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Teaching About AI or With AI? In-Service Teachers' Experiences in a Korean AI Convergence Education Program

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Abstract

As Korea's digital talent development agenda advanced, the 2022 curriculum revision incorporated basic AI literacy into schooling, while the Ministry of Education and local education offices expanded AI convergence education programs for in-service teachers through graduate schools of education. Despite substantial policy support, qualitative research on teachers' experiences remains limited. This study examines how in-service teachers navigate AI teaching and learning across university and school settings. Drawing on interviews with teachers enrolled in an AI convergence education program in the Seoul metropolitan area and an instructor in the same program, the study identifies a persistent gap between policy ambitions and classroom practice. Teachers enrolled largely in response to practical pressures to engage with AI in schools, although their expectations varied by professional experience and position. Participants also reported limited practical guidance on AI ethics and insufficient support for translating AI knowledge into subject-specific teaching. While faculty expertise in AI-related disciplines strengthened participants' understanding of AI, it offered fewer opportunities to explore how AI could be meaningfully integrated into classroom instruction. The study conceptualizes this challenge as pedagogical translation and calls for clearer definitions of AI education and stronger connections between graduate teacher education and school practice.

I. Introduction

Artificial intelligence has entered school curricula across many systems within a very short period, and education policy has answered in broadly the same way everywhere: if the curriculum now contains something teachers were never taught, teachers must be taught it. Inside this response is an assumption rarely examined directly, that the distance between a university classroom in which AI is taught and a school classroom in which a subject is taught can be crossed by knowledge alone. Teacher education research has treated that assumption skeptically for decades, holding that knowledge acquired in one setting is reconstructed in another under conditions the first knows little about (Kennedy, 2016; Korthagen, 2017), yet whether the same holds for AI-focused teacher education has attracted little empirical attention.

Part of the reason is that most provision is too brief to study. South Korea is unusual in this respect. As the national digital talent development agenda gathered pace, the 2022 curriculum revision established digital literacy as a basic literacy and created AI units within the informatics subject (Ministry of Education, 2022), and the re-education of serving teachers was identified as the mechanism through which the new expectation would be met. Since 2019 the Ministry of Education and the metropolitan and provincial offices of education have worked with graduate schools of education to establish AI convergence education majors, which opened at thirty-eight institutions in September 2020 and admit approximately one thousand serving teachers each year with partial tuition support. These institutions exist to re-educate practicing teachers and are taught in evenings and vacation blocks over four to six semesters, so the scheme makes visible, over two years and at national scale, a process elsewhere compressed into a few hours.

A research literature has grown alongside this expansion, concerned largely with defining the competencies such programmes should produce (Heo & Kang, 2023; Park et al., 2021) and with measuring teachers' needs against them (Kim & Kim, 2023). Qualitative research giving voice to the teachers who are the subjects of these programmes has been scarcer, and that imbalance is what this study addresses. Teachers enrolled in these majors occupy two settings at once, as learners in a university classroom and teachers in a school classroom, often in the same week. This study examines their experience across both settings and sets alongside it the account of an instructor who teaches on the programme while continuing to work in a school. Three questions guided the inquiry: why do in-service teachers what do they come to understand AI education, and their own expertise, to be?

II. Literature Review

1. Role of AI in Education

International scholarship on AI in education can be distinguished according to the role AI is expected to play in the classroom. In one strand, AI is an object of learning. Research on AI literacy specifies the competencies learners need to understand, recognize, and critically evaluate AI systems (Long & Magerko, 2020; Ng et al., 2021), while curricular frameworks identify concepts such as perception, representation, learning, and societal impact that students should understand (Touretzky et al., 2019). In a second strand, AI functions as an instrument for teaching and learning, ranging from intelligent tutoring systems to generative AI tools used in lesson planning and classroom activities. Here, the subject matter remains primary and the central question concerns how teachers exercise pedagogical judgement when using AI-enabled tools, including critical consideration of the assumptions embedded in such technologies (Selwyn, 2019). A third strand concerns forms of instruction in which AI is integrated with disciplinary content so that AI contributes directly to achieving the purposes of a particular subject. This form is less consolidated internationally, and the terminology used to describe it remains unstable.

Korean educational discourse provides a more explicit, although not necessarily more settled, vocabulary. Jeon et al. (2021) distinguish four forms of AI education: education for AI understanding, AI values education, AI utilization education, and AI convergence education. Education for AI understanding concerns acquiring knowledge of AI concepts, principles, algorithms, and related skills. AI values education, despite the terminology, is defined in terms of learning to use AI systems and services to solve everyday problems. AI utilization education addresses the ethical and social issues and impacts associated with AI. AI convergence education, finally, refers to the integration of AI into subject teaching, educational content, and instructional methods in order to achieve subject-specific curriculum standards. The final category is particularly relevant to the present study because it moves beyond either learning about AI or simply using an AI tool and instead requires teachers to establish a pedagogically meaningful relationship between AI and the subject they teach. The vocabulary is introduced here as part of the policy and professional environment encountered by participants rather than as an analytic framework imposed on the data in advance.

Table 1. *Definitions of AI Education in Korean Educational Policy Discourse*

Term	Definition
AI Education (Education for AI understanding)	Education in which learners study theories concerning AI knowledge, concepts, principles and laws, algorithms, and related areas, and acquire AI-related knowledge and skills through practical activities.
AI principles education	Education in which learners learn the content and methods for using AI, AI services, and AI agents to solve a variety of problems encountered in everyday life.
AI utilization education	Education through which learners examine the ethical and social issues and impacts arising from AI.
AI convergence education	Education that, based on an understanding of AI concepts, principles, and types, uses AI in subject teaching or integrates AI into educational content and methods in order to achieve subject-specific curriculum standards.

Sources: Translated from Jeon et al (2021).

2. Teacher preparation for AI, and what competence measurement leaves out

Research on teacher preparation for AI has concentrated on specifying and measuring competence, and before-and-after comparisons establish that something changed without establishing what teachers did, or could not do, in the interval. Internationally, existing frameworks have been adapted to the new domain, most visibly through extensions of technological pedagogical content knowledge (Celik, 2023; Mishra & Koehler, 2006). Korean scholarship has followed a parallel course: Park et al. (2021) derived the competencies teachers require, Heo and Kang (2023, 2024) specified those involved in designing such instruction, Kim and Kim (2023) analyzed teachers' needs against them, and a smaller body of work has examined the graduate programmes themselves (Jeon et al., 2021), with reviews confirming the pattern of programme development and effect measurement (Lim et al., 2025).

A second and older literature addresses what competence measurement leaves out. Models of professional growth describe change as cyclical, stalling where enactment is unsupported (Clarke & Hollingsworth, 2002), and Kennedy (2016) argues that programmes fail when they supply prescriptions without engaging the problems teachers are trying to solve. Situated accounts hold that knowing is bound to the settings in which it is used, so what is learned at a university does not travel unchanged into a classroom (Lave & Wenger, 1991). Bernstein (2000) described recontextualization as the process by which knowledge produced in one field is relocated in another, acquiring a pedagogic logic it did not previously possess, and Akkerman and Bakker (2011) described boundary crossing as work requiring objects capable of holding both worlds at once. To these must be added the person doing the moving: professional identity is an ongoing interpretation shaped by biography and available recognition (Beijaard et al., 2004), bound up with vulnerability when the grounds of expertise are unsettled

(Kelchtermans, 2009), while agency is achieved within an ecology of conditions rather than possessed individually (Priestley et al., 2015).

3. Research gap and the significance of the Korean case

Set side by side, these literatures leave a gap. The first tells us what teachers know about AI and how much more they know after instruction; the second tells us that knowing is not the difficult part, but has not been brought to bear on AI-focused teacher education. Between them lies a question neither has addressed empirically: what do teachers encounter when they attempt to carry AI knowledge into the subjects they teach, and what do they conclude from the encounter? The imbalance is marked in Korea, where policy instruments have developed quickly while participants' accounts have rarely been collected, and it is doubly consequential given the conceptual instability documented above.

The Korean graduate school of education is a productive site for that question. Because the major is a degree rather than a course, participants spend two or more years moving weekly between university and school; because these institutions re-educate practicing teachers, students arrive as experienced professionals, so any difficulty they report cannot be attributed to inexperience; and because thirty-eight programmes opened at once under a common design, staffed by whatever expertise each university held, a question usually invisible becomes visible, namely who teaches teachers about a new domain and what their disciplinary formation permits them to teach. The case is also a critical one in Flyvbjerg's (2005) sense, since Korea has pursued the strategy of adding knowledge under conditions close to the most favorable available anywhere.

III. Method

The study adopts a qualitative case study design (Merriam & Tisdell, 2016), bounded by a single AI convergence education major and the participants connected to it. The site is the AI convergence education major at the graduate school of education of a private university in the Seoul metropolitan area, one of the thirty-eight programmes launched in September 2020. Its faculty are drawn principally from artificial intelligence, software engineering and data science, supplemented by part-time instructors with school teaching backgrounds; courses run in evenings and intensive blocks and cohorts are small, so the courses available in a given semester are effectively fixed. Three participants were recruited purposively for the different vantage points they occupied on the same programme (Table 2). T1 and T2 were serving teachers enrolled in the major, at the midpoint and the final semester respectively; L1 taught on the programme while continuing to work as an elementary teacher and holds a doctorate in subject pedagogy, and could speak both to the experience of the curriculum and to the constraints under which it was designed.

Table 2. Research Participants

Code	Position	Subject and background	Stage
T1	Teacher, science high school	Social studies; economics degree; doctoral coursework in social studies education	Semester 3 of 5
T2	Teacher, elementary school	Grade 4 homeroom; MA in ethics education; extensive ICT and software training history	Semester 5 (final)
L1	University lecturer on the graduate school program; former elementary teacher	Practical arts; PhD in elementary social studies education; BA in mathematics education	Third year teaching as a university lecturer

Source: Authors

Each participant took part in one semi-structured online interview lasting between 60 and 80 minutes, covering the decision to enroll, the experience of coursework, attempts to relate programme learning to teaching, and understandings of AI education and of the teacher's role; with L1 the guide also covered curriculum design and its constraints. Interviews were recorded with consent and transcribed verbatim in Korean, and transcripts were returned to participants with an invitation to withdraw any passage, which none did. Excerpts were translated by the author; ellipses mark omissions.

Analysis proceeded thematically from inductive to abductive reading (Braun & Clarke, 2006). Initial readings produced open codes close to participants' wording, and in-vivo codes were retained where a participant's phrasing captured a category more economically than an analytic label (Saldaña, 2021); several are used as subheadings below. Themes were tested against the full data set before being related to the conceptual resources above, which were brought to bear at that stage rather than imposed at the outset. Credibility was pursued through triangulation across three differently positioned accounts, and member checking of transcripts (Lincoln & Guba, 1985) with three participants no claim to representativeness is made.

IV. Findings

Four themes are presented in the order participants lived them. Subheadings reproduce participants' own words where an in-vivo code carried the category more precisely than a summary label.

1. "I don't understand a word of what they're saying": enrolling under pressure

Neither teacher described enrolment as arising from an interest in AI. Both narrated it as a response to circumstances, and both identified the tuition subsidy as the factor that made the decision possible. T1 began with her students at a science high school, several of whom were building projects in programming languages she could not read.

My students were making things with computer languages, and I thought, they're doing this and I don't understand a word of what they're saying. … And around then I saw the official notice, that if you attend an AI convergence graduate programme there's tuition support, so I applied. (T1)

T2, in her final semester, was blunter.

Honestly my motive was impure. They were advertising that tuition would be supported, and at the time I was preparing for the education supervisor examination. … But also, I've done all of it: network administrator, ICT education, software education. This is a field I kept hold of, thinking, one day this will matter. (T2)

Both accounts turn on practical necessity rather than curiosity: a sense that AI had arrived in schools and that teachers would be expected to take a lead in using it. What each expected differed with experience and position. T2 had attached herself to each successive technological initiative in Korean schooling, and the degree continued a professional self she had long been assembling; T1, teaching in a selective science high school, described a more immediate discomfort and a correspondingly narrower expectation. Neither arrived with a definite pedagogical problem, and both later reflected critically on that openness.

2. "We were learning convergence education, but the curriculum itself was not convergent"

Both teachers reported gains. For T1 the gain was interpretive: before the degree she had no idea what supervised and unsupervised learning meant, and afterwards she could read what a student had written and understand approximately what had been done. The criticism in this theme therefore does not concern the quality of instruction but what the curriculum took as its object.

We learned the elements of AI separately. We learned data analysis. We learned Python. … We were learning convergence education, but the curriculum itself was not convergent. It was very fragmented. (T2)

"So there is a thing called Python"

Programming occupied a disproportionate place in both teachers' accounts of what had not worked. T2 completed a semester of Python and described the residue as recognition rather than capability, adding that as the programme progressed she felt less able rather than more. L1, who taught Python in his first semester and then stopped, accounted for the pattern without dismissing it.

Cases where you actually use Python to do AI convergence education are genuinely rare. … But you can't not do it either; without it their basic understanding of computing and of AI is too thin. The proportion, though, has been too high. (L1)

The same structure appears in accounts of worked examples, which stopped where participants' own work would have begun. The cases analysed in class arrived pre-arranged: stroke patients, Titanic

survivors, Covid-19 data. What T1 needed was the craft of taking untidy data from her own subject into a model: “when I try to analyse new data myself, it doesn’t go well.”

“I don’t really know what vision the graduate school has”

Participants did not treat this fragmentation as accidental, tracing it to the disciplinary composition of the teaching staff. Asked what vision of AI convergence education the graduate school held, T1 said she did not know, observing that the major had been led initially by professors from data science and software. A teacher three semesters into a master’s degree could not state what the degree was for, and located the reason in who was teaching it.

Their accounts are not uniformly critical here. A faculty formed in artificial intelligence, software engineering and data science was, by both teachers’ reckoning, effective at what it was formed to do: T1 attributed her new ability to read her students’ work to that instruction, T2 did not dispute the quality of any individual course, and both reported that instructors adjusted once they understood who was in the room. What both described as missing was a forum in which a second question could be pursued, not what AI is but how it might enter a lesson in Korean language or social studies without displacing it. Learning about AI was provided for; learning to teach with it was not. L1 made the institutional point directly: because the programmes were designed and staffed from the technology side, courses treating the social and human dimensions of AI were scarce, and appointments favored computing backgrounds over subject pedagogy.

3. “I was at a loss as to how to apply it”: between the programme and the classroom

Both teachers reported understanding AI substantially better than before, and both reported being unable to convert that understanding into instruction in their own subjects.

I went to the AI convergence graduate school, but when it came to actually applying it in class, there were many times when I was at a loss as to how to apply it. … I do have the desire to graft AI onto my lessons. But I don’t know how to realize it, and that is really frustrating. (T1)

T2 described the same distance through what she did produce: a drawing application so that pupils reluctant about their own drawing could illustrate a picture book, a polling tool, quiz platforms.

If it were convergence, it would be: right, I combine art and computer use and the language-arts element, and design it so that the children go through this process. … Honestly that is a little beyond my capacity. I get as far as thinking, this part would be good to use it in. … So what I do is, literally, use. (T2)

“Each individual teacher’s own portion”

Participants did not present school conditions as excuses; they described attempts and explained why these could not be sustained. Teaching under the national curriculum then in force, T1 observed that no content element in her subject required or invited AI-related work, and concluded that convergence of

that kind is “in the end, each individual teacher’s own portion.” T2 described the same devolution as the terminus of the programme itself: everything beyond a certain point is “left largely to the teacher’s own capacity.” The two reached this independently, at different school levels and stages of the degree.

Beyond that shared conclusion, the obstacles differed by level, and each participant located them in an institutional arrangement rather than in personal capacity. For T1 the high school credit system meant she could not assume shared enrolment across subjects, so a cross-subject task cannot be jointly assessed. For T2 the obstacle was the elementary staffing system, in which grade and subject responsibilities are reassigned annually by the principal.

The picture the ministry had was probably bigger. … Train specialist personnel, and then those people spread what they learned to the other teachers in the school. … But it doesn’t work. It doesn’t. Because there is the staffing system. … The principal has a larger plan: “never mind practical arts, you take the sixth-grade homeroom.” (T2)

L1 identified a third condition and did not begin with AI at all: schools in which pastoral work is already strained, where anything additional arrives as overload. “The grounds for telling other homeroom teachers that this is important and has to be done,” he said, “even I don’t have those.” The three accounts thus describe obstacles at the curricular, administrative and organizational levels, none amenable to a solution located in the individual teacher.

“They throw materials at you”: policy discourse without practical guidance

A related gap ran between what policy documents announce and what reaches schools. T2, whose master’s degree is in ethics education, described it in relation to the ethical dimension of AI use, which is named in the definition of AI education itself (Lim et al., 2022).

Digital literacy comes up a lot, and the concept is presented as though AI ethics were inside it. But in practice most of that provision from the ministry or the education offices is poor. They throw materials at you: teach this, go and find a suitable site, here is some money, teach it. And it simply becomes new work for teachers. … We are only now beginning to make guidelines, and it has not really soaked into the curriculum. (T2)

She traced this to a curricular decision: during the 2022 revision there had been discussion of introducing AI as a subject, and the reason it did not enter was its relation to the university entrance system, so the content is now fitted into cross-curricular provision. Responsibility for converting a policy commitment into teachable material is thus passed to teachers who have neither the expertise nor the time it presupposes.

“So this is how what I learned gets implemented”

T1 reported a single episode in which programme learning did connect to practice, and it occurred outside the programme. During a winter break she entered a lesson-plan competition with the

informatics teacher at her school.

While we were building the plan I kept asking him, is it like this, does it work this way? And in the middle of that I realized: so this is how what I learned gets implemented, so this is the kind of thing you can do with it. (T1)

The division of labour was specific. She supplied the problem, an electoral districting question from the politics content she teaches; he supplied the implementation, having met the reciprocal limit of being able to build a model with less to draw on when judging which problem was worth modelling. The episode paired complementary expertise rather than requiring one teacher to hold both kinds, and it was voluntary: asked whether such a project should become a requirement of the degree, T1 declined without hesitation, since grades would be attached.

"Beyond that I can't find a direction myself": differences across subjects

The difficulty was not evenly distributed. T1 observed that the sciences offer abundant data while social studies data is sparser. The most pointed evidence came from the instructor, and concerned the limits of his own capacity. L1 holds a doctorate in social studies education and an undergraduate degree in mathematics education, and described a hierarchy of tractability in which the natural sciences resemble the social sciences in the data and algorithms they use, mathematics he can handle, and then:

The hardest are English and Korean. If a language teacher comes to me, what I can offer on the algorithm side is sentiment analysis, text mining, about that much. Beyond that I can't find a direction myself. I feel sorry about it, honestly, when those teachers come. (L1)

4. "Because the AI algorithm is there": contested meanings of convergence and expertise

Participants did not agree about what AI convergence education is, and the disagreement was articulated rather than latent. All three separated the teaching of AI principles from the use of AI applications and from instruction in which an algorithm is what makes a problem solvable, distinctions corresponding closely to the policy vocabulary in Table 1 although none cited it. L1 drew the line most sharply, contrasting a colleague's lesson in which pupils used a generative tool to illustrate a law-education topic with his own criterion.

Using a tool to draw what you could draw by hand, that is using AI in a purely instrumental way, with no understanding of the principle inside it. Convergence education is where the problem can be solved *because* the AI algorithm is there. (L1)

His own teaching illustrates the criterion. Dissatisfied with human rights materials that presented rights in stark terms, he began his upper-elementary pupils from the observation that braille labelling is largely absent from snack packaging. The children photographed products, assembled the images as training data and trained an image classifier, and the resulting application was passed to a school for blind

students. The lesson carried the social studies achievement standards for which he is responsible, the machine learning content, and a question about what AI is for.

T2 described the same distinction from between the two positions, attributing the confusion to disagreement among her instructors: some held that convergence cannot be discussed without first knowing AI, others that convergence is the point and AI is not. “These things were not organized systematically,” she said. “They were mixed together.” When the researcher put the three-part distinction to L1 and suggested that what is currently delivered is at best utilization education, he endorsed it without hesitation.

“To teach my subject with AI”

When the research participants were asked what a teacher should be expert in, each participant answered from the position they already occupied.

A teacher who supports students to take the content elements of their own subject, analyze them using AI models and techniques, and interpret the results, that, I think, is an AI education expert. In order to teach my subject with AI. (T1)

The closing qualification is the important part: offered the chance to define a new professional category, T1 defined it from inside the one she already held. T2 did the same in the vocabulary of instructional design, locating AI competence in the capacity to construct curriculum, design teaching and learning, implement and evaluate so that pupils come to understand and apply AI. L1 was the only participant whose identity had actually changed, and he located the change outside coursework.

PCK is a practical thing. I don’t think simply attending graduate school produces it. Graduate school is where you come to learn the basic content and skills that PCK needs in order to develop; you become an expert by using it in your own subject and by building lessons. (L1)

He paired this with a condition on entry rather than exit: convergence requires a base in one’s own subject, and where candidates hold no prior qualification in subject pedagogy, the subject and the AI “feel as though they are moving separately.” The three definitions share a structure, each treating AI as something that acts upon an existing professional domain rather than one that replaces it. The same absence was then reported from two directions: T2 described a discussion among her cohort about how little of the humanities the courses contained, while L1 described teaching elsewhere a course explicitly pairing AI with social studies education. Neither located this orientation within the curriculum they had experienced.

V. Discussion

1. Pedagogical translation as the unaddressed object

The most consistent finding of the study was that research participants reported the learning about AI did not tell them what to do in their practice with AI. Something stood between the two, and that could be specified as: identifying a point in a subject's curriculum at which an AI concept answers a question the subject already asks; designing an activity in which the subject's purposes remain primary; anticipating what will fail in a particular school; and judging whether the result is worth the time it costs. We propose the term *pedagogical translation* for this work, which is a skilled practice with techniques of its own and therefore teachable. That implication is consequential, since competence frameworks describe a state of knowledge and states cannot be taught directly, whereas activities can.

The concept is offered as an addition to the vocabulary of professional learning research rather than a replacement. Transfer names a hoped-for outcome; TPACK and its AI extensions (Celik, 2023; Mishra & Koehler, 2006) and the Korean competency derivations built on the same logic (Heo & Kang, 2023; Park et al., 2021) name a state of knowledge; Clarke and Hollingsworth's (2002) model names the cycle within which such states change. None names the activity between knowing and doing. Two pieces of evidence support treating that activity as the central difficulty: participants at different school levels and stages arrived independently at the same description of what the programme did with it, devolving it to "each individual teacher's own portion"; and the instructor described graduate study as supplying the preconditions of pedagogical content knowledge rather than the thing itself, so that a programme concluding at the preconditions and describing the result as expertise has misdescribed its own product.

2. Translation capacity as an ecological property

The unevenness reported in Chapter IV is difficult to attribute to teachers. If AI convergence were the addition of technology to teaching, it would impose comparable demands across subjects; it did not. Where a subject already contains objects cognate with AI, translation approached extension; where it did not, participants had to establish a relation their subject's own purposes could justify and sometimes concluded that a topic would not bear one. This is recontextualization in Bernstein's (2000) sense, identifying the receiving field not as the school in general but as a particular subject with its own account of what is worth knowing. The instructor's admission that he cannot chart a direction for language teachers removes the explanation of teacher deficit: the limit lies in the relation between AI and a body of subject knowledge, not in the person attempting to cross it.

Priestley et al.'s (2015) argument that agency is achieved within an ecology of conditions rather than possessed by individuals specifies what that ecology consists of here: an elementary teacher whose subject assignment changes annually, a secondary teacher whose students no longer share a timetable, an instructor bounded by the epistemic distance between algorithms and language subjects, and a school already absorbing pastoral strain. A single AI curriculum delivered to teachers of all subjects and levels therefore cannot complete the task, and a teacher's judgement that AI does not fit a given topic should be read as a professional conclusion rather than as resistance. The one successful instance is consistent with this, since a lesson plan built jointly by a social studies teacher and an informatics teacher functioned as a boundary object in Akkerman and Bakker's (2011) sense, and that it occurred

outside the programme and voluntarily indicates that the conditions of translation are as consequential as its content.

3. Conceptual ambiguity and the positioning of the experienced teacher

Korean scholarship has not reached agreement on what AI convergence education denotes, and this conceptual instability has already affected the interpretation of the quantitative evidence base. Importantly, the ambiguity is not confined to academic debate. Lee et al. (2024), in interviews with educational supervisors responsible for AI education policy, identified the lack of a clear educational definition of AI education as a barrier to AI convergence education. Participants in their study described a rapid succession of initiatives, from ICT education to software education, EdTech, and AI education, in which terminology, content, and methods changed before their educational meanings had become firmly established. They also reported practical difficulties in translating rapidly changing policy into guidance and instructional materials as new concepts, terms, and technologies continued to emerge. Conceptual ambiguity therefore has consequences not only for how AI convergence education is classified in research, but also for how policy is interpreted and enacted in educational practice.

This study shows how the same uncertainty enters a graduate teacher education programme. T2 heard some instructors argue that convergence could not be discussed without first understanding AI, while others treated convergence itself as the priority, and she concluded that these perspectives had not been organised systematically. Her uncertainty therefore reflects a broader problem already visible in both scholarship and policy implementation rather than an individual failure to understand the programme. Education for understanding of AI centres on knowledge of AI concepts, principles, algorithms, and related skills, which corresponded closely to much of the technical content participants described learning. What teachers were most readily able to enact in their classrooms resembled what Jeon et al. (2021) classify as AI values education, namely using AI tools and services to address practical problems. The ethical and social dimensions identified as AI utilization education received comparatively limited practical guidance, while AI convergence education required the more demanding task of integrating AI with subject content and instructional methods in order to achieve subject-specific curriculum standards. A programme staffed principally by specialists in artificial intelligence, software engineering, and data science was therefore well positioned to provide AI understanding education, but less well positioned to support the subject-specific pedagogical work required by convergence education. What participants described receiving was primarily the first, what they could most readily enact resembled the second, and the degree itself was named for the fourth. This distinction helps explain how substantial gains in AI knowledge could coexist with continuing difficulty in translating that knowledge into subject-specific classroom practice.

A further consequence concerns identity, and here the graduate school of education differs from other providers of teacher development. Its students are not novices; they arrive holding subject knowledge, classroom judgement and prior master's-level qualifications, which is precisely the resource convergence would require and which L1 named as its entry condition. A curriculum organized around

the foundations of an unfamiliar discipline positions them instead as beginners in someone else's field. Sachs (2001) observed that policy discourses offer teachers identity positions; curricula do so as well, and this one offered a position its students largely declined, since every participant defined AI teaching expertise from inside the identity they already held. The paradox is that a programme designed to extend teachers' professionalism proceeded by suspending the part of it they already had.

VI. Conclusion

This study examined how in-service teachers experienced an AI convergence education programme while moving between graduate study and their own school classrooms. Participants reported substantial gains in their understanding of AI, but these gains did not readily translate into subject-specific teaching. The central difficulty was not simply insufficient technical knowledge. Rather, teachers had to determine where AI could serve the purposes of their subjects, redesign disciplinary content around that possibility, and negotiate curricular and organisational conditions that differed across schools and subjects. This study conceptualises that work as *pedagogical translation*.

The study contributes to research on AI-focused teacher education by shifting attention from what teachers know to what is required to make that knowledge pedagogically meaningful. It also suggests that translation capacity should not be treated solely as an individual teacher competency. The experiences examined here show that it depends on the relationship between AI and particular subject domains, the expertise available within teacher education programmes, and the institutional conditions under which teachers work. In this sense, difficulties in implementing AI convergence education may reflect programme and system design as much as teacher readiness.

For practice and policy, the findings suggest that AI teacher education should provide more explicit opportunities for subject-specific translation rather than assuming that teachers will independently convert technical knowledge into classroom practice. Programmes may benefit from differentiating provision by school level or subject area and from creating sustained collaboration between AI specialists and educators with expertise in subject pedagogy. Greater conceptual clarity about the purposes of AI education would also help align programme curricula, policy expectations, and what teachers are ultimately expected to enact in schools.

The findings of this study and their implications should be interpreted in light of the study's limited scale. The research involved three participants connected to a single graduate programme, and the data consisted of interview accounts rather than observations of classroom practice. The findings therefore do not claim representativeness across Korea's AI convergence education programmes. Further research across programmes, subjects, and school levels could examine whether pedagogical translation operates similarly in other contexts and how particular programme designs support or constrain it. Despite these limitations, the study identifies a problem that competency-based accounts can obscure: learning about AI and learning how to make AI educationally meaningful are related but distinct forms of professional work.

Declarations

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Conflict of Interest

The authors declare no conflict of interest.

Ethics Statement

All participants provided informed consent prior to participation. Participation was voluntary, and all interview data were anonymized to protect participants' confidentiality.

Declaration of Generative AI and AI-assisted technologies

During the preparation of this work, the authors used Claude Opus 5 to translate non-English documents and interview materials and to proofread the manuscript for language editing. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the content of the publication.

Author Contribution

Dr Shin contributed to the conceptualization of the study, facilitated access to the research setting and participants, and contributed to the verification and interpretation of the findings. Dr Yeo designed and conducted the study, collected and analyzed the data, developed the theoretical framework, and drafted the manuscript. Both authors contributed to the interpretation of the findings, reviewed and revised the manuscript, and approved the final version.

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