Teacher Prompt Literacy: Conceptualization, Assessment, and Implications for Professional Development

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Abstract. The quick advancement of generative AI has created unprecedented opportunities and challenges in teacher education. In this regard, AI literacy has become one of the essential competencies. Nevertheless, the contemporary discussion is also not theoretically based, and it commonly reduces the concept of prompt literacy to a single, external, mechanical ability instead of a skilled pedagogical competence. To fill this disconnect, in this paper, prompt literacy is put in the context of TPACK framework in order to redefine it as a form of Technological Pedagogical Knowledge (TPK) - a critically important bridge articulating abstract pedagogical intent into definite technical prescriptions. This paper, through a review of the recent literature, examines the current state of prompt literacy and found that the growth of this model is hindered by the focus on an individual learning process and fragmented training. According to the research outcomes, prompt literacy is not a technical process but a complicated pedagogical reasoning process that needs organization. Accordingly, this paper argues that to successfully integrate generative AI, teacher training should be focused not on haphazard workshops but in a systematic integration of the curriculum in the end that can empower teacher agency in the digital age.

Keywords. Generative AI; Teacher Education; Prompt Literacy; AI Literacy; Professional Development

1. Introduction

The innovative development of generative artificial intelligence (GenAI) has become a paradigm shift that is fundamentally changing the field of knowledge development and pedagogical practice. The skill of AI literacy has become a factor of critical importance in the profession of educator, requiring not only the presence of the ability to use devices, but also the ability to navigate with the intricate aspects of ethics [1]. Nevertheless, the existing discussion of teacher AI competence effectively reduces to two extremes: either the ability

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to stay on a macro-level of abstract ethical principles or reducing to micro-level technical action without a layer to unite the two ends.

To counter this disconnection, this paper will place the pivotal role of operational competence to be Prompt Literacy. However, far from being a mere mechanical skill, prompt literacy functions as quite contrary to being a mechanical ability to write the orders, prompt literacy is an essential medium that can help in translating abstract instructional objectives and moral principles into operative and practical pedagogical methods. Since the idea of generative AI being incorporated into the classroom is becoming the next normal, the skills of designing effective prompts have become effectively identified with instructional design, so that teachers engage in deep professional judgement to maintain conformity with pedagogical beliefs.

Although its significance is highly important, the process of incorporating prompt literacy into teacher training is still structurally unfavorable. Increased focus on AI creates new lower requirements in the profession, but current studies indicate a significant lack of preparation in both pre-service teachers and teacher educators [2]. Even existing training is frequently disjointed or peripheral whereby prompt literacy is treated as an afterthought or add-on or left to independent study instead of institutional encouragement [3]. This self-directed learning lack of institutional support risks contributing to professional disparities with the ability of teachers being more about self-direction than professional development.

It is the purpose of the current paper to fill this literature gap and discuss the ways of developing prompt literacy in teacher education in a systematic way. The third part conceptualizes, using the TPACK, subsequent sections where prompt literacy is redefined as a type of technological pedagogical knowledge. After that, it gives a map of the existing practices, outlining the obstacles in the system and evaluation dilemmas. Lastly, it suggests that a requisite re-framing of prompt literacy is needed as a personal technical ability permitting an individual to generate cut-up knowledge into an institutional duty of shared responsibility.

2. Methodology

In order to rigorously examine the emerging concept of prompt literacy in teacher education, this study adopts the scoping review framework proposed by Arksey & O'Malley [4]. Systematic review is usually used to solve precise quantitative problems. In contrast, scoping review is particularly suitable for sorting out key concepts and clarifying definitions in the rapidly developing field of generative artificial intelligence. This method can comprehensively explore how prompt literacy is conceptualised and operationalised in different educational contexts.

2.1 Search Strategy and Data Sources

A systematic literature search was conducted to identify the relevant research published between January 2023 and January 2026. This time range was chosen to capture the paradigm shift that emerged after the widespread popularisation of LLMs. The search was carried out in three major academic databases: Web of Science, Scopus and Google Scholar. In order to ensure comprehensive coverage, the search strategy adopts Boolean logic strings, combining keywords in three main areas: the target population (including terms such as "Teacher Education," "Pre-service Teachers," and "Professional Development"), the technology (covering "Generative AI ," "Large Language Models," and "ChatGPT"), and the specific competence (focussing on "Prompt Engineering," "AI Literacy," and "Interaction Techniques").

2.2 Study Selection

The selection process follows the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines to ensure transparency and repeatability. A total of 382 records were obtained in the initial search. After removing duplicates, the title and abstract were screened for relevance to teaching applications. To be included in the final review, the research needs to clearly focus on the direct interaction between teachers or pre-service teachers and AI, discuss the use of prompting as a professional skill rather than the ability of ordinary users, and provide empirical or theoretical insights on teachers' knowledge. On the contrary, if the study only focusses on students' use of AI without teacher intervention, or purely computer science and technology papers and lacks educational significance, it will be excluded. Finally, 12 core studies were selected for in-depth analysis. The detailed screening and exclusion process is shown in Fig. 1.

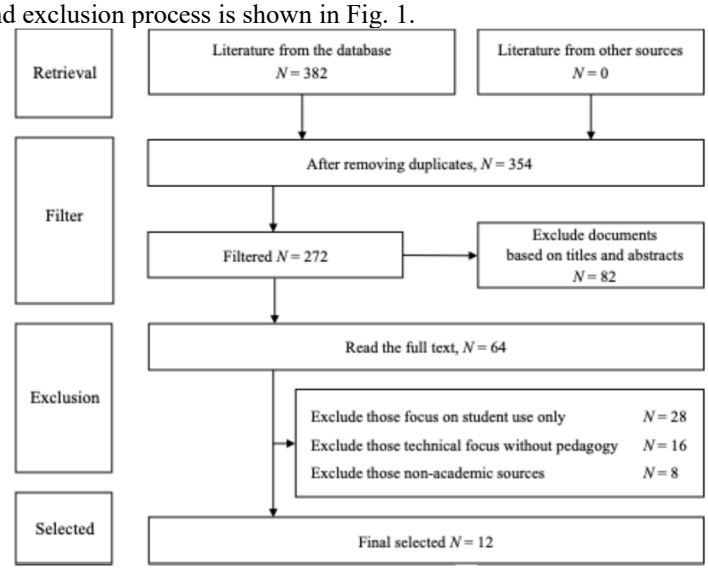

Fig. 1. PRISMA flow diagram detailing the literature search and screening process

2.3 Data Analysis

The selected research is analysed by thematic analysis method based on the TPACK framework [5]. The focus of data extraction is to determine how to conceptualise the generation of prompts in the literature, specifically examine whether it is regarded as an independent technical skill or an integrated teaching reasoning process. This analytical perspective facilitates the redefinition of prompt literacy in subsequent sections, and also makes it possible to criticise the current training practice in a structured way.

3. Conceptualizing Prompt Literacy in Teacher Education

3.1 The Evolution: From AI Literacy to TPACK-based Understanding

In recent years, the concept of AI literacy is becoming more and more multi-dimensional in nature, as a competence and not just a skill, at the level of technical operation. The best comprehension is that it is a construct of functional, critical and socio-cultural orientations [1]. These include the functional orientation, which pays attention to the essential capacity to

use AI tools, the critical orientation, which pays attention to the sense of ethics and critical judgement, and finally the socio-cultural orientation, which frames AI in the context of broad societal and institutional categories. To educators, the orientations together define how educators perceive and adopt AI as well as how AI is used in pedagogical practices. In its turn, AI literacy to be considered as a professional holistic competence, not a collection of technical skills.

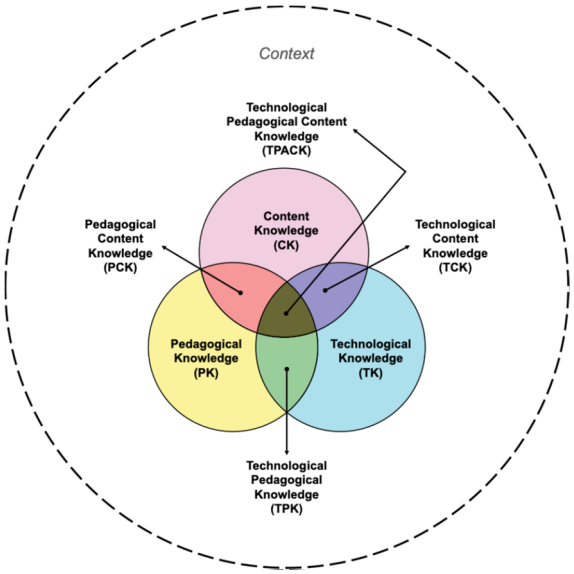

Fig. 2. The schematic diagram of TPACK framework

Regarding the professional standards, on the other hand, defining AI literacy as some general competence is not enough. As a way of embedding this competence in the teaching profession, the Technological Pedagogical Content Knowledge (TPACK) model [5] model as depicted in Fig. 2 needs to be adopted. This paradigm assumes that an effective teaching process involves a combination of three basic elements Technological Knowledge (TK), Pedagogical Knowledge (PK), and Content Knowledge (CK). In the context of GenAI, TK refers to basic operational skills, i.e., creating an account or typing input; PK understanding instructional strategies, i.e., scaffolding or inquiry-based learning. In this framework, Prompt Literacy is almost Technological Pedagogical Knowledge (TPK). It constitutes the most important crossroad where educators need to know how certain technologies can limit or provide certain pedagogical interventions. Consequently, prompt literacy is not a single technical competency but a specialized instance of teacher knowledge that allows the adoption of AI tools within the complicated educational environment.

3.2 Defining Prompt Literacy: A Pedagogical Reasoning Process

Prompt Literacy in theory needs to be theorized not as a technical competency solely, but as a dynamic pedagogical rationale process. Although in recent definitions, the key characteristic of TPACK is the design and adjustability of the inputs [6], a TPACK-based viewpoint opens up a more nuanced layer: prompt literacy is the capacity to apply to the pedagogical intentions (scaffolding, feedback provision, or inquiry-based learning) and subject-specific requirements (CK) with algorithmic instructions that can be processed by generative AI. A successful prompting is dependent on how the teacher is able to encode their Pedagogical Intent (PK) and Content Knowledge (CK) into segmented Technical

Language (TK). As shown in Table 1, this translation varies significantly across disciplines. An example that may be given is where a teacher would need to translate an abstract objective such as promote critical thought to particular timely constraints so that AI delivers Socratic queries instead of straightforward answers.

Table 1. Mapping Disciplinary Logic (CK) to Prompt Strategies (TK)

Subject (CK)	Pedagogical Goal (PK)	Prompt Strategy (TK)
English Writing	Feedback: Protect student confidence while correcting errors.	Role-Play: Assign AI as an "Empathetic Editor" using the "Sandwich Method" (Praise-Critique-Praise).
Mathematics	Scaffolding: Guide logic without revealing answers.	Constraints: Explicitly forbid the final solution; require "Step-by-Step" reasoning (Chain-of-Thought).
Science	Inquiry: Encourage hypothesis testing.	Simulation: Set specific variables (e.g., "Assume zero gravity") and ask for predictions before results.

The process of translating intent into technical instruction is seldom ideal at the first attempt; therefore, prompt literacy is inherently iterative rather than fixed. This requires an ongoing cycle of design-evaluate-revise (see Fig. 3). To illustrate this dynamic reasoning, consider a history teacher using the CLEAR model (Concise, Logical, Explicit, Adaptive, Reflective) [7] to foster critical thinking about WWI. In a typical first iteration, a broad prompt like "Explain the causes of WWI" often yields a passive lecture, failing the pedagogical goal of student engagement. Recognizing this gap, the teacher might attempt a second technical iteration by adding constraints: "Do not explain; ask the student questions instead." However, this often results in a disjointed "quiz" without scaffolding. It is only through a third round of pedagogical alignment—applying specific TPK logic—that the prompt becomes effective: "Act as a Socratic tutor. Ask me only one question at a time to guide me through the alliance system". Therefore, prompt literacy creates an endless bargaining between the pedagogical experience of teachers and the capabilities of a machine, and when it comes to prompt literacy, the task of teachers is to continually change the technical prescriptions of the machine until the output of the latter meets their pedagogical requirements.

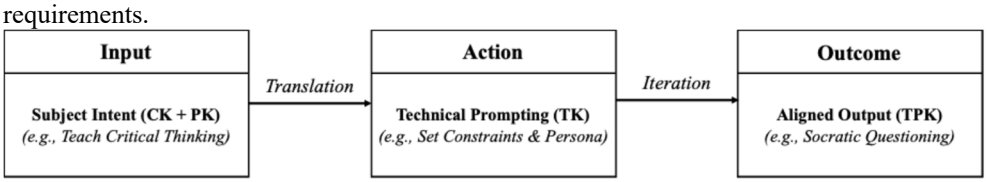

Fig. 3. The translation pathway from pedagogical intent to technical execution

4. The Landscape of Teacher Prompt Literacy: Practices, Barriers, and Assessment

This theoretical reframing of prompt literacy as a form of Technological Pedagogical Knowledge (TPK) provides a critical lens for evaluating the current state of teacher education. By defining prompt engineering not as a mechanical operation but as a complex pedagogical reasoning process, the limitations of existing training models become starkly apparent. Current approaches often reduce AI competency to isolated tool proficiency, neglecting the complex "translation" skills required for meaningful educational impact. Consequently, a gap

emerges between the sophisticated reasoning required for effective prompting and the superficial training currently available.

To understand the barriers to prompt literacy, it is necessary to distinguish between two distinct stages of professional development: pre-service teacher education (university-based) and in-service professional development (school-based). While both groups face technical challenges, their systemic constraints differ significantly. Pre-service education struggles with curriculum integration and faculty readiness, whereas in-service teachers contend with the fragmentation of training and immediate classroom pressures. The following sections examine these distinct landscapes.

4.1 In-service Teachers: Practical Barriers and Attitudes

For in-service teachers, empirical studies suggest that educators are reserved and they are selective on the use of generative AI. In spite of accounting for the potential value of AI in teaching, there are great concerns associated with accuracy, ethical threats, and professional autonomy [8]. Also, the prevalence of AI among teachers remains low on average as it strongly depends on the past experience, the institutional funding, and perceived pedagogical applicability [9].

In addition to attitudinal hurdles, applicable practical challenges to the immediate design are common. It is found that many teachers face difficulties in the manner of task-based prompts construction, typically founded on insufficient or unduly generalized instruction, which restricts the pedagogical power of the AI outputs [10]. This fact indicates that the absence of prompt literacy is now one of the most significant limiting factors of the deep penetration of generative AI in the educational field.

4.2 Pre-service Education: The Curriculum and Educator Gap

In the context of pre-service education, structural and cognitive constraints in the teacher education system are the decisive factor in the training of prompt literacy. Teacher educators are in a fortunate but sadly not equipped role of facilitating generative AI practices. Although most of the interviewed recognize the revolutionary nature of generative AI, they also mention that they do not feel confident in their knowledge in AI and the quality of their instructional preparation [2]. This paradox puts teacher educators in an uncomfortable situation: they are expected to be exemplary responsible and creative users of AI, but it is not always provided that they have a conceptual framework, standards, and institutional directions.

At the cognitive level, it is still unclear what would be considered legitimate or canonical knowledge about AI-related knowledge in pre-service teachers. It suggests a triple definition of AI literacy, including AI as a teaching tool, teaching content, and learning tool [2], which is difficult to translate into a particular structure of the curriculum. Without an explicit curriculum backing, prompt literacy may tend to be regarded as an optional technical practice and not an essential part of the pedagogical rationale and professional judgment.

4.3 Uneven Development and Professional Stratification

The existing growth of teachers' prompt literacy is characterised by high levels of inequality that generates the issue of the new professional inequality. The studies report that institutional support and access to organized training is a determining factor in teacher interest in generative AI [9]. Although teachers who engage in high-quality programs are more confident, most of them are left to do informal self-study or seminar-based study [3, 11].

Such a dependence on personal agency is a Matthew Effect of professional development: educators who already have, or who have access to, digital capital benefit unproportionately, and teachers as less supported get even less supported. Thereby, prompt literacy is becoming not a universal professional norm, but a privilege stratification. Such a bottleneck system indicates that prompt literacy deficiency is not only a capacity-building concern, but an unfair structure that endangers equal incorporation of generative AI in learning institutions.

4.4 Assessing Teacher Prompt and AI Literacy

Assessment of AI of teachers and their prompt literacy has geographical and conceptual difficulties. The current evaluation systems take use of two assessment techniques, which are based on the combination of the merits of standardized self reporting scales, and performance based evaluation. The Artificial Intelligence Literacy Scale of Teachers (AILST) was however created and tested to conceptually define AI literacy on several levels that include cognition, knowledge and skills, application, and ethics [12]. These scales can be considered to be highly reliable and structurally valid and offer scalable instruments to assess large samples and compare across situations.

Nonetheless, the scale-based instruments have inherent constraints in being able to assess prompt literacy which is basically a situated and process-oriented skill of being able to engage in iteration. Self-report-based methods could reflect the perception or confidence but are less effective in telling how teachers actually plan their prompts, change them under the impact of AI results, and make them conform to pedagogical purposes. This is a gap that brings out tension between conceptual breadth and ecological validity in measurement.

This limitation is tried to be solved with the performance-based approaches. The AI literacy of teachers has been conceptualized in terms of prompt engineering tasks by conducting the test with analytical scoring rubrics to determine the quality of prompts and the correlation between perceived usefulness of AI responses and prompt engineering predictor [10]. The findings indicate that there is a moderate positive relationship between the quality of prompts and the perceived quality of AI output by teachers that there is a conjecture that prompt literacy may be used as a visible signal of applied AI literacy. These task-based tests help to give more insight on procedural knowledge and decision making procedures.

However, performance-based mechanisms are expensive, situational and are not scalable to standard. There is also an effect of task design, disciplinary background, and the kind of model that is employed to generate performance that is prompt and this begs questions of comparability and generalizability. On the whole, one type of assessment is not enough; a well-rounded approach should consist of well-developed regular scales and meticulously designed performance tasks as a way of contemplating performance holistically. Notably, assessment must not only serve as an instrument of measurement but as a pedagogical indication as it will explain which AI-related insights and practices get the most attention in the education of teachers.

5. Implications for Teacher Education

Reconsideration of prompt literacy in terms of TPACK creates a strong necessity of reorganizing teacher education programs. Provided an prompt literacy is not considered as a single prowess but rather as an inherent component of pedagogical reasoning, there must be a hypothetical “golden thread” running through the professional growth endeavors. This section indicates how the teacher education needs to change - both as curriculum design to assessment strategies- in order to develop this critical competence in a systematic way.

5.1 Curriculum Integration: Anchoring TK within PK and CK

According to TPACK model, it is impossible to develop Technological Knowledge (TK) without Pedagogical Knowledge (PK) and Content Knowledge (CK) [5]. Thus, prompt literacy should be introduced as the fundamental part of the subject-related curriculum instead of a peripheral skill trained in isolated workshops. Prompt literacy, when it has been taught as just a technical skill, e.g. learning interface commands, does not usually transfer to more complex classroom situations. Rather it needs to be taught as Technological Pedagogical Knowledge (TPK): the ability to use prompts to address particular pedagogical problems.

This theoretical requirement is also supported by the emerging empirical evidence, which proves that interventions that are based on the early training on pedagogical situations present better effects than the generic technical training. As an example, Davila-Moran *et al*. ascertained that clinics with the label of prompt-engineering were actually successful in minimizing anxiety prompted by technology and increasing the AI literacy when they clearly specified the correspondence between the technical operations and the instructional requirements [13]. This reduction in anxiety is not merely psychological relief but a prerequisite for restoring professional agency. Drawing on Priestley et al.'s ecological approach to teacher agency, agency is not an inherent trait but an emergent capability achieved through the interaction of individual capacity and the environment. In the context of GenAI, 'technology anxiety' often stems from a lack of control over the 'black box' of algorithms, which strips teachers of their decision-making power. By reframing prompt literacy as TPK—a bridge connecting pedagogical intent with technical output—teachers regain control over the tool. This shift empowers them to move from being passive consumers of AI content to active instructional designers, thereby reclaiming their professional authority in the digital classroom. Equally, in field-specific application, e.g. STEM education, systematic interventions in the context of iteration in prompt refinement have been found to effectively support the instructional design capacity of teachers [14]. These results can be considered a witness that when training proceeds beyond training-on-how-to-use-the-tool (TK) to training-on-how-to-teach-with-the-tool (TPK) not only do professional competence levels increase but also stratifying of professionals is reduced, meeting the needs of the above-mentioned discussion.

5.2 Assessment Reform: Evaluating the "Translation" Process

With changing definition of prompt literacy, the practice of assessment should also change not to only measure the final technical product. Conventionally, the evaluation may require the questions like whether or not the AI produced a high-quality lesson plan. Nonetheless, this emphasis is not adequate regarding a TPACK view as the quality of the output might be achieved by the mere luck or the employment of ready-made templates instead of the competence of the teachers. Better still, the pedagogical reasoning process needs to be investigated using assessment methodologies.

In a real sense to gauge how prompt literacy has really been achieved, evaluators must find out whether the teacher has been effective in realizing its Pedagogical Intentions (PK) into refined Technical Instructions (TK). The evaluation rubrics must thus emphasize on the continuous improvement process as opposed to one fixed outcome. Indicatively, a valid assessment would look at whether a teacher can identify a pedagogical gap in an AI of a generic responding and, therefore, develop a particular "refinement prompt to respond to such a gap. It entails storing abstract strategies, e.g. scaffolding a failing reader, or correcting a certain misconception, in algorithmic constraints followed by the AI. Through this potentially more useful model of evaluation, teacher education programs can now shift

priorities and focus on educating teachers to become more active instructional designers and less passive consumers of AI generated content.

6. Conclusion

This paper has pushed the main idea of prompt literacy beyond the practical use of generative AI interaction as a technical skill, but re-conceptualized as a form of Technological Pedagogical Knowledge (TPK). This theoretical reframing shows that prompt literacy is the most important pedagogical order of reasoning normally needed to convert vaguely taught intentions into accurate technical ones.

As it can be seen in the conversation about the present state of affairs, prompt literacy is recognized as an important operating bridge between potentials of AI into practical classroom activities, although it is hampered at present by structural fragmentation and an individualistic agenda. Reorganizing the system thoroughly therefore must be a paradigm shift: a shift toward conceptualizing AI competence as institutional and systemic, with coherent and subject integrated systems of curriculum provisions.

There are a number of weaknesses of this review. First, most of the mentioned literature is based on Western settings, thus it might not be applicable to the whole world in terms of education systems. Second, as there is a rapid development of generative AI, the majority of studies reviewed have been published in 2024 and 2025, and, therefore, the longitudinal in terms of teacher professional development and student outcomes are under-researched with the volume of studies verifying the long-term effects of timely-intervention literacy programs.

To further enhance future studies on the topic, a focus should be made on the design of standardised yet context sensitive assessment tools to have a stronger understanding of prompt literacy conscience as a TPK process in various fields of study. Finally, prompt literacy training in teacher education is just an inevitable initiative to enable teachers to be active agents, not as passive users in education redefense by artificial intelligence.

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