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Fostering Interactional Competence through AI-Based Virtual Dialogue: Task Awareness Transformation in Japanese Pre-service Elementary School Teachers

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Abstract

Developing interactional competence (IC) remains a significant challenge in Japanese elementary English teacher education, where pre-service teachers tend to prioritize linguistic accuracy over pedagogical facilitation. This pilot study investigates how a generative AI-based virtual dialogue environment—one specifically designed to introduce "friction" through unpredictable and incomplete responses—may reshape pre-service teachers' task awareness. Two university students took part in a two-week intervention using ChatGPT's voice mode, assuming the role of teachers interacting with an AI "child." Semi-structured interview data were analyzed using a Grounded Theory Approach (GTA). The analysis reveals a four-stage process: (1) initial difficulty arising from the gap between expectations and reality, (2) a shift in awareness from self-oriented linguistic anxiety toward learner-focused facilitation, (3) the concretization of perceived classroom conflicts, and (4) an emerging desire for pedagogical support. A central finding is that AI-mediated "friction" serves as a productive catalyst for professional learning, destabilizing existing frames of reference and prompting participants to redefine IC as the co-construction of meaning. The study carries several implications for teacher education and AI design. It proposes the principle of "intentional imperfection" in AI behavior, suggesting that rather than providing flawless models, AI for teacher training should generate manageable interactional trouble to elicit pedagogical judgment. The findings also highlight the necessity of embedding such simulations within a scaffolded framework that provides diagnostic feedback and links virtual practice to real-world professional vision. Together, these contributions offer a conceptual foundation for utilizing AI to prepare teachers for the interactional complexities of the language classroom.

Keywords: Generative AI, grounded theory approach, interactional competence, teacher education

1. Introduction

When Foreign Language Activities were first introduced as a mandatory area in Japanese elementary schools in fiscal year 2011, it quickly became clear that many elementary school teachers and pre-service teachers lacked sufficient English proficiency—and that this shortfall was compounded by considerable anxiety about teaching in the language (Yonezaki et al., 2016; see also Sakai & Uchino, 2018; Shimatani & Okazaki, 2024). Higher levels of English proficiency have been required since Foreign Languages became a mandatory subject for the 5th and 6th grades in 2020. Even so, a 2023 survey by the Japanese Ministry of Education, Culture, Sports, Science and Technology (MEXT) indicated that the proportion of elementary school teachers whose English level reached CEFR B2 or higher was just 4.3% (MEXT, 2024). That so few teachers meet this threshold remains one of the obstacles most frequently cited in discussions of classroom practice.

The picture becomes more complicated when we consider what teachers are actually asked to do. According to the same MEXT survey, "speaking (interaction)" activities account for around half of all language activities in elementary schools on average. Knowing English, then, is not enough on its own; teachers must also manage interactional activities spontaneously, in response to whatever children happen to say. It is this demand that makes Interactional Competence (IC)—the ability to co-construct interaction with learners and other interlocutors—a central professional skill rather than a desirable bonus. Matsunaga & Tanabe (2025), surveying in-service elementary school teachers about the English abilities they consider necessary for instruction, found that respondents showed a marked preference for skills bound up with responsive classroom interaction: being able to paraphrase expressions as needed, or replying to students' utterances without preparation time.

Building this kind of competence during pre-service education, though, proves genuinely difficult. Consider what is involved in introducing a language activity: the teacher needs to lay out its purpose, model the target interaction, and—crucially—anticipate how students might react. For university students with little or no experience in teaching English, handling all of this at one time is extremely challenging (Toi & Yamauchi, 2022). Nor do conventional programs typically give pre-service teachers many sustained and structured opportunities to develop their IC. Peer-taught simulated lessons are the norm, not practice with actual children; asking real young learners to come to the university will raise ethical concerns; and practicum opportunities for university students are quite limited in Japan. What tends to happen, as a result, is that students frame their difficulties almost entirely in terms of "my English is not good enough"—a framing that stops short of the more pedagogically oriented question of how to facilitate student learning through interaction.

It is partly in response to these constraints that researchers have started looking at what AI might offer teacher education, and the role envisaged goes beyond information provision. In simulation-based work, pre-service teachers have been placed in controlled environments where they interact with AI-powered virtual student agents; findings from these studies point to the potential of such setups for making situational pedagogical decision-making something that can be observed and rehearsed (Dai, 2023; Hong et al., 2025). Other researchers have found that pre-service teachers who engage with AI chatbots gain a low-stakes arena for practicing responsive teaching and experimenting with virtual instruction (Son et al., 2024; Lee et al., 2025; Tegero & Mabini, 2025). Within language teacher education, intervention studies have underlined that equipping pre-service teachers with professional competence in generative AI matters for their readiness to use it once they enter the classroom (Moorhouse et al., 2024). On a broader canvas, scholars of teacher education have noted that generative AI is forcing a reappraisal of what future

teachers need to know and be able to do—a reappraisal that touches on AI literacy, pedagogical judgment, and habits of reflective practice alike (Prilop et al., 2025).

For all this progress, the literature leaves certain questions underexplored. A good deal of existing work is oriented toward AI literacy, attitudes toward AI, instructional design support, or reflection on teaching in general terms; far less attention has gone to the question of whether and how AI-mediated dialogue can alter pre-service teachers' grasp of IC as something they must actively work at in pedagogical terms (Moorhouse et al., 2024; Prilop et al., 2025; Karakaya et al., 2025). Then there is the matter of interactional trouble. Some studies do use simulated environments or chatbots, but few have probed what happens when the dialogue itself goes wrong—when the AI produces an unexpected answer, an incomplete utterance, a response that is hard to make sense of—and whether that trouble might actually spur professional learning (Dai, 2023; Hong et al., 2025; Son et al., 2024). A third gap concerns the Japanese elementary English education context specifically: we still have a limited understanding of how pre-service teachers' worries might gradually give way to a more pedagogically grounded attentiveness to the fragile, emerging utterances that children produce during interaction.

It is these gaps that the present study seeks to address. Designed as a pilot exploration, the study traces how pre-service teachers' task awareness shifts—and what drives those shifts—as they take part in virtual dialogues in which generative AI plays the part of a child. The point is not simply to give students another language practice partner. AI is used here, instead, as a medium that can bring hidden instructional difficulties into view and trigger reflection on what IC actually requires.

The distinctive feature of this design lies in how the AI is set up. Rather than functioning as a straightforward conversation partner or trainer, the AI is configured to generate incomplete or tangential responses—responses that echo the unpredictable behavior of real children in real classrooms. The intention is to put the student teacher in a state of cognitive conflict. What the study then investigates is the mechanism by which encountering "communication that does not go as planned with an unpredictable interlocutor," within a setting where the stakes are low, can prompt students both to pinpoint what they need to work on and, ultimately, to begin seeing themselves less as "users of English" and more as "facilitators of interaction."

Three research questions (RQs) structure the inquiry:

1. RQ1: In what ways does the experience of dialogue with generative AI transform pre-service teachers' task awareness regarding IC?
2. RQ2: Which aspects of the AI's responses and interactional behavior play a role in this transformation?
3. RQ3: What can these changes tell us about how AI-supported practice environments in teacher education should be designed?

2. Literature Review

2.1 Educational Significance of Interactional Competence (IC)

This study adopts Galaczi & Taylor's (2018) definition of IC as "the ability to co-construct interaction in a purposeful and meaningful way, taking into account sociocultural and pragmatic dimensions of the speech situation and event." What this means in practice for elementary school teachers is something more specific: IC operates as the instructional capacity to make sense of children's still-developing utterances and to keep language activities going through well-chosen

linguistic and non-linguistic scaffolding—recasts, clarification requests, confirmation checks, gesture, gaze, and the coordinated use of multimodal resources, among other things.

IC matters most in situations where children's output is fragmentary, halting, or heavily colored by their first language. A teacher confronted with such utterances has to read them as signs of thinking in progress, not simply as mistakes, and respond in ways that hold the interactional space open rather than shutting it down. Japan's core curriculum for teacher training does acknowledge the importance of being able to draw out children's utterances and keep interaction moving (MEXT, 2019), but when it comes to concrete pedagogical tools for actually training these abilities, the cupboard is still fairly bare.

2.2 Educational Use of AI Dialogue Systems and the Role of Simulation

The arrival of Large Language Models (LLMs) has gone a long way toward solving the problems of stilted responses and context mismatches that plagued earlier dialogue agents (Dai et al., 2024). Because generative AI can adjust its linguistic level, how quickly it responds, and its overall interactional style with considerable flexibility, it offers a credible foundation for virtual dialogue environments—spaces where pre-service teachers can try out interactive instructional techniques without real consequences.

Simulation as a training method has been attracting growing interest in teacher education, largely because it promises to cushion the "reality shock" that novice teachers so often experience when they discover how wide the gap between theory and practice really is (Badiee & Kaufman, 2015). The goal of a simulation environment is not to reproduce a classroom in all its messiness; it is to isolate and foreground particular aspects of practice—disruptive behavior, typical error patterns, and so on—so that teachers can rehearse how they would handle them. The virtual environment used in this study fits within that logic: it serves as a rehearsal space for interactional moves, a form of scaffolding in Vygotsky's (1978) sense, intended to prepare students for the complexity they will face in actual classrooms and to foster their IC before they get there.

2.3 Deepening Awareness through Disorienting Dilemmas

A premise of this study is that genuine development of instructional skill depends on something prior: a shift in the learner's own consciousness and stance. Transformative Learning Theory captures this idea well. According to Mezirow (1991), learners begin to question their taken-for-granted assumptions and move toward deeper learning when they run up against unexpected difficulty—what he terms a "disorienting dilemma." These dilemmas are not just intellectual puzzles to be solved; they are experiences that unsettle people emotionally and shake the meaning perspectives they have been relying on.

Within the design of this study, it is the AI child's incomplete and unpredictable responses that manufacture this kind of experience. Things do not go the way the student teacher expected, and the resulting mismatch generates what Festinger (1957) would call cognitive dissonance—a state of psychological discomfort triggered by a perceived inconsistency between one's existing beliefs, self-concept, or expectations and what is actually happening. Festinger argued that people in this state are driven to restore coherence, and the data from this study suggest that the conflict does indeed function as a catalyst: it pushes students to redefine their sense of the task at hand, moving from "my English is the problem" to "there are instructional challenges here that I need to grapple with." It is worth noting, too, that the dilemma unfolds in a low-risk setting. There is no real child who might be let down, and this may well lower the psychological cost of trying things out and getting them wrong.

2.4 Qualitative Insights via Grounded Theory Approach (GTA)

The phenomenon at the heart of this study—internal transformation of task awareness through a technology-mediated experience that is itself new and unfamiliar—calls for a qualitative, exploratory methodology. The Grounded Theory Approach (GTA), first articulated by Glaser & Strauss (1967), lends itself well to this kind of inquiry. Because GTA builds theoretical categories inductively from the data rather than testing pre-established frameworks, it is suited to opening up the "black box" of how interaction with AI reshapes a person's internal awareness.

More concretely, the researchers turn to GTA as a way of tracing how participants talk about the difficulties they encounter, what causes they attribute those difficulties to, and how those attributions change as the experience progresses. There is precedent for this kind of use. Williams & Murray (2025) have shown that GTA can support the analysis of emergent categories in teacher development while also feeding back into practitioner reflection and improved teaching outcomes. Bose (2021) demonstrated its value in educational contexts for surfacing instructional problems that had gone unnoticed and for informing concrete pedagogical responses. Johnston et al. (2024), meanwhile, used GTA to explore interpersonal dimensions of classroom interaction—how teachers communicate high expectations, for example—which connects directly to the interactional competence this study is concerned with. Taken together, these precedents confirm that GTA is well suited to the aims of the present study, particularly where the goal is to deepen understanding of dialogic processes and the instructional interventions that grow out of them.

3. Research Methods

Following from the research questions outlined in Section 1.2, the methods described below were adopted to examine how participants' awareness shifted and what this might imply for AI-supported IC practice.

3.1 Participants and Context

Two university sophomores (hereafter P1 and P2), both enrolled in a teacher training course at a Japanese university, took part in the study. Each aspired to become an elementary school teacher and had completed introductory coursework in English language teaching methodology. Their English proficiency was within the range typically expected of pre-service elementary teachers in Japan, though it remained below CEFR B2 level—a pattern consistent with the broader national situation (MEXT, 2024).

The study was designed as a small-scale exploratory pilot, with the aim of generating an initial conceptual account of how task awareness regarding interactional competence may shift through AI-based dialogue practice. Two information-rich cases drawn from a single teacher education context were selected for this purpose. The intent was not to claim statistical generalizability but rather to develop an analytically grounded interpretation that might offer transferability to comparable contexts in pre-service teacher education.

In practical terms, the study was conducted as part of a pilot workshop embedded in a teacher-education class on communicative language teaching. Participation in both the AI dialogue activity and the subsequent interview was voluntary. Informed consent was obtained from both participants, who were assured that their responses would be anonymized and would have no bearing on course grades.

Regarding ethical and data management considerations, because the dialogue practice involved a third-party generative AI service (ChatGPT voice mode), participants were instructed not to disclose personally identifiable information (e.g., names, locations, student IDs) during the sessions.

Retained materials—interview audio/transcripts and AI dialogue logs—were anonymized by replacing any potentially identifying details with pseudonyms and stored on a password-protected device accessible only to the research team. Participation was voluntary and could be withdrawn without penalty.

3.2 Design of the Virtual Dialogue Environment

3.2.1 Role Setting and Scenario

The AI was set up to act as a Japanese elementary school English learner aged 10–12, while the participant took the role of the teacher leading a short interactional activity. Dialogue topics were everyday themes appropriate for upper elementary learners (e.g., hobbies, school life, likes and dislikes). Participants were told to treat the scenario as a brief warm-up conversation at the beginning of an English class.

3.2.2 Response Characteristics

Through prompt design, the AI's utterances were controlled to include the following characteristics:

- Linguistic level: Simple phrases roughly at CEFR A1 or below, including short sentences and formulaic chunks.
- Intentional incompleteness: Occasional tense errors, lexical gaps, and syntactic fragments.
- Interactional features:
    - Fillers and hesitation markers (e.g., "Umm...")
    - Topic deviation (e.g., "But I like Pokémon!")
    - Learner-like clarification requests
    - Uneven distribution of initiative (e.g., AI suddenly asking questions)

A short silence (2–3 seconds) was also built into the interaction flow after the AI produced an error or incomplete response. The purpose was to give the participant a window in which to intervene—through recasts, clarification requests, or other interactional moves.

3.2.3 Procedure

Over a two-week period, each participant engaged in repeated dialogue practice using the voice mode of ChatGPT-4.0. The AI was configured as described in 3.2.2.

Participants were asked to conduct approximately three-minute dialogue sessions with the AI multiple times a day. On average, each participant completed five sessions per day, yielding roughly 70 sessions (about 210 minutes of interaction) per participant across the two weeks. They were free to choose the timing of sessions within each day but were encouraged to vary the topics within the range of everyday themes suitable for upper elementary learners (e.g., hobbies, school life, likes and dislikes).

Before the two-week practice period began, the researcher briefly explained the activity's purpose: to experience dialogue with an AI child and reflect on the difficulties encountered during interaction. No explicit instruction was given on how to "handle" the AI, so that participants' spontaneous strategies could emerge without priming.

During the two weeks, no formal debriefing took place, in order not to constrain participants' interpretations. That said, participants were informally encouraged to pay attention to moments that

felt particularly difficult, confusing, or surprising, and to keep those episodes in mind for later reflection.

3.3 Data Collection Techniques

The primary data consist of semi-structured interviews conducted individually with each participant immediately after the two-week AI practice period ended. Each interview lasted approximately 30–40 minutes and was audio-recorded with permission. Participants were asked to look back across the series of dialogue sessions and recall specific episodes that felt difficult, confusing, or surprising, and to explain why those moments stood out. The interview questions addressed:

- Perceived difficulty during the AI dialogues over the two weeks
- Perceptions of the AI's language and behavior
- Reflections on the participant's own responses and strategies
- Connections between the AI experience and imagined classroom situations
- Wishes or ideas for improvement of the AI system

The AI conversation logs were also retained as contextual data, enabling the researchers to link interview comments to specific episodes. The present analysis, however, centers on the interview transcripts as the main data source, since the research interest lies in participants' meaning-making rather than in the linguistic details of the AI dialogue itself. This focus is consistent with the epistemological stance of GTA, which prioritizes how participants interpret and reconstruct their experiences over the objective features of those experiences (Glaser & Strauss, 1967). Given that transformative learning hinges on the subjective reframing of meaning perspectives (Mezirow, 1991), retrospective interview data offer a more direct window into the cognitive and affective shifts at the core of this study.

A fine-grained conversation-analytic or interactional analysis of the dialogue transcripts would certainly be valuable for examining performance-level features of interactional competence, but such analysis is positioned as a subsequent phase of the broader research program. For the present pilot, interview-based analysis was judged more appropriate for tracing how participants made sense of the mismatch between their expectations and what actually unfolded in the dialogues, and how that mismatch came to be reinterpreted as a pedagogical issue.

Although the interviews constitute the primary analytic corpus, the retained AI dialogue logs served an episode-level corroborative function: when participants referenced a concrete moment (e.g., rapid turn-taking, topic deviation, hesitation, or "too capable" responses), the researchers located the corresponding segment in the log to confirm what interactional feature was present and to reduce reliance on vague recollection. It should be noted that "aspects of the AI's responses" in RQ2 are interpreted as participants' perceived and consequential features—that is, AI behaviors as they were noticed, interpreted, and connected to shifts in task awareness—rather than as an exhaustive conversation-analytic account of the dialogues. Full CA/IA of the log data is accordingly positioned as a subsequent phase (see Section 5.4), while the present analysis focuses on the meaning-making process through which particular AI features became pedagogically salient.

3.4 Data Analysis: Grounded Theory Approach

The interview recordings were transcribed verbatim in Japanese. Analysis followed the steps of GTA (Glaser & Strauss, 1967), adapted to suit the small-scale, exploratory nature of this pilot.

3.4.1 Open Coding

In the first coding cycle, transcript segments expressing a single idea or evaluation were identified and labeled. A comment such as "I felt rather overwhelmed," for instance, was coded as

"feeling overwhelmed by AI," while "I want it to make more mistakes" received the code "craving for AI errors as intervention opportunities." Codes were kept close to participants' own words so as to preserve their perspectives.

3.4.2 Constant Comparison and Categorization (Axial Coding)

Codes were then compared within and across participants to identify patterns and relationships. Those expressing similar meanings were grouped into more abstract categories—for example, "difficulty due to discrepancy between expectation and reality" or "shift from self-focused to learner-focused awareness." During axial coding, attention was paid to temporal sequences: at what point in the narrative each type of reflection tended to appear (e.g., initial reactions versus later hindsight).

3.4.3 Selective Coding and Core Category

Through iterative comparison and memo-writing, a single core category emerged as central to the data: "Recognition of difficulties in communication with unpredictable others (children) and the desire for support to overcome them." This core category captures both the cognitive recognition of interactional challenges and the emerging orientation toward seeking scaffolding (from AI or teacher education programs). The four-stage model of task-awareness transformation presented in Section 4 was constructed by linking categories along a temporal axis: from initial difficulty through shifts in awareness, concretization of classroom conflicts, and the emergence of requests for support.

3.5 Ensuring Trustworthiness

Although this is a small-scale pilot with only two participants, several strategies were adopted to bolster the trustworthiness of the qualitative analysis beyond standard analyst triangulation.

To begin with, coding was conducted iteratively rather than in a single pass; initial codes were repeatedly reviewed, compared, merged, and refined across the dataset to strengthen conceptual consistency. The researchers also maintained an audit trail documenting coding revisions and category development, so that the path from raw data to higher-order interpretation remained transparent and traceable. Analytic and reflexive memos were written throughout the process to record emerging interpretations, category boundaries, and theoretical links. These memos also served as a check on the researchers' own assumptions as teacher educators and AI users, helping to mitigate the risk of over-attributing positive or negative meanings to the AI. Analyst triangulation was strictly observed: both researchers independently coded subsets of the data, and provisional categories were discussed on an ongoing basis to challenge overinterpretation, resolve discrepancies, and sharpen category definitions.

Finally, the results section provides a thick description through representative quotations, allowing readers to assess the fit between the data and the interpretations offered. The goal of this qualitative inquiry is not statistical generalization but the development of a conceptual model that can inform future design and research.

4. Results

The analysis revealed a storyline in which students' task awareness deepened through four stages, centered on the core category described above. Table 1 summarizes the stages, categories, generated concepts, and excerpts of students' specific utterances.

Table 1: Process of Transformation in Task Awareness

Stage	Category	Generated Concepts	*Excerpts of Students' Specific Utterances*
Stage 1	Difficulty Arising from the Gap between Expectation and Reality	• Sense of being overwhelmed by AI • Mismatch in dialogue speed • Seizure of initiative by AI • AI capabilities exceeding expectations	• *"I felt rather overwhelmed."* • *"The grammar was elementary school level, but the speed... I had the impression it was fast."* • *"(The AI) tends to take the initiative in the conversation."* • *"The other side's [AI's] level gets quite high."*
Stage 2	Transformation of Task Awareness	• Craving for educational intervention opportunities • Shift in consciousness from self-English proficiency to transmission to others • Orientation toward partner-centered communication • Emphasis on mutual understanding construction ability	• *"I want it to make more mistakes."* • *"More than that, it's about how to make the children understand... how to adjust my English."* • *"Like what vocabulary choice (is best). Or what ratio, what ratio of English to Japanese should I use."* • *"I think it probably becomes the most important thing next to 'speaking (English)'."*
Stage 3	Concretization of Conflicts in Real Educational Settings	• Concern about learner diversity • Student non-comprehension and decline in motivation • Difficulty in decoding incomplete utterances • Recognition of mutual misunderstanding risks • Anxiety about missed instructional opportunities	• *"For elementary and junior high students, there are large differences in understanding... so there are situations where the teacher's instructions... are hard to convey uniformly."* • *"Even if I'm speaking (English), the other side (meaning the students) will just lose interest (become 'shira-ke-ru')."* • *"It's like I can't understand the other side's (meaning the student's) part (-> the English the student speaks)."* • *"There are things where I don't know what they are saying, and I have to make sure there isn't a situation where I can't correct them..."* • *"There is a possibility the partner (student) understands it incorrectly. I (the teacher side) don't understand whether that is wrong or not."*
Stage 4	Desire for Support to Overcome Difficulties	• Request for feedback promoting reflective practice • Request for learning support on teaching methods • Request for practice in adapting to learners • Request for individualization (customization) of situation settings • Request for concrete/diagnostic feedback	• *"I want to receive feedback on my English expressions... so I can learn how to improve my expressiveness and natural ways of paraphrasing."* • *"A function that presents teaching methods and error correction points... would be ideal."* • *"I want AI practice where I can practice adjusting the teacher's way of speaking... to match the child's understanding level."* • *"A customization function where I can set the scene myself."* • *"I want a mechanism... that presents concrete points for improvement (e.g., suggestions for paraphrasing, correction of expressions...) from the conversation record..."*

4.1 Stage 1: Difficulty Arising from the Gap between Expectation and Reality

Initially, students faced difficulties due to the gap between their expectations and the reality of the AI. Before the interaction, both participants imagined that the AI would behave as a "supportive tool" that would accommodate their English level and follow their lead. During the actual conversation, however, they felt "overwhelmed" by the AI's response speed and its tendency to seize the initiative in interaction.

Comments such as "I felt rather overwhelmed" and "The grammar was elementary school level, but the speed... I had the impression it was fast" indicate that the difficulty was not purely linguistic. Rather, it was the combination of understandable language with rapid turn-taking that created a sense of being pushed.

Furthermore, one of the participants (Participant A) reported that "the other side's [AI's] level gets quite high," referring not only to the linguistic complexity but also to the AI's ability to introduce new topics and maintain coherence. In other words, the AI was perceived as more resourceful and assertive than an average elementary school learner. This mismatch between the expected "child" and the experienced interlocutor triggered an initial sense of loss of control.

4.2 Stage 2: Transformation of Task Awareness

Interestingly, the very difficulties experienced in Stage 1 catalyzed a shift in focus from "self" to "others." As the participants reflected on the interaction, they began to articulate not only their own struggles but also instructional possibilities that those struggles revealed.

A striking example is the statement, "I want it to make more mistakes." Rather than simply wishing for an easier interlocutor, the other participant (Participant B) expressed a desire for the AI to create "educational intervention opportunities." This marks a shift from viewing AI as a test of one's English to seeing it as a simulation of children's learning process that requires teacher support.

Similarly, Participant A noted that "More than that, it's about how to make the children understand... how to adjust my English." Here, the evaluative focus moves from internal deficiency ("my English is not enough") to a pedagogical question ("how to make my English reachable for them"). They also highlighted concerns about "what vocabulary choice is best" and "what ratio of English to Japanese" would be appropriate, acknowledging the need to balance authenticity and comprehensibility.

These reflections indicate an emerging awareness that IC involves not just producing correct English but monitoring and shaping mutual understanding. Participant A came to recognize, in their own words, that this ability "probably becomes the most important thing next to 'speaking (English)'."

4.3 Stage 3: Concretization of Conflicts in Real Educational Settings

Interaction with the incomplete AI did not remain at the level of a "one-off" technological experience. In the interviews, participants continually connected the AI interaction to imagined or remembered classroom scenarios. This process of concretization formed Stage 3 of the transformation.

For instance, Participant B commented that "for elementary and junior high school students, there are large differences in understanding... so there are situations where the teacher's instructions... are hard to convey uniformly." Here, the AI's behavior serves as a proxy for learner

diversity: rapid responses, unexpected topic shifts, or partial understanding mirror the heterogeneity of real students.

Participant B also expressed concern that "even if I'm speaking (English), the other side (meaning the students) will just lose interest (become 'shira-ke-ru')." The AI's persistence in responding, in contrast, led them to imagine what would happen if a real child simply disengaged. In this way, the AI experience sharpened their awareness of motivation and affective factors.

Another important line of reflection concerned the difficulty of decoding incomplete utterances: "It's like I can't understand the other side's (meaning the student's) part." Both the participants recognized the risk that "there is a possibility the partner (student) understands it incorrectly" and that teachers may not notice or may miss the chance to intervene. This highlights an emerging sense of responsibility for monitoring not only what teachers say but also how learners interpret and respond.

Overall, Stage 3 represents a shift from abstract awareness ("interaction is important") to concrete images of conflict and risk in classroom communication.

4.4 Stage 4: Desire for Support to Overcome Difficulties

In this final stage, recognizing the complexity of these challenges, the participants expressed a strong desire for tools and environments that would help them develop the skills needed to address them. This constitutes Stage 4.

Participant A requested "feedback on my English expressions... so I can learn how to improve my expressiveness and natural ways of paraphrasing." Crucially, this request is not simply for grammar correction but for feedback aligned with interactional goals (e.g., how to rephrase to be clearer for a child).

They also envisioned "a function that presents teaching methods and error correction points," indicating that the AI could be expanded from a dialogue partner into a pedagogical coach. Suggestions included practice in "adjusting the teacher's way of speaking... to match the child's understanding level" and a "customization function where I can set the scene myself," such as choosing the learner's proficiency level or the type of misunderstanding.

Finally, the participants wished for a mechanism that presents concrete points for improvement (e.g., suggestions for paraphrasing, correction of expressions) from the conversation record. This implies an aspiration for AI to support reflective practice by turning interaction logs into diagnostic resources.

Taken together, Stage 4 shows an emerging understanding of IC development as a long-term, supported process, and positions AI not only as a source of friction but also as a potential scaffolding system.

5. Discussion

Recent studies on AI-based teacher education have drawn increasing attention to the value of simulation and virtual practice environments for pre-service teachers. Research on AI-powered virtual students, for instance, has shown that simulation-based environments can support situational pedagogical practice, productive discourse, and the interpretation of students' reasoning in context (Dai, 2023). Exploratory work on generative AI-enhanced teacher simulations has likewise emphasized their potential to provide responsive, scalable, and instructionally useful practice opportunities (Hong et al., 2025). Other studies focusing on AI chatbot simulations have addressed the development of core teaching competencies more directly—lesson delivery, classroom management, and student interaction in virtual teaching scenarios (Tegero & Mabini, 2025; Lee et

al., 2025). Collectively, these lines of work suggest that AI can expand opportunities for rehearsal, feedback, and pedagogical decision-making in teacher preparation.

With this backdrop in mind, the present findings offer responses to the three research questions posed at the outset. Regarding RQ1, the data show that participants' task awareness shifted from self-focused concerns about their own English proficiency toward a more pedagogically oriented awareness of interactional competence—understood here as the ability to co-construct dialogue and support children's incomplete utterances. Regarding RQ2, this shift appears to have been prompted by specific aspects of the AI-mediated dialogue experience: the mismatch between expectation and reality, the AI child's incomplete or unpredictable responses, and the cognitive and emotional conflict that resulted. Regarding RQ3, the analysis suggests that AI-supported practice environments in teacher education should be designed not simply for smooth interaction but for pedagogically meaningful encounters with interactional difficulty, accompanied by appropriate scaffolding and reflection. The sections that follow discuss these points in relation to previous research and their bearing on teacher education.

5.1 The Catalytic Role of Cognitive Conflict

This section addresses RQ1 and part of RQ2 by discussing how task awareness changed and why moments of interactional difficulty played a central role in that change. Perhaps the most striking finding is that the cognitive and emotional conflict generated by AI interaction functioned as a catalyst for deepening task awareness. At the heart of this process lies what might be described as "friction" between expectation and reality: participants expected a compliant, human-like but somewhat subordinate AI child, yet encountered an interlocutor that was simultaneously "too capable" and "insufficiently child-like."

This friction played out on both cognitive and affective levels:

- Cognitive conflict: Unpredictable responses, rapid turn-taking, and occasional incompleteness forced participants to abandon scripted question–answer sequences and improvise. Their consciousness shifted from superficial tasks (e.g., "I must not make mistakes in English") toward more complex cognitive tasks (e.g., "How can I make myself understood?" "How can I respond to what the child is trying to say?").
- Emotional conflict: Feelings of being overwhelmed, frustrated, or "pushed" prompted introspection. Participants began to question whether their discomfort stemmed only from their English ability or from a broader lack of preparation for interactional challenges.

In Mezirow's (1991) terms, the AI dialogue served as a disorienting dilemma that destabilized existing frames of reference—particularly the assumption that teaching is primarily about delivering correct language input. Rather than treating conflict as an obstacle to be removed, what emerges here is its productive role in stimulating reflection and reorientation toward IC as the essential pedagogical challenge.

This finding also resonates with the broader literature on simulation in teacher education (Badiee & Kaufman, 2015), which stresses the importance of confronting novices with "manageable difficulty" before they enter real classrooms. The key is that difficulty should be neither trivial nor overwhelming; it needs to be calibrated so as to provoke reflection rather than resignation. Generative AI, with its flexible controllability, opens new possibilities for designing such calibrated friction. This aligns with the concept of productive struggle, in which learner difficulty fosters deeper conceptual understanding, especially when coupled with supportive environments (Vazquez et al., 2020; Schonberg et al., 2025).

5.2 Implications for AI Design: The Importance of "Intentional Imperfection"

This section further addresses RQ2 by examining which features of the AI-mediated dialogue experience contributed to participants' awareness shift. Participants' craving for errors—"I want it to make more mistakes"—sends a clear message for AI design in teacher training contexts. Standard language-learning applications often strive to make AI speech as fluent and error-free as possible, positioning the AI as an idealized model. For teacher education, however, an "ideal speaker" is not necessarily the most useful interlocutor.

What the present data suggest is that AI for teacher training should be deliberately designed to generate "intentional imperfection." This means not only overt errors in grammar or vocabulary but also subtler phenomena such as hesitation, topic shift, and partial understanding. Such imperfections create "interactional trouble spots" where the teacher must decide whether and how to intervene. Imperfection, in this sense, functions as an "opportunity engine" for practicing IC.

A purely defective AI, though, would be unrealistic and pedagogically limited. Participants also valued the AI's ability to maintain conversation and respond coherently. For design purposes, this points to the need for dynamic balancing between:

- Modeling function: Providing examples of natural, age-appropriate language use that teachers can internalize.
- Problem-generating function: Presenting incomplete or misaligned utterances that require teacher mediation.

The aim is not to simulate an "average child" but to create a constellation of scenarios that highlight different dimensions of IC—repairing misunderstanding, sustaining engagement, or adjusting task difficulty, among others.

The present analysis aligns with this emerging line of research in viewing AI as a practice partner rather than merely an informational tool. It extends the literature in a different direction, however: instead of focusing primarily on usability, broad teaching competencies, or AI literacy, it examines how AI-mediated interactional difficulty can reshape pre-service teachers' awareness of interactional competence as a pedagogical task (Hong et al., 2025; Moorhouse et al., 2024; Prilop et al., 2025). The contribution, then, lies less in demonstrating performance gains and more in clarifying an awareness-level mechanism through which AI-based dialogue may support teacher learning. This distinction also responds to recent mapping work showing that generative AI research in language teacher education has tended to center on AI literacy, readiness, instructional design, and perceptions, rather than on interactional trouble as a mechanism for awareness change (Karakaya et al., 2025).

5.3 The Necessity of Scaffolding to Overcome Difficulties

A further implication concerns the support structures that must accompany AI-based experiences. The data show that participants did not simply want more exposure to difficult interactions; they sought mechanisms to help them make sense of those difficulties and convert them into learning.

Requests for "feedback on my expressions," "functions that present teaching methods," and "mechanisms that present concrete points for improvement from the conversation record" point to several directions for future development. These align closely with findings in AI-integrated educational interventions, which report that students benefit from AI feedback that boosts motivation, engagement, and reflection (Xia et al., 2025; Deng et al., 2025). The use of ChatGPT in flipped classrooms has likewise shown positive effects on learner satisfaction, language

proficiency, and instructional insight (Dung, 2024). Such findings lend support to the claim that AI-based environments, when scaffolded, can effectively support interactional competence development. The participants' shifting perceptions of AI—from viewing it as a linguistic evaluator to seeing it as a dialogic partner—align with broader findings in educational contexts. Liu & Zhang (2024), for instance, identified that students' willingness to engage with ChatGPT was shaped by nuanced personal, institutional, and affective factors.

Drawing on these broader insights and the concrete needs participants articulated, a preliminary pedagogical framework for AI-supported IC practice can be proposed. It consists of three interrelated design principles.

The first principle is that AI should be designed as a dialogic practice partner rather than a flawless model. The data suggest that teacher learning was stimulated not by smooth, idealized interaction but by moments in which the AI child's responses were incomplete, unexpected, or misaligned with participants' expectations. Seen this way, the educational value of AI lies partly in its capacity to create manageable interactional trouble that calls for a pedagogical response.

The second principle is that productive friction must be pedagogically scaffolded. Difficulty alone is not sufficient; participants' reflections also pointed to the need for prompts, feedback, and opportunities for guided interpretation. This aligns with Vygotsky's (1978) notion of scaffolding, which emphasizes that learning occurs most effectively when support is tailored to the learner's current zone of proximal development. In the present context, where the pre-service teacher is the "learner", and the AI acts as interlocutor, diagnostician, and coach, three specific directions for structural scaffolding are recommended:

- Scenario customization: Teacher candidates could specify the learner's proficiency, affective state (e.g., shy, talkative), or typical error patterns, thereby linking practice more closely to anticipated classroom realities and setting the stage for appropriate friction.
- Post-hoc analytic feedback: After a dialogue session, the system could automatically highlight segments where communication broke down or where the teacher successfully resolved trouble, offering alternative phrasings or interactional strategies.
- Rubric-based reflection support: Drawing on existing frameworks for IC, the system could generate simple rubrics (e.g., "clarification strategies," "use of wait time," "responsiveness to learner initiative") and prompt users to self-assess their performance.

The third principle is that AI-supported dialogue practice should be linked to the development of professional vision. The shift observed here—from seeing the problem as one's own English deficiency to seeing it as an instructional challenge—suggests that AI practice environments can help pre-service teachers notice pedagogically consequential features of classroom-like interaction. AI may thus function not only as an interlocutor but also as a mediating tool for helping teachers reinterpret interactional difficulty through a pedagogical lens.

These three principles, taken as a set, suggest that the value of AI-supported IC practice lies not simply in providing additional speaking opportunities but in structuring pedagogically meaningful encounters with uncertainty, followed by scaffolded reflection on how to respond to learners' incomplete and evolving utterances.

Table 2: A preliminary pedagogical framework for AI-supported IC practice

Principle	Description	Educational function
AI as dialogic practice partner	AI is designed not as a flawless model but as a partner that may produce incomplete, unexpected, or difficult-to-interpret responses	Creates interactional trouble that elicits pedagogical judgment
Scaffolded productive friction	AI interaction is followed by prompts, reflection, feedback, and guided discussion	Helps transform difficulty into learning rather than frustration
Link to professional vision	Participants interpret interactional trouble as an instructional challenge involving support for learners' emerging utterances	Shifts attention from self-focused language anxiety to pedagogical awareness

5.4 Methodological Reflections and Limitations

Methodologically, the present work is positioned as an exploratory pilot that uses an AI-based virtual dialogue environment to develop a tentative theory of how pre-service teachers' task awareness and professional vision change over time. Consistent with grounded theory logic, the primary aim is theory generation and the construction of a conceptual model rather than hypothesis testing. Several limitations should accordingly be acknowledged.

The sample consisted of only two pre-service teachers from a single university program. While this design does not permit statistical generalizability, it does facilitate in-depth analysis of information-rich cases, with priority given to the transferability of the emergent model to similar teacher-education contexts. Future research should nonetheless involve a larger and more diverse pool of participants and institutional settings to examine whether comparable patterns of transformation emerge.

The data analyzed here relied primarily on retrospective interviews and written reflections collected immediately after the AI interaction, rather than on fine-grained analysis of the dialogue transcripts themselves. This was a deliberate choice, intended to foreground participants' meaning-making and the transformation of their task awareness. It does, however, limit the extent to which claims can be made about the linguistic organization and micro-level enactment of interactional competence in real time. Transcript-based conversation-analytic or interactional analyses of the AI–teacher talk, utilizing full dialogue logs and multimodal traces, are therefore explicitly positioned as a subsequent phase of this research program. Longitudinal follow-up studies will also be necessary to investigate the durability and practical impact of the identified awareness changes on actual classroom practice.

The AI behavior in this study was controlled primarily through prompt design and manual adjustment, with the child role implemented by a single general-purpose generative AI system. Future iterations could incorporate more fine-grained modeling of learner profiles and error patterns—for example, by training or conditioning the system on corpora of authentic child learner speech—so as to enhance ecological validity and better approximate the unpredictable contingencies of real classroom interaction.

Finally, while the researchers employed several rigorous strategies to strengthen analytic trustworthiness—including iterative coding, memo writing, analyst discussion, and maintenance of an audit trail—qualitative interpretation inevitably remains shaped by the researchers' analytic lenses.

Future studies could further strengthen credibility by incorporating additional forms of validation, such as broader comparative datasets.

Despite these limitations, the present study provides an initial conceptual and empirical foundation for designing and researching AI-based IC training environments that intentionally embed productive friction and disorienting dilemmas into teacher-education tasks.

The findings also point to the pedagogical promise of "intentional imperfection" in AI behavior for teacher education: when AI is designed not only to model fluent language but also to generate interactional trouble, it can create low-risk opportunities for rehearsing scaffolding moves that would otherwise be difficult to practice. This aligns with recent research demonstrating the effectiveness of AI-mediated instruction in increasing student engagement and reflective awareness (Xia et al., 2025; Deng et al., 2025; Dung, 2024).

The participants' articulated need for feedback, reflection prompts, and customizable scenarios underscores, however, that such friction must be embedded in a broader scaffolded learning design if it is to function as a productive rather than discouraging experience. This resonates with studies on productive struggle, which emphasize that difficulty must be paired with appropriate support to become a catalyst for growth (Vazquez et al., 2020; Schonberg et al., 2025).

Though limited in scope, the present work contributes to a growing body of research applying grounded theory to educational practice. At the level of substantive focus, it can be seen as extending classroom interactional competence research—such as Sugianto and Khoirunnisa's (2024) conversation-analytic investigation of teacher talk and embodied actions in primary EFL lessons—into an AI-based simulation environment for pre-service teachers. Prior studies have illustrated GTA's usefulness in surfacing reflective processes in teacher development (Williams & Murray, 2025), identifying instructional needs (Bose, 2021), and mapping interactional behaviors (Johnston et al., 2024). These findings support the methodological credibility of the current approach.

6. Conclusion

This small-scale exploratory pilot examined, through qualitative methods, how pre-service elementary school teachers' task awareness regarding Interactional Competence (IC) may shift when they repeatedly engage with a generative AI-based virtual dialogue environment. By experiencing "friction"—discrepancies between their expectations and the AI's behavior—participants began to move from self-oriented concerns about their own English proficiency toward viewing IC as the core pedagogical task of co-constructing dialogue with children.

On the basis of these findings, a four-stage, process-oriented model was proposed: initial difficulty, transformation of awareness, concretization of classroom conflicts, and desire for support. The model describes how these shifts unfolded across the two-week series of AI interactions. At this stage, it should be understood as a working hypothesis generated from a limited number of cases rather than a stable theory. Its value lies in mapping out possible trajectories of awareness change that can be examined, refined, or falsified in subsequent, more rigorous studies.

Building on both the findings and the limitations discussed above, a three-phase research and development trajectory is envisioned. In the first phase—empirical analysis—future research aims to collect teacher–child dialogue data in real or simulated classrooms to extract realistic child response models, identifying typical "trouble spots" where teacher intervention is consequential. In the second phase, these models will be incorporated into generative AI to develop specific practice modules targeting key IC skills, such as recasting, clarification requests, and managing topic shifts. In the third phase, the educational effectiveness of these modules will be verified by implementing

them in teacher education courses. Using mixed-methods research, changes in students' IC-related awareness, the development of interactional strategies, and the reduction of anxiety regarding classroom communication will be evaluated. The researchers also aim to integrate an automatic feedback system to promote reflective practice directly within the environment.

This pilot research, in short, provides a conceptual foundation for designing more rigorous, large-scale studies at the intersection of teacher education, IC, and generative AI. The broader task for the field is not merely to adopt AI technologies but to craft them into environments that support, rather than supplant, the human competencies central to language education.

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