

Design thinking as a framework for developing AI-ready teachers: Introducing the DT-ART model

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Abstract. Artificial intelligence is reshaping teaching, assessment, and classroom decision-making, yet teacher education programmes often remain insufficiently prepared to respond in pedagogically coherent ways. This conceptual paper develops the Design Thinking for AI-Ready Teaching (DT-ART) model as an original theoretical contribution to teacher education scholarship. Rather than simply transferring design thinking to AI education, DT-ART reconceptualises AI readiness as a recursive design capability: the capacity to diagnose AI-mediated pedagogical problems, negotiate ethical and contextual constraints, prototype human-centred instructional responses, and use evidence from practice to revise both tools and professional judgement. The model integrates design epistemology, AI competency frameworks, technological pedagogical content knowledge, and reflective professional learning into a generative framework organised around five mutually reinforcing mechanisms: contextual sensemaking, ethical problem-framing, human-AI co-ideation, pedagogical prototyping, and evidence-informed professional judgement. The paper clarifies how DT-ART differs from the Stanford design thinking sequence, explains the theoretical logic linking AI competencies to design processes, and proposes a validation agenda comprising expert review, Delphi consensus-building, design-based implementation, and mixed-methods evaluation. In doing so, the article offers a stronger conceptual basis for preparing teachers who can respond critically, creatively, and responsibly to AI-infused educational environments.

Keywords: artificial intelligence in education, design thinking, teacher education, AI-ready teachers, AI literacy, pedagogical innovation, professional learning

1. Introduction

Artificial intelligence has entered educational institutions at a pace few previous technologies have matched, and its implications have outstripped the readiness of many teacher education systems. Adaptive learning platforms, AI-generated instructional materials, automated feedback tools, and generative AI applications capable of producing essays, lesson plans, and assessments at scale have moved rapidly from speculation to routine classroom use [13, 15]. Yet the educators expected to navigate these technologies, and to help students engage with them thoughtfully, have often received limited preparation for this role. The result is a widening gap between the technological realities of contemporary classrooms and the professional formation of the teachers who work within them.

This gap is not merely technical; it is fundamentally pedagogical and ethical. Teachers now mediate students' encounters with AI systems whose inner workings they may only partially understand, whose outputs can reproduce bias or error, and whose use in teaching and assessment raises unresolved questions about equity, agency, authorship, and the purposes of education [11, 25]. Responding adequately requires more than adding a short AI literacy module to an otherwise unchanged programme. It requires a reconceptualisation of what it means to prepare teachers for professional practice amid continuous technological change.

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Teacher education programmes have historically incorporated emerging technologies only gradually. Research consistently documents a lag between the appearance of new tools and their meaningful integration into initial teacher preparation, with digital competence often treated as an adjunct rather than as a core professional capacity [24]. The rise of generative AI intensifies both the urgency and the complexity of this challenge. Understanding how a large language model produces fluent but sometimes inaccurate text, how algorithmic recommendation systems shape learning pathways, or how automated grading tools operationalise contested ideas of quality is not a peripheral technical matter; it is central to sound pedagogical judgement. Addressing them requires an updated understanding of teacher knowledge, one that extends the established TPACK framework [19] to account for what Mishra, Warr and Islam [20] describe as the generative and social dimensions of AI technologies, and what Celik [7] reconceptualises as Intelligent TPACK, which foregrounds ethical evaluation alongside technological and pedagogical knowledge.

Design thinking offers a compelling response to this challenge, but only if it is adapted rather than imported wholesale. Originally developed in engineering and industrial design and later adapted for educational and organisational contexts, design thinking is characterised by empathy, iteration, prototyping, and reflective inquiry – dispositions and practices that align closely with the uncertain, contested, and value-laden nature of AI integration in education. The central claim of this paper is therefore not that existing design thinking stages can be renamed for AI contexts. Rather, it argues that AI readiness requires a distinctive form of professional design capacity in which teachers learn to move recursively among learner evidence, algorithmic affordances, ethical constraints, curricular purposes, and situated classroom judgement.

2. Conceptualising the AI-ready teacher

2.1. Defining AI readiness in teaching

The idea of an AI-ready teacher has emerged in policy and research discourse as shorthand for a cluster of professional capacities that enable educators to engage productively with AI technologies and their educational consequences [11, 18]. The term, however, covers considerable variation in scope. At its narrowest, AI readiness refers to functional competence: the ability to use relevant tools, understand their basic operation, and troubleshoot common problems [7]. At its broadest, it includes critical, ethical, and creative dimensions: the capacity to interrogate the assumptions embedded in AI systems, identify and mitigate bias, reason about the principles that should govern AI use in learning environments, and support students in developing their own AI literacies [11, 13].

This paper adopts the broader conception because it better reflects both the realities of contemporary teaching and the emerging consensus in the field. Holmes et al. [11] argue that AI competence for educators must extend well beyond tool proficiency to include understanding how AI systems learn, where their limitations lie, and which ethical frameworks should guide their use in educational settings. Williamson and Eynon [25] likewise caution that commercially developed platforms often embed contestable assumptions about learning, intelligence, and assessment that teachers must be able to examine critically. In this sense, the AI-ready teacher is not simply a confident technology user, but a critically reflective practitioner who can situate AI within wider educational and social contexts, including the equity implications of algorithmic systems that may reproduce or amplify existing inequalities [2, 16].

This expanded understanding of AI readiness both draws on and extends existing frameworks for technology integration in teaching. The TPACK framework [19], still one of the most widely cited models for conceptualising teacher knowledge for technology integration, posits that effective integration depends on the dynamic intersection of technological, pedagogical, and content knowledge. Several scholars have proposed AI-specific extensions. Mishra, Warr and Islam [20] argue that generative AI demands a broader conception of contextual knowledge that accounts for the societal and educational transformations AI is producing. Celik [7] introduces Intelligent TPACK, proposing that teachers' professional knowledge for AI-based instruction should include ethical assessment as

a distinct knowledge component. Additional guidance is provided by the UNESCO AI competency framework for teachers [18], which identifies five dimensions of competency: a human-centred mindset, AI ethics, AI foundations and applications, AI pedagogy, and professional development.

2.2. The state of AI preparation in teacher education

Despite the urgency of the challenge, evidence suggests that most teacher education programmes remain poorly equipped to develop the kind of AI readiness described above. The systematic review by Zawacki-Richter et al. [26], which examined AI applications in higher education, found that pedagogical and ethical dimensions were consistently underrepresented relative to technical applications. Although that review was not limited to teacher education, it reflects broader tendencies in the field. Tondeur et al. [24], synthesising research on ICT integration in initial teacher education, identified deep-rooted structural and attitudinal barriers, including crowded curricula, insufficient modelling by teacher educators, and persistent misalignment between university coursework and school-based practicum experiences.

More recent research focused specifically on AI in teacher education presents a similar picture. Celik [7] found that while pre-service teachers in his study demonstrated relatively high awareness of AI, their confidence in using AI pedagogically was markedly lower, and their understanding of AI ethics was lower still. Nyaaba and Zhai [21] identified substantial professional development needs among teacher educators themselves, noting that many lack the knowledge and confidence required to model AI integration effectively, creating a problematic gap between programme aspirations and enacted practice. Blundell [4], reviewing design thinking in teacher professional learning, echoes these concerns and highlights the need for sustained, practice-embedded approaches to professional development that extend beyond episodic technical training.

Taken together, these findings point to a systemic challenge that cannot be addressed by inserting isolated AI-focused modules into otherwise unchanged programme structures. What is needed is a more fundamental reconceptualisation of the dispositions, knowledge forms, and practices that teacher education should cultivate. This paper responds by theorising AI readiness as a design-based professional capability rather than as a checklist of technical competencies. Its original contribution lies in specifying how AI competencies become pedagogically actionable through cycles of inquiry, co-design, prototyping, critique, and evidence-informed revision.

3. Design thinking in educational contexts

3.1. Origins and core principles

Design thinking emerged within engineering and industrial design traditions, with early theoretical articulation by Simon [23] and Schön [22], whose concept of the reflective practitioner drew explicitly on design epistemology. The formulation most commonly used in educational contexts today derives from Brown [6] and the Stanford d.school, which popularised a five-phase heuristic model: empathise, define, ideate, prototype, and test. Although the apparently linear presentation of these phases has attracted criticism [8, 10], their heuristic value for structuring iterative, human-centred problem solving has been widely recognised.

The core principles of design thinking deserve explicit attention because they are central to the argument advanced here. Human-centredness directs attention to the needs, experiences, and perspectives of those for whom educational solutions are designed – especially teachers and students. Iteration acknowledges that initial solutions are rarely sufficient and that refinement through cycles of implementation and reflection is a normal and necessary process [6]. Prototyping emphasises the development of testable ideas in order to reduce risk and accelerate feedback [4]. Collaboration recognises that complex, value-laden problems are better addressed by diverse teams than by isolated experts. Taken as a whole, these ideas outline a professional epistemology that is highly compatible

with both the long-standing traditions of inquiry-based professional learning in education and Schön's [22] reflection-in-action.

3.2. Design thinking in teacher education and professional learning

The application of design thinking to teacher education has accelerated over the past decade. Baran and AlZoubi [3] show that design thinking in teacher preparation cultivates four important professional capacities: problem reframing, empathetic understanding of learners, iterative solution development, and reflective evaluation – capacities that conventional didactic models often fail to foster adequately. Alvarado [1], in a systematic review of design thinking as a teaching methodology in higher education, conclude that it promotes creativity and collaboration while also supporting more active and participatory forms of learning. Blundell [4], in a scoping review focused on school-based teacher professional learning and development, similarly identifies design thinking as particularly well suited to the complex and adaptive nature of pedagogical change.

In the specific context of educational technology integration, design thinking has shown particular promise. Research on collaborative curriculum design as a technology-focused professional development approach, which is structurally similar to design thinking, consistently reports more sophisticated reflective practice, increased technological confidence, and deeper engagement with pedagogical possibilities than traditional training approaches [5, 12]. These gains appear to be mediated by the sustained, collaborative, and practice-embedded character of design thinking processes, which align closely with the features that research on effective teacher professional learning identifies as most predictive of lasting impact [9].

At the same time, much of the existing research relies on small-scale, context-specific studies with limited generalisability [3]. Additionally, there remains a lack of research on the relationship between quantitative student learning outcomes and participation in design thinking processes [1]. Most importantly, research examining design thinking as a framework for AI-focused professional learning in teacher education is still nascent. The DT-ART model proposed in the following section should therefore be understood as a conceptual contribution that requires empirical validation, rather than as a fully evidence-based programme model.

4. The DT-ART model: design thinking for AI-ready teaching

4.1. Conceptual foundations

The Design Thinking for AI-Ready Teaching (DT-ART) model synthesises three strands of scholarship: design thinking as a pedagogical methodology [3, 4, 6], AI competency frameworks for educators [11, 18], and frameworks for technology integration and teacher professional learning [19, 24]. Its theoretical contribution is the articulation of a mediating construct termed AI-ready pedagogical design judgement. This construct refers to teachers' situated capacity to interpret AI affordances and risks in relation to learners, curriculum, assessment, equity, and professional ethics, and then to convert that interpretation into defensible pedagogical action. DT-ART therefore treats AI readiness not as tool fluency or general digital competence, but as a practice of disciplined professional judgement enacted through design.

The DT-ART model is not conceived as a standalone course or module to be inserted into existing programmes. Rather, it is an integrative framework intended to organise teacher education experiences across the programme lifecycle, from foundational pedagogy and curriculum courses to supervised practicum and capstone inquiry. Unlike linear versions of design thinking, DT-ART is explicitly recursive: each phase can reopen earlier assumptions when evidence, learner feedback, AI behaviour, or ethical analysis reveals that the original framing was incomplete. This recursive structure is essential because AI systems are probabilistic, opaque, and socially consequential; they require teachers to revisit definitions of the problem rather than merely progress through a sequence of design steps. Its five phases correspond broadly to the Stanford design thinking model but are

substantially recontextualised for AI-focused teacher preparation. At its centre is a conception of the AI-ready teacher characterised by five core attributes: AI literacy, pedagogical judgement, ethical and responsible use, adaptability and creativity, and commitment to reflective practice. These attributes are understood as integrated professional dispositions developed continuously across all five phases, asre illustrated in figure 1.

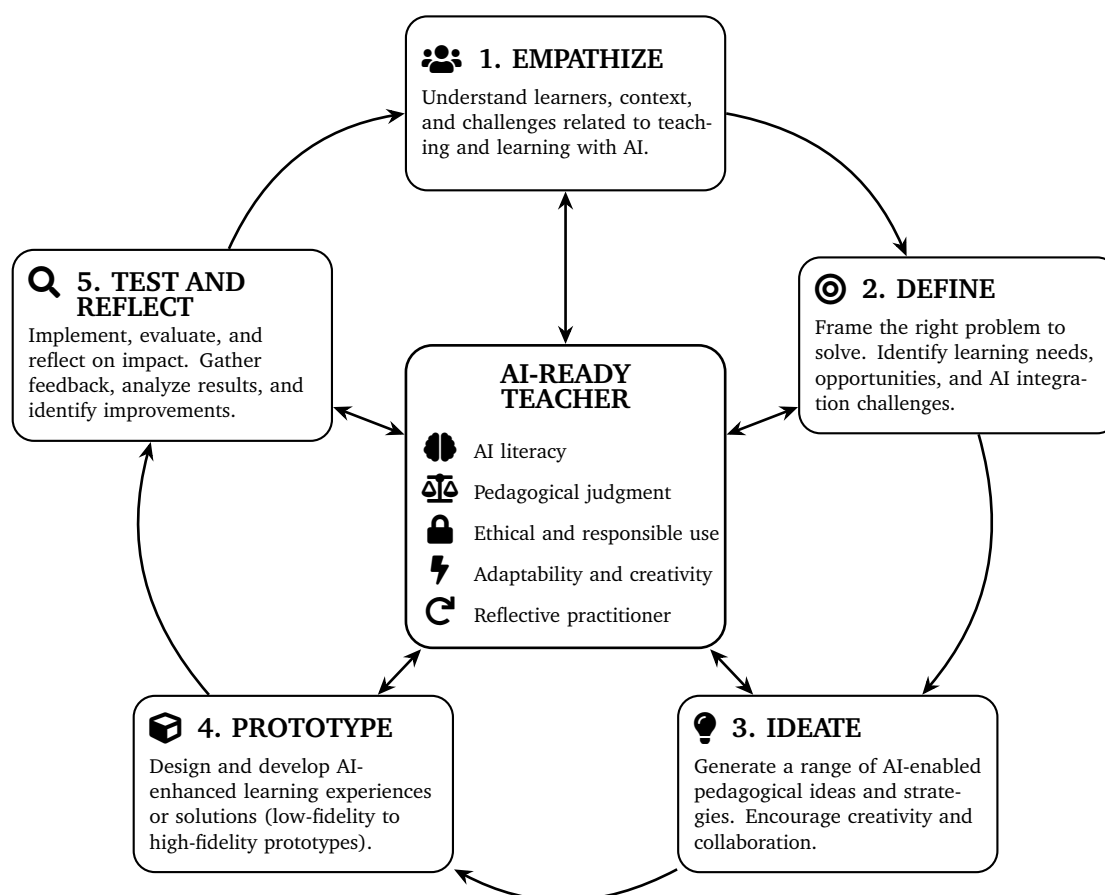


Figure 1: Design Thinking for AI-Ready Teaching (DT-ART) model.

4.2. Phase 1: Empathise – understanding learners and contexts in AI-infused classrooms

The first phase of the DT-ART model develops pre-service teachers' empathetic and evidence-informed understanding of the learners they will teach and the contexts in which they will practise, with particular attention to how students already experience and engage with AI technologies. In DT-ART, empathic inquiry is broadened beyond user-centred observation to include AI-context mapping: identifying students' access to tools, prior experiences with automation, cultural assumptions about machine authority, data privacy concerns, and the institutional rules that shape AI use. This extension makes the phase more than a direct analogue of the Stanford model, because teachers are asked to understand not only learners' needs but also the socio-technical systems mediating those needs.

At the same time, pre-service teachers are encouraged to reflect critically on their own assumptions about AI – assumptions often shaped more by popular narratives than by evidence. Activities such as structured engagement with AI tools, in which outputs are systematically interrogated for accuracy, bias, and limitation, help cultivate both technological understanding and a critical disposition. This phase aligns with Miao and Cukurova's [18] emphasis on a human-centred mindset as foundational to AI competency, and with Holmes et al.'s [11] argument that genuine AI competence for educators must begin with AI awareness and a critical understanding of what AI systems are, how they function, and where they consistently fall short.

4.3. Phase 2: Define – framing pedagogical problems in AI-infused classrooms

The second phase develops the capacity to identify, frame, and articulate the pedagogical challenges that AI introduces in specific classroom and institutional contexts. Problem definition is one of the most cognitively demanding aspects of design thinking: poorly framed problems generate solutions that miss the mark, regardless of their technical sophistication [10]. In the context of AI and teaching, this is especially significant. A teacher who frames the challenge of AI as detecting and penalising academic dishonesty is engaged in a fundamentally different inquiry from one who asks how assessment might be redesigned to cultivate forms of higher-order thinking that AI cannot readily substitute. Both framings respond to genuine concerns, but they open up very different pedagogical possibilities.

The Define phase of DT-ART equips pre-service teachers with conceptual resources for more sophisticated problem framing. Drawing on established frameworks for ethical reasoning in AI, including fairness, accountability, transparency, and explainability [2, 11], it positions problem definition as an ethical and pedagogical act. The distinctive contribution of DT-ART is the requirement that every AI-related design problem be framed across four dimensions: the learning purpose, the learner experience, the AI system's affordances and limitations, and the distribution of risks and benefits. A problem such as 'students misuse generative AI' is therefore reframed as a set of teachable design questions concerning authorship, assessment validity, feedback literacy, disciplinary norms, and equitable access.

4.4. Phase 3: Ideate – generating creative pedagogical responses to AI

The Ideate phase focuses on generating a wide range of possible pedagogical responses to the AI-related challenges identified in the Define phase. Drawing on established approaches to creative problem solving and speculative design thinking [3], this phase cultivates the generative and experimental capacities that are increasingly central to innovative teaching but often underdeveloped in conventional teacher preparation. Pre-service teachers are encouraged to suspend immediate evaluative judgement, explore provisional and imaginative ideas, and build on one another's contributions – practices that explicitly counter the risk aversion often instilled in novice teachers by institutional and social pressures.

The Ideate phase also incorporates what may be termed human-AI co-ideation: the deliberate but critically bounded use of generative AI tools in support of pedagogical imagination. Pre-service teachers are guided in using large language models and other AI applications to brainstorm lesson structures, generate alternative explanations, create differentiated examples, and anticipate learner misconceptions. However, AI suggestions are not treated as solutions. They function as design prompts that must be examined for accuracy, bias, curricular fit, cultural relevance, accessibility, and ethical acceptability. This generative relation between AI competence and design thinking is central to DT-ART: AI is simultaneously an object of study, a design material, and a catalyst for professional judgement.

4.5. Phase 4: Prototype – designing AI-integrated pedagogical artefacts

The Prototype phase involves the creation of tangible pedagogical artefacts – such as lesson plans, assessment instruments, curriculum units, learning resources, or digital tools – that embody the ideas generated during ideation and are intended to function effectively in AI-infused learning environments. The term prototype is used deliberately to signal that these artefacts are working hypotheses open to iterative refinement rather than finished professional products [6]. This framing matters for professional agency: positioning pre-service teachers as designers of contextually responsive pedagogical solutions rather than as consumers of prefabricated materials represents an important shift in professional identity, with implications for efficacy and adaptability [3].

Consistent with the collaborative orientation of design thinking, prototypes in the DT-ART model are developed by teams that include pre-service teachers at different stages of the programme as

well as practising teachers from partner schools. This collaboration embodies the human-centred principle and creates opportunities for meaningful knowledge exchange between university and school contexts – something research on effective professional learning consistently identifies as valuable [9]. Critically, prototypes are expected to make their AI-related design logic explicit: What role, if any, does AI play in the learning activity? What assumptions about student agency, teacher oversight, and pedagogical purpose are embedded in the design? What ethical issues related to data, equity, transparency, and appropriate use must be addressed?

4.6. Phase 5: Test and Reflect – iterative professional learning through evidence

The fifth phase encompasses both the trialling of prototyped artefacts in school settings and structured professional reflection on what is learned through that process. Testing is understood not in a summative sense, but as systematic evidence gathering in the service of further iteration – a concept central to design thinking and action research traditions [14]. In DT-ART, evidence includes learner work, classroom observation, teacher and student feedback, AI-output audits, assessment validity checks, and reflections on equity or unintended consequences. This makes validation part of teacher learning itself: pre-service teachers learn to ask not only whether an AI-supported artefact works, but for whom, under what conditions, at what cost, and according to which educational values.

Structured reflection conducted within learning communities that bring together peers, mentor teachers, and university supervisors constitutes the professional learning core of the DT-ART model. Drawing on transformative learning theory [17], the model aims for forms of reflection that move beyond technical review toward sustained engagement with the values and assumptions embedded in pedagogical choices about AI. This aspiration connects the DT-ART model with critical traditions in teacher education and with contemporary scholarship calling for socially just approaches to educational technology [25]. The process is intentionally iterative: insights from the Test and Reflect phase feed directly into a renewed Empathise phase, as teachers bring richer understanding of their students and contexts to the next design cycle. In this model, the AI-ready teacher is not someone who reaches a fixed state of readiness, but someone who continually learns with and about technology.

5. Implications for teacher education policy and practice

5.1. Curricular and programme design

The DT-ART model has several implications for the design of teacher education programmes. Most fundamentally, it advocates a logic of curricular integration rather than addition. Instead of appending an AI literacy module to an otherwise unchanged programme, the model calls for AI-related learning to be embedded across methods courses, assessment design, practicum seminars, educational psychology, inclusive education, and capstone inquiry. This integration is not additive but generative: AI competencies are developed through design activity, while design activity is deepened by the conceptual demands of AI ethics, datafication, automation, and human-machine collaboration.

The model also has implications for how time is organised within teacher preparation. Authentic engagement in design thinking – including empathic inquiry, collaborative prototyping, and structured reflection on evidence – requires sustained blocks of time that are difficult to accommodate within conventional lecture-seminar formats. Research on effective teacher professional learning consistently shows that sustained, collaborative, practice-embedded activity produces more durable learning than short, episodic, and decontextualised training [9, 12]. Programmes adopting the DT-ART model would therefore need to reconsider not only content but also the organisation of learning, including the possible use of portfolio-based assessment to document design thinking processes and outcomes.

5.2. The role of teacher educators

A consistent finding in the literature on technology integration in teacher education is that teacher educators themselves are often insufficiently prepared to model the practices they are expected to teach [21, 24]. This challenge is especially acute in the context of generative AI, where the speed of development means that even recently updated knowledge can quickly become outdated. The DT-ART model, therefore, implies that teacher educators must themselves participate in ongoing design thinking cycles: empathising with the evolving realities of schools and classrooms, defining AI-related professional challenges, ideating and prototyping pedagogical responses, and testing their own practice through reflective inquiry.

Teacher education programmes need to create conditions for interdisciplinary collaboration, enabling teacher educators to work alongside colleagues in computer science, data science, educational technology, and applied ethics to design programme experiences that reflect current technological realities. Professional learning communities [12], in which teacher educators collaborate across departmental boundaries to build shared AI knowledge and co-design curriculum experiences, can provide an important organisational infrastructure for this work. Partnerships with schools engaged in thoughtful AI integration are equally important because they supply the grounded context that such communities require and foster genuine dialogue between university-based and school-based knowledge.

5.3. Equity and access considerations

Any framework for AI-ready teacher preparation must confront issues of equity, access, and contextual diversity. AI integration is not evenly distributed across schools. Available studies suggest that well-resourced schools are more likely to access sophisticated AI tools and to use them in ways that support higher-order learning, whereas less-resourced schools may lack infrastructure or may rely on available tools primarily for low-level drill and practice [2, 16]. A teacher prepared through the DT-ART model must therefore be equipped not only to use AI effectively, but also to recognise and respond to inequitable patterns of implementation.

The model addresses this challenge partly through the empathic inquiry of its first phase, which requires pre-service teachers to develop a contextually grounded understanding of the structural conditions shaping students' access to and relationships with technology. It also addresses it through the ethical reasoning embedded in the Define phase, which frames AI integration in relation to social justice and educational equity. Even so, the model's equity-oriented ambitions will be difficult to realise if teacher education programmes themselves are unevenly resourced, or if practicum placements are concentrated in schools that do not reflect the diversity of contexts in which trainee teachers will ultimately work. Programme design must therefore attend carefully to the distribution of professional experiences and ensure that design thinking with AI takes place across diverse school communities.

5.4. Policy and institutional contexts

The successful implementation of the DT-ART model depends on enabling policy conditions at institutional, system, and governmental levels, not only on programme-level decisions. In many jurisdictions, accreditation frameworks for teacher education still prioritise content knowledge and general pedagogical competence, while digital literacy is addressed only in broad and often vague terms that permit substantial under-implementation. Revising these frameworks to include explicit and substantive expectations for AI competency – of the kind articulated by Miao and Cukurova [18] and Holmes et al. [11] – would create both the mandate and the legitimacy for the curriculum transformation implied by the DT-ART model.

Teacher education institutions must also establish structural conditions for the interdisciplinary collaboration that AI-focused preparation requires, including workload models that recognise the

time demands of collaborative curriculum design and evaluation frameworks that reward pedagogical innovation alongside research productivity. Accreditation bodies, professional associations for teacher educators, and government education departments all have a role in signalling that AI readiness is not an optional enrichment or specialist strand, but a core dimension of professional preparedness that should run through both initial teacher education and continuing professional development.

6. Conclusions and future directions

Preparing teachers to work thoughtfully in AI-infused educational environments is now a central challenge for teacher education. This paper has argued that design thinking offers a strong conceptual and pedagogical framework for meeting that challenge because it links technological change to human-centred inquiry, iterative learning, and professional judgement. The DT-ART model presented here brings together empathic inquiry, problem framing, ideation, prototyping, and reflective testing as a coherent approach to developing pre-service teachers who are not only capable of using AI tools but also able to evaluate them critically, adapt them to context, and use them responsibly. Its central contribution is to reposition AI readiness as an evolving professional disposition rather than as a fixed set of technical competencies.

This argument also has limitations. The DT-ART model remains a conceptual framework derived from literature synthesis rather than an empirically tested intervention. This limitation is important and should be treated as a boundary condition of the present paper rather than as a weakness to be ignored. The model requires empirical validation through expert review, iterative implementation, and outcome evaluation before strong claims can be made about its effectiveness. In addition, the literature on design thinking in teacher education, while promising, still relies heavily on small-scale and context-specific studies with limited generalisability. The value of DT-ART at this stage is therefore theoretical and programmatic: it offers a coherent set of constructs, mechanisms, and design principles that can guide future research and curriculum development.

Future research should examine how DT-ART-informed programme designs operate across diverse teacher education settings, what professional dispositions and pedagogical practices they foster, and whether they support more equitable and critically informed approaches to AI integration. A staged validation agenda is recommended. First, expert review panels involving teacher educators, practising teachers, AI education researchers, ethicists, and policy specialists should assess the model for clarity, relevance, coherence, and feasibility. Second, a Delphi study could be used to refine the constructs and indicators of AI-ready pedagogical design judgement. Third, design-based research should test DT-ART modules in authentic teacher education courses and practicum contexts. Fourth, mixed-methods studies should examine changes in pre-service teachers' AI literacy, ethical reasoning, lesson-design quality, reflective judgement, and classroom enactment. Comparative studies should also examine whether DT-ART produces stronger outcomes than conventional AI literacy workshops or tool-focused training.

Overall, the paper suggests that if AI is becoming a durable feature of educational life, teacher education must move beyond reactive technology training toward forms of preparation that cultivate curiosity, criticality, creativity, ethical responsibility, and evidence-informed judgement. DT-ART contributes to this shift by theorising AI readiness as a recursive design capability, not merely a set of competencies. In this sense, the model provides a stronger basis for journal-worthy scholarly debate and future empirical work on how teachers can design responsibly with, about, and against AI in the service of learning.

Author contributions

Conceptualization, M.S.K.; methodology and data analysis, M.S.K. and E.A.; writing—original draft preparation, M.S.K.; writing—review and editing, M.S.K. and E.A. All authors have read and agreed to the published version of the manuscript.

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Conflicts of interest

The authors declare no conflicts of interest.

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