

# From Tools to Thinking Partners: Responsible Integration of Generative AI in Pre-Service Teachers' Lesson Planning Practices

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**“For ITE providers, the challenge is not simply whether to include GenAI within their curriculums, but how to do so in ways that: preserve pedagogical thinking; support, and navigate through effective prompting, ethical awareness (including inherent bias); consider social, political and environmental ramifications and empower teachers to critically evaluate AI-generated outputs.”**

## Context

An artificial intelligence (AI) race by technology firms and international governments has fueled rapid investment in, and directives for, AI in education. In the United Kingdom, the current government's Department for Science, Innovation & Technology's (DSIT, 2025) 'AI opportunities action plan' was supported by the Department for Education. These initiatives are often framed around improving efficiency, reducing teacher workload and supporting teaching and learning through new technologies.

Whilst refraining from directing mandatory use of AI in schools, policy from the DfE (2025) demonstrates support for the use of AI 'where it benefits the care and education of children and learners.' Additionally, Ofsted continues to explore emerging practice from schools that are early adopters, thus continuing with a longer-term trend for technological innovation in education (Ofsted, 2025). The direction of travel appears to be one that will lead to a future expectation that schools and other education institutions integrate AI into their policies, systems, pedagogy and curricula. In this context, teachers will require professional development to use these technologies responsibly and



effectively. Recent discussions around teacher training in assistive technologies, including AI, imply that such knowledge may increasingly become part of teachers' professional expectations. This suggests a growing need for integration within Initial Teacher Education (ITE) programmes. However, debates around AI in education also highlight tensions and uncertainties. Critics have questioned elements of 'AI hype' and the influence of commercial technology providers, while others have raised concerns regarding environmental impacts, ethical considerations and potential risks to learners' development and wellbeing (Tobin, 2023). Within higher education, institutional approaches to generative AI (GenAI) currently vary. At Bath Spa University (BSU), AI increasingly features in discussions around digital learning and the university's wider digital transformation strategy. The current institutional stance is one of cautious support, emphasising professional development for staff alongside the development of clear policy and guidance to ensure safe, responsible and effective use.

This is particularly pertinent to our pre-service teachers' (PSTs) experience of 'lesson planning' and learning 'how to plan lessons' effectively with or without the use of GenAI. Learning how to plan lessons is a notoriously complex, time-consuming, yet essential aspect of teachers' practice, which continues to develop well beyond ITE and into early career stages (Mutton, Hagger and Burn, 2011). Early in their development, novice teachers tend to prioritise the visible elements of planning, such as aligning curriculum content, pedagogy and assessment, structuring lessons coherently, and designing activities to maintain pupil engagement. They may pay less attention to the less visible and more complex aspects of planning, including the nuanced understanding of individual learners, the class as a social entity, responsive interaction and assessment during lessons, and broader considerations of pupils' holistic development (Mutton, Hagger and Burn, 2011; Serret and Gripton, 2020).



The Initial Teacher Training Early Career Framework (ITTECF) (DfE, 2024), whilst not naming AI specifically, insists that new teachers are conversant with the judicious use of new technologies to support practice. This, in combination with lesson planning being identified as a key area of significant workload for PSTs and ongoing recruitment and retention issues means the challenge for ITE providers is to balance these principles and priorities. PSTs are already encountering GenAI tools that can generate lesson plans and other teaching resources. Preparing PSTs to engage with such technologies, therefore, requires more than technical familiarity. ITE programmes must support trainees to develop critical and reflective approaches to AI, enabling them to evaluate when and how these tools might appropriately support lesson planning, teaching and learning. In response to this need, this article presents and critically examines an emerging model for integrating GenAI into lesson planning practices within ITE at BSU. The article explores how AI can be positioned not simply as a tool, but as a thinking partner, and considers the implications for responsible sequencing and progression of curriculum content and permissions for its use during pre-service teacher development.

## Analysis: AI-TPACK and lesson planning

Koehler and Mishra's Technological, Pedagogical and Content Knowledge (TPACK) model (2009) is a useful framework for conceptualising the knowledge required to utilise technology effectively for teaching and learning and its intersection with the wider body of pedagogical content knowledge (PCK) that teachers require.

With the advent of Gen AI, this model is being reviewed with the particular constraints and affordances of the new technology in order to develop an understanding of how these GenAI tools are similar and different to other technologies, potentially shifting the nature of teaching and learning. Two key differences between GenAI and other technologies stated are that it is generative and social.



Whereas earlier technologies were typically used to create resources or deliver content, GenAI can generate new content through natural language interaction and respond conversationally to users. In this sense, it can act as an “expert collaborator”, albeit one that can make mistakes (Mishra, Warr & Islam, 2023).

An expanded framework of AI-TPACK conceptualises teachers' professional knowledge as an interaction between pedagogical knowledge, content knowledge, and artificial intelligence technological knowledge. Intersections between these domains produce specialised forms of understanding, including pedagogical content knowledge (PCK), AI technological pedagogical knowledge (AI-TPK), and AI technological content knowledge (AI-TCK). At the centre of the framework is AI-TPACK, representing the integrated application of pedagogy, subject knowledge, and AI technologies within educational practice. The framework is additionally influenced by broader dimensions of AI literacy and broader social, ethical, cultural, institutional and educational conditions that shape AI use in practice. In the context of this article, it supports understanding of the relationships between different areas of knowledge and the expertise required of teachers to effectively integrate this emerging technology into their practice (Ning et al, 2024). Together, these domains show that PSTs need more than tool-familiarity: they require integrated professional judgement.

When using GenAI for lesson planning, PSTs draw upon multiple intersecting forms of knowledge. These include their content knowledge (CK) of the subject being taught, pedagogical knowledge (PK) of how to plan for and support children's learning, and pedagogical content knowledge (PCK) relating to how subject content is best taught. In addition, AI-TPACK emphasises the importance of AI-technological knowledge (AI-TK), including understanding how to use AI tools and how such systems generate outputs. Teachers must also develop AI-technological pedagogical knowledge (AI-TPK), enabling them to integrate AI tools appropriately into working practices, such as lesson planning, alongside ethical knowledge needed to critically evaluate AI outputs (Ning et al, 2024).

For PSTs, these knowledge domains are often still at the novice stages of development. CK, PK and PCK are largely developed through subject and pedagogy components of the ITE curriculum underpinned by the ITTECF (DfE, 2024). Earlier in their studies, PSTs may not yet have developed sufficient PCK - including understanding what effective teaching and learning look like - to critically evaluate AI-generated lesson plans. This is particularly significant given that GenAI outputs may include inaccurate information, overly content-heavy lesson structures, or suggestions that do not reflect the realities of a specific classroom context (Kehoe, 2023). Such outputs may also overlook priorities such as health and safety considerations or subject-specific pedagogical goals, further highlighting the importance of developing strong PCK in order to evaluate AI-generated lesson planning effectively. Furthermore, some studies have suggested that AI-generated



lesson plans may contain pedagogical biases; for example, favouring teacher-centred approaches or prioritising cognitive outcomes and information delivery (Chen et al., 2025). In this way, the emergence of GenAI has intensified existing concerns over teachers' over-reliance on pre-written schemes, which may lead to reduced pedagogical flexibility and professional autonomy (Pabla and Stothard, 2023). However, Chen et al. (2025) also found that thoughtful and precise prompting can mitigate these biases and provide teachers with greater agency over generated materials.

Oppositely, completely avoiding GenAI until PSTs' PCK is more secure could also prove problematic where many, if not all, are likely to be using it in some form already to support with academic work: indeed, as GenAI is increasingly integrated into existing technologies, it is hard to avoid using it. Developing PSTs' AI-TK early in their programme, including AI literacy, critical thinking and ethical use, is therefore likely to be essential. This is particularly relevant given that lesson planning forms part of assessed work within undergraduate ITE programmes.

At the same time, a range of potential benefits of AI integration have been proposed. These include reducing time spent on planning, supporting curriculum design, generating images and resources, adapting materials for different learners

and producing multimodal learning resources that may benefit pupils with additional needs (Mallory, 2024). Nevertheless, increased efficiency may also bring increased expectations and productivity pressures. For this reason, maintaining a critical stance towards the use of GenAI and regularly evaluating its impact on teacher workload and the quality of teaching and learning remains essential. Indeed, subject and age-phase nuances, including typical pedagogy and its interaction with planning for learning, for example in the Early Years (Tapestry, 2026) appear to affect the ways and extent to which AI impacts working practices and workload. These considerations sit most prominently within the AI-TK and AI-TPK domains of the AI-TPACK framework.

## Analysis: Integrating into the ITE curriculum AI-TK for prompt engineering

In response to these challenges, BSU's ITE programmes introduced a staged approach to developing AI literacy for PSTs. The BSU experience outlined here is not presented as a definitive model, but as an emerging example of how one ITE provider is intentionally navigating both the opportunities and the risks of GenAI in initial teacher education. Our aim was to ensure consistency across ITE programmes whilst recognising the nuances and differences required for undergraduate and postgraduate routes and the primary and secondary phases. All routes and phases following a four phase model of progression. Assessment of PSTs' progress is a holistic view in partnership with school-based mentors, using statements from our curriculum progression framework. A simple view of this integration is provided below, followed by a deeper analysis.

In the 25/26 academic year, provision began with a whole-cohort lecture in the first three weeks of the programme prior to school placements starting. This covered the basics of how large language models (LLMs) that power GenAI tools work as statistical models operating on human-designed algorithms to generate the most probable output based on a prompt, alongside an overview of the national policy landscape for schools to ensure safe and ethical use. This was accompanied by a declaration by all PSTs that GenAI would only be used in non-pupil-facing ways, that no protected data or intellectual property would be inputted, and that outputs would be evaluated for potential bias, inaccuracies and overall quality and effectiveness for the intended purpose and class context. Small-scale feedback from school partners, students and colleagues, gathered through school-placement moderation visits and informal conversations, identified this as an important and valued starting point and something that should remain a priority.

The initial input was shortly followed by the introduction of the OCEAN framework for prompt engineering (Calleja, 2023). OCEAN provides a procedural scaffold for writing prompts and critically assessing outputs. It supports more efficient prompt writing while explicitly incorporating an "assess" stage,

| Phase 1                                                                                                                                                                                                                                                                                                                      | Phase 1 through Phase 2                                                                                                                                                                                                                                                                                                                                                                                                           | Phase 3                                                                                                                                                                                                                                                                                                         | Phase 4                                                                                                                                          |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------|
| An introduction to what AI is, how it works and the safe and effective use of AI in education, including ethics, data, bias and critical thinking.<br><br>How AI can and cannot be used whilst on placement in school.<br><br>How AI can and cannot be used for academic assignments and related work (e.g. portfolio tasks) | Prompt frameworks (such as OCEAN) for effective use of GenAI, ensuring outputs are assessed critically and with sustainability in mind.<br><br>The use of AI tools to enhance lesson planning, adaptive resources and assessment tasks.<br><br>GenAI integrated judiciously and critically into subject and component sessions.<br><br>PSTs begin to apply their use of technologies, including GenAI, in non-pupil facing tasks. | GenAI continues to be integrated judiciously and critically into subject and component sessions, including ITAPs<br><br>PSTs continue to apply and refine their use of technologies, including GenAI, in school-related work, primarily for enhancing lesson planning, adaptive resources and assessment tasks. |                                                                                                                                                  |
| Key Related Curriculum Progression Framework Statements                                                                                                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                                                 |                                                                                                                                                  |
| Become fully aware of their duties in respect of local and statutory safeguarding and equalities legislation including Prevent and keeping themselves safe when working in schools.                                                                                                                                          | Demonstrate awareness of appropriate technology, e.g. GenAI, to enhance planning                                                                                                                                                                                                                                                                                                                                                  | Demonstrate awareness and understanding of technology, e.g. GenAI and assistive technology, to meet pupils' needs and support progress                                                                                                                                                                          | Demonstrated judicious (purposeful and considered) use of appropriate technology, e.g. GenAI, to enhance planning and support pupil progression. |

Figure 1 – A simple overview of AI integration and curriculum progression and integration in ITE at BSU



**Objective** – set a clear goal, with clear instructions, and a role for the AI

**Context** – audience, tone, length, parameters

**Examples** – to guide the AI (e.g. linked or uploaded documents)

Await output -----

**Assess** – does it meet your intentions? What is the quality of the output?

**Negotiate** – prompt until refined

Figure 2: the OCEAN framework for prompt engineering

encouraging students to evaluate the accuracy and quality of generated responses and to iteratively refine prompts to improve outputs.

Through modelling the use of OCEAN and providing opportunities for PSTs to practise the framework in familiar contexts requiring little or no pedagogical content knowledge (PCK), students can begin to develop confidence in evaluating AI outputs for inaccuracies or bias. OCEAN can then be revisited throughout the programme in subject and ITTECF component seminars as PSTs' PCK develops. Embedding critical prompt design early empowers PSTs to interrogate GenAI outputs rather than adopt them uncritically.

Alongside this, prompting frameworks that foreground bias mitigation are particularly important. Augmenting prompts to explicitly consider potential bias in generated outputs has thus far largely focused on demographic bias; however, it is also important to address pedagogical bias, such as tendencies for AI-generated lesson plans to prioritise teacher-centred instruction or information delivery (Chen et al., 2025). Prompting strategies that encourage dialogue, pupil agency and varied pedagogical approaches can therefore help maintain teacher authorship and professional judgement.

A further consideration when integrating GenAI into ITE is the need to encourage PSTs to embrace the oftentimes cognitively and emotionally uncomfortable and difficult nature of learning. Learning to plan lessons and develop subject knowledge requires sustained cognitive effort, and there is concern that over-reliance on AI may reduce opportunities for neural engagement, meaning that excessive outsourcing of thinking to technology may weaken learning (Kosmyrna et al., 2025). When introducing OCEAN, we make these issues explicit and encourage PSTs to reflect on when GenAI may support learning and when independent thinking is more valuable.

## From AI-TK to AI-CK and AI-PK in Practice

Following the establishment of AI-TK foundations earlier in the programme, attention shifts toward how GenAI is engaged within subject and pedagogical contexts. In the 25/26 academic year, earlier inputs on AI literacy, ethics, OCEAN and critical evaluation are revisited and extended across subject and component seminars with a stronger AI-CK and AI-PK focus. This requires PST educators to develop their own AI-

TPACK in order to understand the nuances of GenAI outputs within their subjects and to model critical engagement with these tools. For example, in mathematics, prompting GenAI to generate misconceptions or diagnostic questions can support exploration of AI-CK and AI-PK. However, the quality of such outputs varies depending on the domain and the LLM used. Examining these variations across subjects can therefore contribute to PSTs' wider development of AI-TPACK.

Toward the end of the year, as PSTs develop stronger PCK, they are better positioned to think more critically about both existing schemes of learning and AI-generated lesson plans. At this stage, developing prompting strategies that mitigate pedagogical bias (Chen et al., 2025) becomes particularly valuable. PSTs can experiment with prompts that prioritise alternative and creative pedagogies and learning environments (Serrett and Gripton, 2020) where these may be appropriate within the pupils wider curriculum. Integrating these approaches within the final 'Planning for Learning' sessions aims to support greater agency and responsibility when using GenAI to support lesson planning as trainees enter the final phases of school placement.

Staging GenAI engagement in line with developing PCK ensures trainees meet the technology as informed, reflective users rather than passive recipients.

## Conclusion

AI-TPACK has proven a useful framework for analysing the different components of professional knowledge and practice that pre-service teachers (PSTs) will need to develop in order to utilise GenAI for lesson planning, and how these can be supported through Initial Teacher Education (ITE) programmes in primary education at BSU. One potential criticism of the model is the complexity created by layering AI-related domains onto the already interrelated elements of TPACK, which may appear impenetrable to teachers without a particular interest in AI in education. However, for those tasked with designing strategy and curriculum implementation, it provides a valuable lens for understanding the relationships between technological, pedagogical and content knowledge in an emerging AI-integrated landscape.

Integrating GenAI into teacher education requires more than simply introducing new technologies. It demands careful consideration of how PSTs develop professional knowledge, judgement and agency when engaging with AI-generated content. As educators, we also have a responsibility to avoid uncritically accelerating the adoption of technologies that may have significant environmental and social consequences if implemented at scale (Carrigan, 2025), while still preparing students for an uncertain future in which AI is likely to be embedded across many professions. Developing PSTs' critical understanding of the potential personal, social, political, economic and environmental implications of GenAI use is therefore essential.



#### Key Tensions for ITE in the GenAI Era

- Preparing Alliterate trainees without encouraging overreliance
- Balancing efficiency gains with desirable difficulties needed for cognitive development
- Supporting innovation while ensuring ethical and sustainable practice
- Developing tutor expertise as quickly as tools evolve
- Navigating conflicting expectations across policy, schools, trainees and sustainability values

For ITE providers, the challenge is not simply whether to include GenAI within their curriculums, but how to do so in ways that: preserve pedagogical thinking; support, and navigate through effective prompting, ethical awareness (including inherent bias); consider social, political and environmental ramifications and empower teachers to critically evaluate AI-generated outputs. The staged approach outlined in this paper suggests one possible model, beginning with early development of AI literacy and prompt engineering skills, followed by progressive integration across subject and professional studies components as PSTs' pedagogical content knowledge develops. Adapting existing prompt frameworks and practices to include greater focus on mitigating different forms of bias, and using AI ever-more sustainably, if such a thing is possible, will also be essential.

As alluded to earlier, an area for further research and potential integration into ITE curricula is the use of GenAI not simply to generate outputs, but as a collaborative, assistive 'digital mentor' that complements and augments human mentoring relationships. This could be achieved for example by GenAI supporting thinking through Socratic questioning dialogues (Meechan, 2025). Used in this way, GenAI can function less as a shortcut and more as a tool to stimulate reflection and professional reasoning. A specific example of this might be to support PSTs in their regular reflective reviews, where they think and write critically about their progress against previous targets before identifying new ones. This is an area where there is ongoing variation in the quality of reflections and target-setting. In addition, there is scope to deepen exploration of the pedagogical bias inherent in AI outputs, and how such biases might be mitigated to support more pluralised pedagogies that are applied appropriately and critically within lesson planning. However, this should not be at the expense of meaningful human connection with mentors, academic tutors and peers. Supporting PSTs' metacognitive awareness of how they learn with and without technology may therefore help to mitigate such risks.

By illuminating both the potential benefits and risks of GenAI from a critical standpoint, ITE programmes can help PSTs to use these tools judiciously as part of their developing professional practice. When embedded progressively within the curriculum, GenAI has the potential to function not as a substitute for professional judgement but as a reflective and assistive tool that supports the development of PSTs' AI-TPACK for lesson planning.

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## Artificial Intelligence Use

Understand Bath Spa University's [policy and position statement](#) on Generative AI, with guidance on its use for learning, teaching and research.

