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# Using scaffolds to support preservice teachers' reflective practice

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**Introduction:** The primary purpose of this study was to examine the impact of various types of reflection prompt scaffolds on preservice teachers' metacognitive and problem-solving abilities.

**Methods:** Participants were preservice teachers in an educational technology course within an accredited teacher education program. Mixed-methods data were collected using a cycle of reflection beginning with concrete and authentic situations encountered during a simulated teaching activity and resulting in reflective observation through blogs. Two rounds of teaching and reflection occurred, with blog reflections scaffolded by two types of prompts: traditional descriptive and critical incident. Qualitative and quantitative data were analyzed separately and findings were integrated across phases and data type.

**Results:** Results indicated that the type of scaffold impacted ill-structured problem-solving, pedagogical reasoning processes, metacognition, and reflective thinking in various ways.

**Discussion:** Implications for teacher education are discussed.

## KEYWORDS

reflection < teacher education, metacognitive reflective scaffolds, critical incident prompt, preservice < teacher education, experiential learning and education

## Background

Recent literature emphasizes that “Reflective practices are widely advocated for in academic circles, and many teaching courses and seminars include information regarding different methods of reflection” (Machost and Stains, 2023, p. 10), with benefits extending to both students and educators themselves. Reflection is a common and often integral component used in teacher education to encourage and support adaptive metacognition, pedagogical reasoning, and the cultivation of professional judgment (Baran et al., 2017; Darling-Hammond and Bransford, 2007; Taylor, 2023). Its significance is underscored by the focus on reflection within national teaching standards, such as those outlined by InTASC, NBPTS, CAEP, and ISTE (Darling-Hammond and Bransford, 2007). Despite this focus, reflection is defined differently, depending on context and theoretical frameworks (Ide and Beddoe, 2023).

Educators who have attempted to cultivate reflective practice in teacher preparation programs are well aware of the complexities involved (Fuentelba Jara and Russell, 2023). One challenge is identifying the best ways to scaffold reflection to support novice educators in forming meaningful connections between their experiences and pedagogical knowledge. “They know the behaviours of teaching, but they know very little about how teachers think and why they teach in one way rather than another” (Russell, 2022, p. 2). Given the complexity of classroom environments, scaffolding strategies, such as coaching, guided prompts, and structured reflection models, play a critical role in assisting preservice teachers in developing reflective and metacognitive skills (Nagro, 2019; Vygotsky, 1978).

Building on Dewey's and Schön's reflection frameworks, we conceptualize reflection using Kember et al. (2000) framing of reflection as ill-defined problem-solving requiring clarification of solution paths and goals. Reflection operates at multiple levels, involving the review, evaluation, and refinement of past experiences and beliefs. The relationship between beliefs and practice is complex, bidirectional, and iterative (Buehl and Beck, 2015; Heckathorn et al., 2023). When preservice teachers reflect on critical incidences of their teaching, they articulate their reasoning, explore multiple possible solutions (Anselmann, 2023; Tripp, 1994), and develop metacognitive strategies that support adaptation and adaptive expertise in diverse settings.

Drawing on prior research on critical reflection and developmental perspectives (Tripp, 1993; Weaver et al., 2019), this mixed methods study examines how the type of reflective blog scaffold (descriptive prompt scaffold compared to a critical incident reflection protocol) affects reflective thinking level, ill-structured problem-solving skills, and metacognitive regulation during preservice teacher education. We examine not only the impact of different scaffolds on preservice teachers' reflection but also the role of assessment in measuring their effectiveness. Addressing both scaffolding strategies and assessment methods in a single study is crucial because the effectiveness of a scaffold is best understood when paired with robust, meaningful ways to evaluate reflection outcomes. Without a clear connection between scaffolding and assessment, it's difficult to determine whether a specific strategy effectively deepens reflective practice or simply encourages surface-level engagement.

## Teaching reflection

How can we support preservice teachers in using reflection to solve real-world classroom challenges and actively build new understanding based on their prior knowledge? Reflective practice involves a cycle that begins with concrete experiences, moves into evaluation and analysis, and ultimately may lead to assimilation, reframing, and a plan of action (Dewey, 1938; Gibbs, 1988; Schön, 1983). Because teaching involves addressing real-world, ill-structured problems, novice educators require guidance in developing adaptive expertise (Darling-Hammond, 2005). Scaffolding metacognitive skills aid preservice teachers in navigating such problems, although traditional metacognitive interventions, usually designed for well-structured problems, may not fully address classroom variability (Lin et al., 2005). Adaptive metacognition, therefore, is crucial, helping teachers adjust practices by recognizing unique, hidden aspects of classroom scenarios.

Lin and Lehman (1999) found that "reason justification" prompts effectively supported problem-solving in novel, contextually dissimilar tasks, underscoring the importance of selecting instructional scaffolds that align with learning goals. Similarly, studies by Azevedo and Hadwin (2005) highlight the importance of scaffolding in aiding novice teachers' metacognitive development. Tailored prompts and feedback mechanisms should be aligned with various learning contexts and objectives to enhance their effectiveness.

Adaptive metacognition, self-study, and critical incident reflection (Tripp, 1993) further encourage teachers to examine and approach complex classroom situations with flexible, strategic actions. Tripp's triple-loop learning model incorporates reflective cycles that address emotional and cognitive responses, promoting deeper reflection and problem-solving skills. Preservice teachers

require support that guides them through the complexities of a task, embeds expert advice, reduces cognitive load, and helps place focus on aspects of the task that are relevant to the learning goals. The structure of prompts can vary depending on the learning goals, the characteristics of the learners, and the instructional context (Weaver et al., 2019).

Common variations in prompt structure include:

- Multi-Stage Scaffolded Reflective Learning for Design Tasks, which includes reflective learning scaffolded by video cases, a rubric, and peer feedback (Liu et al., 2024).
- Generic or specific prompts are differentiated based on the level of detail and the type of guidance they provide (Wu and Looi, 2012).
- Continuous or faded prompts refer to the persistence and intensity of the scaffolding (Palinscar and Brown, 1984).
- Guided reflection involves an intentional and systematic approach where the teacher educator provides specific prompts and support (Risko et al., 2009; Toom et al., 2014).
- Domain-specific vs. domain-general prompts are distinguished by their focus on subject-matter knowledge versus broader cognitive and metacognitive skills (Bulu and Pedersen, 2010).

Furthermore, several critical studies indicate that various types of reflection prompts may impact self-regulation and problem-solving in different ways (Bixler and Land, 2010; Bulu and Pedersen, 2010; Chen, 2010; Jung et al., 2021). Problem-solving triggered by discordant experience parallels the concepts of disorienting dilemmas (Mezirow, 1991) and critical incident reflection (Tripp, 1993). Common and recurrent events in the course of teaching provide an opportunity to explore differentiated solutions through focused self-study or inquiry into one's own practice concerning particular issues and critical events involved in teaching (Anselmann, 2023; Weaver et al., 2022). "Critical reflection is best understood as critical thinking applied to personal experiences. This occurs when practitioners step back from a problem or experience and reflectively ask probing questions to make meaning from specified events" (Cole et al., 2022, p. 1). When preservice teachers reflect on critical incidences in their teaching, they articulate their reasoning and explore multiple possible solutions, which may build metacognitive strategies that support adaptation and adaptive expertise.

Based on these studies, we investigated the efficacy of two different types of prompts in our research. The traditional descriptive prompt developed by the course professor as the original prompt asked participants to describe a lesson's implementation process, mechanics, assessment, and learning outcomes in alignment with InTASC Standards (see Supplementary Appendix A). In contrast, the critical incident protocol developed by Tripp (1994) required participants to identify a significant event during the lesson, analyze it, and develop a plan of action with a rationale for their decisions (see Supplementary Appendix B). Next, we explored and identified various assessment techniques in order to detect differences in students' reflective practice based on the type of prompt used.

## Methods of assessing reflection

There are various methods for assessing the quality of reflection, most of which involve content analysis often discussed in terms of

phases, levels, or types of reflection. These frameworks often use hierarchical categorization. One of the most influential is [van Manen \(1977\)](#) seminal work on levels of reflectivity. [Van Manen \(1977\)](#) identified three levels of reflection:

1. Technical reflection – Focused on the practical application of educational knowledge.
2. Interpretive reflection – Concerned with analyzing decisions, meanings, and assumptions behind instructional choices.
3. Critical reflection – The highest level, addressing ethical considerations, equity, and broader social implications of teaching practices.

Although [Van Manen's \(1977\)](#) model represents reflection as hierarchical, when the phases of reflection are considered on a continuum rather than as levels, teachers at various professional stages may employ a combination of types of reflection depending on the context, situation, and prior experiences. [Harris et al. \(2010\)](#) suggested that the mentoring process, electronic portfolios, reciprocal journals, and professional growth plans are all examples of how to evaluate reflection so that it promotes growth and impacts instructional practice. Furthermore, teachers do not necessarily move through reflection phases linearly. Contextual factors, such as a challenging classroom situation, supervisory feedback, or collaborative discussions in a team meeting, can trigger deeper reflection and problem-solving at any stage ([Harris et al., 2010](#)).

Many researchers adopt mixed-methods approaches, integrating qualitative insights with quantitative measures to gain a more comprehensive understanding of reflective practice. These approaches help capture the interaction between metacognition, feedback, self-efficacy, and goal orientation. For example, [Chen and Chen \(2022\)](#) used empirical analysis to examine external environmental factors and individual psychology and qualitative analysis to explain the mechanism of the results. Findings demonstrated that combining reflection with pedagogical self-efficacy and goal orientation fosters sustainable learning by enabling teachers to continuously evaluate and adjust their teaching strategies ([Chen and Chen, 2022](#)). Similarly, [Wu and Looi \(2012\)](#) studied how scaffolded prompts in a computer-based tutoring system impacted reflective thinking. Their findings showed that structured questioning elicited higher levels of reflection and encouraged double-loop learning, where individuals examine underlying assumptions and refine their metacognitive strategies.

Other studies have reinforced the role of assessment tools in guiding effective reflection. [Kaya and Adiguzel \(2021\)](#) conducted a qualitative case study supplemented by quantitative data, showing that structured reflection opportunities improved pedagogical content knowledge and multimodal reflective thinking. Similarly, [Ratminingsih et al. \(2017\)](#) discovered that self and peer assessments, along with peer collaboration, fostered a culture of feedback and improved instructional decision-making. Their research emphasizes the importance of supportive environments that include well-designed reflection tasks and feedback mechanisms, which positively influence goal orientation and reflective practice ([Chen and Chen, 2022](#)).

## Reflection scaffolds

Recent research has explored various methods for supporting preservice teachers' reflective practice, examining both the effectiveness

of specific reflection techniques and how different prompt designs influence the quality and focus of reflective thinking.

[Anselmann \(2023\)](#) conducted a pre-post design study with 53 preservice teachers who participated in either online or face-to-face training using the critical incident technique (CIT) for teacher education to determine if the training sufficiently improved their reflection skills. The study was conducted over multiple data collection periods, during which participants completed both online and face-to-face formats. Data were collected through an online questionnaire that included validated scales on educational satisfaction, reflection skills, and learning logs. The data were analyzed using descriptive statistics, t-tests, and qualitative data analysis. The results show that the students significantly enhanced their teaching reflection abilities after completing the training.

[Jung et al. \(2021\)](#) conducted an exploratory case study to analyze the written reflections of 21 preservice teachers in response to three types of prompts (standard-based, concept-based, and task-based) in an online technology integration class. They examined these reflections at the sentence level using both quantitative and qualitative methods. The analysis was guided by a framework that includes descriptive, rationalistic, and anticipatory dimensions. Their results revealed that standard-based prompts generated reflections that were mainly composed of anticipatory and assertive components. In contrast, concept-based and task-based prompts generated reflections that primarily included descriptive and evaluative components. The type of prompt, the use of specific keywords and verb tenses, and the characteristics of the anchoring experience shaped reflections.

[Elsayary \(2023\)](#) examined how preservice teachers' metacognitive knowledge and self-regulation develop in online learning through a reflective practice framework. The study took place during the COVID-19 pandemic, when teaching shifted to an online format. The participants were preservice teachers in an early childhood program in the United Arab Emirates. Preservice teachers' reflection practices had a significant impact on their metacognitive regulation and knowledge development. The use of the reflective practice model connected metacognitive knowledge (declarative, procedural, conditional) with metacognitive regulation (planning, monitoring, evaluating) in a cyclical process, leading to enhanced self-regulation and preparation for future teaching roles.

While these studies demonstrate that structured reflection techniques enhance preservice teacher development, they primarily focus on individual interventions or overall effectiveness, rather than systematically comparing different scaffolding methods to identify which ones are most effective for specific learning outcomes. Building on this research, this study triangulated the Metacognitive Awareness Inventory for Teachers (MAIT), Reflective Thinking Attributes (RTA), Analytical Scoring Rubric (ASR), and [Kember et al. \(2008\)](#) Four Category Scheme to assess students' development in reflective thinking and metacognitive regulation. Although previous studies have examined critical incidents, prompt categories, and the development of pedagogical reasoning, this research provides a unique contribution by directly comparing traditional descriptive prompts with critical incident prompts to assess their respective impacts on pedagogical reasoning and metacognition. Thoughtful assessment and intentional instructional strategies are key to accurately measuring students' reflective thinking growth.

## Theoretical framework

Reflection serves as an organized method for educators to examine their practice systematically, creating bridges between successive teaching experiences (Cambridge International Education Teaching and Learning Team, 2019). However, reflection is not limited to personal experiences; it can also take various forms, including examining the broader social and political contexts that influence teaching practices. McGarr and Emstad (2020) argues that focusing only on one's own teaching limits growth unless it is balanced with an awareness of the larger professional and institutional landscape. Effective reflection, therefore, involves both internal self-examination and external contextual analysis. To ensure reflection leads to growth rather than reinforcing existing beliefs, it should include challenges, self-critique of practice, and alternative perspectives (Tripp, 1993).

## Experiential learning as a framework for reflection

This broader perspective on reflection corresponds with Experiential Learning Theory (ELT), a well-established framework that describes how learning takes place through an ongoing cycle of experience, reflection, and adaptation. ELT promotes a dynamic, iterative approach to professional learning, encouraging educators to move beyond isolated experiences and to consider how broader influences shape their developing practice. ELT outlines four interconnected stages:

- Concrete Experience – Engaging in a real-world teaching or learning situation.
- Reflective Observation – Examining and analyzing that experience.
- Abstract Conceptualization – Identifying patterns, forming generalizations, and developing new insights.
- Active Experimentation – Applying these insights to future practice and testing their effectiveness.

In this learning cycle, learning is transformed through the interplay between content and experience, and the concrete, real-life experiences of the learner create knowledge (Burns and Danyluk, 2017; Dewey, 1933).

Reflective praxis, viewed as a cyclical or spiral model, has the potential to build metacognition, challenge beliefs, develop schema, and reconstruct knowledge, and is instrumental in modern-day designs of reflective practice activities (Gibbs, 1988; Kember et al., 2008). By emphasizing the interplay between experience and reflection, ELT provides a strong foundation for examining how different scaffolds and assessment methods influence the depth and quality of reflective practice.

## Summary and research questions

Effective teacher reflection is contextual, experience-driven, and problem-oriented. Contextual reflection linked to experience and practical problems and focused on multiple solution paths helps teachers to build schema and restructure knowledge (Anselmann, 2023; Gläser-Zikuda et al., 2024; Schön, 1983, 1987; Tripp, 1994). Because teachers tend to move along a continuum of developmental stages, scaffolding should be designed to support metacognitive problem-solving and pedagogical reasoning processes in reflective activities (Anselmann,

2023; Nagro, 2019). Previous research shows that learning environments where preservice teachers reflect on concrete experiences help them develop reflection skills and gain insights into managing critical teaching situations (Anselmann, 2023). Building on these findings, this investigation employed the Critical Incident Prompt to provide participants with opportunities to analyze their personal experiences while introducing them to a structured reflection framework to support their professional practice. Thoughtfully structured reflection prompts can enhance how preservice teachers analyze their teaching, regulate their thinking, and develop adaptive instructional strategies.

This study investigates how different types of reflection prompts influence metacognitive and pedagogical reasoning in novice teachers' reflections. Specifically, we compare:

- Descriptive prompts guide teachers to recount lesson implementation in a narrative format.
- Critical incident prompts (Anselmann, 2023; Tripp, 1994) encourage teachers to analyze significant classroom moments, consider multiple perspectives, and develop an action plan for future practice.

By comparing these scaffolds, this study aims to determine how reflection structure impacts problem-solving depth, metacognitive regulation (planning, monitoring, and evaluation), and reflective thinking attributes.

Our research questions are as follows: 1. What is the relationship between the type of reflective blog scaffold (descriptive prompt scaffold compared to a critical incident reflection protocol) and ill-structured problem-solving and pedagogical reasoning processes found in preservice teachers' post-lesson reflections? 2. What is the relationship between the type of reflective blog scaffold (traditional descriptive prompt scaffold compared to a critical incident reflection protocol) and the metacognitive regulation (planning, monitoring, and evaluating) of preservice teachers? 3. What is the relationship between the type of reflective blog scaffold (descriptive prompt scaffold compared to a critical incident reflection protocol) and reflective thinking attributes of preservice teachers? 4. How does the type of reflective blog scaffold affect preservice teachers' reflection?

## Methods

### Context and design

To explore reflection, ill-structured problems, scaffolding and prompts, metacognition, and pedagogical reasoning, this study used a mixed-method research (MMR) methodology with an explanatory sequential design. The study began with a quantitative strand to provide general insight into preservice teachers' metacognition, reflective thinking attributes, and problem-solving processes and followed up with the qualitative strand to gain in-depth explanations of the quantitative results (Creswell and Plano Clark, 2018). The data were collected across four sections of a course, and the quantitative design included non-random assignment of two of the sections to a treatment group, where they engaged in reflection based on a critical incidence reflective prompt, and two sections to a comparison group, where they engaged in reflection based on a standard open-ended prompt. The data source for the qualitative content analysis included written work from participants



across both groups. The combination of quantitative and qualitative data provided an in-depth perspective on the preservice teachers' depth of reflection as it relates to metacognition, as well as how their pedagogical reasoning and problem-solving processes were impacted by the type of scaffolding prompt the students received.

## Researcher description and participants

The research was conducted as the first author's doctoral dissertation project at a mid-sized research university in the southwestern region of the United States, and the second author served as the primary research mentor. The authors approached the research process from a pragmatic worldview of educational inquiry. They conceived the research as a space for researchers and participants to explore, understand, and reflect upon their own experiences in a specific context.

Participants were selected from four sections of an in-person educational technology course designed to successfully teach preservice teachers technology strategies to integrate technology into teaching. The same participants were used in the study's quantitative and qualitative components. All students were enrolled in the Special/Elementary Education (Dual Certification) Bachelor of Science in Education program at a regional HSI university in the American Southwest, with a 40% first-generation student population. In total,  $N = 58$  students granted permission to participate in the study, though only 49 completed both the pre- and post-course materials, and through listwise deletion, we report only on the data who participated in the entirety of the study.

## Materials and measures

### Analytic scoring rubric

In order to investigate the relationship between the type of reflective blog scaffold and retrospective pedagogical reasoning and problem-solving processes found in the preservice teachers' post-lesson reflections, a modified version of [Ge and Land \(2001\)](#) analytical rubric was used. Ge's rubric has four major constructs centered on ill-structured problem-solving processes: (a) problem representation, (b) developing solutions, (c) justifying the selection of solutions, and (d) monitoring and evaluating the problem space and solutions. Each of the constructs represents specific attributes assigned an ordinal value on different point scales; however, [Ge and Land \(2001\)](#) chose to use the category scales as approximate interval/ratio data, which the researcher replicated in this study.

The measure includes three categories, each with a scoring range from 0 to 10 points, including 1. Representing the problem/event or lesson, 2. Selecting/developing solutions, and 3. Making justifications for and evaluating proposed solutions. The ill-structured problem-solving constructs used in [Ge and Land \(2001\)](#) rubric closely parallel [Shulman \(2004\)](#) retrospective pedagogical reasoning processes: *evaluation*, which Shulman described both in terms of evaluating student learning and one's own teaching, and *reflection*, which he defined as reviewing, reconstructing, and analyzing, aligns with Ge's construct of *problem representation*, which involves defining problems, identifying relevant information, and searching and selecting needed information. Additionally, Shulman's *New Comprehension*, which he described as the consolidation of new

learnings, can be mapped onto Ge's constructs of (1) *selecting and developing solutions*, (2) *making justifications* by constructing an argument and providing evidence, and (3) *monitoring and evaluating solutions*, which requires assessing the solution by examining pros and cons. Since only two of the four course sections that were studied used a critical incident protocol to reflect, Shulman's pedagogical reasoning processes were mapped onto Ge's analytical rubric, in order to use the same assessment tool across both groups to measure the relationship between the type of reflective blog scaffold (descriptive prompt scaffold versus a critical incident reflection protocol) and the retrospective pedagogical reasoning processes (evaluation, reflection, and new comprehension) found in preservice teachers' post-lesson reflections. The rubric provided insight into how each process was affected in different ways depending on the type of scaffolded prompt provided.

### Metacognitive awareness inventory for teachers

The Metacognitive Awareness Inventory for Teachers ([Balcikanli, 2017](#)) is based on self-regulated learning theory, and it is derived from the Metacognitive Awareness Inventory for Adults (MAI) ([Schraw and Dennison, 1994](#)). The questionnaire is an adapted version of the [Brown \(1985\)](#) two-component model of metacognition, Knowledge of Cognition and Regulation of Cognition, and modified to a 5-point Likert-Scale with a range from (1) "strongly disagree" to (5) "strongly agree." The 24-item questionnaire is based on six factors (with four statements each) including Declarative, Procedural, and Conditional Knowledge in Knowledge of Cognition, and activities such as Planning, Monitoring, and Evaluation in Regulation of Cognition.

For the purposes of this study, we examined only the items that measured the planning, monitoring, and evaluating aspects of metacognitive regulation. The dimension of regulation of cognition, in particular, aligns with this research study because it focuses on how metacognition helps coordinate problem-solving processes related to decision-making on the use of resources, steps to be taken, and pacing ([Balcikanli, 2017](#)). Therefore, the following three dependent variable subfactors, or dimensions of metacognitive regulation, were examined and analyzed in this study: (1) planning, (2) monitoring, and (3) evaluating. The instrument was collected at baseline and at the end of the study.

### Reflective thinking attributes instrument

This 30-item Likert survey was used to measure participants' level of reflective thinking on a 4-point scale, where 1 = Seldom, and 4 = Almost always, on a variety of items that describe reflective thinking during problem solving in a teaching context, e.g., *When confronted with a problem situation, I analyze a problem based upon the needs of the student* ([Taggart and Wilson, 2005](#)). The instrument was designed to assess baseline levels of reflection so that growth may be determined and should be used as one of several tools for triangulation of data ([Taggart and Wilson, 2005](#)). The three levels of reflection include: (1) technical, which is where knowledge is derived from experience, pedagogy, content, and methodology; (2) contextual, which is characterized by a willingness to look at contextual factors and alternative approaches; and

(3) dialectical, which is described as an autonomous state of open-mindedness, self-actualization, and disciplined inquiry (Taggart and Wilson, 2005). The instrument was scored by tallying how many times each indicator was chosen, multiplying by the indicator number, then adding the subtotals to reach an overall score. A score below 75 equaled the Technical level of reflection; 75 to 104 equaled the Contextual level of reflection; and 104 to 120 equaled the Dialectical level of reflection. Participants completed this measure at baseline and then at the end of the course.

## Kember's four-category scheme

Reflective blogging occurred as part of the natural educational setting of the courses, and blog reflections were coded and analyzed using Kember et al. (2008) *Four Category Scheme*, which is based on a questionnaire developed and tested by Kember et al. (2000). A confirmatory factor analysis revealed a good fit to the four-factor structure, providing evidence that the most viable scheme for assessing reflective writing has four categories: habitual action/non-reflection, understanding, reflection, and critical reflection.

Given that research question four sought to explore the type of reflective blog scaffold affects preservice teachers' reflection, it was appropriate to utilize a coding process that employs Kember's reflection categories. Qualitative content analysis of participants' post-lesson blog reflections was employed to identify the level of reflection (habitual action, understanding, reflection, and critical reflection) as identified by Kember et al. (2008) utilizing a deductive coding guideline, which includes category name, definition, and a summary of the categories. Deductive or directed coding involves a top-down analysis and tends to use existing codes or categories to guide analysis (Lapan et al., 2012). Specific language proficiency did not impact scoring mechanics. Grammar, mechanics, spelling, and language skills were not part of the measures.

## Procedure

The research process occurred in three phases. In phase one, the quantitative data from the Metacognitive Awareness Inventory for Teachers (MAIT-1) and Reflective Thinking Attributes Instrument (RTA-1) were collected at the beginning of the semester as a natural part of the course. Additionally, all four-course sections completed the first iteration (T1) of simulated teaching and reflection with the traditional descriptive prompt scaffold designed by their professor. In phase two, participants completed the second iteration (T2) of simulated teaching; however, for the post-teaching reflection, two sections used the traditional descriptive prompt, and two sections used the critical incident reflection protocol as outlined by Tripp (1993), to examine its impact on pedagogical reasoning and problem-solving, adaptive metacognition, and depth of reflection.

In phase three, the Metacognitive Awareness Inventory for Teachers (MAIT-2) and Reflective Thinking Attributes Instrument (RTA-2) were collected again collected. The reflections from both the first iteration (T1) and the second iteration (T2) of teaching and reflecting were evaluated using the scores and then categorized

according to research protocols developed by Kember et al. (2000). An outside research assistant verified blog coding for approximately 30% of the blog reflections and initial discrepancies were resolved through additional training and discussion, resulting in good rater consistency, as measured by Cronbach's alpha, ranging from 0.650 to 0.925. Additionally, an interview with the course professor was conducted to illuminate the results. Findings from all three phases were compared, analyzed, integrated, and interpreted (see [Supplementary Appendix C](#)).

Quantitative and qualitative data were analyzed separately, then the results from all of the data sources were triangulated for interpretation. Because qualitative themes were related to quantitative variables, this approach helped provide a better understanding of the relationship between scaffolding, reflection, metacognition, and pedagogical reasoning.

## Results

Statistical assumptions were met for each of the following analyses, except where indicated below. Mean scores on each measure were calculated across times and condition.

### Research question 1

Does type of reflective blog scaffold affect ill-structured problem solving and pedagogical reasoning processes for preservice teachers during post-lesson reflection? To test the difference between critical incident and reflective blog scaffold on ill-structured problem solving and pedagogical reasoning, we conducted a series of between groups comparisons where type of prompt was the independent variable, and scores from time two (T2) from each category (representing, analyzing, selecting, and justifying) of the ASR as the dependent variables. We expected that preservice teachers' who received the critical incident prompt would demonstrate better reflective thinking attributes and level of reflective thinking than those participants who only received a descriptive prompt scaffold (Risko et al., 2009; Tripp, 1994; Lin and Lehman, 1999).

In testing the assumptions, we noted that the data for these variables were not normally distributed, but rather highly skewed. Therefore, rather than using a parametric test, we used the Mann-Whitney U test to compare across the groups. At the time one (baseline), when all groups engaged with the traditional prompt, there were no between group significant differences on representing problems ( $p = 0.55$ ), analyzing problems ( $p = 0.13$ ), selecting problem solutions ( $p = 0.54$ ), or justifying ( $p = 0.49$ ) problem solutions. In contrast, at time 2, we noted no significant differences between groups on representing problems ( $p = 0.56$ ) or analyzing problems ( $p = 0.07$ ), but there were significant differences by type of prompt on selecting (Mann-Whitney  $U = 156.5$ ,  $z = -3.21$ ,  $p = 0.001$ ), and justifying (Mann-Whitney  $U = 206.00$ ,  $z = -2.295$ ,  $p = 0.022$ ) problem solutions, where the treatment group that received the critical incident prompt outperformed the group that received the traditional prompt. These results suggest that students engaged with the critical incident prompt demonstrated higher performance on some aspects of ill-structured problem-solving.

## Research question 2

Does type of reflective prompt affect metacognitive regulation of preservice teachers? To test the influence of reflective prompt on metacognitive regulation, three repeated measures ANOVAs with type of reflective prompt (critical incident vs. traditional) as a between-subject factor, and metacognitive regulation process as measured with the MAIT (planning, monitoring, evaluating) at time one and time two as the within-subjects factor for each respective analysis, were conducted. For each category of metacognitive regulation, the mean scores were calculated at time one and time two. We expect that those in the critical incident prompt would demonstrate the greatest improvement in each category of metacognitive regulation. For each analysis, the Greenhouse–Geisser correction accounted for the lack of sphericity. All other statistical assumptions were met. Results indicate significant time effects for all three dependent variables, planning,  $F(1, 47) = 37.62, p < 0.001$ ; monitoring,  $F(1, 47) = 16.27, p < 0.001$ ; evaluating  $F(1, 47) = 17.53, p < 0.001$ , with higher total means for each DV at time two, indicating that participants improved over time on each aspect of metacognitive regulation. However, there was no time by condition differences for planning  $F(1, 47) = 2.90, p = 0.095$ , and monitoring  $F(1, 47) = 1.26, p = 0.27$ , indicating that the participants performed similarly across the two conditions on these variables. There was, however, a marginally significant time by condition difference interaction on evaluating  $F(1, 47) = 4.02, p = 0.05$ , partial  $\eta^2 = 0.08$ . Examination of marginal means demonstrates that at time one, the traditional prompt group had higher evaluation ratings, but at time two, the critical incident prompt group performed higher on this variable, which suggests that the critical incident prompt engages students in deeper evaluation processes, as demonstrated by greater improvement across time (see Figure 1).

## Research question 3

Does the type of reflective prompt affect the reflective thinking attributes of preservice teachers? To test the influence of reflective prompt on reflective thinking attributes, a repeated measures ANOVA with type of prompt (critical incident vs. traditional) as the between-subjects factor, and mean RTA scores at time 1 and time 2 as the within-subjects factor was conducted. The Greenhouse–Geisser correction was used to account for lack of sphericity. All other statistical assumptions were met. We expect those in the critical incident prompt to demonstrate the greatest improvement in reflective teaching attributes.

Results indicated a significant time effect,  $F(1, 47) = 80.19, p < 0.001$ , with all participants improving over time. There was also a significant time by-condition interaction,  $F(1, 47) = 10.51, p = 0.002$ , partial  $\eta^2 = 0.183$ . Examination of the marginal means demonstrated that at baseline, the traditional group had higher mean scores, but at time 2, the critical incident group demonstrated higher scores on reflective thinking attributes, indicating that this group demonstrated the greatest improvement over time (see Figure 2).

## Research question 4

How does the type of reflective blog scaffold affect preservice teachers' reflection? The qualitative data emerged from Kember et al. (2008) four-category scheme, used in deductive content analysis of the blogs and an interview with the course professor. Blog reflections were examined using the conceptual framework of Kember et al. (2008) four-category scheme, which categorized the reflections on a whole-paper level as either habitual action (H), understanding (U), reflection (R), or critical reflection (CR), to find the highest level of participant reflection. Intermediate cases were marked by a plus or a minus as suggested by

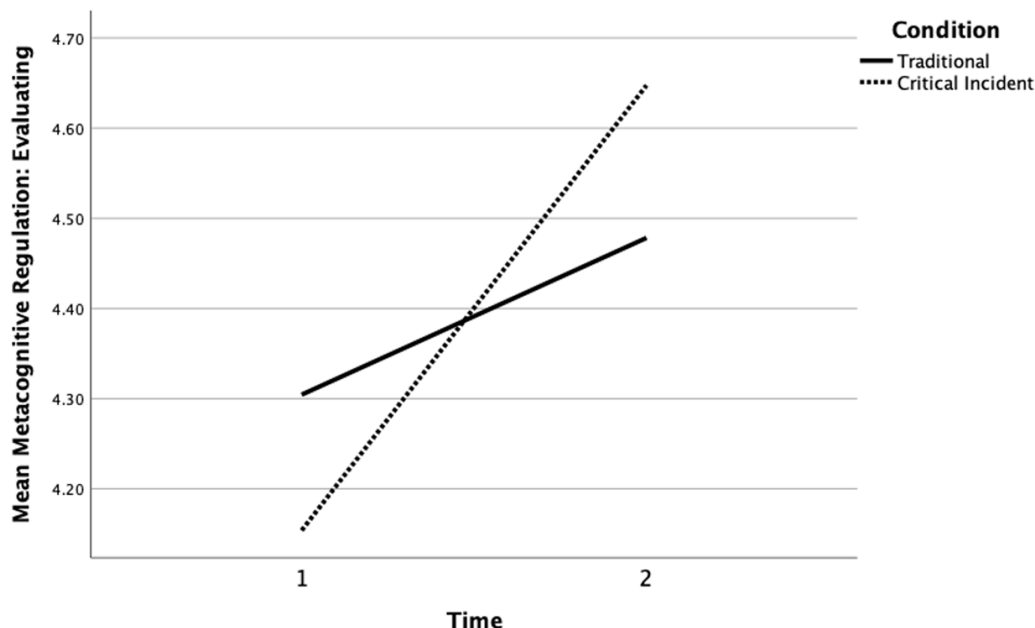


FIGURE 1  
Metacognitive regulation: evaluation over time by condition.

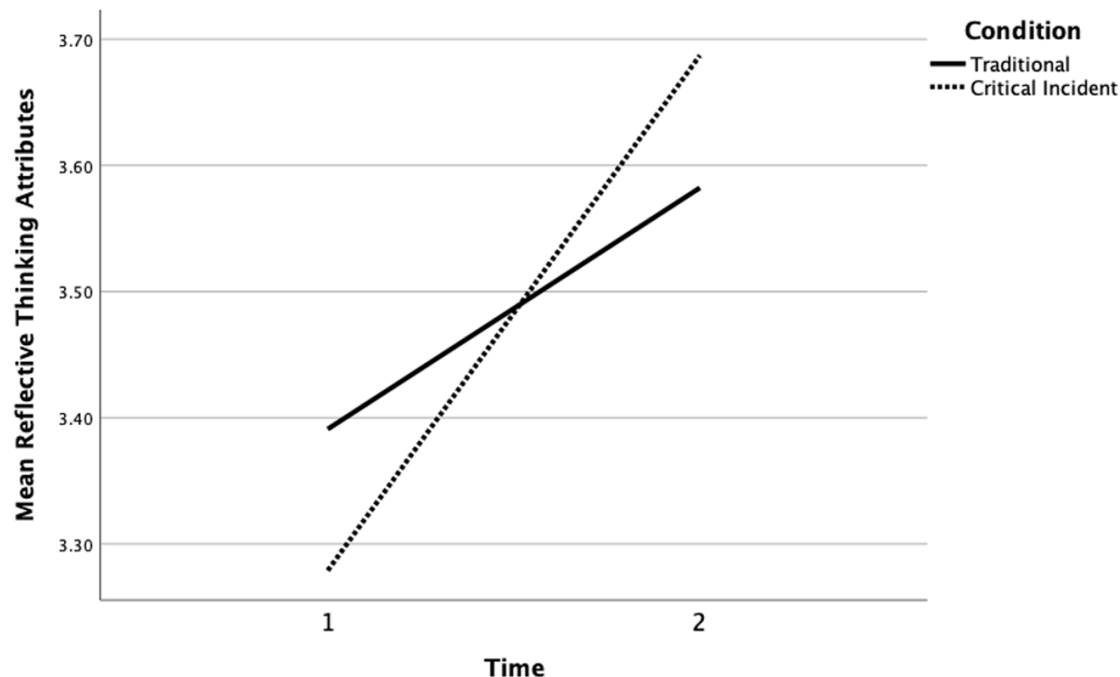


FIGURE 2  
Reflective thinking attributes by condition over time.

Kember; therefore, each scale was assigned three levels, or subcategories, to categorize the reflection and reveal change within each category. Additionally, numerical codes ranging from 0 to 11 were assigned to each subcategory, visually representing each course section's movement within categories.

Blog reflections suggested that in terms of Kember's four-category scheme, the majority of the reflections clustered around the reflection (R) and reflection + (R+) categories for both types of prompts. However, the critical incident prompt group seemed to provoke more overall growth within subcategories or between categories from reflection one to reflection two, which was demonstrated as 62% compared to 48% in the traditional descriptive prompt group. Table 1 provides definitions and examples for each category.

## Using Kember's four-category scheme to understand the interview

After reviewing the deductive coding data analysis of the blog reflections, the researcher determined that it would help answer research question three (Q3) in more depth if the professor was interviewed to ascertain his practical experiences using both scaffolds (traditional prompt and critical incident prompt). The interview was semi-structured in that the researcher prepared some questions prior to the meeting, with the understanding that other questions might have emerged during the conversation. The interview was recorded, transcribed, and analyzed by reading the transcription multiple times and then color-coding the professor's responses for statements aligned with descriptors of each of the categories of Kember et al. (2008) four-category scheme. These categories were (1) habitual action, (2) understanding, (3) reflection, or (4) critical reflection, as well as

concepts related to the existing literature on developing preservice teachers' reflective practice.

Overall, the interview revealed that when the course professor reviewed students' reflections, he noted that both the traditional descriptive and critical incident prompts encouraged the participants to focus on integrating technology into a lesson. The traditional descriptive prompt drew students' attention to successes and challenges and elicited pedagogical shifts in using technology in various ways. The critical incident prompt allowed the students to pedagogically reason about technology integration more specifically and pragmatically. The process of reflection in both cases was further bolstered by the course professor's scaffolding in the form of discussions. For example, in response to the interview question, "What kind of feedback in terms of reflective thinking do you give for the reflections?" the professor described "a change in understanding" or the triggering of "growth" as the central aim of the feedback he provided on students' reflections. The professor focused on helping students to understand the need for flexibility and the ability to adapt teaching, although these skills can be especially challenging for preservice teachers. As discussed in the literature review, the ability to reason about classroom teaching practices to adapt to context-specific situations is an essential indicator of preparation (Shulman, 2004).

## Discussion

Guided question prompts are one technique used to bolster pedagogical reasoning for preservice teachers, and both prompts used in this research (traditional descriptive prompt and critical incident prompt) served to scaffold and support participants' reflective thinking and metacognitive regulation. The preservice teachers in this study



TABLE 1 Kember et al. (2008) four category scheme: definitions and examples.

Category	Definitions	Examples
Habitual	Non-reflection or action that is performed automatically.	None
Understanding	Learning that remains within pre-existing schemes and perspectives	The students/learners used Pixie to answer a series of questions aligned with the standards, and they used Kidspiration to create a character chart. My lesson was completed in the correct time period, but I did not allow for enough time for my students to work on their character charts.
Reflection	Examination and exploration of an experience and critiquing assumptions about the content or process of problem-solving.	Instead of having the students make poems on StoryBird they can choose to make a short story (will only have to be one page) so that they can choose what words they want to put into their Moral of the Story Poems. The reason I would pick Solution 3 is because this solution allows students to continue to share what they felt the moral of the story they read was, but also allows students to pick what words they choose to use, and also allows the teacher to not be tied down to only the StoryBird Poem center.
Critical reflection	Higher level of reflective thinking that transforms our meaning framework.	While “worksheet” has a negative connotation, this would not be a typical worksheet that just fills classroom time. Instead, it would be a guide for students to use in order to have a more purposeful exploration time. It would be differentiated because students would still read the stories that interest them and are at their reading levels. But it would direct them to think critically about how the transition words they found were being used, and this would make their exploration more meaningful. The worksheet could have a required number of words for them to find (which would be combining Solution Number 2). At the bottom, the worksheet would have a question that directs the student to self-reflect on their understanding of transition words and how well prepared they feel to implement transition words in their writing. Lastly, once students become familiar with this exploration model of learning and monitoring their own learning, they may be able to do online explorations without it.

utilized reflective prompts to learn through practical experiences (Dewey, 1938; Schön, 1983, 1987) encountered during simulated or practice teaching activities. Significant differences in each prompt’s structure seemed to play a role in the reflective thinking attributes demonstrated in the participants’ reflections.

The traditional descriptive prompt was explicitly connected to the InTASC standards, making it comprehensive and expansive. Participants discussed and described the implementation process, mechanics related to technology integration, assessment of student learning, and the level of success experienced in teaching the lesson, including two digital artifacts that demonstrated what the students created as a result of the lesson. Furthermore, participants were prompted to consider what they learned from designing and teaching the lesson and how their learning would be used to create future lessons. Subsequently, due to the traditional descriptive prompt that encouraged a balance between an examination of self-performance and the needs and learning of the students (Burns and Danyluk, 2017), the ill-structured problem-solving and pedagogical reasoning processes that focus on representing the lesson event and analyzing/seeking needed information, all were aptly exemplified in participants’ reflections.

In contrast, the critical incident prompt targeted and focused on an event that occurred within the lesson context and was perceived as significant. Participants described the event, brainstormed and researched three possible solutions or alternative viewpoints, chose a plan of action/solution should the incident occur again, and provided a rationale for their choices. The critical incident prompt aligns with Schön (1987) reflective turn, which involves careful consideration of the evidence used to support assertions and their usefulness to everyday practice.

In particular, the critical incident prompt induced ill-structured problem-solving and pedagogical reasoning processes involving new comprehension or learning consolidation (Shulman, 2004) by selecting/developing solutions and making justifications for and evaluating proposed solutions in lesson reflections. These results aligned with the

conclusions of Ge and Land (2001), who found that levels of support within domain-specific scaffolds affected the four problem-solving processes differently. Furthermore, studies conducted by Jung et al. (2021), Nagro (2019), Chen (2010), and Bixler and Land (2010) revealed that the type of prompt and combination of prompts influenced how students made justifications as well as monitored and evaluated solutions.

Likewise, the results of the Metacognitive Awareness Inventory for Teachers (MAIT) indicated that the evaluation phase of metacognitive regulation was impacted explicitly by the critical incident prompt, and participants who used the critical incident prompt self-reported more growth in reflective thinking on the measure of reflective thinking attributes (RTA). Although the MAIT and RTA were self-reported measures, it was noted that the participants’ self-efficacy, which involved evaluating their teaching and putting their learnings back into practice, appeared to be strengthened with the critical incident prompt as it encouraged reflection on an event that challenged assumptions. These results support Dabbagh and Kitsantas’ (2005) mixed-methods study, which confirmed that different categories of web-based pedagogical tools buttressed different self-regulation processes. Likewise, in the current study, the critical incident prompt did not significantly affect the definition and identification of relevant information or the lesson or problem/event analysis. However, the participants’ ability to select and develop solutions or alternatives with explicit explanations and well-constructed arguments (Ge and Land, 2001; Shulman, 2004), as well as evaluate their teaching, was bolstered by a focus on an action plan related to a critical incident.

While recent research has established the value of structured reflection in preservice teacher education, significant gaps remain in understanding how different scaffolding approaches compare in their effectiveness and impact on specific aspects of professional development. Anselmann (2023) study demonstrated that critical incident training generally improves reflection abilities, but it did not compare critical incident approaches to other specific reflection methods, such as traditional descriptive prompts. Similarly, Jung

et al. (2021) examined how different prompts shape reflections generally, using sentence-level coding within three dimensions. In contrast, Elsayary (2023) established that structured reflection enhances metacognitive development. However, these studies primarily examine single interventions or general effectiveness rather than providing systematic comparisons between specific scaffolding methods.

Our study addresses these critical gaps by providing a systematic comparison between traditional descriptive and critical incident prompts using identical participants and comprehensive assessment measures. Building on Anselmann (2023) foundation, we move beyond asking “Does critical incident training work?” to investigating “How does it work differently compared to traditional approaches, and what specific aspects of reflective thinking does each method enhance?” While Jung et al. (2021) utilized theoretical frameworks and concluded with general prompt design features, our study employs four distinct, validated instruments (MAIT, RTA, ASR, and Kember’s scheme) to provide concrete evidence of which specific prompt types are more effective for which specific outcomes in teacher development. Where Jung et al. (2021) found limitations in reasoning and design abilities among their participants, our study explicitly examines how different prompts can enhance pedagogical reasoning processes through Shulman’s framework, mapped onto Ge and Land’s problem-solving constructs.

This research uniquely advances the field by going beyond established findings that prompts and reflection generally support teacher development to showing how specific types of reflection prompts differentially impact distinct components of teacher thinking and pedagogical reasoning. This study provides teacher educators with practical advice on designing reflection activities that target specific professional skills, rather than assuming that all structured reflection leads to growth.

Previous studies have explored various types of reflection prompts, pedagogical reasoning development, and metacognition in teacher education. This study fills a unique research gap by systematically comparing reflection prompt types (traditional descriptive versus critical incident) and their different impacts on specific pedagogical reasoning and metacognitive regulation in preservice teachers. In summary, critical incident prompts enhance teachers’ ability to select, develop, and evaluate solutions, whereas traditional prompts are more effective in supporting broader pedagogical changes and problem representation. Additionally, critical incident prompts particularly improve and target the evaluation component of metacognitive regulation.

## Implications for teacher educators

The data taken together revealed several implications for educators interested in effectively using prompts to scaffold reflection. The findings suggest that a thoughtfully constructed prompt considering standards and course outcomes can meaningfully scaffold preservice teachers’ reflections. When PSTs used the traditional descriptive prompt, pedagogical shifts were observed in both the reflection analysis and the course professor’s interview comments.

The course professor pointed out in the interview that the traditional descriptive prompt was “getting at something like critical incidents but not specifically enough.” Conversely, the reflection from participants given the critical incident prompt for their second iteration (T2) of simulated teaching was targeted and focused on a dilemma or a meaningful incident that occurred during their technology-infused lessons. The specificity inherent in the critical incident prompt encouraged the participants to not only examine a dilemma or an incident from a variety of perspectives but also to choose a plan of action and provide a rationale. Therefore, teacher educators should carefully align learning objectives and instructional outcomes with the design of the prompt. A prompt that encourages students to examine a critical incident may be especially supportive of problem-solving processes that involve analyzing, evaluating, and argument construction, as well as the evaluation phase of metacognitive regulation. Similarly, in a review of five studies on the design of computer-based scaffolds, Azevedo and Hadwin (2005) identified that scaffolds should be designed to fit the type of support needed.

Furthermore, the course professor provided additional types of scaffolds for the participants who used the critical incident prompt, such as examples and discussion. “It can be powerful to share our previous experiences that have surprised us, caught our attention, and generated reframing that led to the practices we are currently using” (Russell, 2022, p. 9). Notably, the process of direct instruction employed by the professor was vital in supporting PSTs’ ability to recognize and reflect on a critical incident. According to Tripp (1994), a critical incident is an ordinary event that is interpreted as significant and an event that attaches meaning to those events that challenge assumptions. The event does not need to be dramatic, but should be important to a broader context. Therefore, it is recommended that teacher educators provide guidance and support for identifying and working with critical incidents in their students’ reflective practice. Reflective activities must be well-planned and tailored to the learner’s needs, context, and goals and scaffolded so that practitioners are taught how to reflect for professional growth (see Table 2).

TABLE 2 Actionable strategies for implementing reflection prompts.

Strategy	Enactment
Identify key standards for reflection.	Connect prompts to specific teaching standards to align the reflection with course goals and emphasize practical teaching competencies.
Integrate critical incident prompts to promote critical thinking and metacognition.	Use prompts that focus on identifying, analyzing, and responding to critical incidents. Encourage teachers to identify a meaningful event and explore its significance, potential responses, and underlying assumptions.
Use descriptive prompts with guided sections, randomize the order of the prompts, or combine prompts to promote depth in reflection.	Adapt the traditional descriptive prompt to include sections focused on successes, challenges, and key learnings, or alternate between descriptive and critical incident prompts to encourage a range of reflective skills.
Provide scaffolded support.	Share model responses and examples and facilitate group discussions to collectively explore varied perspectives and possible solutions to critical incidences.

## Limitations to the study

The study's generalizability is limited by its sample of 49 preservice teachers from a single educational technology course at one university in the Southwest United States. Additionally, since the teaching was simulated with peers, critical incidents may not represent authentic classroom situations or allow for deep pedagogical reasoning practice.

Regarding limitations observed during data analysis, although the MAIT and RTA are validated tools, they depend on self-perception and may be susceptible to social desirability (McLeod, 2008) or the Hawthorne effect, which includes modifications to behavior due to the knowledge that one is being observed (Mummolo and Peterson, 2017). Complementing them with performance-based assessments (e.g., video analysis of teaching followed by reflection) could reinforce validity.

Furthermore, using directed (deductive) content analysis on blog reflections might have overemphasized theoretical frameworks and obscured important contextual factors such as the students' comfort with reflective practices and their writing abilities (Hsieh and Shannon, 2005). An interview with the professor, however, did provide valuable contextual insights, particularly regarding how the professor's examples and discussions helped scaffold the reflective process.

Finally, because the participants who utilized the critical incident prompt for the second iteration (T2) of teaching also used the traditional descriptive prompt for their first iteration (T1), the critical incident prompt was never used in isolation. Therefore, the findings should be interpreted as an indication of what happens when the use of a critical incident prompt follows a traditional descriptive prompt. This sequencing introduces a potential confound: the observed growth may be partly due to prior reflection experience rather than solely the nature of the critical incident prompt. Future designs could counterbalance, randomize the order of the prompts, or combine prompts, which may be an intentional method for scaffolding a wide range of pedagogical reasoning skills and metacognitive regulation processes (Chen, 2010).

## Conclusion

With the ongoing collegiate emphasis concerning preparing beginning teachers to become adaptable practitioners who can reason about their classroom practice, many teacher preparation programs and their adopted standards stress the importance of examining practice through continual study and self-reflection (CAEP, 2024). However, due to a lack of background knowledge and experience, preservice teachers' reflective thinking and metacognition need appropriate scaffolding and support (Crane and Sosulski, 2020; Weaver et al., 2019).

One of the many goals of teacher educators is to help create reflective practitioners who use professional judgment (Schön, 1987) and adaptive expertise/metacognition (Darling-Hammond, 2005; Lin et al., 2005), that are linked to practical problems and learning through experience, or experiential learning (Tripp, 1993). One indicator of preparation is the ability to reason about classroom teaching practices (Shulman, 2004) and adapt to context-specific situations. Teacher educators who use reflection to

help prepare future educators for the rigors of classroom teaching should consider the importance of a well-designed prompt that matches course goals and learning outcomes in support of the gap between developmental processes and learning processes (Crane and Sosulski, 2020).

The current research suggests that a reflection prompt that encourages preservice teachers to focus on a critical incident has the potential to significantly induce ill-structured problem-solving and pedagogical reasoning processes that involve the processes of selecting and developing solutions, evaluating, argument construction, and the consolidation of new learning, as well as the evaluation phase of metacognitive regulation. Thus, these processes scaffold reflection-for-action (Killion and Todnem, 1991) and continuity of experience (Dewey, 1933), as well as the final steps of and Gibbs (1988) reflective cycle, which entails the development of an action plan.

Finally, this study revealed that while most types of preservice reflection were descriptive, participants' writings exhibited a high incidence of multiple perspectives and complex, multidimensional reflection. The development of reflection depended on context and goals. The critical incident prompt, coupled with additional types of scaffolding provided by the course professor, seemed to induce or stimulate pedagogical reasoning and metacognitive regulation processes that may not have otherwise occurred in preservice teachers' reflections.

## Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

## Ethics statement

The studies involving humans were approved by the Northern Arizona University Institutional Review Board (IRB). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study.

## Author contributions

TC: Conceptualization, Investigation, Methodology, Writing – original draft, Writing – review & editing. SA: Supervision, Writing – review & editing.

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The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

## Generative AI statement

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## Supplementary material

The Supplementary material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2025.1621269/full#supplementary-material>

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