Futures Thinking and Strategic Foresight in Teacher Education: Preparing Educators for AI-Mediated Schooling

Joedel O. Peñaranda
Postgraduate Student, Faculty of Education, University of Melbourne, Australia
joedel.penaranda@student.unimelb.edu.au | jedzochea@gmail.com
ORCiD: https://orcid.org/0000-0002-7762-4431

Abstract

Teacher education must prepare educators for AI-mediated schooling while technologies, evidence, and policy expectations continue to change. This article advances anticipatory professionalism as a way of linking professional judgement, collective foresight, and system-level governance. Futures literacy supports educators in questioning assumptions and considering alternative futures. Strategic foresight organises this capacity through shared inquiry, while anticipatory governance creates routes through which the results can affect standards, programmes, and institutional decisions. A qualitative document analysis examines ten official professional standards, teacher education and competency frameworks, AI guidance, and review documents drawn from England and Australia and from UNESCO and the European Commission. Collectively, these documents capture key policy mechanisms through which teacher preparation and AI governance are articulated. Analysis focused on how they frame AI-mediated change, allocate responsibility for anticipation, and connect review with professional formation. Three findings emerge. Professional standards favour durable, technology-neutral language. AI-specific guidance gives clearer ethical and pedagogical direction but is often weakly connected to initial teacher education. Review and monitoring mechanisms are increasingly visible, yet their consequences for programme redesign and accreditation remain unclear. The article argues that readiness for AI-mediated schooling requires recurring institutional processes through which professional experience informs foresight and foresight informs authorised revision. Anticipatory professionalism names this relationship and offers a framework for strengthening teacher agency, ethical responsibility, and institutional learning.

Keywords: *futures literacy, strategic foresight, teacher education, generative artificial intelligence, anticipatory governance*

Introduction

Artificial intelligence (AI) is entering schooling as a teaching tool, administrative system, and object of study. Generative systems can produce lesson materials,

explanations, feedback, and dialogue, while algorithmic systems can influence assessment, content recommendation, and organisational decisions (Kasneci et al., 2023). These developments intensify a longstanding challenge for teacher education: preparing educators to exercise professional judgement when technologies, evidence, and policy expectations are unstable and contested. Recent reviews and international frameworks agree that teachers need sustained support to use AI critically and ethically, rather than opportunities for ad hoc experimentation alone (Brandão et al., 2024; Miao & Cukurova, 2024; Sperling et al., 2024; Tan et al., 2025). A response framed only around tools and immediate skills, however, overlooks how AI can alter knowledge practices, professional authority, assessment, and governance.

This article argues that teacher education needs an explicit anticipatory orientation. Futures thinking provides the broad disposition through which educators imagine and critique alternatives. Futures literacy concerns the capability to examine how assumptions about possible futures shape present choices (Mangnus et al., 2021; Miller, 2007). Strategic foresight refers to organised practices through which institutions explore plausible developments and connect that exploration to current decisions (Tõnurist & Hanson, 2020; Tõnurist & Orlik, 2025). These concepts redirect attention from preparing teachers to use particular tools towards preparing professionals and institutions to interpret, question, and shape technological change.

The paper advances anticipatory professionalism as its central theoretical proposition. Anticipatory professionalism is not an individual trait or another term for flexibility. It describes a relationship among professional judgement, collective inquiry, and authorised institutional change. Futures literacy supports judgement at the level of the educator. Strategic foresight organises inquiry within programmes and institutions. Anticipatory governance determines whether the resulting knowledge can influence standards, accreditation, and system decisions. This multilevel relationship is examined through a qualitative document analysis of ten official policy and professional guidance documents selected for their roles in professional standards, teacher education, AI competence, and technology governance.

The analysis addresses three questions. First, how do the selected documents frame AI-mediated change? Second, where do they locate responsibility for anticipating and governing that change? Third, how do they connect professional standards, institutional learning, and policy revision?

Conceptual framework: Futures thinking, futures literacy, and strategic foresight

Futures thinking in education is sometimes reduced to imagination or creativity. Futures scholarship instead treats imagined futures as socially consequential because they organise expectations, direct resources, and legitimate action in the present (Oomen et al., 2022). In teacher education, narratives about AI personalisation, efficiency, surveillance, or teacher replacement can therefore shape what programmes value and what forms of professional knowledge appear necessary.

Futures literacy provides a more specific account of how people engage with possible futures. Miller (2007) described a scenario-based method for surfacing assumptions, exploring alternatives, and informing present decisions. Mangnus et al. (2021) emphasised reflexivity across plural futures and the power relations that privilege some imaginaries over others. Educational work also points to cognitive, affective, and practical dimensions, described as engagement of heads, hearts, and hands (Vervoort et al., 2025). Applied to teacher education, futures literacy means examining not only what AI can do, but also how claims about AI frame curriculum, assessment, relationships, and policy.

Strategic foresight turns future-oriented inquiry into organised practice. It is not prediction. It uses processes such as horizon scanning, scenario development, experimentation, and iterative review to explore plausible developments and inform present decisions. In public governance, these routines can expose assumptions, identify emerging risks, and reduce dependence on short-cycle reactions (Tõnurist & Hanson, 2020; Tõnurist & Orlik, 2025).

The concepts operate at distinct but connected levels. Futures thinking is the overarching orientation. Futures literacy supports professional judgement by helping educators question assumptions and consider alternatives. Strategic foresight turns that capability into collective inquiry within programmes and institutions. Anticipatory governance provides the authorised routes through which the resulting knowledge can affect standards, accreditation, procurement, and accountability. Teacher competence frameworks matter because they can connect these levels or leave them institutionally separate.

Teacher education is anticipatory because it defines professional responsibility before future conditions of practice are fully known. Institutionally, anticipation differs from responsiveness and adaptation in three respects. It begins before a specific event requires action, uses structured inquiry rather than ad hoc monitoring, and has authorised routes into curriculum or policy revision. Responsiveness addresses a current signal. Adaptation changes practice once a development is observable. Anticipation tests whether current standards and programmes would remain adequate across plausible changes (Guston,

2014; Tõnurist & Hanson, 2020). An institution is therefore not anticipatory merely because it updates guidance. It must repeatedly examine its assumptions and be able to act on the results.

AI-mediated schooling and professional anticipation

UNESCO guidance on generative AI identifies educational possibilities alongside risks involving privacy, bias, inaccurate content, and inappropriate reliance on automated outputs (Miao & Holmes, 2023). These risks are not only technical. They concern procurement, accountability, access, and the authority to decide when AI use is educationally justified. UNESCO's teacher framework accordingly extends beyond tool use across five dimensions: a human-centred mindset, ethics, AI foundations and applications, AI pedagogy, and AI for professional learning (Miao & Cukurova, 2024). This framing places ethical and pedagogical judgement at the centre of AI readiness.

Empirical work suggests that such competence can be developed, but not through exposure alone. Moorhouse et al. (2024) found that an 11-week intervention in an initial language teacher education course strengthened several dimensions of preservice teachers' professional generative AI competence, although gains were uneven. Reviews likewise identify the need for systematic AI literacy and professional development in teacher education (Brandão et al., 2024; Sperling et al., 2024; Tan et al., 2025). Together, this work indicates that competence depends on deliberate curriculum, authentic tasks, critical reflection, and sustained professional learning.

Competence frameworks alone do not address all the professional stakes. AI systems can change how teaching is evaluated and governed through data-intensive monitoring, automated feedback, and platform-mediated decisions. If teacher education focuses only on classroom applications, educators may remain underprepared to participate in organisational decisions about adoption, procurement, assessment, and accountability. Anticipatory governance is therefore relevant because it links foresight with engagement and institutional decision-making before harmful practices become entrenched (Guston, 2014).

The levels must work together. A teacher or preservice teacher may identify a problem with AI-generated feedback. Futures literacy supports critical interpretation of that experience and consideration of alternative responses. A programme-level foresight process can test whether the problem signals a wider change in assessment or professional responsibility. Governance arrangements determine whether the finding leads to revised curriculum, accreditation guidance, or system policy. The relationship also operates in reverse: standards shape what programmes teach, while professional experience supplies evidence for review. Without collective routines, futures literacy remains discretionary.

Without decision authority, foresight remains advisory. Without practitioner and community participation, governance risks becoming technocratic.

Methods

This study examines how official policy and professional guidance documents construct preparedness for AI-mediated schooling. Such documents do more than communicate policy. They define legitimate competence, distribute responsibility, and structure which responses to change become possible. A qualitative document analysis was therefore used to review the texts systematically and interpret their institutional relationships (Bowen, 2009). The procedure was informed by the READ sequence of readying materials, extracting data, analysing data, and distilling findings (Dalglish et al., 2020).

Document selection

A criterion-based purposive sample was assembled through searches of official government, professional body, UNESCO, and European Commission repositories. Searches were completed in July 2026 using combinations of teacher education, professional standards, artificial intelligence, generative AI, competency, ethics, governance, monitoring, and review. The aim was analytical coverage across relevant policy functions, not exhaustive retrieval of every educational AI document.

Documents were included when they were publicly available in English by July 2026, issued by a governmental, national professional, intergovernmental, or supranational authority, and directly addressed at least one of three functions. These functions were professional standards or initial teacher education, teacher AI competence or ethical responsibility, and governance or review of AI use in education. The latest official version was used unless an earlier framework was needed to trace policy development. Documents limited to technical infrastructure or local implementation were excluded unless they also assigned professional or governance responsibility.

The final set comprises ten documents published between 2011 and 2026. Selection followed policy function rather than country. The documents from England form the most continuous sequence across professional standards, initial teacher education, AI guidance, and evidence review (Department for Education, 2011, 2019, 2024, 2025; Open Innovation Team & Department for Education, 2024). This sequence permits closer examination of relationships among connected instruments. Documents from Australia, UNESCO, and the European Commission provide functional contrasts concerning professional competence, recurring review, human oversight, and institutional learning. They are not treated as

equivalent representations of national systems. Table 1 identifies the documents and their analytical roles.

Table 1

Document set and analytical role

Document	Authority and year	Policy function	Reason for inclusion
Teachers' Standards	Department for Education (2011)	Professional standards	Establishes baseline professional expectations and the regulatory context for teacher preparation.
Initial Teacher Training (ITT): Core Content Framework	Department for Education (2019)	Initial teacher education	Provides the earlier minimum entitlement and enables tracing of policy development into the 2024 framework.
Initial Teacher Training and Early Career Framework	Department for Education (2024)	Teacher education and early career	Contains the technology-neutral framing examined in the findings and records the outcome of sector review.
Generative Artificial Intelligence (AI) in Education	Department for Education (2025)	AI guidance	Specifies current expectations for safe use, data protection, intellectual property, and professional judgement.
Generative AI in Education: Educator and Expert Views	Open Innovation Team and Department for Education (2024)	Evidence and policy review	Documents sector concerns and recommendations, including the need for a long-term strategy.
Australian Professional Standards for Teachers	Australian Institute for Teaching and School Leadership (2011)	Professional standards	Provides a functional contrast concerning ICT, ethical use, professional learning, and policy review.
Australian Framework for Generative Artificial Intelligence (AI) in Schools	Australian Government Department of Education (2023)	AI governance	Defines shared principles and responsibilities and commits the framework to recurring review.
2024 Review of the Australian Framework for Generative Artificial Intelligence in Schools	Australian Government Department of Education (2025)	Policy review	Shows how emerging risks and continuing relevance are assessed through an annual review process.
AI Competency Framework for Teachers	UNESCO (2024)	Teacher AI competence	Specifies professional capabilities across ethical, technical, pedagogical, and professional-learning dimensions.
Guidelines on the Ethical Use of Artificial Intelligence and Data in Teaching	Directorate-General for Education, Youth, Sport and Culture (2026)	Ethics and governance guidance	Provides practical scenarios, guiding questions, and human-oversight considerations for context-sensitive decision-making.

Document	Authority and year	Policy function	Reason for inclusion
and Learning for Educators			

Note. Documents are compared by policy function and are not treated as equivalent representations of national systems.

Analytical procedure

Analysis proceeded in three stages. First, each document was read in full. Its issuing authority, date, intended audience, policy function, and relationship to other documents were recorded. The unit of analysis was a passage that framed technological change, defined professional competence, allocated responsibility for an AI-related decision, or prescribed monitoring, experimentation, review, or policy revision.

Second, relevant passages were entered into an extraction matrix. The matrix recorded how change was described, which actors were assigned responsibility, what review mechanisms were specified, and whether those mechanisms were connected to teacher education. Futures literacy, strategic foresight, and anticipatory governance were used as sensitising concepts. They guided attention to assumptions, routines, and decision relationships, but were not treated as a checklist or as terminology that documents were expected to reproduce.

Third, the extracted material was compared within and across the three policy functions. Three analytical categories were aligned with the research questions. Framing AI-mediated change captured language about pace, uncertainty, and whether AI was treated as a generic technology or a structural change. Locating responsibility identified the actors expected to exercise judgement, monitor developments, and initiate review. Connecting review to professional formation examined whether evidence, monitoring, or experimentation had an explicit route into programme design, professional standards, or accreditation. Descriptive summaries were prepared before cross-document comparison. Omissions, relationships among documents, and evidence that challenged an initially critical interpretation were also recorded.

Scope and limitations

The analysis concerns formal policy representations rather than their enactment by teacher education providers or schools. Documents are compared according to policy function, not as equivalent national cases. The study therefore cannot establish the prevalence of anticipatory practice, causal effects, or differences in implementation. The selection is weighted towards English-language documents from high-income systems and international organisations, which limits transferability to other political and educational

contexts. International guidance also lacks the regulatory authority of national professional standards.

As a single-author analysis, the study does not claim intercoder reliability. Interpretive transparency is instead supported through explicit selection criteria, a document-level table, a recorded extraction matrix, operational definitions for the analytical categories, attention to disconfirming evidence, and claims calibrated to what the texts can substantiate.

Findings

Framing AI-mediated change

Professional standards primarily address technological change through durable, technology-neutral language. England's Initial Teacher Training and Early Career Framework states that “the technology available for facilitating great teaching and supporting pupils to succeed is constantly evolving” and therefore “does not refer to specific technological innovations” (Department for Education, 2024, p. 5). The same passage expects teachers to remain conversant with useful developments and encourages providers to support judicious, evidence-informed use. The Australian Professional Standards for Teachers similarly expect teachers to integrate information and communication technologies, use them safely and ethically, and pursue professional learning. At the lead-teacher level, they also address the review and implementation of relevant policies (Australian Institute for Teaching and School Leadership, 2011). These approaches provide durable professional expectations without tying them to technologies that may rapidly become obsolete.

The idea of futureproofing through generality rests on a specific inferential sequence. The frameworks acknowledge continual technological change, withhold tool-specific requirements to preserve durability, and delegate interpretation to providers or supplementary guidance. None of these moves is problematic on its own. Together, however, and without required scenario testing or review triggers tied to teacher education, they can make future-oriented inquiry optional. Durability is not the same as anticipation. Durability protects standards from rapid obsolescence; anticipation tests whether those standards remain adequate under plausible changes to knowledge, assessment, and professional authority. Institutional presentism is therefore identified as a risk created by this arrangement, not as an intention attributed to policymakers.

Locating responsibility for anticipation

AI-specific documents provide clearer ethical and pedagogical direction. England's guidance emphasises safe use, data protection, intellectual property, professional judgement, and organisational responsibility (Department for Education, 2025). The

Australian framework distributes responsibility across school communities and education systems through principles for responsible and ethical use (Australian Government Department of Education, 2023). UNESCO specifies competencies across human-centred, ethical, technical, pedagogical, and professional-learning dimensions and presents the framework as a resource for teacher preparation and professional development (Miao & Cukurova, 2024). European Commission guidance uses practical scenarios and guiding questions to support context-sensitive ethical decisions and human oversight (Directorate-General for Education, Youth, Sport and Culture, 2026).

The documents therefore allocate responsibility vertically as well as professionally. Competency frameworks define what teachers should understand and judge. School guidance assigns operational responsibilities to teachers, leaders, systems, and providers. Review documents place responsibility for monitoring and revision with governing bodies. The key gap is not an absence of responsibility. It is the uncertain transfer of AI-specific expectations into initial teacher education standards, accreditation, curriculum, assessment, and practicum. Where this transfer is not specified, implementation depends on local interpretation and institutional capacity.

Connecting review to professional formation

The document set contains meaningful mechanisms for review and institutional learning. England's 2024 Initial Teacher Training and Early Career Framework followed evidence gathering, sector feedback, and review of earlier frameworks (Department for Education, 2019, 2024). The related evidence report calls for a long-term AI strategy that considers changes to teachers' roles and classroom learning (Open Innovation Team & Department for Education, 2024). Current guidance also anticipates continuing evidence development and organisational review (Department for Education, 2025). Australia requires annual review of its school AI framework; the 2024 review examined emerging risks and the framework's continuing relevance (Australian Government Department of Education, 2025). European Commission guidance uses scenarios and guiding questions to support informed, context-sensitive evaluation (Directorate-General for Education, Youth, Sport and Culture, 2026).

This counterevidence prevents a simple characterisation of policy as merely reactive. The documents show evidence responsiveness, experimentation, and recurring review. The weaker connection lies between these processes and professional formation. Review findings are not consistently linked to required changes in teacher education curricula, accreditation expectations, or professional standards. The central issue is therefore institutional coupling: whether evidence about emerging technology can travel from

classrooms and policy review into the systems that prepare teachers, and whether professional experience can travel back into authorised revision.

Discussion: Towards futures-integrated teacher education for AI-mediated schooling

The findings reveal a recurring separation among durable professional standards, AI-specific guidance, and mechanisms for policy review. This separation is not inherently deficient. Standards need stability, while guidance needs to respond to emerging risks and uses. The problem arises when the connection among them is weak. Teacher education may then become dependent on provider initiative or short-cycle guidance, rather than supported by a recurring process through which professional experience, foresight, and authorised revision inform one another.

Anticipatory professionalism provides the paper's main theoretical contribution. Evans (2008) shows how professionalism is shaped by externally demanded and prescribed expectations as well as by enacted practice. Sachs (2016) places professional learning, research-active practice, agency, and collective responsibility at the centre of teacher professionalism. Anticipatory professionalism extends rather than replaces these accounts. It adds a temporal and institutional obligation: teachers and teacher educators should be able to examine plausible sociotechnical developments before they become normalised and to participate in decisions about how professional practice should change.

Three features make the concept distinctively anticipatory. The first is prospective reach: professional judgement considers plausible conditions that are not yet routine. The second is collective inquiry: assumptions are tested through shared processes rather than left to individual intuition. The third is consequential authority: findings have an identifiable route into programme, institutional, or policy revision. Futures literacy supports the first feature by helping professionals question assumptions and compare alternatives. Strategic foresight supports the second by organising inquiry. Anticipatory governance supports the third by linking inquiry to legitimate decisions. Anticipatory professionalism therefore concerns whether educators have the capability, opportunity, and authority to shape future conditions of practice.

The framework has practical implications for curriculum and assessment. Teacher education programmes can examine competing narratives about AI-mediated schooling, including personalisation, efficiency, surveillance, and equity. Scenario-based tasks can ask preservice teachers to respond to plausible changes in assessment, tutoring, feedback, or data governance and justify their ethical and pedagogical decisions. Such work should engage analytical, affective, and practical dimensions rather than treating uncertainty as a purely technical problem (Vervoort et al., 2025). Structured training can develop generative

AI competence (Moorhouse et al., 2024), but its purpose should include examination of how AI changes responsibility, authority, and educational relationships.

Institutions also need recurring processes that connect professional learning to programme renewal. Providers and regulators can use horizon scanning to track emerging capabilities, regulation, school experience, and evidence of educational effects. Scenario development can test whether current curricula and standards remain adequate. Programme review can then identify decision points, responsible actors, and thresholds for revision. These processes should include teachers, teacher educators, learners, and communities so that foresight does not become detached from professional knowledge or public accountability.

Implications for Social Sciences Futures

Teacher education offers a useful perspective on anticipation because it connects system policy with classroom practice. It shows that governance of emerging technology begins in professional formation, not only in regulation, procurement, or organisational adoption. The analysis therefore shifts attention from whether an institution possesses a foresight method to how anticipatory capacity is distributed across people, programmes, documents, and decision relationships.

First, anticipation is a multilevel social accomplishment rather than only an individual cognitive skill or managerial technique. Professionals may develop futures literacy, but its institutional effect depends on collective routines and authority to act on what those routines reveal. Teacher education makes visible the movement from individual judgement to organisational learning and policy change, and the points at which that movement can fail.

Second, professional standards are instruments of temporal governance. They stabilise accounts of competence, define which aspects of practice are expected to endure, and locate responsibility for responding to change. The contrast between durable standards and more iterative AI guidance shows how policy instruments can create or restrict opportunities for institutional learning. The study of teacher education therefore extends emerging-technology governance into the professional systems through which technologies are interpreted and enacted (Evans, 2008; Guston, 2014).

Third, professional formation is an upstream site of technology governance. Teachers mediate how AI enters classrooms, whose knowledge is trusted, and how risks and benefits are distributed. Participatory foresight in teacher education can expose competing assumptions and include learners and communities that are often marginal to procurement or policy decisions. Institutions govern futures not only through formal rules, but

also through the capabilities they cultivate and the forms of judgement they authorise (Mangnus et al., 2021; Oomen et al., 2022).

Conclusion

Teacher education must prepare educators for AI-mediated schooling while technologies, evidence, and policy expectations continue to change. Treating this challenge as a matter of immediate skills or periodic guidance is insufficient. The analysis shows that durable professional standards coexist with increasingly explicit AI competence, ethics, monitoring, and review. Yet these elements are not consistently connected to initial teacher education, programme redesign, or accreditation. Anticipatory professionalism addresses this gap by linking professional judgement, collective inquiry, and system governance so that educators can help shape, rather than merely respond to, AI-mediated change.

The argument can be operationalised through feasible institutional changes. Providers can use scenario-based assessments in which preservice teachers analyse plausible classroom futures and justify ethical, pedagogical, and assessment decisions. Programme reviews can include periodic AI horizon scanning informed by research, regulation, school partnerships, and learner experience. Accreditation and quality assurance bodies can require evidence that candidates develop futures literacy, AI ethics, and foresight capabilities across coursework and practicum reflection. Partnership schools can use practicum seminars to examine how AI changes feedback, planning, assessment integrity, and accountability. These actions do not require abandoning professional standards. They require clear processes through which standards and programmes are tested and revised as the conditions of teaching change.

Future research should examine how these relationships operate in practice. Comparative studies could trace how AI guidance is translated into programme requirements. Intervention studies could evaluate futures literacy and scenario-based learning in teacher education. Organisational research could investigate whether horizon scanning, participatory foresight, and review mechanisms alter technology decisions in schools and teacher education institutions.

Author biography

Joedel O. Peñaranda is a postgraduate student in the Faculty of Education at The University of Melbourne and an educator based in Melbourne, Australia. Before relocating to Australia, he served as Director of the Strategic Innovation and Knowledge Laboratory (SIKLAB) at Biliran Province State University, Philippines, where he led initiatives in educational innovation, strategic foresight, and education development. He previously taught

English at the university's Laboratory High School and mentored debate, public speaking, and journalism teams that received regional and national recognition. He holds a Master of Arts in Education, specialising in English Language Teaching. He is a Licensed Professional Teacher and holds teaching registrations in Australia and New Zealand. As a Fulbright Scholar in the United States, he pursued advanced study and professional engagement in education.

His research focuses on teacher education, artificial intelligence in education, futures thinking, strategic foresight, educational policy, English language education, and multilingualism. His work examines how emerging technologies and anticipatory approaches reshape teaching, professional learning, curriculum, and educational governance, with particular attention to preparing educators for AI-mediated schooling and future-oriented educational systems.

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