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THE URGENCY OF TRANSITIONING FROM SOLITARY TO SOCIAL LEARNING TO CULTIVATE SOCIAL-EMOTIONAL COMPETENCIES IN PRE-SERVICE TEACHERS: A SYSTEMATIC LITERATURE REVIEW

Asri Widia Ningrum[1], Rohmani[2]
[1]Universitas Muhammadiyah Kotabumi, Indonesia
[2]Universitas Muhammadiyah Kotabumi, Indonesia
Email: asri.widia.ningrum@umko.ac.id1, rohman.orgos@gmail.com

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Abstract :

The transformation of education in the Society 5.0 era demands a paradigm shift in the teacher's role, evolving from a mere transmitter of cognitive content to a skilled facilitator with mature Social-Emotional Competencies (SEC). Although Game-Based Learning (GBL) has been widely acknowledged as effective for developing general pedagogical competencies, this study identifies a critical gap in SEC training for pre-service teachers. Through a Systematic Literature Review (SLR) guided by PRISMA protocols, 32 articles were selected from five academic databases, enabling a thorough analysis of the limitations inherent in the solitary learning paradigm and the transformative potential of collaborative multiplayer approaches. Synthesis findings reveal that solitary learning simulations, which predominantly rely on interactions with Non-Player Characters (NPCs), significantly hinder the formation of SEC due to deterministic NPC responses, off-context dialogues, and a failure to elicit dynamic empathy and emotional regulation. In contrast, the collaborative multiplayer approach offers innovative solutions by facilitating authentic peer-to-peer interactions, dynamic scaffolding, and multimodal communication tools that enhance emotion recognition and regulation. These findings provide theoretical and architectural justification for the development of next-generation pre-service teacher simulation platforms that prioritize social learning for CASEL-grounded SEC development.

Keywords : Social-Emotional Competence; Pre-Service Teachers; Game-Based Learning; Solitary Learning; Collaborative Multiplayer

INTRODUCTION

The transformation of primary education in the Society 5.0 era necessitates a fundamental paradigm shift in the teacher's profile moving beyond the role of cognitive knowledge transmitter toward that of a facilitator with well developed Social Emotional Competencies (SEC). Grounded in the Collaborative for Academic, Social, and Emotional Learning (CASEL) framework, SEC constitutes a critical foundation that enables teachers to foster positive learning environments, constructively manage disruptive student behavior, and mediate interpersonal conflicts in the classroom with empathy (Cipriano et al., 2023; Kasperski et al., 2025).

Recent longitudinal studies indicate that teachers' emotional regulation functions as a primary catalyst in determining the effectiveness of classroom conflict management and students' psychological well being (Valente et al., 2022). In practice, many pre service teachers graduating from teacher education

institutions (TEIs) report experiencing what is termed "reality shock" upon entering field placements a transition characterized by negative emotions such as anxiety and insecurity, rooted in insufficient experiential preparation for the complex, ambiguous social dynamics of real classrooms (Theelen et al., 2019; Hong et al., 2025).

To bridge the gap between theory and field practice, Game Based Learning (GBL) has been widely adopted in pre service teacher education. Digital games and simulations have demonstrated effectiveness in developing CASEL SEC components including empathy, emotional regulation, and relationship skills across various educational contexts (Mukund et al., 2022; Masry Herzallah, 2025; Sáez Delgado et al., 2025). However, GBL research trends remain largely dominated by evaluations of cognitive content mastery, with research specifically targeting the development of interpersonal and relational competence in pre service teacher education remaining limited (Theelen et al., 2019; Vedder Weiss et al., 2020).

In the domain of digital simulation for SEC, current GBL implementations exhibit a significant architectural stagnation. The majority of simulation platforms still adopt the solitary learning paradigm, in which users interact exclusively with Non Player Characters (NPCs) whose responses are deterministic, exhibit off context dialogues, and fail to replicate the authentic ambiguity and psychological pressure characteristic of real classroom environments (Domeshek et al., 2020; Lindberg & Jönsson, 2023; Lindberg, 2025). A key barrier to effective SEC integration through digital tools is the lack of standardized frameworks and specialized training for educators implementing these approaches (Sáez Delgado et al., 2025).

This limitation underscores the urgency of transitioning toward a social learning ecosystem through Collaborative Multiplayer approaches. Unlike static NPC based simulations, synchronous multiplayer environments inherently facilitate authentic peer to peer interactions, dynamic scaffolding, and richer emotional engagement through multimodal communication (Oksanen et al., 2018; Wetcho & Na Songkhla, 2022). This study addresses two central questions: To what extent do the limitations of the solitary learning paradigm in digital simulations impede the formation of Social Emotional Competencies (SEC) in pre service teachers? How can a conceptual framework for collaborative multiplayer approaches orchestrate social learning to bridge this gap and effectively develop SEC in pre service teachers?

RESEARCH METHOD

This study employs a Systematic Literature Review (SLR) approach following the Preferred Reporting Items for Systematic Reviews and Meta Analyses (PRISMA) guidelines to identify, evaluate, and synthesize empirical and conceptual evidence regarding the use of digital simulations in developing SEC among pre service teachers.

Search Strategy

Literature searches were conducted across five major academic databases: Scopus, Web of Science, ERIC, Google Scholar, and ScienceDirect. To ensure systematic and reproducible coverage, search strings were constructed using Boolean operators (AND, OR) with truncation wildcards () applied across three conceptual blocks: (1) population/setting (pre-service teacher education), (2) intervention type (GBL, digital simulation, NPC, multiplayer), and (3) outcome measures (SEC, SEL, CASEL, empathy, emotional regulation). The full TITLE-ABS-KEY query applied in Scopus was as follows:

TITLE-ABS-KEY (("pre-service teacher" OR "preservice teacher" OR "student teacher" OR "teacher education" OR "initial teacher education" OR "teacher training" OR "teacher preparation") AND ("game-based learning" OR "game based learning" OR "serious game" OR "digital simulation" OR "simulation-based learning" OR "virtual simulation" OR "multiplayer" OR "collaborative game" OR "role-playing game" OR "non-player character" OR "NPC" OR "mixed reality simulation") AND ("social-emotional" OR "social emotional" OR "SEL" OR "CASEL" OR "social-emotional competenc" OR "socio-emotional" OR "emotional regulation" OR "empathy" OR "perspective-taking" OR "social awareness" OR "relationship skill")) AND PUBYEAR > 2019 AND DOCTYPE ("ar" OR "cp") AND LANGUAGE ("English" OR "Indonesian")

Equivalent adapted queries were applied in Web of Science, ERIC, Google Scholar, and ScienceDirect. In Scopus AI, Deep Research mode was additionally employed using two natural language queries: (1) “What are the limitations of solitary game based learning simulations using non player characters (NPCs) in developing social emotional competencies among pre service teachers, and how can collaborative multiplayer approaches address these gaps?” and (2) “How effective are digital simulations and game based learning in developing CASEL social emotional competencies including empathy, emotional regulation, and relationship skills in pre service teacher education?” These queries collectively yielded synthesized reports drawing on over 90 Scopus indexed references (Scopus AI, 2026), which were subsequently screened against the inclusion criteria below.

Inclusion and Exclusion Criteria

Inclusion criteria were as follows:

a. Articles published between 2018 and 2025 to capture both foundational and recent developments in GBL simulation for SEC;
b. Articles written in English or Indonesian;
c. Articles focused on pre-service or initial teacher education;
d. Articles addressing GBL or digital simulation within the context of SEC/SEL/CASEL;
e. Publication types limited to peer-reviewed journal articles and conference proceedings.

Exclusion criteria were as follows:

a. Books, book chapters, theses, and news reports;

b. Articles without direct discussion of SEC in the context of pre-service teachers;
c. GBL studies focused exclusively on non-social-emotional (purely cognitive) competencies;
d. Studies on in-service teachers without demonstrable correlation to pre-service training.

Selection Process and PRISMA Flow Diagram

A three-stage selection process was conducted independently by two researchers: (1) title and abstract screening, (2) full text reading, and (3) consensus resolution of disagreements through discussion or third-party arbitration. The entire process was documented in the PRISMA flow diagram below:

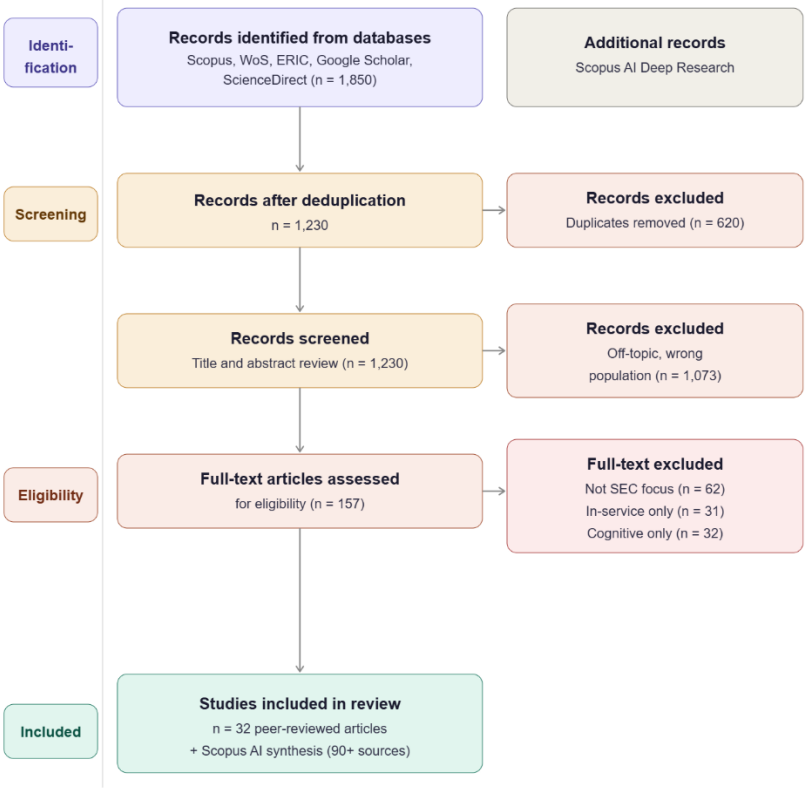

Figure 1. PRISMA Flow Diagram – Article Selection Process (N = 1,850 → n = 32)

FINDINGS AND DISCUSSION

Following the initial search, a total of 1,850 articles were identified across all databases. After deduplication, 1,230 articles remained. Title and abstract screening reduced the pool to 157 potentially eligible articles. Full text review yielded 32 articles that met the inclusion criteria.

Limitations of the Solitary Learning Paradigm in SEC Formation

Analysis of the 32 included articles consistently confirmed that, while solitary learning simulations are effective for cognitive content mastery and basic pedagogical procedures, they exhibit significant limitations in developing SEC among pre-service teachers. Principal findings are summarized in the figure below:

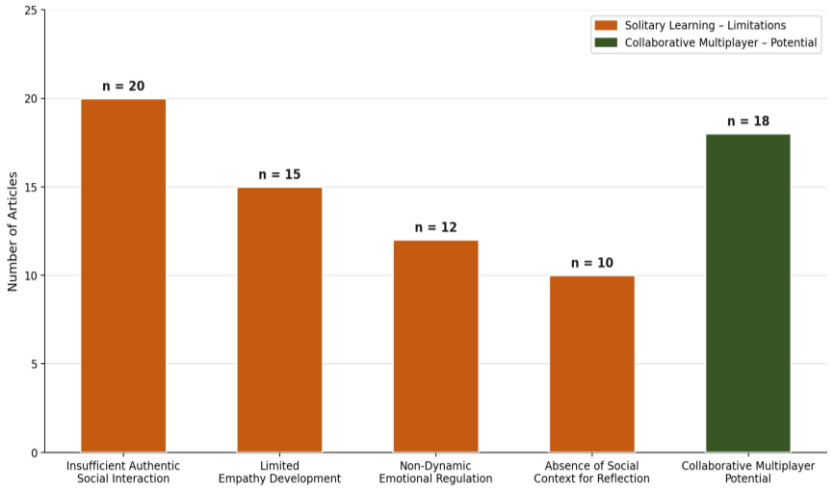

Figure 2. Frequency of Key Themes: Limitations of Solitary Learning vs. Potential of Collaborative Multiplayer Approaches

a. Insufficient Authentic Social Interaction

The majority of studies (n = 20) highlighted that NPC interactions are inadequate for simulating the complex social dynamics and unpredictable emotional responses characteristic of real students. Scripted NPC responses generate off context dialogue, minimal emotional engagement, and limited authenticity, failing to elicit the psychological pressure or emotional adaptation demands that teachers encounter in authentic classroom settings (Domeshek et al., 2020; Lindberg & Jönsson, 2023). Crucially, NPCs struggle with complex queries, maintaining consistent behavior, and replicating nuanced human social interactions a limitation documented across both avatar based and AI driven simulation systems (Warpefelt & Verhagen, 2017; Lindberg, 2025). Comparative studies of digital simulation types further confirm that avatar based simulations reduce social inhibitions and improve communication confidence in pre service teachers, yet this effect does not extend to deeper relational SEC development (Fecke et al., 2025).

b. Limited Development of Empathy

Empathy, as a crucial component of SEC, is difficult to cultivate meaningfully within a solitary learning environment (n = 15). Pre service teachers are not afforded opportunities to directly experience the emotional impact of their decisions from the perspectives of students or colleagues. Emotional engagement metrics including attention, valence, and facial expression analysis consistently reveal that NPC interactions elicit less positive emotion and engagement compared to human interactions, reducing the depth of empathic development (Park & Ryu, 2019; Israelashvili et al., 2025). Furthermore, nonverbal immediacy cues such as proximity, eye contact, and vocal variety are poorly replicated by NPCs, further diminishing emotional presence in solitary simulations (Toivanen et al., 2025).

c. Non-Dynamic Emotional Regulation

Emotional regulation practice in solitary simulations tends to be internal and reactive to pre scripted scenarios (n = 12). Pre-service teachers

are not confronted with situations requiring real time emotional negotiation with other individuals, which represents the core of emotional regulation in the dynamic classroom environment. Emotional experiences in simulated training environments are frequently variable; negative emotions such as anxiety and insecurity are common and may hinder rather than promote SEC development (Stavroulia et al., 2016; Monroy Correa & Manzanal Martínez, 2025). The limited transfer of relational competence to real-world teaching contexts is further compounded by the absence of authentic, reciprocal social interaction (Domeshek et al., 2020; Lindberg, 2025).

d. Absence of Social Context for Reflection

Studies indicate that the most meaningful SEC reflection occurs when pre service teachers can discuss their experiences with peers following complex social interactions (n = 10). Solitary simulations fail to provide the immediate social context necessary for collective reflection. This gap is particularly salient given that socio emotional dynamics in teacher learning including the negotiation of emotional responses and interpersonal meaning making are fundamentally relational processes that cannot be adequately scaffolded through isolated NPC interactions (Vedder Weiss et al., 2020; Theelen et al., 2019). Contextual and cultural factors also shape SEC development, as demonstrated by teacher professional development programs that explicitly integrate experiential, simulation based approaches tailored to teachers' sociocultural contexts (Masry Herzallah, 2025).

Conceptual Framework for Collaborative Multiplayer in SEC Development

Analysis of collaborative multiplayer potential (n = 18) indicates that this approach can bridge the SEC gap through four key mechanisms, as presented in Table 1:

Table 1. Collaborative Multiplayer Mechanisms Mapped to SEC Aspects

SEC Aspect	Collaborative Multiplayer Mechanism	Supporting Evidence
Social Awareness & Empathy	Authentic human to human role exchanges; pre service teachers directly experience the student's perspective through role switching (n = 8).	Israelashvili et al. (2025); Shan & Illingworth (2025)
Dynamic Emotional Regulation	Real time emotional feedback from human players; compels spontaneous adaptation and responsive decision-making (n = 14).	Wetcho & Na-Songkhla (2022); Faber et al. (2024)
Relationship Management	Practice of effective communication, conflict resolution, and collaboration within realistic classroom simulations (n = 10).	Oksanen et al. (2018); Garneli & Chorianopoulos (2021)
Empathy & Collaborative Reflection	Stronger empathy loops; group debriefing deepens collective SEC reflection and peer scaffolding (n = 12).	Knorr & Zinn (2022); Rojas et al. (2022)

The four mechanisms outlined above collectively demonstrate a substantial advantage of collaborative multiplayer approaches over solitary learning in developing SEC competencies among pre-service teachers. To further illustrate this gap, Figure 3 presents a radar chart comparing the estimated SEC development capacity across five key dimensions — authentic social interaction, empathy development, emotional regulation, collaborative reflection, and relationship management. As visualised, solitary learning consistently yields low scores across all dimensions (range: 1.5–2.0), whereas collaborative multiplayer approaches achieve markedly higher capacity scores (range: 7.5–8.5), underscoring the transformative potential of human-to-human simulation environments in teacher education.

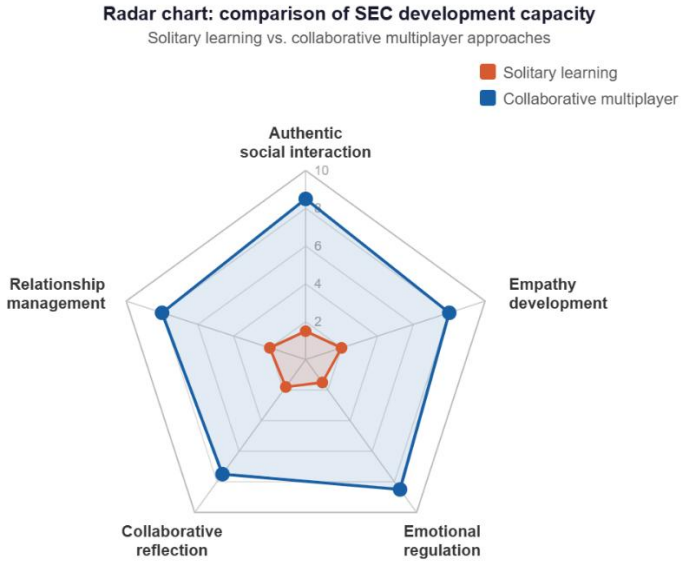

Figure 3. Radar Chart: Comparison of SEC Development Capacity between Solitary Learning and Collaborative Multiplayer Approaches

DISCUSSION

This systematic literature review unequivocally underscores the urgency of a paradigm transition in the development of digital simulations for pre service teacher education, particularly within the domain of SEC. The analysis consistently demonstrates that although GBL within the solitary learning paradigm has made a significant contribution to general pedagogical competency acquisition, its effectiveness for in depth SEC development is substantially limited.

The primary limitation lies in the deterministic, inauthentic nature of NPC interactions, which fail to replicate the emotional complexity and psychological pressure inherent in authentic social interactions in real classroom settings. Solitary NPC based simulations provide controlled, scalable practice but fall short in fostering the complex, dynamic, and reciprocal interactions necessary for deep social emotional competence (Domeshek et al., 2020; Lindberg & Jönsson, 2023; Lindberg, 2025). This explains the "reality shock" frequently reported by pre service teachers: theoretical competency does not automatically translate into the capacity to navigate unpredictable emotional and social dynamics (Theelen

et al., 2019; Hong et al., 2025). While advances in adaptive and LLM based NPCs have improved emotional engagement, these systems still cannot fully replicate the depth and unpredictability of human social interaction (Lee & Lee, 2025; Marincioni et al., 2024). Broader systematic evidence confirms that digital technologies do support socioemotional teacher training, yet their effective implementation requires intentional integration into teacher training programs, contextualized learning approaches, and sustained professional development (Sáez Delgado et al., 2025).

As an innovative solution, the collaborative multiplayer approach offers a robust conceptual framework. Through mechanisms of authentic human to human role exchange, real time feedback, and engagement in dynamic relational management, pre service teachers can experience substantially more realistic social interaction simulations. This enables them to actively practice all five core CASEL competencies in a context that more closely approximates authentic teaching experience. Role plays, group discussions, and collaborative activities in multiplayer settings have been shown to significantly improve empathy, emotion regulation, and communication skills among learners (Garneli & Chorianopoulos, 2021; Barda et al., 2025; Knorr & Zinn, 2022). Evidence from digital game based interventions further demonstrates that structured, empathy focused games can build social awareness and emotional connection even among diverse learner populations (Mukund et al., 2022).

For instance, when a pre service teacher assumes the role of teacher and interacts with a peer enacting a disruptive student, they not only practice classroom management but also directly experience the associated emotional pressure and must apply emotional regulation strategies spontaneously. Upon switching to the "student" role, they gain insight into the impact of the teacher's pedagogical decisions from an alternate perspective, substantially deepening empathic understanding a mechanism empirically supported as highly effective in simulation based training (Israelashvili et al., 2025; Shan & Illingworth, 2025). Tailored professional development programs that incorporate simulations within culturally responsive frameworks further demonstrate that contextual authenticity is essential for effective SEC formation (Masry Herzallah, 2025).

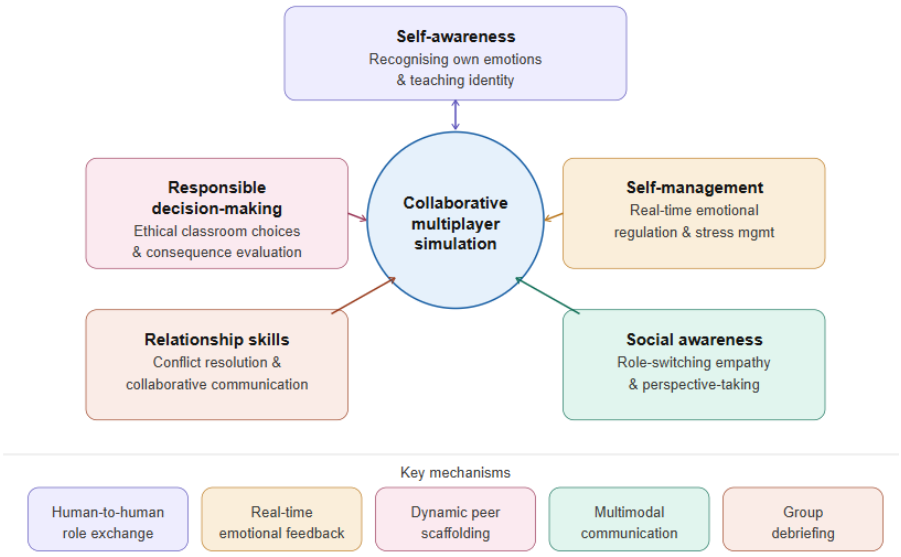

Figure 4. Conceptual Framework: Collaborative Multiplayer Simulation for Five CASEL Competencies in Pre-Service Teachers

These findings affirm the state of the art of this research, confirming a significant gap in the literature that explicitly links limitations of solitary simulation technology to the SEC needs of pre service teachers a gap also identified by Kasperski et al. (2025) in their systematic literature review of simulation based learning for teacher SEL development. Furthermore, the lack of standardized terminology and typologies for simulation types targeting SEL continues to hamper consistent implementation and evaluation in the field (Kasperski et al., 2025; Kollars & Rosen, 2013). The synthesized results provide robust theoretical justification and architectural groundwork for designing the next generation of GBL simulation platforms that prioritize social learning for SEC development.

Limitations And Future Research Directions

While this systematic review offers valuable insights, several limitations warrant acknowledgment. Most included studies focus on short-term interventions, with longitudinal impacts remaining underexplored (Theelen et al., 2019; Monroy Correa & Manzanal Martínez, 2025). Sample sizes are often limited, restricting generalizability (Monroy Correa & Manzanal Martínez, 2025; Fecke et al., 2025). Technical and interface issues are frequently reported across simulation platforms, affecting immersion and emotional engagement (Lindberg & Jönsson, 2023; Theelen et al., 2019). Additionally, the absence of standardized simulation typologies and assessment frameworks for SEL remains a structural challenge for the field (Kasperski et al., 2025), as does the need for specialized training and policy support for educators implementing digital SEC tools (Sáez-Delgado et al., 2025).

Future research directions should encompass the following:

a. Longitudinal, large scale studies comparing solitary and collaborative multiplayer simulations for pre service teacher SEC development (Theelen et al., 2019; Fecke et al., 2025);

b. Development and validation of standardized simulation typologies and multidimensional SEC assessment frameworks, including tools such as MATSEC (Lee et al., 2025) and transformative SEL competency scales (Yang et al., 2025);
c. Exploration of hybrid models combining adaptive AI-driven NPCs with human-facilitated collaboration, leveraging the strengths of both solitary and multiplayer settings (Lee & Lee, 2025; Marincioni et al., 2024);
d. Integration of mixed-methods approaches including behavioral observation, facial expression analysis, and self report to bridge gaps between perceived and actual SEC (Park & Ryu, 2019; Israelashvili et al., 2025; Monroy Correa & Manzanal Martínez, 2025);
e. Design of emotionally supportive, authentic simulations that closely mimic real classroom social interactions, with intentional integration into teacher training programs and culturally responsive pedagogical frameworks (Masry-Herzallah, 2025; Sáez-Delgado et al., 2025; Shapira & Amzalag, 2025).

CONCLUSION

This study confirms the profound urgency for teacher education institutions (TEIs) to transition from the solitary learning paradigm toward social learning, specifically through collaborative multiplayer approaches, in the effort to cultivate Social Emotional Competencies (SEC) in pre service teachers. The significant limitations of solitary NPC based simulations reside in their inability to replicate the dynamics of social interaction characterized by off context dialogues, weak emotional engagement, and non dynamic emotional regulation all of which are essential for deep SEC formation (Domeshek et al., 2020; Lindberg & Jönsson, 2023; Theelen et al., 2019). While digital simulations and GBL tools demonstrate general effectiveness in developing CASEL SEC components including empathy, emotional regulation, and relationship skills (Mukund et al., 2022; Masry Herzallah, 2025; Sáez Delgado et al., 2025), their transformative potential is fully realized only through collaborative, human centered interaction designs. Conversely, the collaborative multiplayer approach through human to human role exchange mechanisms, real time feedback, and dynamic peer scaffolding has demonstrated substantial potential in fostering social awareness, emotional regulation, and empathy that are critical for prospective educators (Oksanen et al., 2018; Israelashvili et al., 2025; Garneli & Chorianopoulos, 2021). Human interaction remains superior in developing nuanced social emotional competencies, with NPCs serving as valuable but limited scaffolds (Kasperski et al., 2025; Lee & Lee, 2025). This transition toward social learning based simulation is crucial to equipping pre service teachers with relevant and adaptive SEC, thereby preparing them to navigate the complexities of the teaching profession in the Society 5.0 era.

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