristics and Findings Across the Included Studies

	Author (s), year,	Aims	Study design	Sampling & participant	Data & Analysis	Findings
1	Leńko-Szymańska (2026)	To compare the performance of pre-service teachers in using corpora and GenAI for linguistic analysis, lesson planning, and materials development.	Qualitative/Case study	Convenience sampling; 8 postgraduate students (pre-service teachers).	Students' assignments, in-class reflections, final projects, semi-structured interviews; structured review framework, pattern-based thematic analysis.	Pre-service teachers could operate the tools but faced difficulties in deep linguistic analysis and pedagogical integration. GenAI was user-friendly, yet its output lacked authenticity. Corpora were authentic, but they had a high learning curve. Most designs remained traditional.
2	Yang & Tsou (2026)	To investigate pre-service EAP teachers' beliefs, attitudes, professional development needs, and to construct a sustainable framework.	Mixed Methods/Sequential explanatory design.	Convenience sampling; 167 tertiary-level teachers in Taiwan.	Questionnaire (36 items); descriptive statistics, coding, and thematic analysis.	Teachers recognized EAP's importance. Challenges were updating knowledge, course development, and collaborating with EMI teachers. Needs focused on motivating students, developing materials, and integrating technology (including AI).

3	Chen et al. (2026)	To investigate how EFT maintains their professional "teacherness" while integrating GenAI.	Qualitative/Participatory Ethnography	Purposive sampling; an ESP instructor at a Thai university	Bi-weekly dialogues, GenAI logs, annotated materials, reflective docs; Grounded analysis with dialogic inquiry principles.	"Teacherness" is sustained via "judgment & translation." Teachers evaluate AI outputs and translate pedagogical knowledge. A new skill, AI - Pedagogical Knowledge, emerges, and teacher identity is strengthened.
4	Herath & Tejada-Sanchez (2025)	To examine how language teacher educators construct individual/collective identities, and the role of emotion.	Qualitative/Collaborative Analytic Autoethnography	Purposive sampling; 2 Language Teacher Educator	Personal/professional narratives, email/meeting records, project drafts, publications; Critical discourse analysis	Identity is dynamic and co-constructed; positive emotion based on trust; empathy drives reflection and transformation; critical practice is a path toward equity.
5	Su & Su (2025)	To investigate the decade-long professional identity formation of CALL teacher-researchers and the role of emotion	Qualitative/Collaborative Analytic Autoethnography	Purposive sampling; 2 CALL teacher-researchers	Semi-structured interviews, reflective journals, CVs; Coding and thematic analysis.	Identity has an "anemone-like" duality (language teaching as root, tech innovation as tentacle); emotional maturity is defined by complexity; support is needed at multiple levels.

6	Huang et al. (2025)	To explore the impact of GenAI training on pre-service English teachers' GenAI literacy.	Mixed methods/ quasi-experimental design	Purposive sampling; 90 university students majoring in English Education; experimental group (n=45) or control group (n=45)	GenAI Literacy Scale, open-ended questionnaire; ANCOVA, descriptive statistics, thematic analysis.	The intervention significantly improved GenAI literacy and fostered a professional identity shift from passive user to active, critical, innovative, and responsible integrator.
7	Xie et al. (2025)	To investigate the relationship between Chinese university English teachers' AI literacy and AI-induced emotions.	Quantitative/ Questionnaire survey	Convenience sampling; 148 Chinese university English teachers.	AI Literacy Scale, AI-Induced Emotions Scale; Partial Least Squares Structural Equation Modeling (PLS-SEM).	AI literacy dimensions positively correlated with emotions (enjoyment, anger, anxiety); applying and evaluating AI predicted enjoyment; evaluating AI also predicted anger.
8	Zaimoğlu & Dağtaş (2025)	To investigate how university EFL teachers understand and use generative AI tools to support student engagement.	Qualitative / Narrative inquiry	Convenience sampling; 9 EFL teachers from a private university in Türkiye.	Personal experiential narratives Phenomenology Data Analysis	AI practice is a process of meaning-making and negotiation within a complex system of personal (emotion/identity), institutional (support/constraints), and societal (policy/divide) factors.

9	Ghiasvand & Seyri (2025)	To explore how AI technology interacts with and contributes to the reconstruction of English teachers' identity.	Qualitative research / Phenomenographic design	Purposive sampling; 15 university EFL teachers from Iran	Collaborative reflection discussion recordings, Written narrative frames Thematic analysis	AI is a transformative force driving the systemic reconstruction of teacher identity across six dimensions: role, pedagogy, educational model, professional growth, reflective capacity, and technology integration.
10	Liang et al. (2025)	To compare AI readiness between pre-service and in-service FL teachers and its impact on behavioral intention.	Quantitative Research/Questionnaire Survey	Purposive sampling; 492 pre-service teachers and 533 In-service teachers in China	Questionnaire survey (CFL Teachers' AI Readiness Scale) Descriptive statistics, independent samples t-test, Latent Profile Analysis, PLS-SEM	Pre-service teachers scored higher for knowledge and innovativeness; in-service teachers perceived higher costs and heterogeneity within groups; pre-service intention was driven by knowledge, and in-service by institutional support.

11	Wu et al. (2025)	To develop/validate a GenAI competence scale for pre-service L2 teachers and identify heterogeneous competence profiles.	Quantitative/ Questionnaire survey	Convenience sampling; Phase 1 (n=350); Phase 2 (n=708)	Questionnaire data (self-assessment scales) item analysis, exploratory factor analysis（EFA）, confirmatory factor analysis（CFA）, latent profile analysis (LPA)	Developed a 21-item scale with three dimensions (awareness/willingness , knowledge/application , social responsibility); identified three profiles: Moderate-Cognitive, High-Awareness-Low-Skill (majority), High-Potential.
12	Ulla et al. (2024).	To explore university teachers' perceptions of GenAI in language teaching and its potential for fostering inclusivity from a critical pedagogy perspective.	Qualitative/ Exploratory study	Convenience sampling; 14 English language teachers from Philippine universities	Open-ended questionnaire surveys, data, and semi-structured individual interviews Thematic analysis	GenAI has the potential to foster inclusive classrooms through personalization, multilingual support, etc., but effective integration depends on the teachers' critical design, institutional policy, and ethical reflection.

13	Urazbayeva et al. (2024)	To investigate the effect of integrating ChatGPT into the PD of in-service EFL teachers on their AI literacy (TPACK) and perceptions.	Mixed-Methods/Sequential explanatory design.	Purposive sampling; 24 in-service EFL university teachers in Kazakhstan	Pre-test and post-test scores; post-intervention open-ended questionnaires; Paired samples t-test (quantitative); Thematic analysis	An 8-week intervention significantly but modestly improved ChatGPT integration skills; teachers valued its creativity and automated assessment but noted the need for verification, and there was content repetitiveness; optimistic about multimodal versions.
14	Moorhouse & Kohnke (2024)	To investigate how language teacher educators perceive GenAI's effects on initial language teacher education (ILTE).	Qualitative / Exploratory study	Purposive sampling; 13 English language teacher educators from four government-funded universities in Hong Kong	Semi-structured interviews Thematic analysis	GenAI will profoundly impact the ILTE curriculum, instruction, and assessment; teacher educators lack confidence/competence; critical AI literacy is a core need; systemic PD support is urgently needed.

15	Özer-Altınkaya & Yetkin (2025)	To explore pre-service English teachers' readiness for AI-integrated instruction, including confidence, attitudes, and training needs.	Qualitative / Exploratory study	Purposive sampling; 9 pre-service English language teachers (PELTs) from Turkish state university	Reflective journals, semi-structured Thematic analysis	Pre-service teachers hold positive attitudes but lack confidence in integration; current programs lack sufficient AI training; they strongly express a need for practical training, tool access, expert guidance, and course integration.
16	Kohnke & Zou (2025)	To explore the impact of ChatGPT on English teachers' methodology, efficiency, and goals, and to identify challenges/opportunities.	Qualitative/ interpretive study	Purposive sampling; 12 English language instructors at a Hong Kong university	Semi-structured interviews Thematic analysis	ChatGPT is deeply integrated into lesson planning and is seen as a "co-teacher"; successful integration hinges on TPACK development; use spans from substitution to redefinition (SAMR); the key challenge is aligning AI output with course objectives.

17	Kohnke et al. (2024)	To explore the factors influencing technostress among English teachers using GenAI and strategies to alleviate it, focusing on TPACK.	Qualitative research/interpretive study	Convenience sampling; 16 English language teachers at 4 public universities in Hong Kong	Semi-structured interviews Thematic analysis	Technostress stems from rapid AI development, insufficient TPACK, integration difficulties, work-life imbalance, and job security concerns; alleviation strategies include online community engagement, and gradual integration; institutional support is crucial.
18	Karaduman (2025)	To explore pre-service EFL teachers' perceptions of their own AI literacy and views on integrating AI literacy into teacher education.	Qualitative / Exploratory study	Convenience sampling; 15 pre-service EFL teachers from a university in Turkey	Semi-structured interviews Thematic analysis	Pre-service teachers have conceptual understanding but perceive limited knowledge/skills; hold positive attitudes toward using ChatGPT but worry about over-reliance, ethics, and role diminishment; strongly call for integrating AI education into programs.

2.3 Eligibility

This phase entailed a two-stage manual review of 68 publications. Topic screening commenced with the evaluation of titles and abstracts. Ambiguous articles proceeded to the second round, involving a more comprehensive assessment of the text. Subsequently, 50 were eliminated, resulting in 18 eligible items.

2.4 Data extraction and Quality appraisal

Two authors independently extracted the author(s), year, study objective, research design, sampling method, and significant findings from the 18 included studies utilizing a pre-designed data extraction form (Table 3). A third author conducted cross-validation of the retrieved results to mitigate bias and ensure data consistency and accuracy.

Table 4: Quality Assessment of the Qualitative Studies

Author(s), year	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	Total
Leńko-Szymańska et al. (2026)	*2*	*2*	*2*	*1*	*2*	*0*	*0*	*1*	*2*	*2*	*14*
Yang & Tsou (2026)	*2*	*2*	*2*	*2*	*2*	*0*	*0*	*2*	*2*	*1*	*15*
Chen et al. (2026)	*2*	*2*	*2*	*2*	*2*	*2*	*0*	*2*	*2*	*2*	*18*
Herath & Tejada-Sanchez (2025)	*2*	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*2*	*1*	*18*
Su & Su (2025)	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*20*
Huang et al. (2025)	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*19*
Zaimoğlu & Dağtaş (2025)	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*20*
Ghiasvand & Seyri (2025)	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*20*
Ulla et al. (2024)	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*20*
Urazbayeva et al. (2024)	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*19*
Moorhouse & Kohnke (2024)	*2*	*2*	*2*	*2*	*2*	*0*	*2*	*2*	*2*	*2*	*18*
Özer-Altınkaya & Yetkin (2025)	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*19*
Kohnke & Zou (2025)	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*2*	*20*
Kohnke et al. (2024)	*2*	*2*	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*19*
Karaduman (2025)	*2*	*2*	*2*	*1*	*2*	*2*	*2*	*2*	*2*	*2*	*19*
Total	*30*	*30*	*30*	*27*	*30*	*21*	*23*	*29*	*30*	*28*	

Description of the question criteria (CASP, 2018):

1. Was there a clear statement of the aims of the research?
2. Is a qualitative methodology appropriate?
3. Was the research design appropriate to address the aims of the research?
4. Was the recruitment strategy appropriate to the aims of the research?
5. Was the data collected in a way that addressed the research issue?
6. Has the relationship between researcher and participants been adequately considered?
7. Have ethical issues been taken into consideration?
8. Was the data analysis sufficiently rigorous?
9. Is there a clear statement of findings?
10. How valuable is the research?

Description of scoring:

Yes =2;
Hesitate=1;
No=0

After that, a thorough assessment of the included literature was conducted. The evaluation tools were selected according to the diverse research methods employed in the investigations. Table 4 presents the Critical Appraisal Skills Programme checklist (CASP, 2023) for qualitative investigations, while Table 5 delineates the Centre for Evidence-Based Medicine criteria for quantitative studies (CEBMa, 2014).

Mixed studies were evaluated in two phases: initially, the qualitative and quantitative elements were examined separately, utilizing the aforementioned approaches. Subsequently, the Mixed Methods Appraisal Tool (MMAT, 2018) developed by Hong et al.(2018) was routinely employed to comprehensively evaluate their research design. Only the initial four MMAT criteria were utilized in this investigation, as the qualitative and quantitative components were evaluated separately (refer to Table 6).

Table 5: Quality Assessment of the Quantitative Studies

Author(s), year	C1	C2	C3	C4	C5	C6	C7	C8	C9	C10	C11	C12	Total
Huang et al. (2025)	2	2	2	1	0	0	2	2	2	2	1	1	17
Xie et al. (2025)	2	2	2	0	1	0	2	2	2	1	2	1	17
Liang et al. (2025)	2	2	2	1	0	0	0	2	2	2	1	1	15
Wu et al. (2025)	2	2	2	0	1	2	1	2	2	0	2	1	17
Urazbayeva et al. (2024)	2	2	2	0	1	0	2	2	2	0	2	1	16

Description of the question criteria (CEBM, 2014):

1. Did the study address a clearly focused issue?
2. Is the research method (study design) appropriate for answering the research question?
3. Is the method of selection of the subjects (employees, teams, divisions, organizations) clearly described?
4. Could the way the sample was obtained introduce (selection) bias? (R)
5. Was the sample subject representative with regard to the population to which the findings will be referred?
6. Was the sample size based on pre-study considerations of statistical power?
7. Was a satisfactory response rate achieved?
8. Are the measurements (questionnaires) likely to be valid and reliable?
9. Was the statistical significance assessed?
10. Are confidence intervals given for the main results?
11. Could there be confounding factors that have not been accounted for?
12. Can the results be applied to your organization?

Description of scoring:
Yes =2;
Hesitate=1;
No=0

To maintain rigor, three researchers evaluated each study independently. Cohen's Kappa for inter-rater reliability was 0.84, indicating substantial agreement. All differences were settled through dialogue until a consensus was achieved. According to previous systematic reviews (Deng et al., 2025; Lee et al., 2008), the articles were classified into four quality tiers based on the final percentage scores: low (<50%), acceptable (50%–70%), good (71%–80%), and excellent (>80%). All subjects were retained for analysis at the acceptable threshold (Table 7).

Table 6: Quality Assessment of Qualitative Studies

Author(s), year	C1	C2	C3	C4	Total
Yang & Tsou (2026)	*2*	*2*	*2*	*2*	
Huang et al. (2025)	*2*	*2*	*2*	*1*	*7*
Urazbayeva et al. (2024)	*2*	*2*	*2*	*1*	*7*

Description of the question criteria (MMAT, 2018):

1. Is there an adequate rationale for using a mixed method designed to address the research question?
2. Are the different components of the study effectively integrated to answer the research question?
3. Are the outputs of the integration of the qualitative and quantitative components adequately interpreted?
4. Are the divergences and inconsistencies between the quantitative and qualitative results adequately addressed?

Description of scoring:
Yes =2;
Hesitate=1;
1. No=0

Table 7: Results of the Quality Appraisal

Research Approach	Study	Total score (%)	Quality
Qualitative Approach (n=12)	Leńko-Szymańska et al. (2026)	70%	Acceptable
	Chen et al. (2026)	90%	Excellent
	Herath & Tejada-Sanchez (2025)	90%	Excellent
	Su & Su (2025)	100%	Excellent
	Zaimoğlu & Dağtaş (2025)	100%	Excellent
	Ghiasvand & Seyri (2025)	100%	Excellent
	Ulla et al. (2024)	100%	Excellent
	Moorhouse & Kohnke (2024)	90%	Excellent
	Özer-Altınkaya & Yetkin (2025)	95%	Excellent

	Kohnke & Zou (2025)	100%	Excellent
	Kohnke et al. (2024)	95%	Excellent
	Karaduman (2025)	95%	Excellent
Quantitative Approach (n=3)	Xie et al. (2025)	71%	Good
	Liang et al. (2025)	63%	Acceptable
	Wu et al. (2025)	71%	Good
Mixed-Methods Approach (n=3)	Yang & Tsou (2026)	82%	Excellent
	Huang et al. (2025)	90%	Excellent
	Urazbayeva et al. (2024)	88%	Excellent

Scoring Method:
1. For qualitative/quantitative studies, the total score is the sum of the item ratings converted to a percentage of the theoretical maximum.
2. For mixed-methods studies, the score integrates ratings from the qualitative, quantitative, and mixed-methodology dimensions, divided by the sum of their respective maximum scores to yield a composite percentage.
Quality Classification: Studies are classified as: Poor (< 50%), Acceptable (50%–70%), Good (71%–80%), or Excellent (> 80%).

3. Results and Findings

3.1 What are the current trends in research methods and objectives?

The research methodology predominantly employs qualitative methods (n=12), whereas quantitative (n=3) and mixed-methods (n=3) investigations are comparatively seldom (Table 7). The 12 qualitative studies employ exploratory (n=4), ethnographic (autoethnography and participatory ethnography, n=3), interpretative (n=2), case study (n=1), narrative inquiry (n=1), and phenomenographic (n=1) research methodologies.

Exploratory research (Moorhouse & Kohnke, 2024; Ulla et al., 2024) investigates teachers' perspectives, attitudes, and practical challenges with AI. Ethnographic research (Herath & Tejada-Sanchez, 2025; Su & Su, 2025) investigates the intricate negotiation of teacher identity and emotions in technology integration via the researchers' personal experiences or prolonged participant observation, or it explores how educators preserve their "teacherness" while engaging with AI (Chen et al., 2026). Phenomenographic study aims to understand the foreign language teachers' relationship with artificial intelligence and their multifaceted identity reconstruction (Ghiasvand & Seyri, 2025). Interpretive studies (Kohnke et al., 2024; Kohnke & Zou, 2025) examine how FLTs construct meaning, employ methodologies, and address challenges in AI-enhanced educational contexts.

All quantitative studies employed survey methods (n=3), but their research objectives and analytical approaches fell into one of two categories: predictive and relationship-verification studies (n=2), and assessment and classification studies (n=1). For instance, Xie et al. (2025) utilized structural equation modeling to

examine the predictive relationships between emotional experiences and various dimensions of AI literacy among FLTs. Liang et al. (2025) combined t-tests, latent profile analysis, and structural equation modeling to compare AI readiness between pre-service and in-service FLTs, identifying internal heterogeneity within the population. Meanwhile, Wu et al. (2025) used factor analysis to construct a generative AI competency scale and employed latent profile analysis to identify distinct proficiency profiles among pre-service FLTs.

Three mixed-methods studies (n=3) adhered to two research paradigms: explanatory sequential design (n=2) and embedded quasi-experimental design (n=1). The former uses qualitative data to elucidate quantitative patterns and intergroup disparities. Yang and Tsou (2026) surveyed 167 English for Academic Purposes (EAP) instructors to evaluate the structural distribution of their professional development requirements and employed qualitative coding to discern their cognitive beliefs and institutional contexts.

Urazbayeva et al. (2024) analyzed pre- and post-test data to assess the impact of ChatGPT training on foreign language teachers' AI literacy and gathered educators' perspectives on the tool's advantages, disadvantages, and uses. The embedded quasi-experimental technique employs qualitative data to elucidate intervention mechanisms. Huang et al. (2025) employed ANCOVA to demonstrate that the pre-service teachers' AI literacy was enhanced following generative AI training, but the theme analysis indicated a transformation in teacher identity.

3.2 What are the main methodological limitations in existing literature?

Qualitative studies frequently exhibit insufficient reflexivity about researcher-participant relationships, encompassing teacher-student, colleague, and peer-competitor interactions (Leńko-Szymańska, 2026; Moorhouse & Kohnke, 2024; Yang & Tsou, 2026). Latent connections can influence data collection, participant responses, and researchers' interpretations. Opacity in ethical reporting endures, with studies deficient in specific information regarding ethical approval and informed consent protocols (Chen et al., 2026; Leńko-Szymańska, 2026; Yang & Tsou, 2026).

The absence of statistical power-driven sample size planning and the bias in sampling process selection are the principal issues in quantitative research. Convenience sampling (Yang & Tsou, 2026) and purposive sampling (Huang et al., 2025; Urazbayeva et al., 2024; Wu et al., 2025; Xie et al., 2025) constrain these studies. Although some researchers acknowledge voluntary response bias (Urazbayeva et al., 2024; Xie et al., 2025), these methodologies skew the samples towards AI enthusiasts, diminishing the generalizability of the results. Notably,

only one of the five quantitative studies conducted an a priori power analysis (Wu et al., 2025), while the remaining four lacked a robust statistical rationale for their determined sample sizes.

In the mixed-methods design literature, discrepancies between quantitative and qualitative outcomes are not adequately addressed. Specifically, Yang and Tsou (2026) identified substantial discrepancies in their quantitative analysis of two EAP training issues, "similarity of training models" and "degree of focus on language development." Nevertheless, they did not employ qualitative data for elucidation. Urazbayeva et al. (2024) identified a discrepancy between their quantitative findings, which indicated no enhancement in the instructors' capacity to incorporate ChatGPT, and their qualitative results, which reflected extremely favorable evaluations of ChatGPT's utility. They did not investigate this discrepancy to ascertain the underlying reasons.

3.3 How does Activity Theory explain the role reconfiguration of university foreign language teachers in the context of AI technology?

3.3.1 Contradictions within the Six Elements

According to Engeström (1987), primary contradictions emerge within each constituent of an activity system as inherent tensions. Building upon this, the following section analyzes these internal contradictions to explore the role reconstruction of higher education FLTs in the AI era, with a summary of this analysis presented in Table 8.

Table 8: Summary of the Six Components - Core Contradictions

AT Component	Empirical Findings from the Literature
Subject	Pre-service: High AI readiness vs. low pedagogical depth. In-service: Recognition of AI value vs. multidimensional cognitive/ethical burdens.
Object	Evolution of professional goals from "Efficiency Enhancer" to "Irreplaceable Guide," constrained by systemic inertia and lack of supportive conditions.
Tools	High recognition of transformative potential vs. low-level practical integration
Rules	Absence of formal institutional AI policies/ethics vs. pervasive implicit pressures (AI replacement anxiety & disciplinary marginalization).
Community	Fragmentation among institutional, formative, and affective online communities; reliance on "emotional self-help" due to formal support failure.
Division of Labor	Ambiguous human-AI task allocation; Critical lag between institutional transformation pace and rapid technological iteration.

The subjects, both pre-service and in-service educators, encounter diverse conflicts related to AI integration. Pre-service FLTs exhibit significant AI adoption and cognitive awareness, reflecting the benefits of digital natives in terms of AI cognition and receptivity (Liang et al., 2025). Nevertheless, they lack the proficiency to incorporate AI knowledge into pedagogy, and their ideologies and linguistic beliefs remain entrenched in outdated "vocabulary-discrete grammar point" frameworks (Leńko-Szymańska, 2026). Research indicates that this group's AI literacy is heterogeneous and negatively correlated with anxiety (Liang et al., 2025; Wu et al., 2025).

In-service FLTs have high perceived value and AI integration expertise, and they think AI has educational value (Kohnke & Zou, 2025; Ulla et al., 2024). They also acutely perceive the temporal, energetic, cognitive, and ethical challenges (Liang et al., 2025; Urazbayeva et al., 2024). This cohort demonstrates a "high readiness, high perceived cost" profile (Liang et al., 2025), resulting in heightened identity anxiety, meaning that there is a need for negotiation and emotional labor in the context of technology adoption (Chen et al., 2026; Su & Su, 2025; Zaimoğlu & Dağtaş, 2025).

AI is the tool that associates FLTs (the subject) with the transformation of their professional roles (the object) through Activity Theory (Engeström, 1987). Elevated perceived worth and minimal actual usage conflict within the instrument. AI is broadly seen as the forthcoming wave of disruptive technology (Moorhouse & Kohnke, 2024), and it possesses the capacity to enhance efficiency, innovation, and equity(Kohnke & Zou, 2025). Nevertheless, educators are only "moderately prepared" to implement it (Liang et al., 2025). Pre-service foreign

language teaching interns have deficiencies in their technological, pedagogical, and ethical literacy abilities (Wu et al., 2025), and frequently perceive AI solely as a retrieval instrument (Leńko-Szymańska, 2026). The majority of in-service foreign language educators exhibit exploratory tendencies (Kohnke & Zou, 2025; Xie et al., 2025).

The objective is FLT role reconstruction, a continual evolution from "efficiency optimizer" (Kohnke & Zou, 2025; Urazbayeva et al., 2024) to "irreplaceable guide" (Ghiasvand & Seyri, 2025; Huang et al., 2025; Kohnke & Zou, 2025; Urazbayeva et al., 2024). Educators occasionally find it challenging to reconcile enhancements in efficiency with reforms in their roles (Liang et al., 2025; Urazbayeva et al., 2024). A teacher remarked, "Slowing down the brain and breaking down the thinking process is very hard for one whose brain works fast and accurately" (Chen et al., 2026, p.8), while attempting to translate their implicit instructional knowledge into AI-executable directives.

Others must "… repeatedly check the content generated by ChatGPT" (Urazbayeva et al., 2024, p. 10), only to discover that the AI-generated material "lacked the nuance I was hoping for" (Urazbayeva et al., 2024, p.11). Another teacher expressed, "It's convenient to have ready-to-use activities, but they often lack the personal touch" (Kohnke & Zou, 2025, p.13). Significantly, the majority of educators perceive themselves as inadequately equipped to manage this transition (Moorhouse & Kohnke, 2024).

This review identifies that the rules manifest as a dual structure of explicit and implicit within the context of AI integration. Although explicit rules, such as university regulations, resource availability, and peer collaboration, significantly influence teachers' aspirations to integrate AI more than individual competencies (Liang et al., 2025), there is a deficiency in institutional AI usage policies, ethical guidelines, and systematic training. In the absence of explicit standards, educators are deprived of formal backing and a structured action plan, resulting in institutional ineffectiveness (Liang et al., 2025; Zaimoğlu & Dağtaş, 2025).

For example, one study found that "very few programmes or their universities had clear guidelines on how GenAI could be used in assessments" (Moorhouse & Kohnke, 2024, p. 7). Informal social discourses and professional identity constitute the pressure of implicit rules. On the one hand, public discourse about AI replacing FLTS triggers the teachers' sense of professional existential crisis (Herath & Tejada-Sanchez, 2025). On the other hand, national education policies favoring STEM and related disciplines may relatively diminish the professional value of foreign language teachers, exacerbating their identity anxiety (Su & Su, 2025).

Community-level contradictions arise from the inability to meet the needs of diverse teacher groups. In AI-enhanced educational settings, in-service foreign language educators require both functional and institutional support to effectively manage their workload (Liang et al., 2025; Urazbayeva et al., 2024). While teacher education programs establish structured learning communities for pre-service foreign language educators, they require more specialized training and practical opportunities (Karaduman, 2025; Özer-Altınkaya & Yetkin, 2025). The systematic input from these training groups facilitates their acquisition of AI-TPACK (Liang et al., 2025). FLTs have turned to online communities for emotional support, receiving emotional resonance and strategy exchange.

However, this support is spontaneous, informal, and unsustainable (Kohnke et al., 2024). The prevalence of "emotional self-help" communities indicates the inadequacy of official support systems (Herath & Tejada-Sanchez, 2025; Yang & Tsou, 2026). Educators at various stages of their careers possess distinct functional requirements yet they all want a feeling of belonging in the midst of technological disruptions. Therefore, a sustainable framework for teacher professional development must be contextualized and multifaceted, integrating emotional support and community engagement (Yang & Tsou, 2026). Current practices clearly fall short of meeting this requirement.

The synthesis of the findings reveals that the division of labor manifests as a three-tier framework: AI enhances efficiency and automates support (Kohnke & Zou, 2025; Ulla et al., 2024; Urazbayeva et al., 2024); EFTs deliver essential assessment, emotional safeguarding, and ethical guidance (Chen et al., 2026; Huang et al., 2025; Moorhouse & Kohnke, 2024; Su & Su, 2025; Ulla et al., 2024), and institutions provide the necessary policy frameworks and training (Liang et al., 2025; Yang & Tsou, 2026). However, the actual situation significantly diverges from this ideal. AI tools frequently provide inaccurate or superficial information, presenting ethical dilemmas (Leńko-Szymańska, 2026; Zaimoğlu & Dağtaş, 2025), necessitating that educators engage in "additional cognitive labor" for validation (Urazbayeva et al., 2024).

If used improperly, AI may also exacerbate pedagogical homogenization and ethical risks (Leńko-Szymańska, 2026; Zaimoğlu & Dağtaş, 2025). Educators are anticipated to serve as instructional leaders, technological curators, critical evaluators, learning facilitators, and guardians of emotional and ethical standards (Chen et al., 2026; Herath & Tejada-Sanchez, 2025; Huang et al., 2025; Moorhouse & Kohnke, 2024), yet the majority are inadequately equipped. Pre-service teachers exhibit deficiencies in their technical and analytical skills (Leńko-Szymańska, 2026), whereas in-service teachers predominantly operate at the lower application levels of the SAMR model (Kohnke & Zou, 2025). Institutions should transition

into enablers and ecosystem builders, serving as policymakers, resource providers, and culture cultivators (Huang et al., 2025; Kohnke et al., 2024; Liang et al., 2025; W. Yang & Tsou, 2026; Zaimoğlu & Dağtaş, 2025). In reality, an absence of policies and insufficient training prevail (Liang et al., 2025; Yang & Tsou, 2026), exacerbated by a widespread lack of clear AI standards and ethical guidelines at the institutional level (Zaimoğlu & Dağtaş, 2025).

3.3.2 Contradictions Existing in the Sub-System

During the reconstruction of the FLTs' roles, secondary contradictions emerge from the tensions among the four subsystems of production, exchange, distribution, and consumption (Engeström, 1987). Building upon this framework, the following section provides a detailed analysis of the systemic conflicts within the context of AI-driven higher education.

The tension between subject and object, exacerbated by AI tools, is the production sub-system's core paradox (subject—tool—object). Pre-service teachers have "high cognition, low skills"; they recognize AI's importance but lack the ability and confidence to integrate it (Liang et al., 2025; Wu et al., 2025). A pre-service teacher admitted, "I know the benefits of AI in education, but I feel lost when it comes to integrating those tools into the class" (Özer-Altınkaya & Yetkin, 2025, p. 8, Table 9). AI tools thus expose the gap between theoretical input and practical output in pre-service teacher education. In-service teachers generally recognize the value of AI for teaching but feel a significant burden in its actual integration, including the time cost for verifying AI outputs, technological anxiety, and the insecurity that "AI might replace teachers" (Kohnke et al., 2024; Liang et al., 2025).

One in-service teacher remarked, "It was a bit frustrating to have to constantly double-check what ChatGPT produced" (Urazbayeva et al., 2024, p.10). AI tools amplify the contradiction between in-service teachers' value recognition and practical burden. Within the communication subsystem (subject—rules—community), the absence of explicit guidelines and the weight of implicit pressures create a "double predicament." This lack of systematic guidance, paired with psychological strain, triggers emotional resistance, such as anxiety and frustration, that hinders role reconstruction (Kohnke et al., 2024; Zaimoğlu & Dağtaş, 2025). Consequently, the subject-community bond is severed: teachers hesitate to seek help, fearing that disclosing AI use may be stigmatized as a sign of professional incompetence (Zaimoğlu & Dağtaş, 2025).

Within the distribution subsystem (community—object—division of labor), a fundamental conflict endures institutional communities do not facilitate role transition, while a chaotic division of labor exacerbates teacher workload. The lack of explicit AI policies generates uncertainty regarding formal obligations,

obstructing effective community support (Liang et al., 2025). The absence of AI training in the existing curriculum indicates a disparity in professional development (Karaduman, 2025; Özer-Altınkaya & Yetkin, 2025), resulting in intricate technological responsibilities being assigned to people instead of being integrated inside the company. In the absence of a consensus regarding human-AI boundaries (Leńko-Szymańska, 2026; Wu et al., 2025), teachers are forced to not only handle instruction but also to cope with the uncertainty of AI outputs (Urazbayeva et al., 2024). This imbalance transfers systemic difficulties to the educator, putting them under considerable cognitive strain.

Community support reduces unpleasant feelings during role transitions, according to the consumption subsystem (subject—community—object) (Huang et al., 2025; Urazbayeva et al., 2024). One teacher expressed, "It turns out I'm not the only one who can't figure it out... Seeing my colleagues also exploring, I'm no longer so afraid of making mistakes" (Urazbayeva et al., 2024, p.11). However, when community support is lacking, instructors impulsively turn to online forums for emotional resonance and strategy exchange (Kohnke et al., 2024). FLTs can feel lonely and insecure due to rapid technological change, personal capacity concerns, and "AI replacement" rhetoric identity threats (Herath & Tejada-Sanchez, 2025). Technical and emotional help is available in online groups.

One participant said, "It's reassuring to know that I'm not alone in this journey" (Kohnke et al., 2024, p.313). This informal support is effective, but it forces teachers to organize their own emotional support networks, highlighting the lack of formal support (Herath & Tejada-Sanchez, 2025; Yang & Tsou, 2026).

4. Discussion

Prior review studies identified a bias in AI-driven language education research, emphasizing technological efficacy above teacher participation (Özçelik, 2025; Yang & Kyun, 2022). This analysis carefully incorporated 18 highly relevant empirical publications to refocus the emphasis on university FLTs and their roles.

However, several methodological limitations persist in teacher-focused studies: qualitative studies dominate (in = 12) but lack reflexivity concerning the researcher-participant relationship and transparency in ethical reporting; quantitative studies are constrained by non-probability sampling and an absence of power analysis, compromising their conclusions; and mixed-methods studies exhibit similar deficiencies. These results serve as a reminder that the field of foreign language teacher role reconstruction in the AI era is still in its infancy.

The terms "emotional connection" and "contextualized scaffolding" indicate that the fundamental value of FLTs in the AI era lies in their scaffolding function (Ma & Chen, 2025; Tutton & Cohen, 2025), consistent with Vygotsky's (1978) concept of the "teacher as a more knowledgeable other." Scaffolding theory posits a consistent, resource-abundant educational setting. This review demonstrates that university FLTs in the AI era are unstable and lack resources, as revealed by contradiction analysis. Algorithmic debugging—validating AI outputs and dissecting cognitive processes—exhausts instructors' mental capacity, hindering the analysis of their students' zones of proximal development (Chen et al., 2026; Urazbayeva et al., 2024). Institutions lack definitive AI utilization rules and ethical frameworks (Liang et al., 2025; Moorhouse & Kohnke, 2024), resulting in ambiguity for educators on the appropriate contexts for AI's application versus human scaffolding. Consequently, the ability of instructors to fulfill the function of "more knowledgeable other" is contingent upon their expertise and the structural prerequisites of their activity system.

Tutton and Cohen (2025) assert, through Self-Determination Theory (SDT), that educators fulfill students' needs for relatedness, autonomy, and competence to foster emotional connections that artificial intelligence cannot replicate. Our contradiction analysis indicates that educators require emotional assistance as well. Instructors experience a decline in emotional wellbeing when confronted with "professional identity threats" and "technological anxiety" (Su & Su, 2025; Xie et al., 2025). Consequently, a teacher's emotional connection is a contingent and exhaustible form of professional capital, rather than an inherent resource. Educators face the peril of emotional exhaustion and diminished competitiveness against AI displacement in the absence of institutional stress alleviation and community development. This result significantly undermines the idealized duties of teachers established by previous research.

Karimi and Keshvari (2026) identified that learner-driven AI autonomy renders teachers emotionally susceptible and creates friction in their professional identity, whereas Liu and Chang (2024) established that positive emotions and adaptive expertise mutually reinforce one another in the context of AI adaptation. These two studies illustrate the detrimental and advantageous aspects of teacher emotions in the era of artificial intelligence. This study contextualizes these two ostensibly contradictory emotional states through an investigation of the Activity Theory subsystem.

Negative emotions such as anxiety, anger, and frustration emerge from conflicts within the trade subsystem. When educators lack institutional support in their division of labor, they react explosively. This corroborates the findings of Karimi and Keshvari (2026). The operational functionality of the consuming subsystem

elicits positive emotions (exploratory motivation, sense of accomplishment) when educators obtain emotional resonance and strategic assistance from the community (including online and informal sources). This corroborates Liu and Chang (2024), where positive emotions and adaptive expertise mutually enhance one another. However, this study reveals that the formal institutional framework lacks a generative mechanism for positive emotions and is predominantly dependent on teachers' individual agency and spontaneous informal network organization.

Chu and Wang's (2025) notion of "foreign language teachers' epistemological agency" offers a robust cognitive framework for comprehending the reconstruction of teacher roles in the AI era. The swift emergence of AI serves as the primary stimulus, disrupting instructional equilibrium, while educators employ secondary stimuli such as collaborative lesson planning and critical thinking to address conflicts and devise innovative instructional solutions. This study offers a structural enhancement of the conceptual model through Activity Theory: the absence of rules and community dysfunction within the activity system effectively obstructs the provision of secondary stimuli.

When institutions lack explicit mechanisms for collaborative lesson planning, their efficacy is significantly diminished. Chu and Wang (2025) propose that individual, micro, and macro factors drive transformation processes. The contradiction analysis of this study indicates that micro-level aspects (institutional support, peer atmosphere) impose greater constraints than macro-level factors (socio-cultural context) at this juncture.

5. Conclusion

Current research trends prioritize qualitative approaches but frequently lacks the necessary reflexivity regarding researcher-participant dynamics. Meanwhile, quantitative studies suffer from inadequate statistical power due to limited sampling, and mixed-methods research lacks comprehensive data integration. Through the lens of Activity Theory, this study reveals that the reconstruction of teacher roles is fundamentally impeded by structural incongruities, including regulatory voids, community dysfunction, and an ambiguous division of labor between humans and AI.

To address these systemic gaps, institutions must establish robust AI utilization standards and training frameworks. Crucially, teacher education should prioritize AI-PCK (Technological Pedagogical Content Knowledge) over basic technical skills to ensure the vital integration of pedagogy. Professional development systems must evolve from informal "self-help" into institutionalized support

networks capable of addressing the complex emotional intricacies of role transition.

However, this evaluation is limited by its primary dependence on English language literature, which may restrict its relevance to non-Anglophone cultural and educational contexts. Additionally, while Activity Theory excels at identifying systemic contradictions and tensions, its focus may inadvertently obscure instances of efficient adaptation or harmonious integration. Future research should therefore employ longitudinal qualitative monitoring designs to examine how instructors navigate their institutional environments over extended periods. Such methodologies move beyond traditional cross-sectional studies to provide a more profound understanding of the dynamic evolutionary principles underlying teacher professional identity in the AI era.

Conflicts of Interest

The authors declare no conflict of interest.

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