OPPORTUNITIES AND RISKS OF AI IN LESSON PLANNING: INSIGHTS FROM PRE-SERVICE TEACHERS

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ABSTRACT

This paper, which forms part of an international project on the use of AI in teacher training on teaching designing, presents the exploratory phase of a critical phenomenological study. The theoretical framework is Intelligent-TPACK (Celik, 2023), which integrates ethical dimensions into the use of AI. The open-ended responses of 237 trainee teachers and the lesson plans they produced are analysed using a qualitative and triangulated approach. The results show a positive assessment of AI as a support for lesson planning, but also highlight risks (dependence, errors, depersonalisation) and the need for critical use.

KEYWORDS
AI; teacher training; lesson planning.

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Introduction

In recent years, the advent of artificial intelligence (AI) has attracted increasing attention in the field of education, supporting its progressive integration into learning environments (Khuibut et al., 2024; Chakraborty et al., 2022). AI is also influencing everyday lifestyles (Gocen & Aydemir, 2022; Markauskaite et al., 2022) as well as teaching and organisational practices in schools. Following the onset of the global pandemic, AI has emerged as a major driver of transformation in educational systems, generating new opportunities and significant challenges (Ng et al., 2023; Viberg et al., 2022).

This has fostered a broad academic debate on the risks and potential benefits of the widespread use of AI technologies in teaching (Felix, 2020; Cukurova et al., 2024; Santoianni, 2024).

While research consistently recognises the potential of AI to support learning processes (Chen, 2023; Panciroli et al., 2022), teaching practices (Perla et al., 2025) and schools more broadly (Rivoltella, 2020), its integration into educational contexts raises critical issues related to teacher training, trust in technology, ethics, organisation and adequate implementation conditions (Cukurova et al., 2023; Lei et al., 2026).

Of the many areas in which AI can make a meaningful contribution, instructional design has received particular attention. In fact, lesson planning is considered essential for improving student learning outcomes (Gess-Newsome et al., 2019; Iqbal et al., 2022; Calvani & Marzano, 2020), representing a fundamental professional competence for teachers. It is also explicitly included among the training objectives of the teaching profession in Italian regulations (D.M. 249/2010). It is a systematic process beginning with analysing the context and students' educational needs, proceeding to defining learning objectives, and translating this into coherent planning of content, activities, methodologies, tools and assessment methods to achieve the expected learning outcomes (Anggrella et al., 2023).

Within this context, studies are emerging that explore the role of artificial intelligence in supporting instructional design with a specific focus on future teachers (Acquah et al., 2024; Leńko-Szymańska, 2026). Findings show that factors such as performance expectancy, effort expectancy, social influence, facilitating

conditions and habit significantly affect pre-service teachers' intentions to use AI tools (Acquah et al., 2024). These results highlight the importance of further investigating the dynamics that either promote or hinder the adoption of AI in lesson planning processes.

Lesson plans are a micro-design tool that makes teachers' instructional decisions explicit in terms of objectives, content, activities, strategies and assessment. The ability to design effective lesson plans is recognised as a core professional competence as it enables educational intentions to be translated into coherent teaching actions oriented towards student learning (Ellerani & Ferrari, 2024).

In light of these considerations, the aim of this study is to explore how pre-service teachers perceive the use of AI tools for designing lesson plans. The study will investigate the potential and limitations of these tools, as well as the conditions that facilitate or hinder their use.

1. Theoretical Framework

To better understand the role of artificial intelligence in the use of lesson plans and in the development of instructional design skills, the present study adopts the Technological Pedagogical Content Knowledge (TPACK) framework as its theoretical reference. The TPACK framework was developed by Mishra and Koehler (2006) on the basis of Shulman's (1986, 1987) concept of Pedagogical Content Knowledge.

With the emergence of AI-based technologies, Celik (2023) proposed an extension of the model through the Intelligent-TPACK framework, designed to describe the knowledge teachers need for the effective integration of artificial intelligence into teaching and learning processes (Fig. 1).

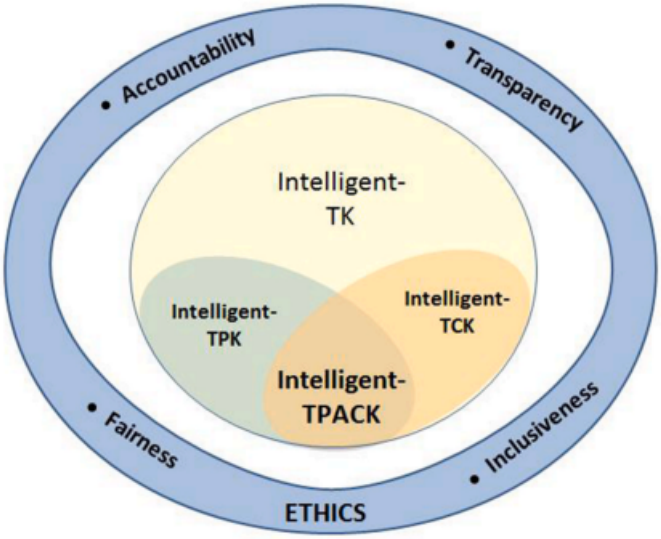


Figure 1: Intelligent-TPACK Framework and its components. Adapt. Celik (2023)

The model retains the original TPACK structure, incorporating a dimension related to the ethical evaluation of AI-based tools. This dimension is grounded in the principles of transparency, accountability, inclusiveness, and fairness. Teachers are expected to understand not only the pedagogical potential of intelligent technologies, but also how they function, how to critically evaluate their effects, and how to select them consciously in relation to learning objectives and students' characteristics.

The framework considers tools such as chatbots, intelligent tutoring systems, learning analytics dashboards and automated assessment systems. It highlights that using these tools requires integrating technological, pedagogical and disciplinary knowledge. It also requires the ability to address the ethical implications of algorithmically generated decisions and recommendations (Celik, 2023).

This need is particularly relevant in light of the ethical issues associated with the use of AI in educational contexts. Numerous studies have demonstrated that algorithms can perpetuate biases inherent in training data, thereby contributing to the reproduction of inequalities and discrimination (Shin, 2020; Holmes et al., 2021; Moussawi et al., 2024).

To broaden this perspective, the present study adopts an approach consistent with recent developments in critical AI literacy, which call for a critical examination of the social, cultural, ethical, and political implications of artificial intelligence in

educational contexts (Rice et al., 2025; Rice & Argüello de Jesús, 2024). This approach integrates the Intelligent-TPACK framework with contributions from the critical pedagogy of Freire (2006, 2008) and Illich (1975). From this viewpoint, teacher competence encompasses the effective integration of AI into teaching practices and the capacity to recognise its limitations, biases and potential impact on educational practices and the communities involved.

From this standpoint, technologies are not considered neutral tools, but rather as instruments that influence educational practices, power relations, and the construction of knowledge. Consequently, using artificial intelligence in instructional design requires technical competencies and the capacity to critically examine the assumptions, values and implications embedded in intelligent systems' outputs.

In line with this theoretical framework, this study considers lesson plans produced by AI as pedagogical artefacts through which to observe the reflective processes of future teachers (Agrati, 2017; Perla & Agrati, 2020). The focus is not solely on the quality of the plans generated, but also on how they are interpreted, discussed and reworked by participants, thereby relating technological competence, pedagogical judgement and professional responsibility.

2. Method

The study adopts a critical phenomenological research design (Todd, 2016), which involves administering a pre-post questionnaire, conducting semi-structured interviews and analysing lesson plans (Kvale, 1983).

The study is part of the transnational project *Pre-service Teachers' Application of Critical Lenses to AI Lesson Plans*, which was approved by the ethics committee and presented within the framework of ISATT. The project involves teacher educators and researchers from Greece, Italy, Spain and the United States, enabling insights into the engagement of pre-service teachers with AI to be compared.

Specifically, this study provides a qualitative, triangulated analysis of open responses gathered via an initial questionnaire focusing on integrating AI into lesson plan design.

The guiding research question was:

- *How do pre-service teachers perceive the use of artificial intelligence (AI) tools for lesson-plan design, and what opportunities, limitations and conditions for use do they identify?*

The study involved a non-representative convenience sample of teachers enrolled in the secondary school teacher certification program at the Pegaso Online University (n. 237). Table 1 below presents the sociodemographic and professional characteristics of the participating teachers.

Table 1: Socio-professional characteristics, n. and % of responses.

Characteristic	Answers	N. (Tot. 549)	% (Tot. 100%)
Subject Area	Humanities and Literature *(A011, A012, A017, A018, A019, A022, A050)*	73	32.9
	Science and Mathematics *(A001, A028, A049)*	36	16.2
	Foreign Languages *(AB55, AC55, AJ55, AJ56, AK55, AK56, AL56)*	15	6.8
	Arts and Music *(A030, A053, A064)*	17	7.7
	Law and Economics *(A045, A046)*	18	8.1
	Technical and Vocational Education *(B014, B015, B016, B017, B019, B020, B024)*	52	23.4
	Other subject areas	11	5.0
	Missing	15	6.3
School level	Kindergarten	3	1.3
	Primary School	25	10.5
	Lower Secondary School	62	26.2
	Upper Secondary School	102	43.0
	Missing	45	19.0
Length of service (*years*)	1-5	61	25.7
	6-10	55	23.2
	11-20	15	6.3
	21-over	9	3.8
	Missing	97	40.9

The participants represented a wide range of subjects taught in secondary education. The largest group was made up of humanities and language arts teachers (32.9%), followed by technical and vocational education teachers (23.4%), and science and mathematics teachers (16.2%). Smaller proportions were

represented by law and economics (8.1%), arts and music (7.7%), and foreign languages (6.8%) (see Table 1).

Additionally, participants were teaching at various educational levels. The majority were employed in upper secondary education (53.1%), followed by lower secondary education (32.3%), primary education (13.0%) and early childhood education (1.6%) (see Table 1).

Regarding teaching experience, 25.7% of participants reported having between one and five years of experience (n. 61), while 23.2% reported having between six and ten years of experience (n. 55). Smaller proportions had 11–20 years' experience (6.3%; n. 15) or more than 20 years' experience (3.8%; n. 9) (see Table 1).

The questionnaires were administered remotely via Google Forms. The accompanying information sheet guaranteed participants' anonymity and specified that the data would be used exclusively for research purposes. All participants provided informed consent for this.

The first questionnaire collected socio-professional information about the participants and investigated whether they had previously used lesson plans in their teaching practice. The second questionnaire explored participants' perceptions of integrating Artificial Intelligence tools into instructional planning. Specifically, it examined: (a) their attitudes towards using AI in lesson design; (b) their perceptions of AI-generated lesson plans' ability to address students' learning needs; and (c) their perceived suitability for achieving subject-specific learning objectives.

Table 2: Questionnaire sections, questions and data types.

Questionnarie	Questions (Q)	Data types
First Phase	Socio-professional data	quantitative
	Have you ever used lesson plans? (Q1)	qualitative
Second Phase	What are your thoughts on using an artificial intelligence tool to plan your lessons? (Q2)	qualitative
	To what extent do you think a lesson plan created using an artificial intelligence tool can meet the learning needs of the pupils in the class you will be teaching? (Q3)	qualitative
	To what extent do you think a lesson plan generated by an AI tool could meet the learning objectives of the subject you will be teaching? (Q4)	qualitative

The textual data were analyzed using a three-stage coding procedure: (a) open, as conceptualisation through significant text units and identification of labels; (b) axial, as identification of frequent macro-categories emerging from the text units, through the number of occurrences; (c) selective, as hierarchical and analytical ordering of the identified macro-categories, for the final emergence of the main categories (Creswell, 2013).

A total of 140 out of 237 teachers (59%) responded to the first question (Q1), "Have you ever used lesson plans?". Table 3 (and the subsequent tables) presents the main thematic categories that emerged from the analysis, together with the corresponding axial and open codes, accompanied by illustrative excerpts drawn directly from the analyzed corpus.

Table 3: Categories and codes emerging from text corpora, with n. occurrences

Core category strings (Tot. 140)	**Axial coding**	**Open coding**	**Examples of answers**
No (n. 127)			No; Never
Yes (n. 112)	General (n. 43)		Yes; I have used it
	Planning (n. 29)		Curriculum planning
	Class involvement (n. 7)		Yes, involving the class in research and discussion
	Students' adaptation (n. 9)		Yes… of course, I have created lesson plans across various subjects in primary school… always adapting them to the pupils' needs.
	Cooperation (n. 2)		Yes, in organising cooperative learning activities using gamification, starting with the development of questions based on material provided by the teacher.
	Subject (n. 22)	Science (n. 2)	Yes, a micro-lesson on a science topic using the flipped classroom methodology
		Civic education (n. 6)	Yes, in civic education
		Music (n. 6)	Yes, I ran music workshops in primary schools, and I organised writing activities set to music that had various twists and turns during the production process
		Italian (n. 7)	Yes. I had planned lessons using Slide… with examples and assessment tasks for Year 3 primary pupils on the topic of Italian verbs

	Technical subjects (n. 1)	In a technical context, the lesson plan I help to create usually follows a three-part structure: Theory, Simulation and Workshop. […]
No answer (n. 1)		.

While most participants reported having used lesson plans (n. 112), a substantial number reported not having done so (n. 127). Among those who indicated prior use, responses mainly referred to general lesson plan use (n. 43) and instructional planning activities (n. 29). Some participants highlighted using lesson plans to promote classroom engagement (n. 7), adapt activities to students' needs (n. 9) or organise cooperative learning activities (n. 2). References to specific subject areas also emerged, including Italian language (n. 7), civic education (n. 6), music (n. 6), science (n. 2) and technical subjects (n. 1). One non-response was recorded.

Table 4: Categories and codes emerging from text corpora, with n. occurrences

Core category strings (Tot. 192)	**Axial coding**	**Open coding**	**Examples of answers**
Usuful (n. 186)	General (n. 98)		Useful; Positive
	Does not replace the teacher (n. 5)		It's certainly a help, but it shouldn't replace the teacher's work.
	Critical thinking (n. 33)		It's useful, but it must be used critically, keeping the AI in check.
	Creativity (n. 15)		I consider it an excellent tool for speeding up the structuring of content and stimulating teaching creativity.
	Adaptability (n. 8)		Very useful; it facilitates teaching, especially for pupils with special educational needs
	Planning (n. 13)		It can help to optimise lesson planning
	Facilitator (n. 5)		It makes the work easier but isn't always a targeted tool
	I don't find it useful (n. 9)		I'm not keen on it
I don't use IA (n. 4)			I've never used it
No answer (n. 2)			/

A total of 192 teachers responded to Question Q2, which asked, "What do you think about the use of an artificial intelligence tool for planning your lessons?"

Of these, 97% expressed a positive view of using AI for instructional planning (n. 186). In particular, responses focused on the general perception of usefulness and positivity (n. 98). However, some participants emphasised the importance of AI not replacing the teacher's role (n. 5) and stressed the need for a critical and informed approach to its use (n. 33). Others pointed to AI's potential to foster instructional creativity (n. 15), adapt to students' needs (particularly those with special educational needs, n. 8) and support lesson planning activities (n. 13).
Some responses described AI as a facilitator of teachers' work, albeit not always fully aligned with specific instructional needs (n. 5). A minority of participants reported that they did not find it useful (n. 9), had never used it (n. 4) or did not respond.

Table 5: Categories and codes emerging from text corpora, with n. occurrences

Core category strings (Tot. 192)	**Axial coding**	**Open coding**	**Examples of answers**
Measure (n. 160)	High (n. 38)		Very
	Good (n. 50)		Quite
	Satisfactory (n. 13)		Sufficient
	Needs review / monitoring (n. 40)		I think it needs to be revised in any case
	Minimal (n. 10)		To a minimal extent
	Not useful (n. 9)		I think the textbooks are very helpful and that no other reference materials are needed
I don't know (n. 4)			I'm not sure
No answer (n. 2)			/
Useful because (n. 23)	Adaptable (n. 12)		It can be adapted to suit the pupils' different personalities
	Facilitator (n. 11)		It could make it easier to achieve the objectives
It depends (n. 3)			It depends on how the learning unit is designed and how the tool and its use are integrated

A total of 192 teachers responded to Question Q3, which asked, "To what extent do you believe that lesson plans generated with an artificial intelligence tool can meet the learning objectives of students in the class you will be teaching?"
The responses indicated a generally positive perception of the ability of AI-generated lesson plans to address students' learning objectives. Several

participants rated this capacity as high (n. 38), good (n. 50) or satisfactory (n. 13). However, a significant proportion of teachers emphasised the importance of teacher review and monitoring prior to implementation in the classroom (n. 40). Some participants offered a more cautious evaluation, considering the contribution of AI to be minimal (n. 10) or not particularly useful (n. 9). The main advantages of using AI reported by participants were the ability to adapt materials to students' characteristics (n. 12) and its role in supporting the achievement of instructional objectives (n. 11).

A small number of respondents noted that the effectiveness of lesson plans depends on how the tool is integrated into instructional design practices (n. 3), while a few reported being unable to provide an evaluation (n. 4). Two non-responses were recorded.

Table 6: Categories and codes emerging from text corpora, with n. occurrences

Core category strings (Tot. 192)	**Axial coding**	**Open coding**	**Examples of answers**
Measure (n. 188)	High (n. 38)		To a high degree, as it allows tasks to be personalised and technical language to be adapted to the different levels within the class.
	Fairly / to a good extent (n. 79)		Fairly; To a good extent, particularly depending on the teacher
	Needs revision / review (n. 60)		I believe it should still be revised
	Minimal (n. 4)		Minimal
	Not useful (n. 8)		I don't think it would be useful, because only the teacher knows what sort of class they are teaching. It is the teacher's job to put together an effective lesson
	It depends (n. 4)		It depends
I don't know (n. 5)			I'm not sure
No answer (n. 1)			/

A total of 192 teachers responded to Question Q4, which asked, “To what extent do you believe that lesson plans generated with an artificial intelligence tool can address the learning needs of students in the class you will be teaching?”
The responses demonstrate a high level of confidence in the ability of AI-generated lesson plans to align with students’ learning needs. Participants rated this capacity as high (n. 38) or fairly good (n. 79). However, a substantial proportion of teachers emphasised the importance of revising and reviewing lesson plans prior to use, highlighting the need for professional teacher oversight (n. 60). A smaller proportion considered AI’s contribution to be minimal (n. 4) or useless (n. 8), arguing that only teachers can truly understand their own classrooms’ characteristics and needs. Some participants also noted that the effectiveness of lesson plans depends on how the tool is used and integrated into instructional design processes. Five teachers reported being unable to provide an evaluation, and one response was not recorded.

3. Results

The methodological approach adopted in the study made it possible to collect textual data aimed at identifying teachers’ perceptions regarding the use of AI for lesson plan design.

- *How do pre-service teachers perceive the use of artificial intelligence (AI) tools for lesson-plan design, and what opportunities, limitations and conditions for use do they identify?*

Textual analysis of the open-ended responses to the questionnaire revealed that participants had a predominantly positive perception of using artificial intelligence tools for instructional design.
Regarding the question on the use of AI in lesson planning (Q2), the majority of respondents gave a favourable response. Many participants, in particular, described AI as a useful tool for supporting instructional design activities. Alongside this positive assessment, however, respondents emphasised that AI should not replace the professional role of teachers and that its use requires a critical and informed approach.
Some participants further highlighted AI’s potential to stimulate instructional creativity, adapt activities to students’ needs and assist in the lesson planning process.

Responses to questions about the ability of AI-generated lesson plans to address learning objectives (Q3) and students' learning needs (Q4) also confirm this positive overall orientation. Indeed, most pre-service teachers considered these tools to be highly or at least satisfactorily effective in a school context. Nevertheless, many respondents stressed the need to revise and monitor AI-generated materials prior to their use in educational settings, while acknowledging their limitations and potential errors.

4. Discussion

The study aimed to analyse pre-service teachers' perceptions of using AI to design lesson plans, paying particular attention to its perceived usefulness and capacity to address students' learning objectives and needs.

Overall, the findings suggest that AI is predominantly perceived as a valuable instructional design tool. Participants attributed functional value to the tool, particularly in terms of supporting planning activities, making teachers' work easier, and encouraging creativity in lesson design. However, this perceived usefulness was dependent on the presence of professional teacher supervision to verify, adapt and contextualise AI-generated outputs.

At the same time, a non-substitutive view of AI emerged: the tool was interpreted as a support for instructional planning rather than as an alternative to teachers' professional expertise. From this perspective, the quality of AI-generated lesson plans is not considered to be an inherent property of the tool itself, but rather a function of the teacher's ability to critically integrate it into the design process.

The results also show that pre-service teachers generally consider AI-generated lesson plans to be highly or moderately adequate in relation to both learning objectives and students' needs. However, this evaluation is consistently accompanied by a need for revision and monitoring, suggesting conditional rather than absolute trust.

These findings are consistent with studies identifying perceived usefulness as a key predictor of technology adoption intentions. In particular, literature on the Technology Acceptance Model and its educational extensions highlights the significant influence of perceived usefulness and ease of use on the adoption of digital tools among pre-service teachers (Acquah et al., 2024; Leńko-Szymańska, 2026). The present data support this, showing that AI is mainly evaluated positively for its contribution to simplifying and streamlining instructional planning.

With regard to lesson plan design specifically, the results are in line with studies that ascribe a supporting role to AI in instructional design and personalised teaching (Ellerani & Ferrari, 2024; Acquah et al., 2024). In particular, the ability to adapt content and activities to students' levels is one of the main forms of perceived usefulness reported by participants.

At the same time, the need for critical review of AI-generated outputs is evident and consistent with literature highlighting the limitations of intelligent systems in educational contexts, particularly with regard to the reliability of content and the risk of overly simplifying instructional design (Holmes et al., 2021; Cukurova et al., 2024). Concerns about the importance of teacher judgement also reflect the widely discussed idea that the effectiveness of AI depends on its integration with pedagogical and contextual competencies that are inherently human.

Ultimately, viewing AI as a means of supporting rather than replacing teacher professionalism is consistent with approaches that emphasise the importance of controlled, responsible and pedagogically sound use of intelligent technologies in education (Perla et al., 2025; Rivoltella, 2020).

Conclusions

This study investigated how pre-service teachers perceive the use of artificial intelligence (AI) tools for designing lesson plans.

The findings suggest that pre-service teachers primarily view AI as a supportive tool for lesson plan design. They perceive the tool as useful for facilitating planning, reducing workload and designing instructional activities that adapt to students' needs. However, this perceived usefulness is consistently dependent on teacher supervision, which is considered essential to ensure pedagogical coherence and the validity of AI-generated outputs.

Overall, the study reveals a non-substitutive view of AI, with the technology being seen as a resource that can be integrated into the design process rather than as an autonomous agent. Instructional design is therefore conceived as an activity requiring critical processing and continuous contextual adaptation of technological input by the teacher.

The study has some limitations. Firstly, the non-representative sample limits the generalisability of the findings. Secondly, the data are based on self-reported perceptions rather than direct observation of actual AI use in instructional design practices. This aspect constitutes an additional analytical dimension already

foreseen within the project's broader research design, which will allow perceptual data to be integrated with an examination of actual lesson planning products and practices.

In terms of implications, the findings suggest a need to reinforce initial and in-service teacher training in the critical application of AI in instructional design, as previously emphasised in the literature (Gunbatar et al., 2025; Leńko-Szymańska, 2025). This should focus particularly on developing evaluative and decision-making skills. Further research is needed to investigate the relationship between perceived usefulness and actual lesson planning competence, including through longitudinal designs or comparative analyses across different disciplines and schools.

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