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Classroom Simulations for Social–Emotional Learning and Inclusive Teacher Education: A Four-Layer Conceptual Framework in the Age of AI

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Abstract

Teachers work in socially and emotionally complex environments that require rapid professional decision making under conditions of uncertainty. Classroom simulations provide opportunities for preservice and in-service teachers to practice, receive feedback, and reflect without placing students or teachers at unnecessary risk. Despite their growing use, the field lacks a contemporary and inclusive definition of classroom simulation. Existing frameworks often categorize simulations by technology or immersion level, overlooking important differences in agency, responsiveness, adaptation, and instructional design. These limitations have become more significant with the emergence of generative artificial intelligence (AI) and AI agents. This conceptual paper defines classroom simulations as deliberately designed approximations of classroom practice embedded within a structured learning process that includes preparation, enactment, and reflection. We propose a four-layer framework encompassing the professional practice represented, the simulated situation, the distribution of agency and adaptation, and the orchestration of learning. The framework is used to examine how simulations can support social-emotional and inclusive teaching competencies and how AI may influence scenario generation, student behaviour enactment, personalization, and feedback. Effective implementation requires theoretically grounded representations of learners and classroom interactions, alignment with learning goals, meaningful human oversight, and protections for agency, inclusion, privacy, and emotional safety.

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1. Introduction

Classroom simulations offer teacher educators a structured way to approximate the complexity of teaching and enable teachers to practice professional decision-making in inclusive and socially and emotionally demanding situations. Teaching is a practice of continuous interpretation, decision-making, and interaction. In the course of an ordinary lesson, teachers monitor students' understanding and participation, respond to behaviour, regulate the emotional climate, make instructional adjustments, and attend to individual and collective needs. Models of professional competence similarly position perception, interpretation, and decision-making as situation-specific processes that connect teachers' dispositions to observable performance (Blömeke et al., 2015; Loughran, 2014; van Es & Sherin, 2002). These processes are tightly interconnected and influence students' social and emotional states. For example, a response intended to restore order may influence a student's sense of belonging; a pedagogically sound question may fail when it overlooks anxiety or cultural differences; and a teacher's own stress may shape how a student's behaviour is interpreted (Wettstein et al., 2023). The social and emotional dimensions of teaching are therefore not additions to instruction but part of its professional core (Jennings & Greenberg, 2009; Schonert-Reichl, 2017). Against this background, this conceptual paper develops a four-layer framework for examining how classroom simulations can support teachers' social-emotional and inclusive competence and how emerging AI applications reshape their design.

In this paper, inclusive classrooms refer to learning environments in which students with and without disabilities, as well as students from diverse cultural, linguistic, and social backgrounds, learn together. Inclusive pedagogy requires teachers to support all learners through appropriate instructional and organisational practices, collaboration, monitoring of progress, and social-emotional and behavioural support (Finkelstein et al., 2021). Teachers must consequently respond to situations that are ambiguous, emotionally charged, or ethically sensitive: a student who persistently withdraws, a conflict involving exclusion or discrimination, behaviour that may have multiple underlying causes, a difficult conversation with parents, or tension between an individual accommodation and the needs of the group. Such situations require more than declarative knowledge. They call for professional noticing, interpretation, emotional self-regulation, empathy, perspective-taking, communication, and responsible decision-making (Jennings & Greenberg, 2009; van Es & Sherin, 2002).

In special and inclusive teacher education, simulations can provide repeated, low-risk opportunities to rehearse complex situations that cannot be guaranteed during clinical placements, such as Individualized Education Program (IEP) meetings, family conversations, collaboration with related service providers, and decisions concerning accommodations or behavioural and academic support. Such scenarios allow teachers to practice professional judgment alongside empathy, perspective-taking, communication, advocacy, and responsible decision-making, supported by feedback and reflection. This is particularly valuable because empathy, the capacity to recognize another person's emotional state, adopt their perspective, and respond appropriately, is central to inclusive practice and can be developed through training. Research suggests that simulations and role play can strengthen empathy and other interpersonal and social-emotional competencies while preparing teachers to work with learners with diverse abilities and support needs (Fraser & Vitro, 1975; Chua et al., 2021; Siker, 2023; Lindberg, 2025).

To ensure conceptual clarity, it is necessary to explicitly distinguish between two related, but distinct constructs used throughout this paper: Social-Emotional Learning (SEL) and teacher social-emotional competence. We utilize SEL to refer to the broader developmental framework and pedagogical process through which emotional and relational skills are acquired. In contrast, we define teacher social-emotional competence as the specific professional outcome and capability being targeted—namely, the integrated set of capacities required to navigate the interpersonal, emotional, and ethical demands of teaching. With this distinction established, teacher social-emotional competence presents a particularly useful lens through which to examine classroom simulations because the broader process of SEL depends upon the interaction of cognition, emotion, relationships, context, and judgment. Teachers' social-emotional competence cannot be developed through knowledge acquisition alone; it requires rehearsal of authentic professional situations in which teachers experience, interpret, and respond to socially and emotionally complex interactions. We therefore argue that simulation designs intended to support this professional competence must be evaluated not simply by their technological sophistication but by the coherence of the professional practices represented, the responsiveness of the environment, the distribution of agency, and the quality of learning orchestration.

Teacher education has long struggled to create sufficient opportunities for developing these interconnected competencies. Coursework can introduce theories, frameworks, and possible strategies, but theoretical understanding does not automatically become responsive action, a persistent concern in research on the relationship between theory and practice in teacher education (Korthagen & Kessels, 1999). School placements offer authentic experience, yet what student teachers encounter is partly determined by circumstance. Critical situations may occur infrequently, mentors may differ in how they support learning, and mistakes can have real consequences for students and for the developing teacher's confidence and professional identity. Novices can also become overwhelmed by the complexity of the classroom before they are able to practice particular skills and strategies (Chernikova et al., 2020). These limitations have motivated growing interest in approximations of practice: deliberately designed opportunities to engage with selected elements of professional work under conditions that make practice, feedback, and repetition possible (Grossman et al., 2009).

Classroom simulations are one such approximation. They can allow preservice and in-service teachers to enter a professional role, interact with representations of students or other educational actors, try out decisions, observe consequences, and revisit their reasoning in a structured debriefing. Research across higher education, and particularly in adjacent fields such as healthcare and medical simulation, indicates that simulation-based learning can have substantial positive effects on the development of complex skills, particularly when simulations are combined with appropriate instructional support (Chernikova et al., 2020). While the empirical evidence base in teacher education is still maturing compared to these established clinical fields, within teacher education specifically, simulations have been used to practice instruction, classroom management, communication, diagnostic reasoning, inclusive decision-making, and difficult conversations. They have also been associated with professional identity development, reflection, self-efficacy, and social-emotional learning (Kasperski et al., 2025; Schön, 1983/2017).

At the same time, the conceptual language used to describe classroom simulations has not kept pace with the diversity of practices in the field. Role plays with peers, actor-based clinical simulations, branching scenarios, virtual exchange, video-based environments, mixed-reality classrooms, virtual reality, serious games, and AI-supported encounters may all be described as simulations. Sometimes simulations are categorized primarily according to the technology employed; in other cases, the term refers to an entire pedagogical

methodology, including briefing and debriefing. Immersion is frequently treated as a defining or progressive feature, even though a highly immersive environment may offer little meaningful interaction, while an apparently simple actor-based encounter may display high psychological and functional fidelity. The boundaries between a case, role play, video analysis, simulation, and game consequently remain blurred.

The emergence of generative artificial intelligence further exposes these conceptual limitations. Earlier computer-supported classroom simulations relied mainly on predefined rules, decision trees, or a human operator controlling virtual students (Theelen et al., 2019). Large language models and agentic systems can now generate open-ended dialogue, maintain character profiles, adapt responses to a teacher's actions, and coordinate multiple simulated actors (Martynova et al., 2025; Yue et al., 2024). AI may also generate scenarios, select tasks, analyse performance, or support debriefing. These roles cannot be captured adequately by a simple distinction between non-immersive and immersive technology. A simulation may be visually simple yet highly agentic and responsive, or technologically immersive but behaviorally scripted and non-adaptive.

Building on research that has already disentangled technological modality from human agency and shown that technologies such as virtual platforms and video acquire pedagogical meaning through their integration with interaction, feedback, and reflection, what remains underdeveloped is an integrated framework that explains how these dimensions interact within increasingly hybrid and AI-enabled simulation designs (Frei-Landau & Levin, 2023). Hybrid designs demonstrate that modality and source of agency are not equivalent: a virtual environment may preserve direct human interaction, while a digitally represented character may be controlled by a human operator, a predefined script, or a computational system. Likewise, video supports learning not through its mere presence, but through its purposeful integration into facilitated reflection, feedback, and ethically responsive learning design (Levin, 2025). Existing labels such as human-based, computer-based, immersive, or AI-supported remain useful descriptors, but do not by themselves explain who or what controls the interaction, what function the technology performs within the learning process, or how it is coordinated with human agency and mediation. An integrative conceptual framework is therefore needed to distinguish these functions and explain how their alignment shapes the educational value, inclusiveness, and risks of classroom simulations.

Existing scholarship offers valuable perspectives on simulation-based learning, but these perspectives have largely evolved in parallel. Some frameworks focus on fidelity and the extent to which simulations represent professional reality (Hamstra et al., 2014; Dieckmann et al., 2007). Others conceptualize simulations as approximations of practice, emphasizing opportunities for novices to rehearse and reflect on professional actions in manageable ways (Grossman et al., 2009). More recent work has examined technological modalities, immersive environments, and the growing role of artificial intelligence in simulation-based learning (Dieker et al., 2017; Ledger et al., 2022; Theelen et al., 2019). Together, these traditions have substantially advanced the field, yet they tend to explain particular aspects of simulation rather than how those aspects interact.

This limitation becomes increasingly visible as simulations grow more complex. Contemporary classroom simulations often combine multiple forms of representation, varying degrees of human and technological agency, adaptive interactions, and different forms of pedagogical facilitation (Kasperski & Blau, 2023). As a result, simulations that appear similar in format may create very different learning experiences depending on how these elements are configured. Existing frameworks help explain individual dimensions of simulation design, but offer less guidance for understanding the relationships between them.

This limitation creates a tangible conceptual gap when analysing contemporary, complex simulations. Because these theoretical traditions remain largely siloed, researchers

lack a unified language to evaluate how design choices in one domain affect outcomes in another. For instance, practice-based frameworks excel at identifying the core teaching competencies to be rehearsed (Grossman et al., 2009), but they offer limited analytical tools for evaluating whether an AI-driven avatar or a human actor provides the most appropriate interactional agency for that specific task. Conversely, frameworks focused on technological modalities and AI adaptivity (Theelen et al., 2019; Yue et al., 2024) thoroughly explain system responsiveness, but often treat pedagogical orchestration—such as structured debriefing—as a peripheral background variable. Consequently, a simulation might be technologically advanced but pedagogically weak, or clinically authentic but poorly integrated into a learning progression.

The challenge, therefore, is not a lack of standalone concepts, but the absence of an integrated conceptual architecture. The proposed four-layer framework addresses this unresolved theoretical problem by explicitly mapping the dependencies between these previously disjointed domains. Its added conceptual value lies in providing a systematic mechanism to evaluate alignment. It demonstrates that professional practice (Layer 1), scenario design (Layer 2), agency and adaptation (Layer 3), and learning orchestration (Layer 4) cannot be evaluated in isolation; a design decision at any single layer intrinsically constrains or enables the others.

Rather than proposing entirely new constructs, the framework synthesizes these established traditions into a single coherent model. In doing so, it provides a robust theoretical tool for diagnosing why a simulation succeeds or fails, offering a common language for analysing increasingly hybrid and AI-enabled simulation environments beyond isolated evaluations of technological fidelity or instructional support.

Although the framework is intended as a general model for analysing classroom simulations, its relevance to social-emotional learning and inclusive teacher education is particularly significant. Teaching for inclusion requires professionals to respond to complex interpersonal situations involving diversity, emotions, relationships, uncertainty, and competing perspectives. Such situations are often difficult to address through declarative instruction alone because they require not only knowledge, but also judgement, self-awareness, emotional regulation, and relational decision-making. Classroom simulations provide opportunities to rehearse these dimensions of practice in structured yet authentic contexts. The framework therefore seeks to explain how simulation environments can be designed and orchestrated to support the development of professional capacities associated with socially and emotionally responsive and inclusive teaching.

To further clarify the conceptual contribution of the proposed framework, Table 1 positions it in relation to several influential traditions in simulation research and teacher education.

To address this gap, this conceptual paper therefore asks three interrelated questions: What constitutes a classroom simulation in contemporary teacher education? Through which processes can classroom simulations support social-emotional and inclusive professional competence? And how does AI alter the design possibilities, agency, and educational risks of these environments? We first propose an updated definition of classroom simulations. We then conceptualize classroom simulations through four interdependent layers: professional practice, simulation design, agency and adaptation, and learning orchestration. Finally, we use this framework to examine the opportunities and boundaries of AI-supported and agentic classroom simulations. Our purpose is not to rank simulation formats or to suggest a linear progression from low-technology to high-technology forms. Rather, we seek to provide a conceptual language for judging how well a simulation aligns professional practice, learner needs, social-emotional goals, and instructional design.

Table 1. Positioning the proposed framework in relation to existing approaches.

Approach	Primary Focus	Main Contribution	Limitation Addressed by the Present Framework
Fidelity frameworks	Realism and authenticity	Explains simulation validity	Limited attention to pedagogy, agency and orchestration
Practice-based teacher education	Professional enactment	Focus on authentic teaching practice	Less explicit treatment of simulation architecture and adaptation
AI simulation frameworks	Adaptivity and responsiveness	Explains interaction with virtual agents	Often under-specifies pedagogical orchestration
Debriefing and instructional frameworks	Reflection and learning support	Explains how experiences become learning	May treat simulation design itself as background
Four-layer framework	Integration across dimensions	Connects professional practice, design, adaptation and orchestration	Provides a unified analytical model

Methodologically, the proposed four-layer framework was derived through a conceptual synthesis of previous literature and the integration of existing models from simulation-based learning, teacher education, and artificial intelligence (as mapped in Table 1). Rather than emerging inductively from a single empirical dataset, the framework was constructed deductively by identifying the recurring, yet often fragmented, pedagogical and technological dimensions discussed across these distinct scholarly traditions. This synthesis was further refined through our collaborative conceptual work and clinical-pedagogical experience in designing and evaluating inclusive simulation environments. By continuously mapping the theoretical literature against authentic simulation design challenges, we distilled the vast array of variables into four essential, non-redundant layers necessary for a comprehensive pedagogical architecture.

2. What Constitutes a Classroom Simulation?

2.1. From Role Play to Approximation of Practice

Role play has historically been one of the most common approaches to simulating classrooms. Participants enact realistic classroom events and assume the roles of teachers, students, parents, or colleagues. By acting rather than only discussing what could be done, teachers can experiment with professional behaviour and experience how an interaction develops (Kaufman & Ireland, 2019). Technology has extended these possibilities through text-based scenarios, virtual worlds, avatars, mixed-reality environments, and virtual reality (Dieker et al., 2017). However, defining classroom simulations primarily as technology-enhanced role play is now too narrow. Some simulations ask participants to diagnose a situation and make consequential decisions without sustained dramatic enactment (Machts et al., 2024), while others combine human enactment and digital representation. Conversely, not every use of an avatar, virtual classroom, or educational game constitutes simulation-based learning (Kaufman & Ireland, 2019).

The concept of an approximation of practice provides a more durable starting point. A simulation deliberately selects, represents, and sometimes reduces elements of professional reality so that they become available for learning (Grossman et al., 2009). It is not a copy of a real classroom, nor should realism be its only criterion. The relevant question is whether the simulation preserves the functions and relationships that matter for the targeted professional practice (Hamstra et al., 2014). A parent-conference simulation, for example, does not need

to reproduce a school building visually. It does need to create a credible interaction in which the teacher must listen, interpret concerns, communicate a professional perspective, respond to emotion, and make decisions with consequences for the relationship. This distinction reflects the importance of functional fidelity over surface realism (Hamstra et al., 2014).

Simulations also differ from cases and demonstrations because participants have a consequential role within the represented situation. A written case may describe a classroom dilemma and invite analysis. It becomes simulation-like when the participant enters the professional role, must act or decide within the unfolding situation, and encounters responses or consequences generated by the environment (Kaufman & Ireland, 2019; Machts et al., 2024). Likewise, video can support professional vision through observation and analysis without necessarily constituting a simulation (van Es & Sherin, 2002). Video becomes part of a simulation when it is embedded in a responsive scenario, used to prompt decisions that influence what follows, or employed to revisit and analyse the participant's own enacted performance (Levin, 2025). These boundaries are not always categorical, but they help distinguish simulation from adjacent pedagogies.

2.2. A Proposed Definition

We define classroom simulations as follows:

Classroom simulations are deliberately designed approximations of classroom practice in which preservice or in-service teachers assume a professional role, perceive and interpret classroom-relevant information, and make decisions or perform actions in interaction with represented students, colleagues, parents, or other educational actors. These representations may be enacted by humans, computer-controlled avatars, or AI-based agents and may vary in modality, immersion, responsiveness, and adaptivity. Classroom simulations are embedded in a structured learning process that includes preparation, enactment, and reflection or debriefing and are intended to develop or assess complex professional competencies.

Several elements of this definition require emphasis. First, the simulation is deliberately designed. Professional reality is selected and represented in relation to a learning or assessment purpose (Grossman et al., 2009; Kaufman & Ireland, 2019). Second, participants assume a professional role and do something with the information available to them. Observation may be part of the process, but classroom simulation requires interpretation, decision, action, or interaction (Machts et al., 2024). Third, the represented social actors are not restricted to students. Teaching involves relationships with parents, colleagues, school leaders, and other professionals, and interactions with these actors can be central to inclusive practice (Kasperski et al., 2025). Fourth, modality and technology are variable characteristics rather than defining features. Human actors, peers, scripted avatars, and AI agents can all enact social roles that drive participants' decisions. Finally, the enactment is only one phase of the learning process. Preparation, scaffolding, feedback, reflection, and debriefing shape what participants can learn from the experience (Cheng et al., 2014).

This final point is particularly important. Simulation-based learning typically includes pre-briefing or broader learner preparation, a focused briefing immediately before the scenario, enactment, and debriefing (McDermott et al., 2021; Rudolph et al., 2014). Pre-briefing can establish prerequisite knowledge, psychological safety, expectations, and the purpose of the activity. Briefing introduces the specific scenario, roles, constraints, and fiction contract. Enactment creates an experience that can be examined. Debriefing supports participants in reconstructing events, surfacing assumptions, connecting action to professional knowledge, and considering alternatives (Cheng et al., 2014). A technologically sophisticated scenario without these instructional processes may be engaging but educationally weak.

2.3. Fidelity, Authenticity, and Purposeful Simplification

Discussion of simulation quality frequently centres on fidelity. Yet fidelity is multidimensional. Physical fidelity concerns sensory or visual resemblance to the professional environment. Psychological fidelity concerns the extent to which participants experience the cognitive, relational, and emotional demands associated with practice. Functional fidelity concerns whether the actions, decisions, interactions, and consequences in the simulation correspond meaningfully to those of the professional task (Gat & Shapira-Lishchinsky, 2025; Hamstra et al., 2014).

For teacher learning, functional and psychological fidelity are often more important than physical resemblance (Hamstra et al., 2014). A peer role play in a plain seminar room can have limited visual realism but still require authentic listening, emotion regulation, and responsive communication (Gross, 2002). A virtual reality classroom may look highly realistic but offer low functional fidelity when student behaviour follows a small number of predictable scripts or does not respond meaningfully to the teacher. Increasing visual immersion should therefore not be equated with increasing educational value.

Purposeful simplification is also not a deficiency. Approximations of practice deliberately reduce complexity to make components of professional work learnable (Grossman et al., 2009). Novices may benefit from a reduced number of students, a slower interaction, or a scenario focused on one high-leverage practice, because lower-prior-knowledge learners often require more guidance and examples. As competence develops, scenarios can become more ambiguous, socially complex, and time pressured. Machts et al. (2024) show how simulated diagnostic situations can be described through the physical environment, social embeddedness, tasks, activities, information, and decisions. Their distinction between access, prominence, simplicity, and clarity of diagnostic information is particularly useful for classroom simulations. Designers can manipulate not only what happens but also whether critical information is available, noticeable, interpretable, or ambiguous. This provides a principled basis for increasing complexity beyond simply adding more avatars or visual detail.

Authenticity should therefore be understood as a holistic and relational quality of the simulated experience. Perceived authenticity emerges through the interplay among physical elements of the environment, contextual elements of the scenario, and experiential elements of its enactment (Levin et al., 2025). A visually convincing setting cannot compensate for an implausible professional context or an enactment that does not respond credibly to the participant, as authenticity may be undermined by the way actors portray the situation or by professional approaches that participants perceive as unconvincing (Kasperski & Hemi, 2026). Conversely, a relatively simple environment may support an authentic experience when the situation is professionally relevant, its internal relationships are coherent, and the enactment captures the cognitive, emotional, and interpersonal demands of practice. From this perspective, authenticity is an emergent quality of the relationships among the elements that constitute the simulation experience. Because authenticity emerges from the alignment of professional purpose, scenario design, responsiveness, and instructional support, a multidimensional framework is needed to examine these relationships.

3. A Layered Conceptualization of Classroom Simulations

The diversity of classroom simulations is difficult to understand when formats are arranged in a single sequence from non-technological to immersive. We propose instead that a classroom simulation be examined through four interdependent layers. The layers are analytical rather than chronological: each is present in any complete simulation design, and choices in one layer constrain or enable choices in the others.

Figure 1 represents the four layers as a nested configuration of pedagogical specification. Professional practice forms the outer frame because the purpose of the simulation determines what must be represented and learned. The design of the simulated situation translates this purpose into a structured approximation of practice; agency and adaptation determine how that situation unfolds in response to the participant(s); and learning orchestration shapes how the resulting experience is prepared, interpreted, connected to professional knowledge, and developed through feedback and reflection. The inward progression shows how each layer gives greater pedagogical specificity to the preceding one, culminating in meaningful professional learning. Educational value therefore depends on coherence across the entire configuration, because misalignment at any layer may constrain the learning potential of the simulation. The nested configuration represents increasing pedagogical specification rather than temporal sequence or hierarchical importance; the four layers remain interdependent and mutually constraining.

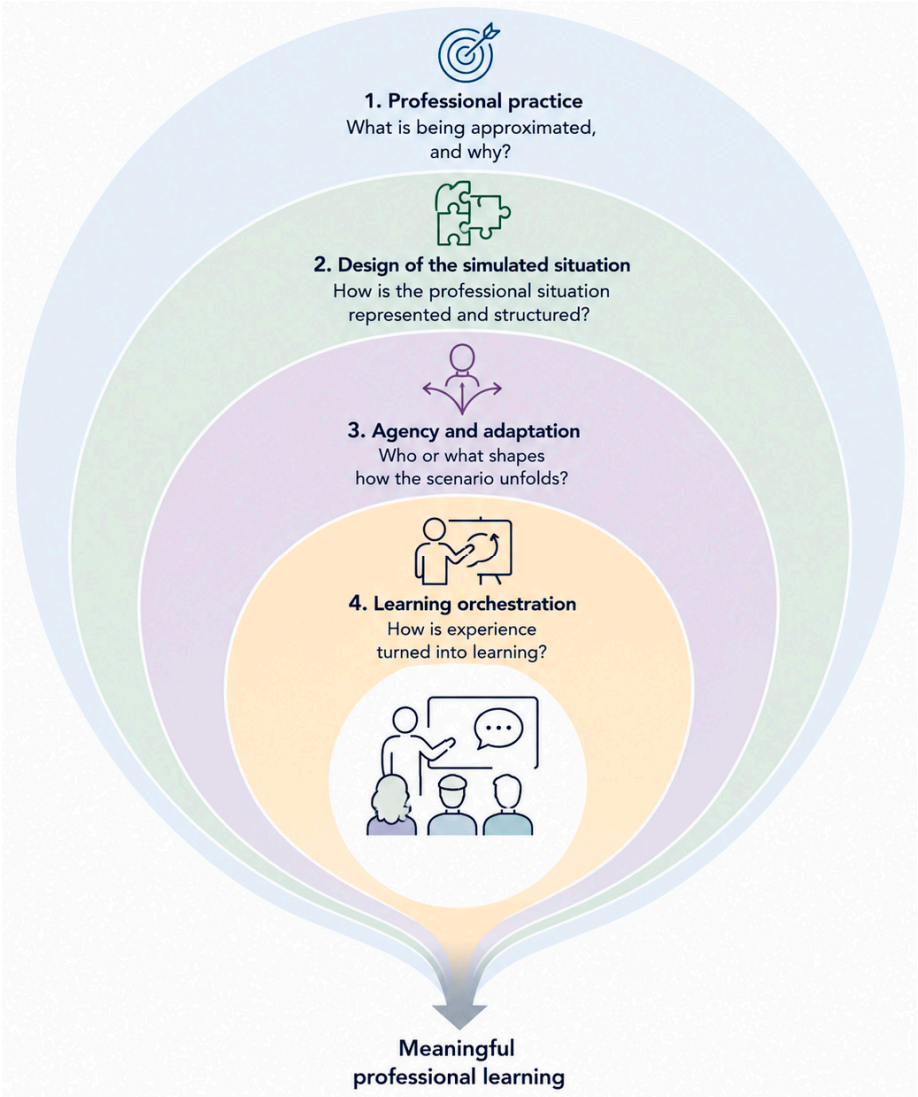


Figure 1. A Nested Framework of Pedagogical Alignment in Classroom Simulations.

Importantly, the four layers should not be understood as novel constructs in themselves. Each has been discussed extensively within different strands of simulation, teacher education, and learning-design research (Fanning & Gaba, 2007). The contribution of the framework lies in conceptualising these dimensions as an interconnected system rather than as separate features of simulation design. By making their relationships explicit, the

framework provides a basis for comparing different forms of simulation using a shared analytical lens and for understanding how design decisions made at one layer influence possibilities and constraints at another.

The analysis begins with professional practice, as it establishes the purpose from which all subsequent design decisions follow.

Although the four layers are closely related, they fulfil different explanatory functions and therefore operate as analytically distinct dimensions rather than overlapping categories. Professional Practice addresses the question of what aspect of professional work is being represented and learned. Scenario Design concerns how that practice is translated into a simulated environment through tasks, roles, contexts, and representations. Agency and Adaptation address who or what drives interaction within the simulation, including the extent to which responses are scripted, human-mediated, or dynamically generated. Learning Orchestration focuses on how learning is supported, including facilitation, scaffolding, reflection, feedback, and debriefing processes. While decisions made at one layer influence possibilities at other layers, each layer contributes a distinct explanatory lens and cannot be reduced to the others. Together, they provide a comprehensive description of simulation architecture while remaining conceptually separable for analytical purposes.

A useful way to distinguish the layers is to recognise that they address four different questions. Professional Practice asks *what is being practised*; Scenario Design asks *how that practice is represented*; Agency and Adaptation ask *who or what shapes the interaction*; and Learning Orchestration asks *how learning from the experience is facilitated*. This distinction helps avoid conceptual overlap while highlighting the interdependence of the layers within a complete simulation system.

When applied to social-emotional and inclusive teacher education, the four layers operate as mechanisms through which professional competencies can be developed. Professional Practice determines which social-emotional and inclusive challenges are represented, such as responding to learner diversity, managing conflict, or addressing exclusion. Scenario Design shapes how these challenges are experienced by participants. Agency and Adaptation influence the extent to which interactions respond dynamically to participants' decisions, creating opportunities to exercise empathy, judgement, and emotional regulation. Learning Orchestration supports meaning making through facilitation, feedback, reflection, and debriefing. Together, these layers provide a structured explanation of how simulation experiences may contribute to the development of inclusive and socially responsive professional practice.

3.1. Layer 1: Professional Practice

The first layer concerns what part of teaching is being approximated and why it matters. Possible targets include explaining content, eliciting student thinking, noticing misconceptions, managing group interaction, responding to behaviour, conducting a parent conference, collaborating with colleagues, or creating an inclusive response to a student's needs. These practices combine different forms of knowledge and skill, and they place different demands on cognition, emotion, communication, and professional judgment (Blömeke et al., 2015; Jennings & Greenberg, 2009).

Starting with professional practice prevents technology from determining the learning goal. If the purpose is to practice a difficult conversation with a parent, open dialogue, perspective-taking, and emotional responsiveness may be essential, whereas a visually detailed classroom is not (Levin, 2024a). If the purpose is to notice subtle participation patterns across a group, the distribution of attention and the salience of information may be central. If the purpose is to practice inclusive instructional adaptation, the simulation must make students' thinking and needs visible without reducing them to diagnostic labels.

This layer also specifies the intended level of approximation. Some simulations isolate a single teaching move so that it can be repeated deliberately. Others represent extended, ill-structured situations in which multiple goals and values must be balanced (Grossman et al., 2009; Machts et al., 2024). Neither is intrinsically superior. The appropriate level of complexity depends on the learner's prior knowledge, the stage of professional development, and the intended transfer to practice (Chernikova et al., 2020, 2025).

3.2. Layer 2: Design of the Simulated Situation

The second layer concerns how the professional situation is represented. This includes the physical or digital environment, the social actors, the information available, the activities participants can perform, and the decisions the scenario requires (Machts et al., 2024). Representation may involve peer role play, professional actors, text and branching choices, prerecorded video, screen-based virtual worlds, mixed reality, immersive virtual reality, or combinations of these elements (Dieker et al., 2017; Kasperski et al., 2025; Theelen et al., 2019).

The key design issue is not which format appears most advanced, but whether its affordances correspond to the professional practice. Human-based clinical simulations can offer nuanced social responsiveness because an actor can interpret the participant's language and emotion in real time (Dotger & Chandler-Olcott, 2022). Mixed-reality simulations can combine embodied interaction with standardizable scenarios and repeated practice (Dieker et al., 2017). Intercultural virtual exchange simulations can situate professional dialogue in authentic cross-cultural collaboration and make differences in assumptions and communication visible (Angelini, 2025). Screen-based or branching environments can make decision pathways explicit and allow learners to revisit consequences. Video can slow down interaction and direct attention to professional noticing or support detailed reflection on one's own performance (Levin, 2025).

The simulated situation also has an internal logic. Designers determine which actions are possible, what information becomes available, and how the environment responds (Machts et al., 2024). A scenario can invite one predetermined correct response or sustain multiple defensible courses of action. For social-emotional and inclusive practice, excessive simplification into correct and incorrect choices is particularly risky. Complex interpersonal situations rarely have one universally appropriate response, and the meaning of an action often depends on context, relationship history, culture, and the student's interpretation (Florian & Black-Hawkins, 2011; Jennings & Greenberg, 2009). The simulation should therefore make professional reasoning visible without presenting inclusive teaching as a collection of decontextualized scripts. Layer 2 specifies the response architecture built into the simulated situation; Layer 3 specifies where control over those responses is located and how adaptation occurs within that architecture.

From an analytical perspective, this layer determines the treatment of difference within the scenario. To avoid stereotypical characterization, an inclusive scenario design must not treat learner characteristics (such as a disability or cultural background) as deterministic variables or flat caricatures. Instead, difference must be operationalized as multidimensional. For example, a scenario designed to assess inclusive competence should measure whether a teacher can differentiate between a student's linguistic background and their cognitive ability, or how they respond when a simulated student's behaviour contradicts stereotypical expectations. By designing scenarios that embed cognitive and cultural diversity into the fabric of the task, researchers can analytically examine how teachers interpret difference under pressure. Empirical evidence from inclusive classrooms underscores this need for multidimensionality; as Kasperski and Yariv (2026) demonstrated, effective clinical-pedagogical interventions require a 'structured but flexible' approach tailored

to the unique manifestations of a pupil's characteristics, rejecting universally applied or deterministic protocols.

Another example of Layer 2 design is intercultural virtual exchange role-play simulation, in which pre- and in-service teachers from different countries co-construct scenarios and enact recurring roles (e.g., tutor, parent, school leader) in synchronous online meetings (Angelini, 2023; O'Dowd, 2022). Building on work in cross-border virtual exchange, Angelini's "School of Valtance" simulation shows how such environments can embed ethically charged dilemmas (e.g., inclusion, digital ethics, parent–teacher conflict) within an authentic intercultural dialogue, thereby explicitly integrating dissonance, emotional regulation, and collective reflection (Angelini, 2026; O'Dowd & Vinagre, 2024; Werner & O'Dowd, 2025). Here, Layer 1 specifies the targeted practice (e.g., conducting a difficult conversation with parents from different cultural backgrounds), Layer 2 structures the situation through role profiles, prompts, and interactional rules, Layer 3 distributes agency between human participants and, increasingly, AI-based agents that can enact additional student or parent voices, and Layer 4 orchestrates through structured debriefing and reflective writing, for example using the Describe-Examine-Articulate Learning (DEAL) model of critical reflection (Ash & Clayton, 2009; Lederman, 1992; Rudolph et al., 2014). In such hybrid designs, AI agents can extend the range of perspectives represented, for example, by simulating additional student reactions or alternative parent personas, yet their educational value still depends on the same principles of functional fidelity, ethical representation, and human-facilitated debriefing outlined in our layered framework (Hamstra et al., 2014; Martynova et al., 2025).

3.3. Layer 3: Agency and Adaptation

The third layer concerns who or what determines how the scenario unfolds. In peer or actor-based simulations, human participants interpret the scenario and generate responses. In mixed-reality environments, a human operator may control one or more avatars, sometimes referred to as a human-in-the-loop or Wizard-of-Oz design (Dieker et al., 2017). In branching scenarios, system responses are predetermined (Azukas et al., 2025). Rule-based systems select responses using programmed conditions. Generative AI systems can produce responses dynamically (Kasperski et al., 2026), while AI agents may act on the basis of roles, goals, memory, and changing internal states (Martynova et al., 2025; Yue et al., 2024). Agency should not be confused with visual representation. An avatar is the perceptible representation of an actor; the actor may be a peer, a trained simulation specialist, a script, a rule-based model, or an AI agent (Yue et al., 2024). This distinction matters because two visually identical virtual students may offer fundamentally different interactions. One may deliver fixed statements, another may be performed by a human operator, and a third may generate dialogue based on an agent profile and the history of the encounter (Martynova et al., 2025). Crucially, the distribution of agency among simulated participants is a defining feature of an inclusive simulation. If agency resides exclusively with the teacher while simulated students with diverse needs act merely as passive subjects waiting to be 'managed' or 'included,' the simulation reproduces hierarchical power dynamics. In an analytically robust inclusive simulation, marginalized or neurodivergent simulated characters must possess interactional agency—the capacity to push back, question the teacher's assumptions, or shape the direction of the dialogue. Measuring how a prospective teacher responds when a simulated student with a disability exercises self-advocacy provides a concrete analytical indicator of inclusive professional competence. This aligns with recent clinical-pedagogical findings indicating that successful inclusive interventions rely on empowering pupils with diverse needs to actively participate in open dialogue and problem-solving, rather than treating them as passive subjects of teacher management (Kasperski & Yariv, 2026).

Beyond identifying the source of control, agency also concerns the capacity to interpret the participant's actions and adapt the encounter in relation to both the internal logic of the represented role and the pedagogical purpose of the simulation. Research on professional actors shows that such adaptation occurs through reflection-in-action: actors work within a structured scenario while continuously calibrating their responses to the participant, the character they portray, and the intended learning goals (Levin & Muchnik-Rozanov, 2023). This illustrates that standardization and adaptation are not opposites. A simulation may preserve a common scenario while allowing contingent responses within pedagogically defined boundaries. The same distinction is critical in AI-supported simulations, where fluent or variable responses should not automatically be equated with pedagogically meaningful adaptation. The relevant question is not only whether the response changes, but what information guides that change, toward whose goals, and under what form of human oversight.

Adaptation can also occur at several levels. The represented student may adapt behavior within the interaction. The system may adjust scenario complexity or select a different task. Instructional support may be adapted by offering prompts, examples, or reflection questions. Feedback and debriefing may be personalized to observed performance. Chernikova et al. (2025) distinguish adaptivity, in which a computer system makes adjustment decisions, from adaptability, in which learners make choices about their own support or task progression. Their meta-analysis suggests that the location of control matters: computer-controlled adaptivity appears particularly promising for scaffolding, whereas learner-controlled adaptability may be beneficial for task progression. This cautions against treating full automation as the ideal. The most educationally appropriate distribution of control may differ across phases of learning.

3.4. Layer 4: Learning Orchestration

The fourth layer concerns how experience is turned into learning. It includes preparation, facilitation, observation, scaffolding, feedback, repetition, video use, and debriefing. Research on simulation-based learning consistently indicates that experience alone is insufficient. Learners need support to direct attention, interpret what occurred, connect experience to theory, and formulate alternatives (Cheng et al., 2014; Levin, 2025).

Learning orchestration should therefore be understood as the coordination of mediation across roles, phases, and tools. Research in clinical simulation-based learning shows that mediation is distributed: professional actors shape the interaction and create consequential learning moments, facilitators organize their subsequent interpretation, peers broaden the range of perspectives considered, and video anchors reflection in observable evidence (Levin & Flavian, 2022; Levin et al., 2026). The educational potential of any one component depends on whether it is taken up by the others. A powerful interaction may remain pedagogically underdeveloped if it is not connected to the learning focus during debriefing, while feedback or reflection may become fragmented when detached from what unfolded during enactment. From this perspective, orchestration is the process through which distributed contributions are aligned into a coherent learning trajectory. This proposition offers a basis for examining how human and technological mediators are coordinated throughout the simulation-based learning process.

The required support depends partly on prior knowledge. In the meta-analysis by Chernikova et al. (2020), learners with lower prior knowledge benefited more from examples, whereas learners with higher prior knowledge benefited more from reflection phases. For novice teachers, an open and emotionally intense scenario without sufficient preparation may overload rather than educate. More experienced teachers may learn less from

highly constrained choices and more from ambiguity, self-explanation, and comparison of alternatives.

Debriefing is especially central in simulations of social and emotional practice. It can help participants reconstruct how they perceived the situation, identify the assumptions that informed their actions, consider how the represented other may have experienced the interaction, and connect individual decisions to broader questions of inclusion, power, and professional responsibility (Cheng et al., 2014). Actor feedback can add the perspective of the person with whom the participant interacted, while peer dialogue can reveal multiple interpretations. Video can support close examination of language, timing, gaze, posture, and turning points, although being recorded can also increase vulnerability or anxiety (Levin, 2025).

Learning orchestration must therefore include emotional as well as cognitive scaffolding. Simulations can productively unsettle habitual thinking, but discomfort is not automatically transformative. Levin et al. (2025) show that anxiety and fear can function as hindrances within simulation-based learning while also mediating learning processes. Angelini (2026) similarly conceptualizes simulation as a scaffolded emotional trajectory in which dissonance can support unlearning when it is accompanied by emotion regulation, reflective reappraisal, and structured containment. The design challenge is not to eliminate all discomfort, but to create a psychologically safe environment in which uncertainty can be examined without humiliation or harm.

Beyond emotion regulation, many classroom simulations implicitly foster metacognitive awareness and regulation, yet these processes are rarely named explicitly (Levin, 2024b; McWilliam, 2008). In our own work with pre-service teachers, we have observed how structured debriefings and tools such as the DEAL model support not only retrospective reflection but also prospective planning and in-the-moment monitoring of one's own thinking and emotional reactions (Lederman, 1992; Rudolph et al., 2014). Angelini's four-phase model of disruption, regulation, reframing, and integration demonstrates how learners move from affective activation to increasingly intentional forms of self-observation and strategy use, treating discomfort as a cue to pause, re-interpret the situation, and experiment with alternative responses (Angelini, 2026). Framed in terms of metacognitive knowledge and regulation, simulations become spaces where future teachers learn to notice what they are attending to, how they are interpreting events, and which strategies they deploy under pressure, thereby strengthening the intrapersonal dimension of simulation-based learning alongside its cognitive and interpersonal effects (Angelini, 2023; Levin et al., 2025).

3.5. Theoretical Propositions Emerging from the Four-Layer Framework

While the four-layer framework is intended primarily as an analytical tool for understanding classroom simulations, it also generates a set of theoretical propositions concerning how different configurations of simulation design may influence professional learning. These propositions do not constitute empirical findings. Rather, they are theoretically derived expectations that synthesize existing research on simulation-based learning, teacher professional competence, social-emotional learning, and learning design. Their purpose is to provide a foundation for future empirical investigation.

Proposition 1. *Learning potential increases when the four layers are pedagogically aligned.*

The educational value of a classroom simulation is expected to depend not on any single feature, such as technological sophistication or immersion, but on the coherence among professional practice, scenario design, agency and adaptation, and learning orchestration. We explicitly define alignment as the functional integration and pedagogical consistency across these four dimensions. Operationally, alignment is a measurable characteristic

identified when the cognitive and emotional demands embedded in the scenario (Layer 2) and the interactional agency granted to actors (Layer 3) directly correspond to the targeted professional practice (Layer 1) and are systematically scaffolded in the debriefing protocol (Layer 4). Alignment across layers should increase the likelihood that participants engage in professional reasoning that is consistent with the intended learning goals, whereas misalignment may constrain learning even when individual layers appear well designed.

Proposition 2. *Agency and adaptation influence learning through the quality of professional interaction rather than through technological complexity alone.*

Increasing responsiveness and adaptation may create richer opportunities for professional decision-making, perspective-taking, and social-emotional engagement. However, learning benefits are expected to depend on whether adaptation remains pedagogically meaningful and professionally credible. Adaptation that lacks functional validity may increase interactional complexity without improving professional learning.

Proposition 3. *Learning orchestration mediates the relationship between simulation experiences and professional learning.*

Experiencing a simulation is unlikely to be sufficient for developing complex professional competencies. Learning is expected to occur through processes of preparation, scaffolding, feedback, reflection, and debriefing that help participants interpret and reconstruct the experience. Consequently, the effects of simulation design on learning are expected to be mediated by the quality of learning orchestration.

Proposition 4. *Functional fidelity moderates the relationship between simulation design and professional competence development.*

The extent to which participants perceive a simulation as relevant to professional practice is expected to depend primarily on functional rather than physical fidelity. Simulations that preserve meaningful relationships among perception, interpretation, action, and consequence should be more likely to support transferable professional learning than simulations that prioritize visual realism without maintaining professional authenticity.

Proposition 5. *Social-emotional and inclusive learning emerge from the interaction of all four layers rather than from participation in simulation alone.*

The framework proposes that opportunities for developing capacities such as empathy, emotional regulation, perspective-taking, and inclusive judgment arise when targeted professional challenges are represented through appropriate scenarios, enacted through meaningful interaction, and interpreted through structured reflection. These outcomes should therefore be understood as theoretically expected consequences of aligned simulation designs rather than automatic products of simulation participation.

4. How Classroom Simulations Support Social-Emotional and Inclusive Competence

Having specified how classroom simulations are pedagogically configured, we now turn to the forms of professional learning that such configurations may support. We first examine these through cognitive, interpersonal, and intrapersonal dimensions, and then consider their relevance to teachers' social-emotional and inclusive competence.

4.1. Learning in Cognitive, Interpersonal, and Intrapersonal Dimensions

The professional learning enabled by classroom simulations cannot be reduced to observable performance during enactment. Levin (2024a) identifies cognitive, interpersonal, and intrapersonal dimensions of deep learning in simulation-based learning. These dimensions provide a useful lens for explaining the relevance of simulations to teachers' social-emotional competence.

Each of the four layers of simulation design contributes differently to the development of teachers' social-emotional competence. Layer 1 defines which social-emotional competencies are targeted; Layer 2 shapes the situations in which those competencies become visible; Layer 3 determines how social and emotional interactions unfold through agency and responsiveness; and Layer 4 supports the reflection and meaning-making necessary for durable social–emotional learning. Social-emotional outcomes therefore emerge not from scenario participation alone but from alignment across all four layers.

The cognitive dimension involves interpreting information, applying knowledge, comparing possible actions, and understanding consequences (Blömeke et al., 2015; Levin, 2024b). In a classroom simulation, teachers may need to distinguish disengagement from lack of understanding, interpret a student's response in context, or revise an instructional plan as new information emerges. Simulations can expose gaps between what teachers know in principle and what they notice or use under pressure (Machts et al., 2024; van Es & Sherin, 2002).

The interpersonal dimension involves listening, dialogue, coordination, empathy, and responsiveness to others. It is central to interactions with students, parents, colleagues, and other professionals. Simulation makes interpersonal action visible and consequential. Participants cannot rely only on stating what a teacher should do; they must phrase a response, manage timing, respond to emotion, and sustain a relationship as the interaction evolves. Actor-based simulations and virtual exchange approaches are particularly well suited in this regard because meaning is negotiated with another person rather than selected from a fixed menu (Angelini, 2025).

The intrapersonal dimension includes self-awareness, emotion regulation, professional identity, values, and the capacity to reflect on one's own assumptions (Angelini, 2026; Levin, 2024b). Classroom situations can evoke frustration, defensiveness, uncertainty, or fear of losing control. In a well-designed simulation, these responses become material for learning. Participants can examine not only whether a strategy worked, but why a situation affected them, which expectations they brought into the encounter, and how their reactions shaped the other person's opportunities to participate (Angelini, 2026; Levin et al., 2025). Angelini's (2026) longitudinal study of "The School of Valtance" illustrates how simulation can support intrapersonal learning through an iterative process of unlearning. Emotional arousal, reflective regulation, and dialogic reconstruction are deliberately scaffolded so that dissonance challenges established professional scripts without overwhelming psychological safety. Structured debriefing then helps teachers recognize affective thresholds, regulate their responses, and articulate alternative ways of acting (Angelini, 2023, 2026; Crookall, 2010; King & Kitchener, 2004; Nolan & Molla, 2018; Rudolph et al., 2014).

These three dimensions are intertwined. A teacher's interpretation of behaviour influences emotion; emotion influences communication; communication changes the social situation and creates new information. Classroom simulations are valuable precisely because they can preserve these reciprocal relations while maintaining enough design control to support focused practice.

4.2. From SEL Frameworks to Teacher Social-Emotional Competence

Drawing on SEL as a framework, teacher social-emotional competence can be understood as an integrated set of professional capabilities for navigating the interpersonal, emotional, and ethical demands of inclusive teaching (Table 2). Consistent with the framework developed by the Collaborative for Academic, Social, and Emotional Learning (CASEL, 2023), these capabilities include self-awareness, self-management, social awareness, relationship skills, and responsible decision-making. Rather than operating independently, they interact dynamically as teachers interpret classroom events, regulate their emotions, communicate with students and families (Swidrak et al., 2025), and make instructional and relational decisions. Simulation-based learning offers a promising context for developing these capabilities because it enables teachers to rehearse authentic professional situations while receiving feedback and engaging in structured reflection (Hemi, 2025).

Table 2. Mapping Teacher Social-Emotional Competencies to Classroom Simulation Experiences.

Social-Emotional Competence	Example Simulation Experience
Self-awareness	Reflecting on emotional triggers during a parent conference
Self-management	Responding calmly to escalating student behavior
Social awareness	Interpreting diverse student perspectives and experiences
Relationship skills	Building trust and rapport with families, students, and colleagues
Responsible decision-making	Balancing individual accommodations with broader classroom needs

Note. Adapted from the CASEL framework for application within simulation-based teacher education contexts (CASEL, 2023).

As shown in Table 2, classroom simulations can create targeted opportunities to rehearse each dimension of teacher social-emotional competence within realistic professional contexts. Self-awareness is fostered when teachers examine how their beliefs, assumptions, and emotional reactions influence professional judgment. Self-management is strengthened through opportunities to practice regulating emotions and maintaining composure during challenging interactions. Social awareness develops as participants engage with diverse perspectives, cultural backgrounds, and learner experiences that may differ from their own. Relationship skills are reinforced through repeated interactions that require active listening, empathy, collaboration, and effective communication. Finally, responsible decision-making is cultivated through complex scenarios that require teachers to evaluate competing priorities, consider multiple stakeholder perspectives, and anticipate the consequences of their actions. Simulations create conditions for developing responsible decision-making skills, as they require students to make choices, justify those choices, and reflect on the consequences of their actions (Ferry et al., 2005; Görücü et al., 2024).

Importantly, these competencies rarely function in isolation during authentic teaching practice (Kasperski & Hemi, 2026). A teacher's emotional reaction can influence how a student's behaviour is interpreted, which subsequently shapes communication and decision-making. Classroom simulations are valuable because they preserve these interrelationships while providing a structured environment in which participants can pause, reflect, receive feedback, and rehearse alternative responses. In this way, simulations serve not only as opportunities to practice discrete social-emotional competencies but also as spaces

for developing the integrated professional judgment required for inclusive and socially responsive teaching.

Kasperski et al. (2025) found that simulation-based learning has been used to develop a range of teachers' social-emotional competencies, while also identifying inconsistencies in terminology and categorization. A more intentional connection between simulation design and these competencies is therefore needed. A more intentional connection between simulation design and teacher SEL is therefore needed. A classroom-management scenario, for instance, should not be evaluated only by whether the teacher stops disruptive behaviour. It may also reveal whether the teacher recognizes their own escalation, interprets the student's perspective, communicates respect, protects the group's learning, and makes a proportionate decision. Similarly, an inclusive parent conference involves not only conveying information but listening, acknowledging emotion, negotiating expertise, and sustaining trust (Levin, 2024a).

Simulation can support these competencies through repeated cycles of enactment and reflection (Kasperski et al., 2025). Evidence from an adjacent professional-learning context similarly suggests that repeated simulation cycles can contribute to perceived growth in communication and professional competence (Torrijos-Martí, 2026). Teachers can try an approach, receive a response, reconsider their interpretation, and enact an alternative. This iterative structure makes social-emotional competence observable and discussable without suggesting that it can be mastered through one successful performance. It also permits attention to how competence changes across contexts, because professional competence develops along a continuum and becomes visible through situation-specific interpretation and performance (Blömeke et al., 2015). A communication strategy that supports one student may be ineffective or harmful for another.

4.3. Inclusion, Diversity, and the Risk of Simulation

To address inclusion not merely as a normative aspiration but as an analytical construct within simulation-based learning, it is necessary to define what constitutes an inclusive simulation. Operationally, an inclusive simulation is an environment designed to make the negotiation of equity and difference observable and measurable. It can be identified by three analytical criteria: (1) representation of diversity that embeds intersectional learner characteristics within complex social contexts rather than reducing them to diagnostic labels; (2) a distribution of agency that endows simulated marginalized learners with the capacity to initiate, resist, and negotiate meaning, preventing them from becoming passive recipients of teacher interventions; and (3) an interactional architecture that requires prospective teachers to actively confront, rather than merely observe, issues of inequity, bias, and power dynamics in real-time.

Classroom simulations are particularly promising for inclusive teacher education because they can provide access to situations that student teachers may not encounter consistently during placements, including situations involving learners with diverse abilities and support needs (Kaufman & Ireland, 2019; Kasperski et al., 2025; Siker, 2023). Scenarios can foreground participation barriers, cultural misunderstandings, communication differences, special educational needs, or tensions around identity and belonging. Intercultural virtual exchange can expose teachers to perspectives and educational realities beyond their immediate context and support critical reflection on assumptions that otherwise remain implicit (Angelini, 2025).

In special education contexts, developing social-emotional competencies goes beyond the classroom and may include conducting IEP meetings, collaborating with paraeducators and related service providers, supporting students who use augmentative and alternative communication systems, implementing accommodations and modifications, and

engaging in difficult conversations with families regarding progress, placement, or behavioural support.

However, representation creates ethical responsibilities. AI systems have historically underrepresented disability experiences, creating additional challenges when generating simulations involving learners with disabilities and complex support needs. Simulated students are designed representations, not neutral reproductions of real children. When a disability, cultural background, language profile, or behavioural pattern is reduced to a small set of visible traits, the simulation may reproduce stereotypes or deficit perspectives, contrary to the inclusive-pedagogy principle of responding to learner difference without marking some learners as categorically separate (Florian & Black-Hawkins, 2011). This risk may increase when generative AI draws on patterns embedded in large, opaque datasets. A fluent AI-generated response may appear authentic while relying on associations that are inaccurate, culturally narrow, or stigmatizing; emerging evaluations already identify authenticity, emotional, linguistic, and consistency problems in LLM-simulated learners (Martynova et al., 2025).

Inclusive simulation design should therefore involve people with relevant lived and professional experience, make diversity multidimensional rather than diagnostic, and avoid treating a student profile as a deterministic script. Designers should clarify what a scenario can and cannot represent with input from members of the community being portrayed. They should also examine whose perspective defines successful performance. A response judged effective because it quickly restores order may silence a student or leave the source of exclusion unaddressed. Debriefing should create room to examine these tensions rather than merely confirming the intended solution.

Ultimately, integrating inclusion into this four-layer theoretical model transforms it from an overarching value into an assessable mechanism. By tracking how a simulation is designed (Layer 2), how agency is distributed (Layer 3), and how dissonance is debriefed (Layer 4), researchers can evaluate the extent to which the simulation forces prospective teachers to confront inequity. An analytically sound inclusive simulation does not allow the teacher to act as a detached observer of diversity; it implicates them in the interaction, requiring them to make consequential decisions that either mitigate or perpetuate exclusion. This operational clarity allows future empirical studies to measure specific changes in teachers' inclusive practices, moving the field from designing simulations *about* diverse students to designing authentically inclusive simulation architectures. This operational clarity allows future empirical studies to measure specific changes in teachers' inclusive practices—particularly the development of an active 'clinical-pedagogical mindset' (Kasperski & Yariv, 2026)—moving the field from designing simulations about diverse students to designing authentically inclusive simulation architectures.

5. From Scripted Scenarios to Agentic Classroom Simulations

Viewed through the four-layer framework, generative AI does not constitute a new simulation category. Rather, it can reshape the simulated situation, redistribute agency and adaptation, and participate in learning orchestration, while professional practice remains the pedagogical point of departure. These developments are directly relevant to social-emotional and inclusive competence because learning depends on whether simulated actors respond credibly to teachers' relational and emotional decisions. The four-layer framework helps specify where AI changes these learning conditions and where human judgment and oversight remain essential.

5.1. What Changes with Generative AI?

Artificial intelligence has been present in educational simulations in different forms for decades, including learner models, rule-based systems, intelligent tutoring, and automated feedback (Chernikova et al., 2025). Generative AI changes the design space because it can produce context-sensitive language and behaviour without every response being written in advance. Large language models can be prompted or configured to enact student personas, generate questions and misconceptions, remember previous turns, and respond to a teacher's language. Multi-agent systems can represent several students who interact with the teacher and with one another. Emerging work illustrates the feasibility of LLM-enabled classroom environments and simulated learners, while also showing that behavioural and educational validity remain unresolved (Martynova et al., 2025; Yue et al., 2024). Recent cross-cultural pilot work has also begun to examine how multilingual GenAI simulations can support social-emotional learning in teacher education across different linguistic and national contexts (Kasperski et al., 2026).

The central change is therefore not simply that dialogue becomes more natural. Generative systems redistribute authorship and control, shifting pedagogical responsibility among the teacher educator, the prospective teacher, and the computational system. In a scripted simulation, designers specify the available paths before use. In an agentic simulation, designers specify goals, constraints, knowledge, profiles, memories, and decision policies, while the exact interaction emerges during use (Yue et al., 2024). This potentially expands variability and responsiveness but also reduces predictability; logical inconsistency, unnatural attentiveness, and weak emotional authenticity have already been observed in simulated LLM learners (Martynova et al., 2025). The design problem shifts from writing every line to governing a space of possible behaviours, which requires strict attention to algorithmic bias to ensure AI does not perpetuate structural inequities under the guise of technological neutrality.

5.2. Three Roles for AI Agents

Building on the different functions already assigned to AI in personalized simulation environments and emerging agentic classrooms, it is useful to distinguish at least three agent roles within classroom simulation-based learning (Yue et al., 2024).

Simulated social agents enact students, parents, colleagues, or other actors within the professional situation. Their purpose is to generate behaviour to which the teacher must respond. A simulated student agent might be defined through prior knowledge, misconceptions, participation patterns, emotional state, social relationships, and goals. In a multi-agent classroom, different student agents may influence one another and produce group dynamics rather than independent teacher-student dialogues (Zhang et al., 2026).

Coaching agents support the learner before or after enactment, helping set practice goals prior to simulation (Zagami, 2025) or asking participants to explain decisions and guide post-hoc diagnostic reflection (Bauer et al., 2024, 2025). Crucially, a coaching agent should not be confused with the simulated student: blurring these roles risks role confusion and disrupts the authenticity and perspective integrity of the professional encounter (Lindberg, 2025; Zhuang & Zhang, 2025).

Orchestration agents manage the learning environment. They may select scenarios, adjust complexity, provide scaffolds, determine when to pause, or recommend repetition based on performance and learner preferences. These agents operate at the boundary between simulation design and instructional design. Their adaptive decisions may affect which professional experiences learners receive and how their performance is interpreted, making transparency, explainability, and educator oversight essential to prevent the AI

from usurping the human educator's pedagogical responsibility or subjecting learners to opaque computational judgments.

Separating these roles clarifies both possibilities and risks. A system may use AI to generate student dialogue while leaving debriefing to a human facilitator. Another may retain actor-based enactment but use AI to retrieve video segments for reflection. A third may use scripted scenarios but personalize task progression. "AI-supported simulation" is therefore not a single format; AI can occupy different functional positions in the learning process (Martynova et al., 2025).

5.3. Multimodal and Adaptive Behaviour

Future classroom simulations may combine generative dialogue with information from voice, gaze, movement, posture, or interaction patterns. These signals could allow simulated students to respond not only to what a teacher says but to how the interaction unfolds. For example, a system might register that the teacher repeatedly addresses the same students, increases speaking speed, provides little wait time, or moves closer to a student. Such information could change agent behaviour or become part of a debriefing. Multimodal information may thus extend existing uses of video and behavioural observation in simulation-based reflection (Dieker et al., 2017; Levin, 2025).

These possibilities should be approached cautiously. First, the meaning of nonverbal behaviour is context-dependent and cannot be inferred reliably from a single signal. Movement toward a student may communicate availability in one situation and threat in another. Second, automated affect recognition remains contested, especially when systems infer internal states from facial or physiological data; facial movements do not map consistently onto specific emotions across people and contexts (Barrett et al., 2019). Third, extensive measurement can undermine psychological safety and create the impression that professional competence is reducible to a behavioural score, even though competence involves interacting dispositions, situation-specific processes, and performance (Blömeke et al., 2015).

A more defensible approach is to use multimodal data as prompts for interpretation rather than definitive diagnoses. A system might identify a possible interaction pattern and invite the learner and facilitator to examine the corresponding video segment. Professional judgment remains part of the debriefing rather than being replaced by an opaque inference.

5.4. Personalization Without Loss of Learner Agency

AI may support personalization by adjusting scenarios and scaffolding to prior knowledge, performance, goals, or preferences (Chernikova et al., 2025). A novice might begin with a short interaction involving one clearly signalled issue and receive an example before practice. A more experienced teacher might encounter several plausible interpretations, competing goals, and incomplete information, consistent with findings that learners at different levels of prior knowledge benefit from different forms of instructional support. Repeated scenarios could vary the social context while holding the targeted practice constant.

Personalization nevertheless raises several questions. Which learner characteristics are pedagogically relevant? Who decides the desired level of challenge? Can participants see and contest the model on which adaptation is based? Does adaptation expand learning opportunities or confine learners to a profile inferred from limited data? Chernikova et al.'s (2025) distinction between adaptivity and adaptability suggests the value of mixed control. A system may recommend a scenario or scaffold, while the learner and teacher educator retain the ability to choose, decline, or reinterpret it.

6. Design Principles and Ethical Boundaries

The following principles translate the four-layer framework into design criteria, while treating safety, validity, privacy, and inclusion as cross-layer responsibilities.

6.1. Begin with Professional and Social-Emotional Goals

The selection of technology, agents, and data should follow from the professional practice to be learned. Designers should specify which cognitive, interpersonal, and intrapersonal processes are targeted and why simulation is appropriate for them. Novelty, immersion, or automation are not learning goals.

6.2. Prioritize Functional Fidelity

The simulation should preserve the relationships among perception, action, response, and consequence that define the professional situation. Physical realism should be added only when it supports these functions. A less visually realistic but socially responsive simulation may offer the stronger approximation of practice (Hamstra et al., 2014; Kasperski et al., 2025).

6.3. Design Productive Challenge Without Causing Harm

Emotion and discomfort can support reflection, unlearning, and professional identity development, but only within a psychologically safe learning process (Angelini, 2026; Levin, 2026; Levin et al., 2025). Participants need clear expectations, a fiction contract, appropriate choice, skilled facilitation, and opportunities to pause or withdraw. Pre-simulation briefing is central to establishing a "safe container" in which learners can expose uncertainty and engage with feedback without fear of humiliation (Rudolph et al., 2014). Challenge should be calibrated and followed by structured reflection.

Seen through this lens, design decisions about "how much discomfort" are inseparable from unlearning: simulations that remain affectively flat may never trigger the disruption needed for teachers to question entrenched assumptions, while uncontained intensity risks closing reflection down (Fleming, 2018; Kitchenham, 2008; Mezirow, 2000, 2003). Angelini's notion of simulations as scaffolded emotional trajectories suggests that psychological safety, clear briefing, and paced debriefing are not peripheral considerations but core design variables for cultivating unlearning as an intended outcome of classroom simulations (Angelini, 2026).

6.4. Ground and Validate Simulated Behaviour

AI agents should not be judged only by fluency or participants' sense of presence. Their behaviour must be examined for functional, pedagogical, psychological, and cultural validity. Studies of LLM-simulated learners show that conversational plausibility can coexist with logical inconsistency, implausible attentiveness, and insufficient emotional or linguistic realism (Martynova et al., 2025). Validation should therefore include comparison with relevant practice data, expert judgment, input from intended users and represented communities, and systematic testing for stereotypes and harmful behaviour.

6.5. Make Adaptation and Agency Transparent

Learners and teacher educators should understand what information influences an adaptive decision and what aspects of the simulation are controlled by people, scripts, or AI. They should be able to question recommendations and override inappropriate adaptations. Because the balance between system-controlled adaptivity and learner-controlled adaptability affects learning differently, control should be treated as an explicit pedagogical decision.

Human-in-the-loop designs should be viewed as a principled distribution of expertise and responsibility, not merely as an intermediate stage on the path to automation.

6.6. Keep Reflection and Debriefing Central

Automated feedback may point to patterns, retrieve evidence, or generate questions, but debriefing should remain a process of professional meaning-making. Debriefing is a core mechanism through which simulation experience is reviewed, interpreted, and connected to future action (Cheng et al., 2014). Especially in inclusive and emotionally complex situations, the goal is not simply to identify the correct response but to explore interpretations, consequences, values, and alternatives. Human facilitation may be indispensable where vulnerability, identity, conflict, or ethical judgment is central (Angelini, 2026; Rudolph et al., 2014). In addition, reflection might be individual or done in small groups to allow participants more privacy and allow for more vulnerable self-assessment and feedback. Expert facilitation is crucial regardless of the modality of debriefing.

6.7. Protect Privacy and Limit Unnecessary Inference

Data collection should be proportionate to the learning purpose. Biometric or behavioural data should not be collected merely because they are technically available. Participants need meaningful information about what is recorded, how it is interpreted, and who can access it. Systems should avoid unsupported inference about emotion, personality, disability, or competence.

6.8. Design Diversity Without Stereotyping

Represented students should have multidimensional identities, variable responses, and contextualized needs. Designers should avoid deterministic links between background characteristics and behavior. Scenarios and agent profiles should be reviewed with relevant communities and should make space for examining structural and relational dimensions of inclusion, not only individual deficits (Florian & Black-Hawkins, 2011; Martynova et al., 2025).

7. A Research Agenda

The four-layer framework also generates a research agenda for examining how different configurations, and particularly misalignments across layers, shape learning, inclusion, and transfer to practice. The development of AI-supported classroom simulations makes this agenda especially urgent. First, the field needs stronger construct and behavioural validation. Empirically, researchers can assess alignment by measuring the congruence between the intended social-emotional goals (Layer 1), the interactional pathways participants actually utilize during enactment (Layers 2 and 3), and the extent to which debriefing transcripts (Layer 4) explicitly connect those enacted decisions back to the targeted professional competence. To what extent do simulated students display the misconceptions, interaction patterns, emotions, and variability that the learning goal requires? When do participants' perceptions of realism correspond to functional validity, and when are they primarily responses to linguistic fluency or visual presence? Comparisons should move beyond "AI versus no AI" and specify whether AI functions as a simulated student, scenario author, coach, assessor, or orchestrator. Hybrid configurations may be especially valuable. Human actors or facilitators could manage emotionally sensitive turning points while AI supports variation, preparation, or repetition.

Second, the field needs design studies on multi-agent classroom dynamics. Most interpersonal simulations focus on one teacher and one represented student or adult. Classrooms involve peer influence, shifting attention, group norms, and simultaneous demands. Multi-agent systems may make these dynamics more feasible to represent, but researchers

must establish whether emergent behaviour is controllable, interpretable, and educationally meaningful.

Third, research should investigate how adaptivity and adaptability interact with learner development. The optimal balance of system and learner control may change with prior knowledge, self-regulation, and the nature of the targeted competence. Studies should examine not only performance gains but learner agency, trust, emotional safety, and transfer to authentic practice.

Fourth, social-emotional and inclusive outcomes require more precise conceptualization and measurement (Levin, 2024b). Self-efficacy or satisfaction alone cannot demonstrate that teachers have developed empathy, emotion regulation, inclusive judgment, or relationship skills. Scenario-based assessment, observation, stimulated recall, reflection, and practice-based transfer measures may need to be combined. Outcome measures should also examine unintended effects, including anxiety, overconfidence, stereotyping, and reliance on automated feedback.

Finally, the field needs participatory and cross-cultural research. What counts as appropriate teacher behaviour differs across educational, cultural, and institutional contexts. International collaboration can help distinguish general design principles from local professional norms. Teachers, students, parents, people with disabilities, and minoritized communities should participate in the design and evaluation of scenarios that represent their experiences. Future studies should also investigate whether simulations improve teachers' preparedness for disability-related decision making, family partnerships, inclusive instructional planning, and collaborative problem solving in authentic school settings.

Limitations of the Proposed Framework

While the four-layer framework provides a structured analytical lens for examining classroom simulations, several limitations must be acknowledged. First, although the layers are conceptually distinct, in practice there may be functional overlaps between them; for instance, the boundaries between dynamic agency (Layer 3) and adaptive orchestration (Layer 4) can blur in highly automated AI environments. Second, the framework synthesizes literature predominantly grounded in Western educational contexts. Its assumptions regarding inclusive pedagogy, emotional expression, and psychological safety may not universally align with diverse cross-cultural educational traditions, necessitating careful contextual adaptation. Finally, as a conceptual proposition, the framework's analytical utility has not yet been empirically examined. Future empirical studies are required to validate whether applying this framework systematically improves the design, evaluation, and outcomes of simulation-based teacher education.

8. Conclusions

Classroom simulations have developed from peer role play and relatively simple computer scenarios into a diverse field that includes clinical simulation, virtual exchange, mixed reality, immersive environments, and emerging AI-supported and agentic systems. This development makes a technology-based definition increasingly inadequate. What unites classroom simulations is not a particular interface but a pedagogical structure: a deliberately designed approximation of professional practice in which teachers enter a professional role, interpret information, act or decide, encounter responses or consequences, and reflect on the experience.

The four layers proposed in this paper direct attention to the professional practice represented, the design of the simulated situation, the distribution of agency and adaptation, and the orchestration of learning. Together, they make it possible to analyse a classroom simula-

tion without assuming that greater immersion, automation, or complexity produces better learning. The educational value of a simulation depends on alignment across the layers.

The framework should therefore be understood not simply as a model of simulation design, but as a conceptual explanation of how simulation architectures can support the development of social-emotional and inclusive professional competence through the interaction of practice representation, scenario construction, adaptive participation, and guided reflection.

This alignment is especially important when simulations target the social and emotional demands of inclusive teaching. The framework suggests that simulations may create opportunities to practice emotion regulation, perspective-taking, communication, relationship-building, and responsible decision-making while making the assumptions underlying professional action available for reflection. Existing research provides support for such possibilities in particular simulation contexts, but the extent to which different simulation configurations contribute to these outcomes remains an important empirical question.

AI expands what classroom simulations can generate, adapt, and scale. AI agents may play the roles of students and other educational actors, coaching agents may support reflection, and orchestration agents may personalize learning trajectories. These affordances are promising, but they do not make simulations educationally sound by themselves. Their value depends on theoretically grounded and validated models of teaching and social interaction, functional fidelity, transparent distributions of control, meaningful human oversight, and careful protection of inclusion, privacy, learner agency, and emotional safety. The future of classroom simulations should therefore not be framed as a transition from human role play to autonomous AI. It is better understood as the design of responsible hybrid rehearsal spaces in which human and technological agency are deliberately combined to prepare teachers for the relational complexity of their profession.

Ultimately, the significance of classroom simulations extends beyond technological innovation. Their greatest potential lies in helping educators develop the social, emotional, and inclusive competencies necessary to support diverse learners. As schools increasingly prioritize equity, belonging, inclusion of students with disabilities, and social–emotional development, simulations offer structured opportunities to rehearse the professional judgment required to navigate these practices responsibly. The proposed framework provides a foundation for designing, evaluating, and researching such learning environments in ways that place inclusion, SEL, and human development at the centre of innovation.

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