

From Chalkboards to Chatbots: A Neo-Vygotskian Perspective on AI and Digital Learning Tools

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Abstract

This paper revisits Lev Vygotsky's seminal ideas through the lens of 21st-century technological innovation. By exploring the intersection of the Zone of Proximal Development (ZPD), scaffolding, and digital tools, it argues that artificial intelligence (AI), educational applications, and game-based platforms now act as “new guides” in learning processes. These technologies extend Vygotsky's theory into contemporary classrooms, supporting learners through adaptive feedback, collaborative interaction, and dynamic digital scaffolds. A Neo-Vygotskian framework demonstrates both the opportunities and the ethical challenges of relying on AI-driven guidance. The paper concludes by calling for a balanced approach—where teachers, learners, and technology co-construct meaningful educational experiences in the digital age.

Keywords: Neo-Vygotsky, Zone of Proximal Development, Educational Technology, AI, Learning Apps, Game-Based Learning, Online Platforms

1. Introduction: Learning in a Digital Era

The last two decades have witnessed a profound transformation in educational practices, driven largely by technological advancements and the integration of artificial intelligence (AI) into learning environments (Johnson, Adams Becker, Estrada, & Freeman, 2014). From mobile applications to massive open online courses (MOOCs) and AI-powered adaptive systems, learners now have unprecedented access to personalized, interactive, and collaborative educational experiences that transcend traditional classroom boundaries (Holmes, Bialik, & Fadel, 2019).

Despite the promise of these technologies, their effectiveness depends heavily on grounding in robust theoretical frameworks. Vygotsky's sociocultural theory (1978), particularly the Zone of Proximal Development (ZPD), offers a powerful lens for understanding how learners can achieve beyond their independent capacities when guided by a more knowledgeable other (MKO). In modern classrooms, the concept of scaffolding extends beyond human teachers and peers to include technological mediators such as AI tutors, intelligent tutoring systems, and interactive educational applications (Pea, 2004).

1.1 Definition of Key Terms

- **Neo-Vygotsky:** A modern interpretation of Vygotsky's sociocultural theory, emphasizing the integration of technology, globalization, and collaborative digital learning (Kozulin, 2003; Lantolf & Thorne, 2006).
- **Zone of Proximal Development (ZPD):** The difference between what a learner can accomplish independently and what they can achieve with guidance or scaffolding (Vygotsky, 1978).
- **Scaffolding:** Temporary support provided to learners to help them accomplish tasks slightly beyond their current ability, gradually removed as competence develops (Wood, Bruner, & Ross, 1976).

- **Artificial Intelligence (AI) in Education:** Software systems capable of providing adaptive, personalized instruction, feedback, and learning guidance (Holmes et al., 2019; Baker & Inventado, 2014).
- **Game-Based Learning (GBL):** Educational approach using games to engage learners in interactive, immersive environments that support cognitive and social development (Gee, 2007; Papastergiou, 2009).

2. Vygotsky Revisited: Why His Theory Still Matters

Vygotsky's sociocultural theory emphasizes that higher cognitive functions develop through social interaction and the use of cultural tools. According to Vygotsky (1978), learning is inherently social; knowledge is co-constructed through dialogue, collaboration, and mediation. The ZPD is central to this process: it represents the gap between what a learner can do independently and what they can accomplish with guidance. Scaffolding, as later conceptualized by Wood, Bruner, and Ross (1976), provides structured support that enables learners to operate just beyond their current abilities.

For example, when a student struggles to solve a complex mathematics problem, a teacher may break the problem into smaller steps, provide strategic hints, and gradually withdraw assistance as competence develops. This scaffolding allows the learner to internalize problem-solving strategies and eventually perform the task independently. Such guidance ensures cognitive growth while preventing frustration or stagnation.

The enduring relevance of Vygotsky's theory lies in its applicability to modern digital learning environments. Today's learners encounter educational technologies that can mimic many aspects of human scaffolding, from real-time corrective feedback in apps to collaborative virtual platforms that allow peer-to-peer support (Chen & Lee, 2011; Huang, Chen, & Chou, 2020).

3. Neo-Vygotskian Perspectives on Education

3.1 Scaffolding in the 21st Century

Neo-Vygotskian scholars extend Vygotsky's insights to contemporary contexts by emphasizing the role of digital and virtual tools as cultural mediators (Kozulin, 2003; Lantolf & Thorne, 2006). In this view, scaffolding is not limited to teacher interventions but includes AI systems, educational apps, and online collaboration platforms. These tools can provide adaptive, immediate, and personalized guidance, allowing learners to operate within their ZPD even without direct human assistance.

For instance, Duolingo uses gamified scaffolding to guide learners through language acquisition. Tasks increase in complexity as learners progress, and AI-driven hints provide feedback when errors occur. Similarly, Khan Academy's analytics track learner progress and recommend exercises tailored to individual knowledge gaps, effectively functioning as a digital MKO (Holmes et al., 2019).

3.2 The Zone of Proximal Development Reinterpreted

The ZPD in Neo-Vygotskian thought is dynamic and digitally mediated. Technology can act as a scaffolding agent by:

- Adjusting difficulty in real-time to challenge learners appropriately.
- Providing multimodal feedback (visual, auditory, textual) to reinforce understanding.
- Facilitating collaborative learning, enabling peer interaction in virtual classrooms.

In essence, Neo-Vygotsky positions technology as a “co-teacher,” extending Vygotsky's concept of the MKO into the digital realm (Siemens, 2005).

3.3 Comparisons with Other Learning Theories

While Piaget (1952) emphasized universal stages of cognitive development, Vygotsky highlighted the social and cultural embeddedness of learning. Bruner (1996) reinforced scaffolding and

narrative-based instruction, while Siemens (2005) emphasized networked learning in digital spaces. Compared to these theories, Neo-Vygotskian perspectives uniquely integrate technology as an active participant in guiding learning.

4. Digital Tools as the “New Guides”

4.1 Educational Apps and Interactive Platforms

Mobile and web-based applications exemplify Neo-Vygotskian principles by providing personalized scaffolding within learners’ ZPD. Examples include:

- **Duolingo:** Gamified challenges, adaptive hints, and immediate feedback promote incremental learning.
- **Khan Academy:** Analytics-based exercises target knowledge gaps and provide structured guidance.
- **Photomath:** Step-by-step solutions scaffold mathematical problem-solving.
- **Quizlet:** Flashcards and AI-driven repetition schedules reinforce memory in alignment with learner readiness (Chen & Lee, 2011).

These platforms demonstrate how technology can function as an interactive tutor, guiding learners through tasks that would otherwise exceed their independent capabilities.

4.2 Game-Based Learning as Playful Scaffolding

Game-based learning (GBL) platforms such as Minecraft Education, Prodigy Math, and coding games like LightBot offer immersive environments for cognitive and social development (Gee, 2007; Papastergiou, 2009). GBL supports Neo-Vygotskian learning by:

- **Fostering intrinsic motivation:** Engaging narratives sustain attention and persistence (Deci & Ryan, 2000).
- **Progressive scaffolding:** Levels, rewards, and missions align with incremental ZPD challenges.
- **Peer collaboration:** Multiplayer environments facilitate co-construction of knowledge.

For example, Minecraft Education allows students to collaboratively design engineering structures or historical models, integrating problem-solving with social learning. AI-driven hints and embedded challenges scaffold cognitive growth in real-time.

4.3 Artificial Intelligence as a More Knowledgeable Other

Intelligent tutoring systems (ITS) and AI-powered MOOCs (Coursera, EdX, FutureLearn) exemplify technology acting as a digital MKO. Key features include:

- Adaptive learning paths: AI algorithms adjust content to learners' knowledge and skill levels (Baker & Inventado, 2014).
- Recommendation engines: Platforms suggest resources aligned with individual learning goals (Holmes et al., 2019).
- Collaborative digital spaces: Forums and peer-review mechanisms foster social constructivist learning (Dillenbourg, 2000).

Carnegie Learning's MATHia continuously monitors student performance, dynamically adjusting task complexity and providing feedback—a direct parallel to human scaffolding in the ZPD.

5. Opportunities and Dilemmas in AI-Mediated Learning

5.1

Opportunities

AI and digital tools offer numerous advantages when implemented with Neo-Vygotskian principles in mind:

- **Personalized scaffolding:** Learners receive targeted guidance that mirrors teacher interventions (Chen & Lee, 2011).
- **Interactive social learning:** Platforms support collaboration beyond classroom walls (Lantolf & Thorne, 2006).
- **Scalable education:** AI systems can reach millions of learners, making personalized guidance accessible globally.

5.2

Challenges

Despite the benefits, challenges remain in integrating AI and digital tools in education:

- **Digital divide:** Unequal access to devices and reliable internet can exclude learners from AI scaffolding, disproportionately affecting low-income or rural students (Selwyn, 2016).
- **Over-reliance on technology:** Excessive dependence on AI risks diminishing critical human interaction, which is essential for social learning and cognitive development (Pea, 2004).
- **Ethical concerns:** Algorithmic bias, privacy issues, and data surveillance challenge equitable education delivery (Williamson & Eynon, 2020).
- **Teacher adaptation:** Educators must evolve from sole knowledge providers to facilitators who guide technology use effectively, requiring professional development and ongoing support.

6. The Teacher's Evolving Role in Technology-Rich Classrooms

In AI-enhanced classrooms, teachers act as coordinators, facilitators, and ethical overseers rather than only knowledge providers. Their responsibilities include:

- Monitoring learner progress and intervening when AI scaffolding is insufficient.
- Ensuring equitable access to technology and mitigating algorithmic bias.
- Blending traditional pedagogy with digital scaffolds to maintain human interaction.

For example, teachers using EdTech platforms can focus on higher-order thinking activities while AI handles repetitive drills and adaptive exercises. This creates a blended scaffolding environment that nurtures autonomy while ensuring learners stay within their ZPD (Pea, 2004; Lantolf & Thorne, 2006).

7. Conclusion:

Balancing Human and Digital Guidance

Digital technologies, from educational apps to AI-driven learning systems, are reshaping education by providing scalable, interactive scaffolding within learners' ZPD. Neo-Vygotskian theory provides a valuable framework to understand these transformations, highlighting how technology can act as a "new guide" while preserving the social dimension of learning.

To maximize the benefits, educators and policymakers should:

- Prioritize equitable access to devices and connectivity.
- Train teachers to integrate AI responsibly.
- Address ethical concerns related to privacy and algorithmic bias.

Ultimately, the future of education relies on a balanced partnership between human instructors and digital tools. By combining human guidance with AI scaffolding, learners receive adaptive, collaborative, and meaningful educational experiences aligned with Neo-Vygotskian principles.

References:

Baker, R. S., & Inventado, P. S. (2014). Educational data mining and learning analytics. *Learning Analytics*, 61–75. Springer. https://doi.org/10.1007/978-1-4614-3305-7_4

Bruner, J. (1996). *The culture of education*. Harvard University Press.

Chen, C. M., & Lee, T. H. (2011). Personalized mobile English vocabulary learning system based on item response theory and learning memory cycle. *Computers & Education*, 57(3), 1546–1556. <https://doi.org/10.1016/j.compedu.2011.02.015>

Deci, E. L., & Ryan, R. M. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. *American Psychologist*, 55(1), 68–78. <https://doi.org/10.1037/0003-066X.55.1.68>

Dillenbourg, P. (2000). Collaborative learning: Cognitive and computational approaches. Pergamon.

Gee, J. P. (2007). *What video games have to teach us about learning and literacy* (2nd ed.). Palgrave Macmillan.

Holmes, W., Bialik, M., & Fadel, C. (2019). *Artificial intelligence in education: Promises and implications for teaching and learning*. Center for Curriculum Redesign.

Huang, Y. M., Chen, T. C., & Chou, Y. S. (2020). A review of digital learning games and adaptive feedback. *Educational Technology Research and Development*, 68, 1117–1141. <https://doi.org/10.1007/s11423-019-09703-6>

Johnson, L., Adams Becker, S., Estrada, V., & Freeman, A. (2014). *The NMC Horizon Report: 2014 Higher Education Edition*. New Media Consortium. <https://library.educause.edu/resources/2014/1/2014-horizon-report>

Kozulin, A. (2003). Vygotsky's educational theory in cultural context. Cambridge University Press. <https://doi.org/10.1017/CBO9780511840975>

Lantolf, J. P., & Thorne, S. L. (2006). *Sociocultural theory and the genesis of second language development*. Oxford University Press.

Papastergiou, M. (2009). Digital game-based learning in high school computer science education: Impact on educational effectiveness and student motivation. *Computers & Education*, 52(1), 1–12. <https://doi.org/10.1016/j.compedu.2008.06.004>

Pea, R. D. (2004). The social and technological dimensions of scaffolding. *The Journal of the Learning Sciences*, 13(3), 423–451. https://doi.org/10.1207/s15327809jls1303_6

Piaget, J. (1952). *The origins of intelligence in children*. International Universities Press.

Selwyn, N. (2016). *Education and technology: Key issues and debates* (2nd ed.). Bloomsbury Academic.

Siemens, G. (2005). Connectivism: A learning theory for the digital age. *International Journal of Instructional Technology and Distance Learning*, 2(1), 3–10. http://www.itdl.org/Journal/Jan_05/article01.htm

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Williamson, B., & Eynon, R. (2020). Mapping AI in education. *Learning, Media and Technology*, 45(3), 223–235. <https://doi.org/10.1080/17439884.2020.1686019>

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>



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