Indian Journal of Multidisciplinary Research (IJOMR)
(Yearly, Blind Peer-Reviewed, Multidisciplinary Journal)
Home Page: https://ijomr.org

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

Vygotsky in the Digital Age: Rethinking Zone of Proximal Development Through SNS-Based Peer Interaction

***Suman Maji*[1]** ***Monika Sardar*[2]** ***Dr. Dilip Kumar Mondal*[3]**
[1]*Research Scholar, Department of Education, West Bengal State University*
[2]*Research Scholar, Department of Education, West Bengal State University*
[3]*Associate Professor and HOD, Department of Education, Mrinalini Datta Mahavidyapith*

Received:
10.06.2026

Accepted:
18.06.2026

Published:
09.07.2026

Abstract

The Zone of Proximal Development (ZPD), originally theorized by Lev Vygotsky as the conceptual space between what a learner can accomplish independently and what they can achieve under guided support, has remained one of the most enduring constructs in educational psychology. However, Vygotsky formulated this theory within the context of face-to-face, dyadic interactions in structured learning environments. The proliferation of Social Networking Sites (SNS) — including WhatsApp, Instagram, YouTube, and Facebook — among adolescent learners in the contemporary era necessitates a fundamental rethinking of how peer interaction facilitates cognitive and academic development. This conceptual paper argues that SNS-based peer interaction constitutes a digitally extended ZPD, wherein learners co-construct knowledge, scaffold academic understanding, and regulate their learning through asynchronous and synchronous peer exchanges on digital platforms. Drawing on Vygotsky's sociocultural theory, Bandura's Social Cognitive Theory, and contemporary digital learning scholarship, this paper theorizes the mechanisms through which SNS-based peer interaction replicates, extends, and complicates the classical ZPD framework. The paper is grounded in the Indian higher secondary school context, with specific relevance to students preparing under WBCHSE and CBSE boards. Implications for pedagogy, curriculum design, and future research directions are discussed.

Keywords: *Zone of Proximal Development, Social Networking Sites, peer interaction, sociocultural theory, personalized learning, digital scaffolding, higher secondary education*

Introduction

Lev Vygotsky's Zone of Proximal Development (ZPD) has occupied a central place in educational theory since its introduction in the early twentieth century. Vygotsky (1978) conceptualized the ZPD as "the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers" (p. 86). At its core, the ZPD is a relational and interactional construct — learning does not occur in isolation but is inherently mediated through social engagement, dialogue, and collaborative meaning-making.

For decades, educational researchers and practitioners have operationalized the ZPD primarily within the boundaries of the physical classroom, the tutoring session, or the supervised laboratory

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

environment. The "more knowledgeable other" (MKO) — a concept derivative of the ZPD — was understood to be a teacher, a parent, or a more advanced peer physically present in the learner's environment (Wood, Bruner, & Ross, 1976). However, the emergence of digital communication technologies in the twenty-first century has fundamentally disrupted these spatial and relational assumptions.

Social Networking Sites (SNS) have become ubiquitous in the lives of adolescent learners globally and in India specifically. Data from the Internet and Mobile Association of India (IAMAI, 2023) indicate that over 64% of students between the ages of 15 and 18 use SNS platforms daily, with WhatsApp, Instagram, and YouTube dominating usage patterns. Among higher secondary students preparing for competitive and board examinations under the West Bengal Council of Higher Secondary Education (WBCHSE) and the Central Board of Secondary Education (CBSE), SNS platforms serve not merely as sites of social leisure, but as informal academic ecosystems in which students share notes, explain concepts, co-solve problems, and regulate one another's learning strategies.

This paper argues that this emergent phenomenon demands a rethinking of Vygotsky's ZPD for the digital age. It posits that SNS-based peer interaction constitutes a Digitally Extended Zone of Proximal Development (DE-ZPD), wherein the classical mechanisms of scaffolding, mediated learning, and collaborative sense-making are transposed into asynchronous and multimodal digital environments. The paper is organized as follows: Section 2 reviews the relevant literature on ZPD, digital scaffolding, and SNS-based peer learning; Section 3 states the specific objectives of the study; Section 4 outlines the methodology adopted for this conceptual inquiry; Section 5 reviews Vygotsky's original framework; Section 6 examines the landscape of SNS use among Indian higher secondary students; Section 7 develops the theoretical case for DE-ZPD; Section 8 discusses implications; and Section 9 concludes with directions for future research.

Review of Related Literature

Empirical and Theoretical Scholarship on the Zone of Proximal Development

A substantial body of scholarship has revisited and elaborated Vygotsky's ZPD since its introduction to Anglophone educational psychology. Chaiklin (2003) undertook a close textual analysis of Vygotsky's original writings and cautioned against reductive interpretations of the ZPD as a mere instructional technique, arguing instead that it is best understood as a diagnostic principle concerned with a learner's maturing psychological functions. Shabani, Khatib, and Ebadi (2010) reviewed the instructional implications of the ZPD for classroom practice and teacher professional development, concluding that effective scaffolding requires continuous diagnostic attention to the learner's shifting zone of readiness. Verenikina (2008) similarly reviewed the concept of scaffolding as it has been taken up in educational research, noting a persistent tension in the literature between scaffolding as a structured, teacher-controlled intervention and scaffolding as an emergent, co-constructed feature of social interaction. Taken together, this literature establishes that the ZPD and its associated construct of scaffolding remain theoretically contested and continually reinterpreted, which creates conceptual space for the kind of digital-era extension undertaken in this paper.

Social Networking Sites and Adolescent Academic Engagement

A parallel and largely separate literature has examined the relationship between SNS use and

academic outcomes among adolescents and young adults, generally without direct reference to Vygotskian theory. Ito et al. (2010), in an influential ethnographic study, distinguished between friendship-driven and interest-driven forms of youth new-media practice, documenting how informal peer-to-peer exchange on digital platforms supports both social bonding and self-directed learning. Junco (2012) and Kirschner and Karpinski (2010) reported mixed and sometimes contradictory findings regarding the relationship between Facebook use and academic performance, with the former identifying particular Facebook activities, such as sharing links and checking updates on course-related content, as positively associated with engagement, and the latter reporting a negative association between overall Facebook use and grade point average. Selwyn (2009) examined the ways university students informally appropriated Facebook for education-related purposes such as venting frustration, exchanging practical information, and providing moral support, arguing that such use is better understood as a form of informal backstage academic talk than as a distraction from learning. Dabbagh and Kitsantas (2012) proposed that personal learning environments built around social media can support self-regulated learning by scaffolding goal-setting, information management, and reflection. Greenhow and Lewin (2016) synthesized this literature to argue that social media use by young people increasingly blurs the boundary between formal and informal learning, a boundary-blurring that is central to the argument advanced in this paper.

Digital Peer Learning Among Indian Higher Secondary Students

Within the Indian context specifically, an emerging body of research has begun to document the academic uses of SNS among school and college students. Bhat, Singh, Gaur, and Biswas (2018) conducted one of the earliest systematic examinations of WhatsApp as a learning tool among Indian secondary students, finding that subject-specific groups functioned as informal repositories of notes, worked examples, and peer explanation. Sharma and Bhatt (2019) extended this line of inquiry to higher secondary students preparing for board and competitive examinations, reporting that digital peer networks were perceived by students as a significant source of academic motivation and practical examination-related support, operating alongside rather than in place of formal coaching and classroom instruction. Kumar and Sharma (2021), surveying Class XII students in urban India, found that a large majority relied on SNS-based peer networks as a supplementary source of academic support, with usage patterns varying by subject difficulty and examination proximity. National-level usage data compiled by the Internet and Mobile Association of India (IAMAI, 2023) corroborate the scale of this phenomenon, indicating high daily SNS usage among the 15–18 age cohort. Despite this growing empirical record, the Indian literature to date remains largely descriptive, documenting patterns of SNS-based academic peer interaction without situating these patterns within a coherent developmental or sociocultural theoretical framework.

Objectives of the Study

Building on the literature reviewed above, this conceptual paper is guided by the following specific objectives:

- To critically review the classical Vygotskian Zone of Proximal Development and its associated construct of scaffolding, with particular attention to the assumptions of co-presence, dyadic structure, and unimodal communication embedded in the original framework.

- To examine the nature, forms, and extent of Social Networking Site (SNS)-based peer academic interaction among higher secondary students in India, with reference to the WBCHSE and CBSE contexts.
- To theoretically develop and define the construct of the Digitally Extended Zone of Proximal Development (DE-ZPD) as an extension of Vygotsky's original framework.
- To identify and explain the specific mechanisms, namely the reconceptualization of the more knowledgeable other, asynchronous and multimodal scaffolding, and the distributed peer-network structure, through which SNS-based peer interaction replicates and transforms the classical ZPD.
- To identify the principal contradictions and risks (including inaccurate peer scaffolding, academic dependency, and social-comparison-related affective distortion) that SNS-based peer interaction introduces into the learning process.
- To derive implications of the DE-ZPD framework for personalized learning, pedagogy, and future empirical research within the Indian higher secondary education context.

Methodology

Research Design

This is a conceptual and theoretical paper rather than an empirical study; accordingly, it does not employ a sampling frame, primary data collection instrument, or statistical analysis. The paper follows the "theory synthesis" and "conceptual introduction" approaches to conceptual article design described by Jaakkola (2020), combining an integrative review of existing empirical and theoretical literature with an original process of conceptual analysis aimed at constructing a new theoretical framework, the DE-ZPD. The design is further informed by MacInnis's (2011) framework for conceptual contributions, which distinguishes explication (clarifying an existing construct), envelopment (situating a construct within a broader domain), and integration (combining previously disconnected constructs into a unified framework); this paper undertakes primarily integrative and explicative conceptual work, combining Vygotskian sociocultural theory with the empirical literature on SNS-based peer learning.

Literature Search and Selection Strategy

Relevant literature was identified through structured searches of Scopus, Web of Science, ERIC, and Google Scholar, supplemented by manual citation tracking (backward and forward snowballing) from key theoretical and empirical sources. Search terms included combinations of "zone of proximal development," "scaffolding," "sociocultural theory," "social networking sites," "social media," "peer learning," "personalized learning," "higher secondary," and "India." Sources were included if they were peer-reviewed journal articles, foundational theoretical monographs, or authoritative policy documents (such as the National Education Policy 2020 and IAMAI industry reports) directly relevant to the theoretical constructs or the Indian higher secondary context under discussion. Foundational theoretical texts (for example, Vygotsky, 1978; Wood, Bruner, & Ross, 1976) were included irrespective of publication date given their canonical status, while empirical sources on SNS-based peer learning were prioritized from the post-2008 period, reflecting the timeframe of SNS proliferation among adolescent users. Non-peer-reviewed blog posts, promotional industry material other than the cited IAMAI report, and sources not available in English were excluded.

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

Conceptual Synthesis and Framework Development

The conceptual synthesis proceeded in three analytic stages. In the first stage, the components of the classical ZPD (the more knowledgeable other, scaffolding, and the interactional zone between independent and assisted performance) were extracted from the theoretical literature and treated as the base categories for analysis. In the second stage, empirical findings from the SNS and digital-peer-learning literature were thematically mapped against these base categories to identify points of correspondence and points of divergence, for example, where peer roles in SNS groups appeared functionally similar to the classical MKO role but differed in their temporal and distributional structure. In the third stage, these points of divergence were used to generate the four defining transformations proposed in Section 7 (reconceptualization of the MKO, asynchronous and multimodal scaffolding, the distributed peer-network structure, and the introduction of digitally specific contradictions), which together constitute the DE-ZPD framework. The resulting framework was iteratively cross-checked against allied theoretical resources, namely Bandura's (1997) Social Cognitive Theory, Engeström's (1987) Activity Theory, and Festinger's (1954) Social Comparison Theory, to ensure that the proposed constructs were theoretically coherent with, rather than redundant to, existing frameworks. As a conceptual paper, the framework offered here is intended to be empirically testable in future research (see Section 9), rather than to constitute empirical proof in itself.

Vygotsky's Zone of Proximal Development: The Original Framework

Sociocultural Foundations

Vygotsky's theoretical project was, at its heart, a critique of decontextualized models of cognition. Against the backdrop of Piagetian stage theory, which emphasized individual cognitive maturation as the primary driver of learning, Vygotsky (1978) insisted that "human learning presupposes a specific social nature and a process by which children grow into the intellectual life of those around them" (p. 88). For Vygotsky, cognition was not a private, internal process but a socially distributed activity that first appeared on the interpsychological plane — between individuals — before being internalized on the intrapsychological plane — within the individual.

This foundational principle — that social interaction precedes and enables individual cognitive development — is what gives the ZPD its theoretical force. The ZPD is not merely a pedagogical tool; it is a window into the inherently social nature of human learning. The scaffolding that occurs within the ZPD does not simply transfer knowledge from an expert to a novice; it restructures the novice's cognitive architecture through dialogic engagement (Wertsch, 1985).

The Role of the More Knowledgeable Other

Wood, Bruner, and Ross (1976) elaborated the concept of scaffolding as the instructional support provided by an MKO to help a learner accomplish tasks within their ZPD. The MKO could be a teacher, parent, or peer who possesses greater competence in a given domain and who adjusts their support contingently — providing more assistance when the learner struggles and withdrawing it as competence develops. This contingent, responsive quality is what distinguishes scaffolding from simple instruction or information transfer.

Importantly, subsequent scholarship expanded the identity of the MKO beyond the adult expert. Peer-mediated learning research established that learners of similar or slightly unequal competence could productively scaffold one another, particularly through collaborative problem-solving and

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

reciprocal teaching (Palincsar & Brown, 1984). This expansion of the MKO concept is particularly significant for understanding SNS-based peer interaction, as it suggests that the horizontal peer relationships characteristic of SNS exchanges can constitute genuine ZPD experiences.

Figure 1: Vygotsky's Classical Zone of Proximal Development

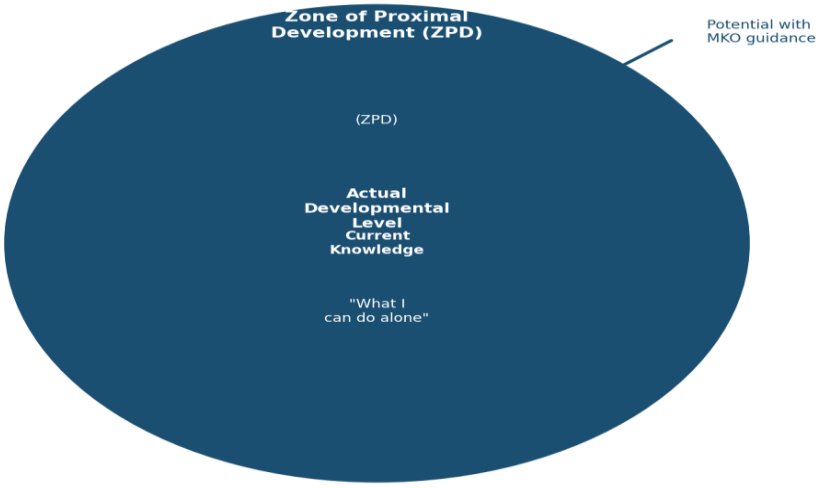

Figure 1: Vygotsky's Classical Zone of Proximal Development (ZPD)
Source: Adapted from Vygotsky (1978). Mind in Society. Harvard University Press.

Limitations of the Classical Framework in Digital Contexts

Despite its theoretical richness, the classical ZPD framework contains implicit assumptions that limit its direct applicability to digital learning environments. First, it presupposes co-presence: the MKO and the learner occupy shared physical and temporal space, enabling real-time responsiveness (Lantolf, 2000). Second, it assumes a relatively stable dyadic or small-group structure — one expert, one or a few novices — rather than the large, distributed, and fluctuating networks characteristic of SNS platforms. Third, the classical ZPD framework does not account for multimodality: the integration of text, image, video, and hyperlink in digital communication fundamentally transforms the nature of scaffolding and meaning-making (Jewitt, 2008).

These limitations do not invalidate the ZPD as a theoretical construct; rather, they signal the need for its theoretical extension and renovation to accommodate the realities of digital peer learning.

SNS-Based Peer Interaction Among Higher Secondary Students in India

The Indian Digital Education Landscape

India presents a distinctive context for examining SNS-based peer learning. The National Education Policy 2020 (Ministry of Education, 2020) explicitly endorsed the integration of digital technologies into the educational ecosystem, and the COVID-19 pandemic significantly accelerated the adoption of online and blended learning modalities across school boards including CBSE and WBCHSE. As a result, Indian adolescent students have become deeply embedded in digital communicative networks that bridge formal and informal learning.

WhatsApp, in particular, has emerged as the dominant platform for peer academic interaction among Indian students. Bhat, Singh, Gaur, and Biswas (2018) documented the formation of subject-specific WhatsApp groups among secondary students in which peers share handwritten notes, question papers, video explanations, and motivational content. This phenomenon is

especially pronounced among higher secondary students facing the dual pressures of board examinations and competitive entrance tests such as JEE and NEET, where peer networks serve as critical academic survival mechanisms (Sharma & Bhatt, 2019).

Forms of SNS-Based Peer Academic Interaction

SNS-based peer academic interaction among higher secondary students takes several distinct forms. Synchronous interaction includes real-time doubt resolution in group chats, live study sessions conducted via video calls on platforms such as WhatsApp or Instagram Live, and collaborative problem-solving in shared digital spaces. Asynchronous interaction includes the sharing of study materials and notes, the posting of solved practice problems for peer review, the circulation of curated YouTube explanations, and the exchange of motivational and academic organizational content (Ali, 2012).

Particularly notable is the emergence of academic micro-communities on Instagram and Telegram, where students follow subject-specific accounts, engage with educational content creators, and interact with peer communities organized around shared academic goals. Kumar and Sharma (2021) found that among Class XII students in urban India, over 70% reported using SNS-based peer networks as a supplementary source of academic support alongside formal classroom instruction.

The Asymmetrical Knowledge Landscape of SNS Peer Networks

One of the most theoretically significant features of SNS-based peer academic interaction is its asymmetrical knowledge landscape. Unlike a traditional classroom in which knowledge authority is concentrated in the teacher, SNS peer networks are characterized by distributed and differentiated competence. A student who struggles with organic chemistry may possess superior command of mathematics, and peer networks on SNS enable the fluid and reciprocal exchange of this distributed expertise. This distributed knowledge structure aligns closely with the networked intelligence concept proposed by Levy (1997) and anticipates the theoretical elaboration of DE-ZPD offered in the following section.

Rethinking the ZPD: Towards a Digitally Extended Zone of Proximal Development

Theoretical Foundations of the DE-ZPD:

This paper proposes the concept of the Digitally Extended Zone of Proximal Development (DE-ZPD) as a theoretical framework for understanding how SNS-based peer interaction replicates and transforms the classical ZPD. The DE-ZPD is defined as the interactional space constituted by SNS-based peer exchanges in which learners co-construct meaning, provide and receive contingent scaffolding, and advance beyond their current level of independent academic performance through digitally mediated social engagement.

The DE-ZPD retains the three core elements of the classical ZPD: the learner's current level of independent performance, the learner's potential level of performance with support, and the interactional zone between them in which scaffolded learning occurs. However, it transforms the conditions of these elements in four critical ways: the MKO is reconceptualized, scaffolding is rendered asynchronous and multimodal, the learning network becomes distributed and horizontal, and the temporal structure of learning is radically reorganized.

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

Figure 2: The Digitally Extended Zone of Proximal Development (DE-ZPD) Framework

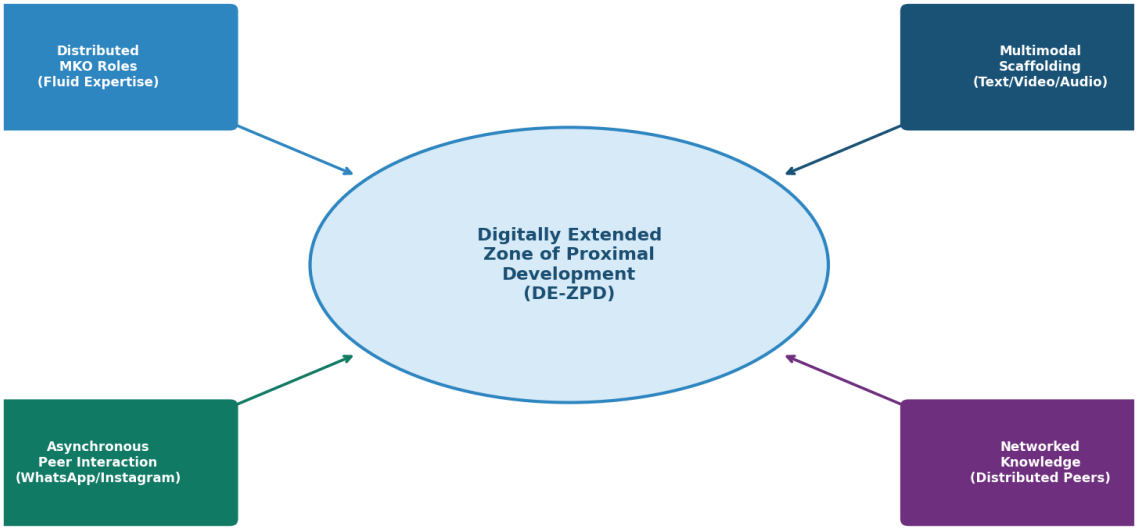

Figure 2: The Digitally Extended Zone of Proximal Development (DE-ZPD) Framework
Source: Author's own conceptualisation, based on Vygotsky (1978) and Moll (1990).

Reconceptualizing the More Knowledgeable Other in SNS Environments

In SNS-based peer networks, the MKO is no longer a single, stable authority figure but a fluid, distributed, and context-dependent role that different participants occupy at different moments. A student who explains a concept in a WhatsApp group becomes, for that moment, the MKO for their peers — regardless of whether they are formally designated as more advanced. This role fluidity transforms the ZPD from a hierarchical dyadic relationship into a networked, reciprocal dynamic in which any participant may simultaneously occupy the role of novice and expert across different knowledge domains (Moll, 1990).

This reconceptualization has important implications for learner identity and self-efficacy. Bandura's (1997) Social Cognitive Theory posits that self-efficacy — the belief in one's capacity to perform specific tasks — is a critical determinant of academic persistence and achievement. When students experience themselves as competent explainers and knowledge contributors within their SNS peer networks, this experience of mastery reinforces academic self-efficacy and motivates deeper engagement with learning content. The DE-ZPD thus functions not only as a site of cognitive scaffolding but as an arena of identity formation and motivational development.

Asynchronous Scaffolding and Multimodal Mediation

Classical scaffolding within the ZPD is premised on synchronous, contingent responsiveness — the MKO adjusts their support in real time based on the learner's moment-to-moment performance. SNS-based scaffolding introduces a fundamentally different temporal structure: asynchronous scaffolding, in which support is provided across discontinuous time, is preserved in searchable digital archives, and is accessible to multiple learners simultaneously and repeatedly.

This asynchronous quality transforms the economics of scaffolding. A single explanation posted by a peer in a WhatsApp group at 10 PM can scaffold the learning of dozens of students who access it hours or days later. In this sense, asynchronous SNS scaffolding achieves a scale and durability impossible within face-to-face ZPD interactions (Lim, 2004). Moreover, SNS scaffolding is inherently multimodal: students share not only text-based explanations but annotated

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

images, short video clips, voice notes, and linked educational videos. Kress and van Leeuwen (2001) argued that multimodal communication enables the construction of meaning through the simultaneous orchestration of multiple semiotic resources, each contributing distinct affordances for learning. Multimodal SNS scaffolding thus extends the cognitive reach of the ZPD beyond what verbal or textual explanation alone can accomplish.

The Distributed Peer Learning Network as ZPD Infrastructure

Engestrom's (1987) Activity Theory extended Vygotsky's framework to encompass collective, tool-mediated activity systems rather than dyadic interactions alone. From an Activity Theory perspective, the SNS-based peer learning network constitutes an activity system in which the community (the peer group), the tools (the SNS platform and its communicative affordances), the rules (norms of academic sharing and peer support), the division of labour (differentiated roles of explainer, questioner, curator), and the object (academic understanding and examination performance) interact dynamically to produce learning outcomes.

This activity system perspective reveals the DE-ZPD not as a property of individual dyadic interactions but as an emergent property of the entire peer learning network. The zone of proximal development is distributed across the network; it is constituted collectively by the cumulative interactions, shared resources, and relational dynamics of all participants. This distributed conception of the ZPD aligns with Rogoff's (1990) participatory appropriation model, in which learning occurs through guided participation in shared cultural practices rather than through isolated instructional transactions.

Figure 3: Engestrom's Activity Theory Applied to SNS-Based Peer Learning Network

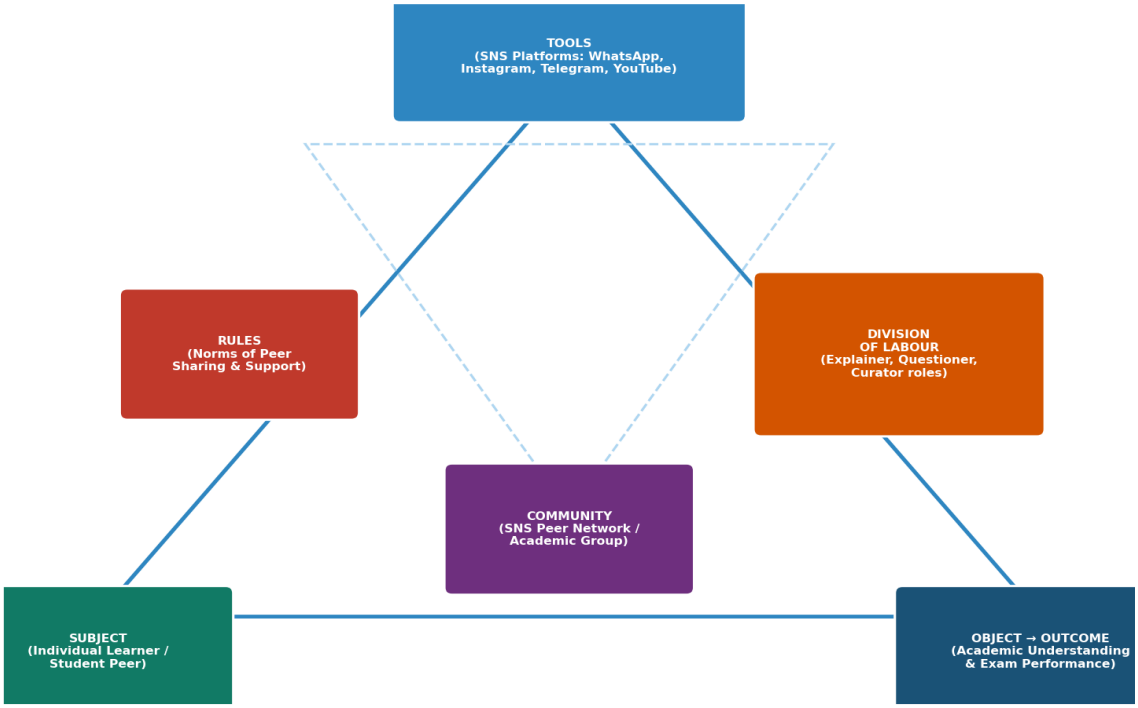

Figure 3: Engestøm's Activity Theory Applied to SNS-Based Peer Learning Network

Source: Adapted from Engestrom (1987). Learning by Expanding. Orienta-Konsultit.

Contradictions and Complications of the DE-ZPD

The DE-ZPD framework must also account for the complications and contradictions that SNS-based peer interaction introduces into the learning process. First, the quality of scaffolding in SNS

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

environments is highly variable and largely unregulated. Unlike teacher-provided scaffolding, which is informed by pedagogical knowledge and responsive to individual developmental trajectories, peer scaffolding on SNS may be inaccurate, incomplete, or cognitively mismatched to the learner's actual ZPD (Littleton & Light, 1999). The circulation of incorrect solutions and oversimplified explanations in student WhatsApp groups is a documented phenomenon that represents a significant risk within DE-ZPD frameworks.

Second, the constant availability and social pressure of SNS networks can transform the ZPD from a space of productive challenge into a space of dependent anxiety. When students habitually outsource academic problem-solving to their peer networks without engaging in the productive struggle that generates genuine cognitive advancement, the scaffolding collapses into a form of academic dependency that ultimately undermines self-regulated learning (Kirschner & Karpinski, 2010).

Third, the motivational dynamics of SNS — including social comparison, peer approval-seeking, and the quantification of social capital through likes, views, and shares — introduce affective distortions into the learning process that classical ZPD theory did not anticipate. Festinger's (1954) Social Comparison Theory predicts that exposure to peers' academic performances on SNS can either motivate upward striving or produce debilitating self-depreciation, depending on the learner's attributional style and self-efficacy beliefs.

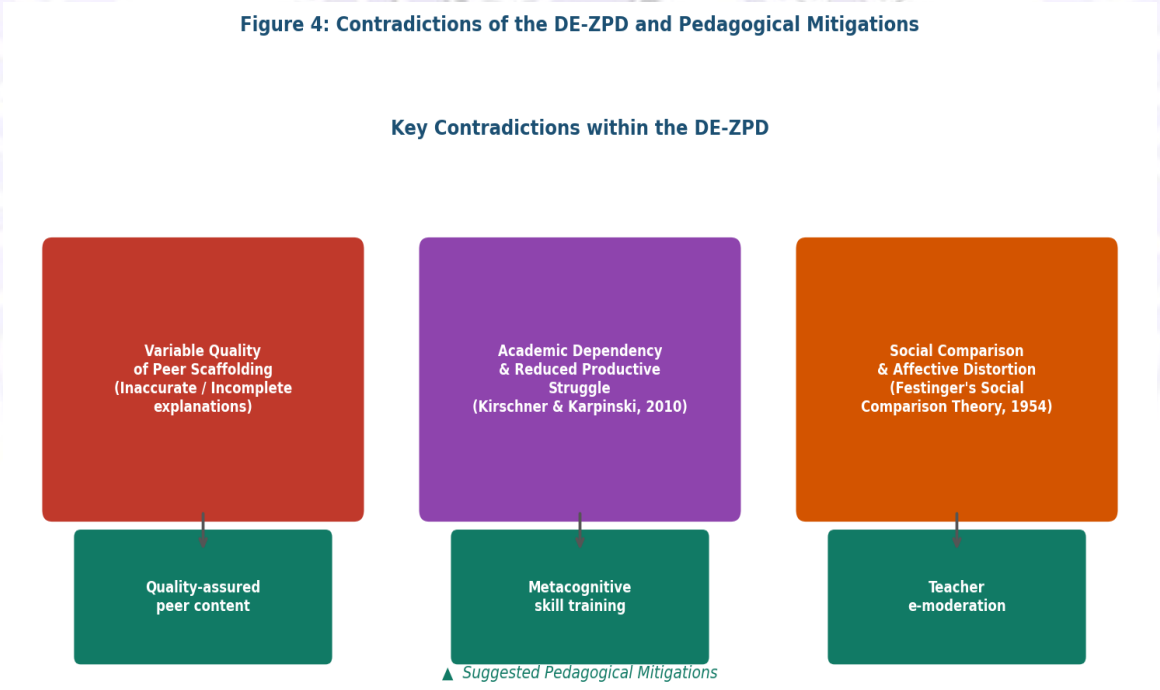

Figure 4: Contradictions of the DE-ZPD and Pedagogical Mitigations

Source: Author's own conceptualisation, drawing on Kirschner & Karpinski (2010) and Festinger (1954).

Implications for Personalized Learning and Pedagogy

Implications for Personalized Learning

The DE-ZPD framework carries significant implications for the theory and practice of personalized learning. If the ZPD is understood as a distributed, networked, and peer-constituted phenomenon, then personalized learning cannot be conceived solely as an individualized,

ISSN: 3048-8036 *(Online)*
July, 2026 Vol. 3 Issue 1
Page No: 60-73

technology-platform-mediated process. Rather, personalized learning in the digital age must be understood as socially embedded: the learner's choices regarding content, pace, strategy, and focus are continuously shaped by the academic culture, norms, and knowledge flows of their SNS peer networks.

For Indian higher secondary students in particular, this social embeddedness has concrete and consequential implications. The choice of study resources, the selection of examination strategies, and the prioritization of topics are frequently negotiated within WhatsApp groups and through peer discussion on Instagram. Recognizing this social dimension of personalized learning can help educators design more ecologically valid interventions that work with, rather than against, the informal digital learning ecosystems students inhabit (Reigeluth, Beatty, & Myers, 2017).

Pedagogical Implications

From a pedagogical standpoint, the DE-ZPD framework suggests that teachers should move beyond viewing SNS as a distraction to be managed and towards leveraging SNS-based peer networks as intentional instructional scaffolding infrastructure. Structuring peer learning communities on SNS platforms, providing quality-assured academic content for peer sharing, and teaching students metacognitive skills for evaluating the accuracy and helpfulness of peer-provided scaffolding are all pedagogical strategies consonant with DE-ZPD principles.

Furthermore, the DE-ZPD framework highlights the importance of what Salmon (2000) called e-moderating: the light-touch facilitation of online learning communities by educators who help sustain productive interaction norms without displacing the peer-driven dynamics that give SNS learning networks their motivational vitality.

Conclusion

This paper has argued that Vygotsky's Zone of Proximal Development, while formulated in the context of face-to-face pedagogical interaction, possesses a theoretical generativity that enables its productive extension into the digital learning environments of the twenty-first century. The concept of the Digitally Extended Zone of Proximal Development (DE-ZPD) proposed here captures the ways in which SNS-based peer interaction among higher secondary students replicates the core mechanisms of ZPD — scaffolding, mediated learning, the role of the MKO, and the interactional constitution of cognitive development — while also transforming them through asynchronous temporality, multimodal mediation, distributed knowledge networks, and the affective dynamics of digital sociality.

For Indian higher secondary students navigating the dual demands of board examinations and competitive tests, SNS-based peer interaction has become an irreducible feature of their academic lives. Theoretical frameworks adequate to this reality must move beyond simple dichotomies of distraction versus engagement, risk versus benefit. The DE-ZPD framework offers a more nuanced and generative conceptual lens: one that honours the social, cultural, and cognitive complexity of peer learning in digital spaces while remaining alert to the contradictions and risks that such spaces introduce.

Future research should empirically investigate the DE-ZPD through qualitative phenomenological studies that capture students' lived experiences of SNS-based scaffolding. Comparative studies across WBCHSE and CBSE contexts, mixed-methods investigations of the relationship between

SNS peer interaction quality and academic performance, and intervention studies that deliberately structure DE-ZPD experiences within school settings are all promising directions for a research agenda that takes seriously the Vygotskian imperative: to understand learning as, fundamentally and irreducibly, a social act.

References

Ali, A. (2003). Instructional Design and Online Instruction: Practices and Perception. TechTrends: Linking Research and Practice to Improve Learning, 47(5), 42-45. Retrieved June 9, 2026 from https://www.learntechlib.org/p/97420/.

Bandura, A. (1997). Self-efficacy: The exercise of control. Freeman.

Bhat, S., Singh, C., Gaur, A., & Biswas, A. (2018). Using WhatsApp groups as a learning tool in higher secondary schools. *Journal of Educational Technology & Society*. 21(4), 103–116.

Chaiklin, S. (2003). The zone of proximal development in Vygotsky's analysis of learning and instruction. In A. Kozulin, B. Gindis, V. S. Ageyev, & S. M. Miller (Eds.), *Vygotsky's educational theory in cultural context* (pp. 39–64). Cambridge University Press.

Dabbagh, N., & Kitsantas, A. (2012). Personal learning environments, social media, and self-regulated learning: A natural formula for connecting formal and informal learning. *The Internet and Higher Education*, 15(1), 3–8. https://doi.org/10.1016/j.iheduc.2011.06.002

Engestrom, Y. (1987). Learning by expanding: An activity-theoretical approach to developmental research. Orienta-Konsultit.

Festinger, L. (1954). A theory of social comparison processes. Human Relations, 7(2), 117–140. https://doi.org/10.1177/001872675400700202

Greenhow, C., & Lewin, C. (2016). Social media and education: Reconceptualizing the boundaries of formal and informal learning. *Learning, Media and Technology*, 41(1), 6–30. https://doi.org/10.1080/17439884.2015.1064954

Internet and Mobile Association of India. (2023). IAMAI India internet report 2023. IAMAI. https://www.iamai.in

Ito, M., Baumer, S., Bittanti, M., Boyd, D., Cody, R., Herr-Stephenson, B., Horst, H. A., Lange, P. G., Mahendran, D., Martinez, K. Z., Pascoe, C. J., Perkel, D., Robinson, L., Sims, C., & Tripp, L. (2010). *Hanging out, messing around, and geeking out: Kids living and learning with new media*. MIT Press.

Jaakkola, E. (2020). Designing conceptual articles: Four approaches. *AMS Review*, 10(1–2), 18–26. https://doi.org/10.1007/s13162-020-00161-0

Jewitt, C. (2008). Multimodality and literacy in school classrooms. *Review of Research in Education.* 32(1), 241–267. https://doi.org/10.3102/0091732X07310586

Junco, R. (2012). The relationship between frequency of Facebook use, participation in Facebook activities, and student engagement. *Computers & Education*, 58(1), 162–171. https://doi.org/10.1016/j.compedu.2011.08.004

Kirschner, P. A., & Karpinski, A. C. (2010). Facebook and academic performance. Computers in Human Behavior, 26(6), 1237–1245. https://doi.org/10.1016/j.chb.2010.03.024

Kress, G., & van Leeuwen, T. (2001). Multimodal discourse: The modes and media of contemporary communication. Arnold.

Kumar, R., & Sharma, P. (2021). Digital peer networks and academic achievement among Class

XII students in urban India. Indian Journal of Educational Research, 10(2), 45–62.

Lantolf, J. P. (2000). Introducing sociocultural theory. In J. P. Lantolf (Ed.), Sociocultural theory and second language learning (pp. 1–26). Oxford University Press.

Levy, P. (1997). Collective intelligence: Mankind's emerging world in cyberspace. Plenum Trade.

Lim, C. P. (2004). Engaging learners in online learning environments. TechTrends, 48(4), 16–23. https://doi.org/10.1007/BF02763440

Littleton, K., & Light, P. (Eds.). (1999). Learning with computers: Analysing productive interaction. Routledge.

MacInnis, D. J. (2011). A framework for conceptual contributions in marketing. *Journal of Marketing*, 75(4), 136–154. https://doi.org/10.1509/jmkg.75.4.136

Ministry of Education. (2020). National Education Policy 2020. Government of India. https://www.education.gov.in

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record*, 108(6), 1017–1054. https://doi.org/10.1111/j.1467-9620.2006.00684.x

Moll, L. C. (1990). Vygotsky's zone of proximal development: Rethinking its instructional implications. Infancia y Aprendizaje, 13(51–52), 157–168. https://doi.org/10.1080/02103702.1990.10822280

Palincsar, A. S., & Brown, A. L. (1984). Reciprocal teaching of comprehension-fostering and comprehension-monitoring activities. Cognition and Instruction, 1(2), 117–175. https://doi.org/10.1207/s1532690xci0102_1

Reigeluth, C. M., Beatty, B. J., & Myers, R. D. (2017). Instructional-design theories and models: The learner-centered paradigm of education (Vol. 4). Routledge.

Rogoff, B. (1990). Apprenticeship in thinking: Cognitive development in social context. Oxford University Press.

Salmon, G. (2000). E-moderating: The key to teaching and learning online. Kogan Page.

Selwyn, N. (2009). Faceworking: Exploring students' education-related use of Facebook. *Learning, Media and Technology*, 34(2), 157–174. https://doi.org/10.1080/17439880902923622

Shabani, K., Khatib, M., & Ebadi, S. (2010). Vygotsky's zone of proximal development: Instructional implications and teachers' professional development. *English Language Teaching*, 3(4), 237–248. https://doi.org/10.5539/elt.v3n4p237

Sharma, R., & Bhatt, A. (2019). Peer learning and academic motivation among higher secondary students in India: The role of digital networks. Journal of Indian Education, 45(3), 78–94.

Verenikina, I. (2008). Scaffolding and learning: Its role in nurturing new learners. In P. Kell, W. Vialle, D. Konza, & G. Vogl (Eds.), *Learning and the learner: Exploring learning for new times* (pp. 161–180). University of Wollongong.

Vygotsky, L. S. (1978). Mind in society: The development of higher psychological processes (M. Cole, V. John-Steiner, S. Scribner, & E. Souberman, Eds. & Trans.). Harvard University Press.

Wertsch, J. V. (1985). Vygotsky and the social formation of mind. Harvard University Press.

Wood, D., Bruner, J. S., & Ross, G. (1976). The role of tutoring in problem solving. Journal of Child Psychology and Psychiatry, 17(2), 89–100. https://doi.org/10.1111/j.1469-

7610.1976.tb00381.x

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory Into Practice*, 41(2), 64–70. https://doi.org/10.1207/s15430421tip4102_2