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ISSUES

AI-Driven and Peer Feedback as Mediators of Student Language Teachers' Reflective Practice, Autonomy, and Agency: A Sociocultural Perspective

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Grounded in a sociocultural theoretical framework, this study examined the interplay between AI-driven feedback and peer feedback in shaping the reflective practice, autonomy, and agency of student language teachers. The study employed a case study design to explore the experiences of 14 student language teachers enrolled in a teacher education course at one teacher education university in Iran. Drawing on semi-structured interviews, reflective journals, peer feedback sessions, and AI-generated feedback logs, the study findings indicated that AI-driven feedback functioned as an objective, data-driven tool, recognising pedagogical patterns and areas for development, while peer feedback offered contextualised, empathetic critiques, enhancing co-constructed meaning-making. The findings also highlighted that in combination, these factors create a meaningful feedback ecosystem that provides reflective depth, promotes teachers' self-regulated learning and their exercise of professional agency. The study emphasises that technological and social mediation in teacher education be balanced to support development of AI literacy and the adaptation of culturally responsive tools through scaffolded peer collaboration.

1. Introduction

The incorporation of artificial intelligence (AI) and peer feedback into teacher education can substantially enhance how student teachers approach their professional development (Duan & Zhao, 2024). Reflective practice is a keystone of teacher development, reinforcing that effective teachers must examine their practices and modify their strategies via critical self-assessment (Korthagen, 2017; Schön, 1983). However, traditional approaches to reflection have been criticised for inadequate engagement with the social and collaborative aspects of learning (Johnson & Golombek, 2018; Vygotsky, 1978). AI-driven technologies and collaborative peer feedback present novel possibilities for inspiring reflective practice, enhancing teacher autonomy, and developing a sense of agency (Duan & Zhao, 2024). These developments

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support sociocultural theories that cognitive development is integrated in social interaction and cultural tools (Lantolf & Poehner, 2014; Wertsch, 1991).

As a mediating tool, AI can change reflective practice by providing immediate feedback and producing personalized learning analytics (Mueller-Csernetzky et al., 2025). Relatedly, peer feedback strengthens the social nature of reflection, supporting student teachers to co-construct knowledge and foster joint understandings (Carless & Young, 2024). Despite growing research on AI and peer learning, a significant gap exists in understanding how these two facets interconnect to form student language teachers' reflective capacities, autonomy, and agency.

Reflective practice has transformed since Schön's (1983) work. Current approaches identify the role of external mediation, such as digital platforms, in cultivating reflective processes (Farrell, 2022; Mann & Walsh, 2017). AI-powered tools present new opportunities for scaffolding reflection (M. L. Yang, 2025), but their effectiveness depends on whether they work as passive data providers or active peers (Selwyn, 2022). Peer feedback aligns with Vygotskian principles of social learning, where knowledge is constructed collectively (Lantolf & Thorne, 2006; Vygotsky, 1978). Peer interactions generate a more democratic space for experimentation and mutual development than hierarchical supervisor feedback (Carless & Boud, 2018). When shared with AI, peer feedback can be improved via structured prompts and data-driven understandings (Yu, 2025).

Autonomy and agency are principal to professional development, prompting student teachers' ability to make informed decisions and have ownership of their learning (Benson, 2021; Kayi-Aydar, 2019). From a sociocultural perspective, agency is a distributed phenomenon that appears through interactions with social and material resources (Eteläpelto et al., 2013). AI can sustain teacher autonomy by providing personalised learning pathways and allowing data-informed decision-making (Wang, 2021), though an overreliance may risk lessening human agency (Williamson, 2023). Peer feedback strengthens agency by placing student teachers as both learners and contributors (Wenger, 1998).

This study seeks to advance research on AI-mediated and peer feedback by examining their influence on reflective practice, autonomy, and agency among student language teachers. The findings offer implications for teacher educators integrating AI-driven tools and peer learning models. The study also provides suggestions for planning AI-enhanced peer feedback systems that highlight equity, inclusivity, and teacher empowerment.

2. Literature review

2.1. AI-driven feedback and peer feedback from a sociocultural perspective

The incorporation of AI-driven and peer feedback in teacher education has developed as a transformative approach for student language teachers (Bader et al., 2024). From a sociocultural perspective, learning is a mediated process where tools and social interactions form cognitive development (Vygotsky, 1978). AI and peer feedback function as critical mediational tools, scaffolding reflective thinking and collaborative learning (Cai et al., 2025).

This study is built upon Vygotsky's (1978) sociocultural theory, operationalised through three concepts. First, mediation is central: we examine AI-driven feedback as a technological tool and peer feedback as a social interaction. Second, the Zone of Proximal Development (ZPD) frames how peer collaboration and AI scaffolding provide support for developing professional competencies. Finally, we view agency as a capacity that emerges through critical engagement with these mediating resources (Eteläpelto et al., 2013).

AI works as a technological mediator, providing automated, data-driven insights, while peer feedback acts as a social mediator, cultivating dialogue and co-construction of knowledge (Wood, 2021). AI-powered tools offer immediate, personalised feedback on lesson plans and reflective journals (Zawacki-Richter et al., 2019). NLP analyses reflective writing, and virtual teaching assistants (VTAs) simulate classroom interactions for AI-generated critiques (Hwang et al., 2020).

Peer feedback supports social constructivism, where knowledge is co-constructed via interaction (Vygotsky, 1978). It facilitates reflective dialogue and agency, with peers providing contextualised insights that AI cannot reproduce (Carless & Boud, 2018). Models like Critical Friends Groups (CFGs) offer organised peer review, and video-based peer assessment allows for mutual feedback (Troudi & Mazandarani, 2024). However, peer feedback has limitations, including unpredictable quality and social obstacles like power dynamics (Carless & Boud, 2018; Gielen et al., 2010).

Linking AI and peer feedback generates a dual scaffolding system. AI offers objectivity, while peers suggest practical ideas (Guo, 2024). In hybrid models, AI identifies development areas and peers discuss explanations, boosting reflective depth (Cukurova, 2025). This research seeks to investigate how both tools can enhance teacher development courses by creating a balanced, reflective learning ecosystem.

2.2. AI-driven feedback and peer feedback in language teachers' professional development

Reflective practice, autonomy, and agency are crucial constituents in the professional development of pre-service teachers (Y. Yang et al., 2020). Established upon sociocultural theory (Vygotsky, 1978), this literature review probes how AI and peer feedback nurture these competencies. Reflective practice is a foundation of effective teacher education (Schön, 1983), connecting theoretical knowledge and classroom practice (Korthagen, 2017). However, enhancing reflective skills needs organised support, as novice teachers often cope with self-directed reflection (Mann & Walsh, 2017).

Peer feedback, embedded in sociocultural theory, plays an important role in cultivating autonomy and agency by producing a collaborative learning environment (Vygotsky, 1978). Research suggests that peer feedback improves metacognitive awareness and contributes to augmented self-efficacy (Gundel & Piro, 2021). Yet, the quality of peer feedback differs, requiring scaffolding mechanisms. This is where AI tools can play a corresponding role.

AI technologies are progressively being incorporated into teacher education to facilitate reflective practice and autonomy (Chang & Sun, 2024). AI-driven platforms can examine teaching videos and written reflections to offer instant, personalised feedback (Cai et al., 2024). Such systems support Vygotsky's notion of the 'more knowledgeable other'. Nevertheless, concerns continue about over-reliance on automated systems, which may reduce human contact. Hence, a balanced approach that connects AI analytics with peer collaboration is vital.

The integrated use of AI and peer feedback offers an encouraging framework for increasing reflective practice, autonomy, and agency in student teachers (Yu, 2025). Although previous research has highlighted the significance of digital and social mediators, there remains a scarcity of research exploring the role of AI-driven feedback and peer feedback in shaping language teachers' reflective practice, autonomy, and agency, which is the aim of this study.

In this regard, this study aims to answer the following research question:

> How do AI-driven feedback and peer feedback interact to influence the development of reflective practice, autonomy, and agency among student language teachers in a teacher education course?

3. Method

3.1. Design

This study used an instrumental case study design (Stake, 1995) to explore how AI-driven and peer feedback interact within a single teacher education course. This design was adopted to offer a detailed, context-dependent

understanding of a complex phenomenon (the connection of technological and social mediation) in an authentic setting, aligning with the sociocultural principle that learning is situated (Vygotsky, 1978). A purposive sample of 14 second-year student teachers were selected to ensure all participants were at a similar developmental stage and were embedded in the same instructional context, thereby offering rich, information-rich cases for exploring the research question.

3.2. Context and participants

The study was conducted at a teacher education university in Tehran, Iran. Participants were 14 second-year undergraduate student teachers specialising in English language education, with an average age range of 20 to 25 years (M=24). They had limited instructional experience, with only 80 to 100 hours of supervised classroom practice from former coursework.

The teacher education course in which they were registered encompassed weekly teaching practicums in simulated and real classroom settings, followed by feedback sessions from peers and instructors. The course also combined AI-driven tools, including automated lesson plan evaluators and virtual classroom simulators, to offer data-based feedback.

The university is a public teacher training institution with a prominence on sociocultural approaches and a blended learning model. The urban context of Tehran exposed participants to diverse classroom environments, fostering their reflective and adaptive skills. This particular course was selected as the research site because it offered a rich, contextually embedded case for investigating how AI and peer feedback interact within a socio-culturally framed learning environment.

3.3. Teacher education course

The teacher education university is recognised as Iran's chief university for teacher education, providing a four-year bachelor's degree. The university focuses on reflective practice and sociocultural learning theories, with a curriculum organised to nurture collaboration, peer mentoring, and scaffolded development.

A key feature is its blended learning environment, which integrates face-to-face teaching with digital learning platforms. AI-powered technologies, including automated lesson plan evaluators and virtual classroom simulators, are rooted in coursework, offering data-driven feedback.

The university places a strong emphasis on practical experience, requiring student teachers to complete supervised instructional practicums. These are supplemented by micro-teaching sessions where student teachers obtain feedback from both AI analytics and peer discussions.

Another crucial element is the structured peer feedback system, which functions together with AI-generated insights. This supports Wenger's (1998) concept of communities of practice, where learning is socially constructed.

The course is planned to develop reflective practitioners, cultivate teacher autonomy and agency, and link theory and practice. By joining AI-driven feedback with peer collaboration, the course boosts student teachers to take agency of their professional development.

3.4. Data collection

The data collection process for this study was carefully designed to capture the interactions between AI-based feedback, peer feedback, and the development of reflective practice, autonomy, and agency among student teachers. A multi-method approach was employed to ensure comprehensive data triangulation, incorporating different qualitative instruments. The study spanned one full academic semester and involved various stages of data collection. Participants were selected via purposive sampling to ensure they met the study's criteria: they were second-year undergraduate TEFL student teachers with approximately 80 to 100 hours of prior practicum experience. The final sample comprised 14 student teachers (6 female and 8 male), selected according to their participation in the teacher education course during the academic semester. The selection aimed for variations in instructional styles and engagement levels to attract diverse responses to AI and peer feedback. Before the intervention, a two-day workshop was conducted to familiarise participants with the AI tools (e.g., ChatGPT for reflective writing analysis) and structured peer feedback protocols. The training covered AI tool implementation, peer feedback techniques, and ethical guidelines. The intervention incorporated AI and peer feedback into weekly pedagogical practicums in three phases: (1) Pre-Intervention Preparation and Baseline Data Collection, (2) Intervention Implementation, and (3) Post-Intervention Evaluation. The student teachers needed to work with AI tools and their peers to prepare lesson plans, reflect on their teaching, find teaching strategies, develop their teaching practices, solve problems, develop curriculum and assessment, enhance students' learning, and improving their pedagogical knowledge and practice.

Initially, a semi-structured interview, lasting 30–45 minutes, was conducted at the beginning of the course to investigate student teachers' experiences with both feedback types. To this end, the interview protocol involved questions about student teachers' previous experiences with feedback. The teachers were queried about their experience with AI-produced and peer feedback, and their perceptions of the methods' practicality, challenges, and impact on their instructional development. Next, the interview questions investigated student teachers' initial perceptions of the roles of AI (e.g., objectivity, data-driven insights) against peers (e.g., empathy, contextualized suggestions) in their reflective practices. They were also asked about their

expectations of the course, their reflections of how they expected AI-driven and peer feedback would impact their autonomy, agency, and teaching skills throughout the course. Finally, they were questioned on their potential concerns or reservations about algorithmic biases in AI or social dynamics in peer feedback, and how they intended to explore these issues. These questions provided a baseline understanding of participants' attitudes and set the stage for investigating shifts in their reflective practice, autonomy, and agency during the course. The first researcher conducted the interviews in a semi-structured manner to explore the significance of AI-generated and peer feedback, recognise challenges and strengths and their influence on the participants' reflective practices, and evaluate perceived autonomy and agency.

During the teacher education course, the student teachers were asked to keep reflective journals (Richards & Farrell, 2005) on the role of AI-based and peer feedback. Particularly, they were to consider the importance of having agentic actions to develop their teaching, the prominence of AI and peers during reflective actions and autonomous decision making, and the value of responses to feedback and critical incidents. The journals were written in Persian and were translated into English. The student teachers wrote their journals on paper, which were returned for personal reflection.

Furthermore, peer feedback sessions were conducted each week for about two hours and audio-recorded and transcribed each week by the first researcher, guided by rubrics assessing lesson clarity and engagement. The first researcher functioned as a participant-observer, fostering interactions, directions, and sustaining field notes while minimising bias via standardised peer interactions. To establish the validity and reliability of the feedback mechanisms, different measures were enacted.

The criterion validity of the AI-produced feedback was assessed through a pilot phase. A sample of 20 lesson plans and 15 video-recorded instructional segments were individually assessed by both the AI system and two expert teacher educators. The alignment between AI and the human experts was calculated with a percentage agreement formula, and the value was 85% (142 out of 167 evaluative statements; 95% CI [79.2%, 90.8%]). This metric reflected the proportion of evaluative statements (e.g., 'teacher talk time is high', 'use more open-ended questions') on which the AI output matched the assessment recognised by at least two of the three raters (two human experts and AI itself). Additionally, intercoder reliability for the qualitative analysis was established, as detailed in Section 3.5.

Participants engaged with different types of AI-powered tools that offered feedback on their teaching practice. The tools and their uses were as follows:

- *For written reflection & lesson plan analysis*: ChatGPT (GPT-4 model) was implemented via a structured prompt template (see Appendix) to analyse reflective journals and

lesson plans. The prompt was formulated to recognise patterns in critical thinking and instructional strategies, and to suggest areas for development.

- *For classroom interaction analysis*: A dedicated Virtual Classroom Simulator (developed by Mursion) was adopted to generate simulated teaching scenarios. Participants' performances were recorded and analysed by the simulator's built-in NLP analysis engine to track metrics such as teacher/student talk time, question types (open vs. closed), wait time, and non-verbal communication cues.
- *For feedback logging and dashboards*: A custom Learning Analytics Dashboard collected feedback from all sources (AI and peer) into a single interface for participants. This dashboard did not produce its own feedback but presented the analysed data from the other tools.

All participant data input into these systems (written texts, video recordings) were anonymised using participant codes (e.g., T1, T2) before processing. No personal information was stored on the AI platforms. Video and audio data from simulations were processed on secure, encrypted servers, and raw data were deleted after analysis, with only collected, non-identifiable ideas used for the study.

Finally, in order to examine the student teachers' feedback experiences and how these experiences may have influenced their reflective practice, autonomy, and professional agency over time, another interview was conducted at the end of the course. That interview expanded on their initial responses, the reflective journals, and peer feedback sessions. It should also be mentioned that ethical considerations were considered, including informed consent detailing data usage and anonymity, along with compliance with data security protocols.

Data collection was prepared for methodological triangulation, collecting various perspectives on the same phenomena. Semi-structured interviews offered ideas into participants' perceptions and experiences, reflective journals captured their internal thought processes, peer feedback sessions documented collaborative sense-making, and AI-generated feedback logs provided objective, data-driven evidence of instructional behaviours. This multi-dimensional approach allowed for cross-verification of findings and a more all-inclusive understanding of the feedback ecosystem.

3.5. Data analysis

The data (peer feedback sessions, reflective journals, semi-structured interviews, and AI-generated feedback logs) were analysed based on the guidelines of thematic analysis (Braun & Clarke, 2006). A rigorous

translation protocol was followed to guarantee conceptual equivalence. All Persian data (interviews, journals, peer sessions) were originally translated into English by the first author, a bilingual native Persian speaker with academic proficiency in English. To verify accuracy, a professional translator, independent of the study and certified by the Iranian Translators Association, back-translated a 20% sample of the data. The research team then compared the original Persian, the initial translation, and the back-translation to resolve any minor discrepancies in meaning.

The subsequent thematic coding was performed on the finalised English transcripts to foster analysis and discussion within the research team. To establish intercoder reliability, two researchers individually coded the same 30% of the data using the initial codebook. Intercoder reliability was formally assessed to confirm the consistency of the qualitative coding. The data included excerpts from interviews, journals, and peer feedback sessions. Cohen's Kappa was calculated to be 0.82 (95% CI [0.76, 0.88]), representing a strong level of agreement beyond chance. Any coding discrepancies were discussed in regular meetings until a full consensus was reached, and the codebook was refined accordingly before the first author completed the coding of the entire dataset.

Before starting the coding process, the data were translated into English to be easier for analysis. At this stage, we engaged in separate analysis of the sources so that first themes from each of them could be extracted. Moreover, we kept in mind the components of AI-driven feedback, peer feedback, and their contributions for teachers' agency, autonomy, and reflective practice so that a mixture of theoretical and inductive analyses of the data could provide a thicker description of the available data. Such a reservation was in line with the theoretical stance of study (i.e., sociocultural perspective).

The data were analysed following the six-phase process of reflexive thematic analysis (Braun & Clarke, 2006), which permits both inductive and theoretical coding. The analysis was implemented on English transcripts, generated through a rigorous translation and verification protocol as formerly described.

3.5.1. THEMATIC ANALYSIS PROCEDURE

Familiarisation: Researchers repeatedly read all data (interview transcripts, journals, peer-session transcripts, and AI feedback logs) to immerse themselves in the content.

Initial coding: Systematic coding was integrated across the entire dataset. Codes were produced inductively from the data and deductively from the study's focus on reflective practice, autonomy, and agency.

Generating initial themes: Codes were gathered and grouped into potential themes. This involved generating thematic maps to visualise relationships between codes and candidate themes.

Reviewing and developing themes: The potential themes were checked against the coded data and the whole dataset to ensure they formed a coherent pattern. Themes were refined, split, or discarded during this iterative stage.

Defining and naming themes: The essence of each theme was clearly defined and named to capture its core narrative. The three final themes were: (1) Reflective practices: linking data and dialogue; (2) Autonomy: from external guidance to self-directed development; and (3) Agency: claiming power in the professional landscape.

Producing the report: The analysis was woven into a coherent narrative, supported by vivid data extracts.

3.5.2. INCORPORATION OF AI-GENERATED FEEDBACK LOGS

It was vital that AI outputs (the feedback logs) were used as data to be analysed, offering evidence of pedagogical patterns. AI tools were *not* used to conduct the analysis itself; coding and theme generation were performed manually by the researchers to keep interpretive depth.

3.5.3. ENSURING TRUSTWORTHINESS

Different procedures were used to ensure the rigor of the analysis:

- *Triangulation*: As described in the data collection section, findings were cross-checked across various data sources.
- *Intercoder reliability:* Two researchers independently coded a 30% stratified sample, gaining strong agreement ($\kappa = 0.82$). Discrepancies were resolved through discussion until consensus was reached, refining the codebook in the process.
- *Member checking*: Preliminary interpretations were shared with a subset of participants to confirm the credibility of the findings.
- *Peer debriefing*: The research team engaged in regular discussions to challenge assumptions and explore alternative interpretations of the data.

3.6. Researcher positionality

This study was conducted by a team of three researchers, two based in Iran and one in Norway, who have experience in language teacher education. The Iranian researchers, working within the context of the study, brought

deep contextual knowledge and sustained engagement with participants. The Turkish researcher, based in Norway, contributed a comparative and critical lens shaped by experiences in digitally integrated teacher education.

While we collectively support the potential of AI in education, we also approached this study with a shared critical awareness of its limitations, particularly in relation to teacher agency, autonomy, and reflective practice. These positions informed our ethical and methodological decisions throughout the research process. The first researcher, responsible for data collection, guided participants in using AI tools with careful scaffolding and support, ensuring their engagement was reflective and pedagogically meaningful. The second researcher collaborated closely in the design of the instruments, supported local coordination, and contributed to culturally sensitive interpretation of the data. The first researcher played a key role in framing the study within a broader sociocultural and technological context, and worked closely on the analysis and writing to ensure theoretical and methodological coherence.

We maintained a reflexive stance and engaged in iterative cross-contextual dialogue throughout the study. This collaborative approach allowed us to balance AI-driven and human-led feedback, while attending to issues of bias, power, and ethical responsibility in introducing AI to teacher learning contexts.

4. Findings

Building on sociocultural theory and analysed through thematic analysis, data analyses indicated a symbiotic feedback ecosystem where technology and human interaction interdependently functioned to support teacher development. The findings indicated a significant interconnection between AI-based feedback and peer feedback in developing and promoting reflective practice, autonomy, and agency among student language teachers, in line with the tenets of a sociocultural perspective. Relatedly, the corresponding roles of AI and peers underscore how technological and social mediation can synergistically foster teacher development, while the findings recognise pressures that need critical consideration.

4.1. Reflective practices: Bridging data and dialogue

Reflection is indicated to have been established by the complementary strengths of AI and peer feedback. Teachers' narratives showed that AI functioned as a persistent observer, which the participants used for particular purposes, and promoted instructional practices with algorithmic precision. As T12 mentioned: '*AI held up a mirror to my teaching, illuminating blind spots like my overuse of closed questions.*' (T12, interview). However, this objectivity came with restrictions. AI irregularly misread cultural codes, interpreting rapport-building pauses ('um') as faults or imposing Western teaching norms ill-suited to local classrooms. Its feedback, though instant

and standardised, required instant human judgement and questioning for validation. Peers, on the other hand, supported such reflection with empathy by providing context-sensitive information to raise further awareness. Peers highlighted issues, shared their experiences and practices, provided constructive feedback, and resolved problems collectively:

> My peers inform and guide me *in* how to manage time better, personalise my teaching to meet students' level and different needs, and enhance my creativity in teaching. We brainstormed the ways to enhance our teaching for different scenarios and for various situations, especially the challenges we might face in our classes and the best strategies for each of such situations.
>
> (T5, reflective journal)

Teachers' narratives indicated that such interaction and collaboration transformed reflection from a private act into a collective process, where knowledge and skill could be co-constructed. T4 also noted:

> We discussed different teaching strategies and alternatives, what we have learned in the courses, what we have experienced which was unique. We laughed together and built personal connections, we shared our ideas and worries, and we tried so hard to put theories into practice collectively by means of collaborations.
>
> (T4, interview)

The subjectivity of peer feedback sometimes caused irregular critiques, including overvaluing friends or skirting painful facts. One of the teachers mentioned: *'Sometimes, I realized that my peers supported me even when I made mistakes and avoided emphasizing noticeable mistakes to not hurt my feelings'* (T5, interview). When the participants were exposed to AI-based feedback and feedback from peers, they engaged with and used multi-source feedback. While AI could generate curiosity and identify new areas for development: '*Why do I take over 80% of talk time?*' (T12, peer feedback session), peers helped interpret it and find different practical solutions: '*Your questions and explanations are too complex— use more direct questions, try wait time, and be specific and short*' (T12, peer feedback session). Although AI recognised patterns and noticed new areas, peers could explain and clarify them more contextually. For example, when AI marked frequent student disengagement, peers contextualized it: *'It's not about the pace of the lesson; it is because of the post-lunch slump. You need to try a kinesthetic warm-up and fun-based activities to energize them'* (T2, reflective journal). This dichotomy motivated teachers to go beyond surface-level solutions (e.g., '*speak slower*') toward critical inquiry (e.g., '*How does my questioning privilege certain learners?*'), as stated by T6 in the reflective journal.

4.2. Autonomy: From external guidance to self-directed development

The analysis of the data revealed that the combination of AI-mediated feedback and peer feedback cultivated a shift from dependence to self-regulated professionalism, making student teachers more autonomous in their decisions, actions, and experiences. AI had real-time analytics and worked as a relentless yet neutral coach, pushing teachers toward improvement and allowing them to visualise their development over time. T13 noted: *'My dashboard indicated my teacher-talk reducing each week.'* (T13, interview). AI also democratised feedback, providing novice teachers with the same granular perceptions once reserved for mentor observations. T3 stated:

> Previously, only our mentors detected insignificant particulars such as how often I repeated teachings or paused too long for replies. Now, the AI monitors the whole thing: my question types, talk time, even student response gaps. AI worked as an expert and helped me with each and every lesson.
>
> (T3, reflective journal)

Nevertheless, some became excessively dependent on its metrics, treating its recommendations as edicts rather than constructive reminders for reflection. In addition, peers played a vital but equally important role as they normalised experimentation. T11 noted: *'AI helped me to be more autonomous as I could receive constructive feedback and wise advice to regulate my teaching, emotions, and personality factors'* (T11, interview). When AI fostered student participation, peers could exchange real strategies, empowering risk-taking and creative practices. T9 indicated: '*I received enough support from my friends that made me motivated to innovate new practices.*' (T9, peer feedback session). On the other hand, with no structured protocols, some feedback circles transformed into 'support groups' that circumvented realities, as T5 mentioned: *'I believe that groups that I was engaged in were a bit unstructured and led to irrelevant discussion.'* (T5, reflective journal).

Data analyses showed that the interplay between these forces enhanced autonomy. AI offered 'what' (e.g., *'Your changes are sudden'* (T11)), while peers provided the 'how' (e.g., *'Use a visual timer'* (T14)). Student teachers were informed how to use different feedback, like T7, who double-checked the AI evaluation of her pacing with peers before modifying her lesson: '*Whenever AI offered some feedback to enhance different aspects of my teaching, I reflected on them collectively with my peers to enhance the practicality and applicability of AI-based feedback.'* (T7, interview). Teachers' narratives indicated that they internalised this process, depending less on external validation and being more expert at self-assessment.

4.3. Agency: Claiming power in the professional landscape

Data analyses indicated that the feedback forms influenced student teachers' identities, skills, and knowledge as practical change-makers. Thus, they became more autonomous and gained more agency to change their teaching beliefs, theories, methods, and actions by means of AI-based and peer reflection. AI expanded student teachers' understanding and awareness, revealing them to international and local teaching strategies and methods and measuring their practices against broader trends. T6 stated: *'AI noticed my bias toward teacher-centred teaching. Now I use different ways to enhance my students' engagement and inclusion'* (T3, peer feedback session). Nonetheless, its 'neutral' algorithms sometimes caused cultural biases, such as favouring native-like or standard English over local varieties. T7 mentioned:

> AI provided reading passages and listening tasks that were not according to Islamic values and Iranian culture. However, working on these values is of significance for the Ministry of Education. Also, it focused on native-like accent, which was not the main objective of my course, since we see English as an international language for communicative purposes. I could not use them in my class.
>
> (T7, peer feedback session)

Data analyses also revealed that peer feedback supported professional relationship. One of the teachers noted: *'I could interact with my peers to share my experiences, emotions, feelings, and practices. This helped me form a strong relationship with my peers through a new community.'* (T2, interview). Unstructured interactions and questions, shared lesson plans, constructive feedback, and mutual support were some of the benefits of working with peers. *'In fact, we weren't only peers, but we could be seen as allies. We discussed, asked questions, and prepared lesson plans'* (T3, reflective journal). This camaraderie lasted beyond training, changing into strong networks where student teachers shared resources and promotion strategies within a community of practice. Further, the most meaningful shift happened when teachers started fostering feedback. T8 demonstrated: '*I integrate AI to identify trends, then discuss them with peers to design interventions.*' (T8, Interview). They questioned and analysed the responses and insights of AI and fostered peer suggestions through negotiation. This critical, agentic stance equipped them to explore future challenges autonomously.

In conclusion, the findings revealed tensions and pressures, such as AI's inflexibility, peer subjectivity and unpredictability, and cultural mismatches and vagueness. For example, T13 mentioned:

> I could not tolerate AI's responses sometimes, as it provided some established answers without flexibility and creativity. Also, it could not culturally understand my specific context. Moreover, peers provided different answers from their own perspectives and experiences.
>
> (T13, reflective journal)

To join this synergy, the research calls for organised peer training (e.g., rubric-guided feedback), critical AI literacy (e.g., probing algorithmic biases), hybrid reflection models where AI and peers scaffold one another's development meaningfully. This research conceptualised feedback not as a top-down evaluation but as an iterative, collaborative process. When the logical competence of AI combines with peers' empathetic wisdom, teachers don't just struggle in the classroom, but rather they flourish as reflective practitioners, autonomous reformers, and agentive professionals. The future of teacher education lies in cultivating this balance, ensuring that technology and humanity symbiotically promote one another.

5. Discussion

The findings of this study indicated a significant interconnection between AI-based feedback and peer feedback in developing reflective practice, autonomy, and agency among student language teachers. Although sociocultural theory illuminates the mediated nature of learning, incorporating self-regulated learning theory (Zimmerman, 2002) elucidates how teachers internalise feedback cycles to plan, monitor, and change practices autonomously. Likewise, communities of practice (Eckstein, 2023) contextualise the role of peer feedback in supporting agency, as collaborative networks changed reflection from individual to collective praxis.

Together, these lenses show how data-driven scaffolding of AI and peers' social scaffolding merge to nurture self-directed, contextually grounded development. The corresponding roles of AI and peers underscore how technological and social mediation can synergistically foster teacher development, while the findings also recognise pressures that need critical consideration.

This could support new research focusing on the value of AI in recognising teaching patterns while highlighting the unique role of human collaboration in meaning-making (Johnson et al., 2024). Nonetheless, the study also discloses limitations in both feedback mechanisms. AI's algorithmic accuracy, though valued for distinguishing quantitative patterns (e.g., talk time ratios, discourse structures), rarely had cultural sensitivity and misunderstood local teaching norms or favoured Western teaching biases. That issue has resonated in critiques of AI's embedded inequalities (Selwyn, 2022; Williamson, 2023). On the other hand, the subjectivity of peer feedback sometimes restricted critical depth, supporting Carless and Boud's (2018) findings on collegiality

limitations. These findings offer that neither AI nor peer feedback alone is adequate but rather their integration makes a more vigorous reflective ecosystem.

Autonomy appeared through self-regulated feedback cycles (Zimmerman, 2002), where AI metrics and peer dialogue encouraged iterative modifications. The role of AI as a continuous coach offered student teachers with practical metrics, enhancing self-regulated learning, which is a finding in line with Zimmerman's (2002) model of autonomy in professional development.

Yet, an overreliance on AI-generated suggestions risked weakening critical autonomy, as some participants treated algorithmic recommendations as prescriptive rather than reflective prompts. This supports warnings about the automation bias in AI-assisted education (Williamson, 2023), where users uncritically accept automatic feedback. Peer interactions counterbalanced this by boosting interpretive flexibility, empowering student teachers to assess, change, or reject feedback according to contextual needs. The shift from dependence to self-directed decision-making mirrors Kayi-Aydar's (2019) concept of agency as a socio-culturally mediated process, where tools (AI) and social interactions (peers) jointly scaffold professional growth.

Agency is established when teachers critically synthesize feedback. In countering AI's concentration on native-like pronunciation, the teachers emphasised teaching English for communication, not imitation, and they demonstrated a struggle with algorithmic prescriptivism. The transition from passive feedback consumers to active designers of their own development reflects Eteläpelto et al.'s (2013) statement that agency appears through engagement with mediating resources. Particularly, the study underlines the role of peer communities in supporting long-term agency, as collaborative reflection enhanced professional solidarity, a finding supported by Wenger's (1998) communities of practice framework. The research also surfaces tensions in agency development chiefly when AI-driven feedback clashes with cultural or institutional teaching norms. For example, AI's focus on native-like English proficiency unintentionally marginalised local teaching practices, strengthening critiques that AI can continue leading to differences unless it is intentionally prompted for equity (Regmi, 2025). This calls for critical AI literacy in teacher education, suggesting that student teachers question algorithmic biases while leveraging AI's analytical strengths.

Implications for teacher education courses are multidimensional. First, the study promotes using organised hybrid models where AI and peer feedback are deliberately sequenced, such as using AI to recognise reflection prompts, followed by peer discussions to contextualise insights. Such models necessitate arranged learning environments that balance automation and human collaboration. Second, training in both AI literacy and peer feedback protocols is vital to mitigate the pitfalls recognised. Student teachers require

help to critically evaluate AI-generated data (Selwyn, 2022) and to be involved in constructive peer collaboration. Lastly, the study emphasises the need for culturally responsive AI tools, planned in partnership with educators to confirm alignment with diverse instructional contexts. Whereas this study establishes the synergistic potential of AI and peer feedback, its application needs careful exploration of tensions.

6. Conclusion

This study has indicated that the dynamic interplay between AI-based feedback and peer feedback in influencing reflective practice, autonomy, and agency among student teachers, as supported by sociocultural framework. While AI worked as an objective, data-driven mirror, recognising meaningful patterns in instructional behaviours, discourse structures, and teaching efficiency, peer feedback augmented reflection by means of contextualised, collaborative meaning-making. Together, they produced a synergistic feedback system that bridges theory and practice by means of AI and peers, facilitating more profound professional development than either could accomplish alone. AI's simultaneous analytics offered practical ideas, but its restrictions, including cultural insensitivity or algorithmic rigidity, underscored the requirement of human interpretation. Peer feedback opposed these gaps by providing detailed, compassionate critiques, renovating reflection from an isolated exercise into a cooperative, mutually embedded process. AI's personalized dashboards stimulated self-regulated learning, however they risked nurturing dependency when observed as prescriptive. In response to that risk, peer interactions democratised feedback, enabling student teachers to selectively integrate, adjust, or challenge recommendations, thus promoting professional autonomy. The transition from feedback consumers to co-designers of their own development underlined agency as a socio-culturally mediated phenomenon, with peer communities working as supporting networks that strengthened long-term agency beyond formal training.

Responsible AI statement

The integration of AI in this study was directed by a commitment to responsible and ethical research practices. We applied numerous measures to guarantee fairness, alleviate bias, and preserve contextual sensitivity:

Bias mitigation and fairness: We explicitly admitted the potential for Western-centric and culturally insensitive biases in pre-trained AI models like ChatGPT-4. To counter this, our prompt engineering (Appendix) included directives for contextual adaptability and prohibited judgement of personal attributes. Moreover, AI-produced feedback was never presented as a definitive evaluation but as one data point to be critically discussed and contextualised within peer feedback sessions.

Contextual sensitivity: The main role of peer feedback was to offer the vital cultural and contextual framing that AI lacks. Participants were instructed to use AI outputs as a 'discussion starter' and to collaboratively assess the applicability of AI suggestions to the particular Iranian classroom context, often rejecting or adapting suggestions that were culturally misaligned (as evidenced in the findings).

Transparency and human-in-the-loop: The research design was explicitly 'human-in-the-loop'. AI worked as a tool to augment, not replace, human judgement. The final interpretation of all feedback, the decision-making about instructional practices, and the reflective meaning-making remained firmly with the participant teachers and the researchers.

Data privacy and anonymisation: As detailed in the method section, all data processed by AI tools was thoroughly anonymised. Participants were fully informed about which data would be processed by AI systems and offered explicit consent for this particular use.

Author contributions

Arefian led the data collection and analysis and prepared the initial draft of the manuscript. Karbalaei provided critical intellectual input, contributed substantially to manuscript revisions. Both authors approved the final for all aspects of the work.

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Competing interests

The authors declare no competing interests

Ethics approval

This study was approved by the Ethics Committee of the English Department, Farhangian University, Tehran. Informed consent was obtained from all participants for their inclusion in the study, including the use of audio- and video-recorded sessions

Data and materials availability

Parts of the data are publicly available. https://viraacademy.com/upload/files/File-24.docx.

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Appendix A: Example Prompt for AI-Driven Feedback

Prompt Template for Reflective Journal Analysis (Used with ChatGPT-4)

"You are an expert teacher educator offering constructive feedback to a student teacher. Analyse the following reflective journal entry. Your task is to:

1. Recognise and list the key instructional issues or successes the teacher has described.
2. Provide two particular, practical alternative strategies the teacher could try, according to teaching theory.
3. Pose one open-ended question to prompt deeper critical reflection on their central assumptions about instruction and learning.

Important Guidelines

- Focus on the teaching actions, not the teacher's personal attributes.
- Ensure suggestions are practical and adaptable to different classroom settings.
- Your tone should be supportive and constructive, not judgmental.

Journal Entry to Analyze

"Today's lesson on vocabulary for 'daily routines' felt a bit flat. I clarified the words such as 'brush my teeth,' 'go to school,' and 'do homework' and used the pictures from the book. I tried to have the students to repeat after me, but only a few of them joined. Most of them were quiet and just copied the words into their notebooks. I'm not sure if they were bored or if they didn't understand. I felt like I was talking too much, but I didn't know what else to do to make it more engaging. I wanted to finish covering all the words in the unit, so I moved quickly. Maybe I should have spent more time on practice, but I was worried about the lesson plan."