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Leveraging Cultural-Historical Activity Theory (CHAT) in Education: Navigating the Globalized Digital Era

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Abstract

The rapid development of digital technology around the world has significantly transformed education, influencing how knowledge is produced, disseminated, and consumed globally. This paper explores the application of Cultural-Historical Activity Theory (CHAT) within education, emphasizing its potential to navigate the complexities and opportunities presented by the digital era. CHAT, grounded in the works of Vygotsky and expanded by Engeström, provides a comprehensive framework for understanding the interplay between cultural artifacts, tools, and social interactions in educational settings. This theoretical approach is particularly relevant in analyzing how digital tools mediate learning processes, reshaping pedagogical practices and learning outcomes. Through a thorough review of existing literature and case studies, this paper highlights CHAT's role in fostering adaptive, culturally responsive, and technologically integrated educational environments worldwide. Furthermore, it identifies gaps in current research, particularly concerning the systematic study of digital technology's impact on educational activity systems and the effectiveness of CHAT-based interventions. By integrating key concepts of CHAT with contemporary digital tools, this paper contributes to the discourse on educational innovation, offering insights into the dynamic relationship between technology, pedagogy, and student engagement in education.

Keywords: Cultural-Historical Activity Theory (CHAT), Culturally responsive framework, Education, Pedagogical Practices, Digital technology,

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1. Introduction

The rapid advancements in digital technology have fundamentally transformed education, reshaping the ways in which knowledge is produced, disseminated, and consumed. Educational institutions are increasingly integrating digital tools and platforms to enhance teaching and learning experiences, foster student engagement, and streamline administrative processes (Selwyn, 2016; Bates, 2015). The digital era has ushered in a paradigm shift from traditional face-to-face instruction to more dynamic, flexible, and interactive learning environments, including online courses, blended learning models, and massive open online courses (MOOCs) (Siemens, 2013). This transformation necessitates a reevaluation of pedagogical frameworks to effectively harness the potential of digital technologies in education (Anderson, 2008).

Cultural-Historical Activity Theory (CHAT), originally developed by Vygotsky (1978) and further expanded by Engeström (1987), offers a robust theoretical lens for examining the complexities of human activities within their cultural and historical contexts. CHAT posits that human actions are mediated by cultural artifacts, tools, and social interactions, emphasizing the importance of understanding the socio-cultural dimensions of learning and development (Engeström, 2001). This theoretical approach has been instrumental in analyzing educational practices, particularly in understanding how students and educators interact with and adapt to new technologies (Engeström, Miettinen, & Punamäki, 1999).

This paper aims to explore the application of Cultural-Historical Activity Theory in education, focusing on its potential to navigate the challenges and opportunities presented by the digital era. By leveraging CHAT, educators and researchers can gain deeper insights into the dynamic interplay between digital tools, pedagogical practices, and learning outcomes. The significance of this paper lies in its contribution to the ongoing discourse on educational innovation, providing a theoretical framework that bridges the gap between traditional educational paradigms and the emerging digital landscape. Through a comprehensive review of highly cited references, this paper highlights the critical role of CHAT in fostering an adaptive, culturally responsive, and technologically integrated approach to education.

2. Overview of foundational background

2.1. Historical development and foundational principles

Cultural-Historical Activity Theory (CHAT) traces its roots to the seminal contributions of pioneering psychologists Lev Vygotsky and Alexei Leontiev, who view the significance of sociocultural contexts in human learning and development. Vygotsky

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(1978) argued that cognition evolves through social interactions embedded within specific cultural environments, a concept fundamental to CHAT. This theoretical perspective emphasizes the role of social context and cultural tools in shaping cognitive development, proposing that higher mental functions develop through mediated activities (Vygotsky, 1978). Building on Vygotsky's work, Leontiev (1978) further articulated the notion of activity as a unit of analysis, highlighting the hierarchical structure of activities, actions, and operations.

The work of Engeström (1987) significantly expanded CHAT by introducing the concept of activity systems, which comprise interconnected components such as subjects, objects, tools, rules, community, and division of labor. This framework allows for a comprehensive analysis of human activities, considering the dynamic interplay between individuals, artifacts, and their socio-cultural contexts. Engeström's model has been instrumental in illuminating how collective practices and cultural norms influence individual learning processes and developmental trajectories (Engeström, 1987). Over the years, CHAT has grown to incorporate contemporary insights into technology-mediated learning environments and socio-cultural dynamics, thereby perpetuating its relevance in understanding the complexities of human behavior and cognition in diverse contexts (Yamagata-Lynch, 2010; Sannino et al., 2016).

2.2. Previous applications of CHAT in educational research

Cultural-Historical Activity Theory (CHAT) has emerged as a pivotal framework in educational research, particularly for examining learning processes within dynamic social environments. Engeström's (1999) concept of expansive learning cycles illustrates CHAT's utility in identifying and resolving contradictions within activity systems, paving the way for transformative interventions in educational settings. This framework facilitates a deeper understanding of how educational practices can evolve through collective problem-solving and iterative reflection (Walker, 2014).

Vygotsky's socio-cultural theory, foundational to CHAT, emphasizes the role of social interactions and cultural tools in shaping learning experiences. These perspectives have been instrumental in exploring how collaborative learning environments and mediated discourse contribute to knowledge construction (Wertsch, 1991). Recent applications of CHAT in educational technology research have highlighted its adaptability in studying digital learning platforms and the integration of technology into pedagogical practices (Sannino et al., 2016). For instance, research has demonstrated how digital tools mediate collaborative learning and support the co-construction of knowledge, emphasizing the interplay between individual cognition and social context (Hakkarainen et al., 2004). Through these applications, CHAT continues to offer profound insights into the complexities of educational processes and the potential for systemic improvement.

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2.3. The current landscape of digital transformation in education

Education is currently experiencing a profound digital transformation, characterized by the pervasive integration of digital technologies into pedagogical strategies and institutional frameworks. This evolution is driven by the inherent capabilities of digital tools to augment collaboration, enrich engagement, and broaden accessibility across educational contexts (Selwyn, 2016). Cultural-Historical Activity Theory (CHAT) offers a critical lens through which to examine how these digital tools mediate learning processes and catalyze fundamental shifts in educational methodologies and practices (Kaptelinin & Nardi, 2006).

Research shows the transformative impact of digital transformation on education, emphasizing its potential to democratize learning opportunities and foster innovative pedagogical approaches (Bates, 2019; Garrison & Kanuka, 2004). Digital technologies such as learning management systems (LMS), virtual classrooms, and online discussion forums have reconfigured traditional educational practices, enabling more flexible and interactive learning environments. However, as institutions navigate this digital landscape, challenges such as digital inequality and the need for faculty development in digital literacy emerge as pivotal concerns (Jandrić et al., 2018; Duderstadt et al., 2002). Ensuring equitable access to digital resources and supporting educators in developing digital competencies are essential for maximizing the benefits of digital transformation in education.

2.4. Gaps in the Existing Research

Despite its relevance, gaps persist in applying Cultural-Historical Activity Theory (CHAT) to the digital era of education. Existing research frequently overlooks systematic studies on how digital technologies impact activity systems and the cultivation of students' higher-order cognitive skills. Moreover, there is a distinct lack of empirical investigations into the efficacy of CHAT-based interventions within digitally mediated learning environments (Stetsenko, 2008). This deficiency suggests the necessity for further research to comprehensively understand the dynamics of CHAT in contemporary educational settings.

Incorporating insights from prominent scholars such as Engeström (2001) and Leontiev (1978), whose foundational works continue to shape discourse in educational psychology and instructional design, is crucial for advancing theoretical frameworks. Addressing these gaps is essential for enhancing pedagogical practices that integrate CHAT principles with modern educational technology. Future research should focus on exploring the impact of digital tools on activity systems, the development of higher-order cognitive skills, and the effectiveness of CHAT-based interventions in diverse educational contexts. By doing so, researchers can contribute to a more comprehensive



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understanding of how digital technologies can be harnessed to support meaningful learning experiences and outcomes.

3. Main theoretical framework

Cultural Historical Activity Theory (CHAT) is a theoretical framework that originated from the works of Lev Vygotsky and his followers in the socio-cultural tradition. It provides a holistic approach to understanding human activity within social contexts, emphasizing the interconnectedness of individuals, artifacts, and their environment.

CHAT posits that human activities are shaped by cultural and historical contexts, emphasizing the dynamics of social interactions and the role of mediating artifacts (Walker, 2014). At its core, CHAT seeks to analyze activities as complex systems rather than isolated actions. Activity systems, central to CHAT, represent interconnected networks of actions, tools, and participants engaged in a collective endeavor (Engeström, 1987). The Activity System in Cultural-Historical Activity Theory (CHAT) is a conceptual framework used to analyze the complexities of human practices as they unfold in socio-cultural contexts. Originating from the work of Vygotsky, Leontiev, and further developed by Engeström, the activity system is viewed as a unit of analysis to understand the dynamic interactions between individuals and their environment.

According to Engeström (1987), an activity system consists of six elements: subjects (individuals or groups acting), objects (goals or outcomes of the activity), tools (artifacts used in the activity), rules (norms and regulations governing the activity), community (social context where the activity occurs), and division of labor (distribution of tasks among participants). The subject refers to the individual or group engaged in the activity, driven by their motivations and goals. The object represents the objective or purpose of the activity, which guides the actions and operations within the system. Mediating artifacts include tools, signs, and symbols that facilitate the interaction between the subject and the object. These artifacts can be physical tools, such as textbooks and technology, or symbolic tools, such as language and diagrams. Rules encompass the norms, conventions, and regulations that govern the activity, shaping how subjects interact within the system. The community comprises the social group or network involved in or affected by the activity, providing a broader social context. The division of labor details the distribution of tasks and responsibilities among members of the community, reflecting the collaborative nature of human activities. Finally, the outcomes are the intended and unintended results of the activity, including knowledge gained, skills developed, and changes in social practices.

Applying the activity system framework to enhance educational practices in education can lead to a more holistic and contextual understanding of teaching and

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learning processes. For instance, when designing a new curriculum, educators (subjects) must consider the diverse objectives (objects) of their students, such as acquiring specific skills or knowledge for future careers. By leveraging mediating artifacts like digital platforms, interactive simulations, and collaborative software, educators can create engaging and effective learning experiences that bridge theoretical concepts with practical applications. By integrating the elements of the activity system, educators can create a more adaptive and responsive educational environment that meets the diverse needs of students and society.

In education, the rules governing academic activities are critical. These rules include institutional policies, assessment criteria, and ethical guidelines. A clear understanding and consistent application of these rules can ensure that educational practices are fair, transparent, and supportive of student learning. The community in this context extends beyond students and faculty to include administrative staff, industry partners, and alumni, whose contributions and feedback can enrich the educational environment. The division of labor in education involves not only the distribution of teaching responsibilities among faculty but also the roles of students as active participants in their learning journey. Encouraging collaborative projects, peer-to-peer learning, and research initiatives can foster a more engaged and participatory learning culture. The outcomes of educational activities, such as improved critical thinking, problem-solving skills, and professional competencies, should be continually assessed and aligned with the evolving needs of the community and the labor market.

4. Integration of Digital Tools and Technologies

The integration of digital tools and technologies within the framework of Cultural-Historical Activity Theory (CHAT) significantly broadens its applicability in contemporary educational contexts. Digital artifacts, such as software applications, online platforms, and virtual environments, function as mediating tools that transform traditional methods of communication, collaboration, and knowledge sharing among participants (Hakkarainen et al., 2004). These technologies facilitate a more dynamic and interactive learning experience, allowing for real-time feedback, personalized learning paths, and enhanced engagement. The incorporation of digital tools within CHAT provides a nuanced understanding of how technology mediates human activities, emphasizing the interplay between cultural tools and social interactions in shaping educational outcomes (Kaptelinin & Nardi, 2006).

Digital technologies not only extend the capabilities of traditional artifacts but also introduce novel forms of interaction and modes of engagement within activity systems. In educational settings, for instance, learning management systems (LMS), virtual

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classrooms, and online discussion forums have fundamentally reconfigured how students and educators collaborate, exchange information, and co-construct knowledge (Kozulin, 2003). LMS platforms such as Blackboard and Moodle offer comprehensive tools for managing course content, tracking student progress, and facilitating asynchronous and synchronous communication. Virtual classrooms enable real-time interaction and collaboration, breaking down geographical barriers and fostering a sense of community among remote learners. Online discussion forums provide spaces for reflective discourse and peer learning, allowing students to engage with course material and each other in meaningful ways (Garrison & Anderson, 2003).

Moreover, the integration of digital tools within CHAT implies the potential for these technologies to support innovative pedagogical practices. Mobile-assisted language learning (MALL) tools, for instance, enable students to access language learning resources on their devices, promoting flexibility and self-directed learning. Novawan et al. (2021) explore students' experiences with online English language learning via YouTube, highlighting how digital tools serve as mediating artifacts that transform traditional learning environments into dynamic, interactive platforms. YouTube and other video-sharing platforms offer vast repositories of educational content that can be used to supplement traditional teaching methods and provide diverse perspectives on various topics. Furthermore, artificial intelligence (AI) technologies facilitate personalized learning by adapting instructional content to meet individual student needs, providing instant feedback, and supporting differentiated instruction. The transformative potential of AI as a mediating artifact, capable of reshaping pedagogical practices and facilitating expansive learning, has been explored in studies (e.g. Novawan et al., 2024).

However, technologies can also impact negatively on student learning experience when they are not managed properly. Complexities of technologies (Novawan et al., 2021) and negative effects of AI (Novawan et al., 2024) can be coped well by using CHAT to understand how technology transforms learning experience. Collaborative projects and virtual simulations leverage CHAT principles by promoting active participation, critical thinking, and problem-solving skills. These digital environments encourage students to engage in authentic tasks and apply theoretical knowledge in practical contexts, thereby enhancing their learning experiences and outcomes (Hakkarainen et al., 2004). However, the effective implementation of digital technologies in education requires careful consideration of factors such as digital literacy, access, and equity. Ensuring that all students have the necessary resources and skills to engage with digital tools is essential for fostering inclusive and equitable learning environments (Warschauer, 2003). As such, ongoing professional development and support for educators are crucial to effectively integrating digital technologies within the CHAT



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framework and maximizing their potential to enhance educational practices (Garrison & Vaughan, 2008).

5. Application of CHAT in Education

5.1. Implementation of CHAT in Online Learning Environments

Numerous case studies have demonstrated the efficacy of applying Cultural-Historical Activity Theory (CHAT) in online learning environments. These studies highlight how digital technologies mediate educational activities and transform pedagogical practices. For instance, Engeström (2009) explored collaborative learning processes within virtual communities, emphasizing the role of digital tools in facilitating collective knowledge construction and problem-solving. Engeström's work illustrates how activity systems in digital environments can enhance student engagement and collaborative efforts by providing platforms that support interactive learning and shared objectives. Additionally, other studies have examined the application of CHAT in various online settings, showing how it can help identify contradictions within activity systems and foster expansive learning, where participants collaboratively develop solutions to complex problems (Engeström, 2001; Sannino et al., 2009).

5.2. Innovative Pedagogical Practices

CHAT has also been instrumental in informing innovative pedagogical practices that leverage digital technologies to enhance student engagement and learning outcomes. For example, collaborative projects and virtual simulations integrate CHAT principles by fostering interactions among students and instructors, promoting active participation and critical thinking skills (Hakkarainen et al., 2004). These practices enable learners to engage in authentic, context-rich tasks that mirror real-world challenges, thereby deepening their understanding and application of knowledge. Studies have shown that such digital environments not only support individual learning but also create opportunities for peer-to-peer interaction and collaborative problem-solving, which are essential for developing higher-order cognitive skills (Scardamalia & Bereiter, 2006). By incorporating digital tools within the CHAT framework, educators can design learning experiences that are more engaging, interactive, and conducive to deeper learning.

Walker (2014) contributes to the understanding of English literacy teaching and education in the United Kingdom through the lens of Cultural Historical Activity Theory (CHAT). This case study provides an in-depth analysis of how CHAT can be applied to explore the complexities of literacy instruction, examining the interactions between teachers, students, and educational tools within their socio-cultural contexts. By focusing on the practical application of CHAT in real-world educational settings, Walker's work highlights the potential of this theoretical framework to uncover the dynamic and

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systemic nature of literacy teaching, revealing how various components of the educational activity system-such as institutional policies, curricular materials, and classroom practices-interact and influence learning outcomes. This study reveals the value of CHAT in identifying and addressing challenges in literacy education, thereby contributing to the broader discourse on effective and innovative pedagogical strategies and educational reforms.

5.3. Challenges and Considerations

Despite the potential benefits of integrating digital technologies in education, significant challenges remain, particularly concerning digital inequality and access. Research indicates that the digital divide exacerbates existing disparities in educational opportunities, with students from marginalized backgrounds often facing difficulties in accessing and effectively utilizing digital tools (Warschauer, 2003). This inequality can hinder the widespread adoption and success of technology-enhanced learning environments, as students lacking adequate resources and digital literacy skills may struggle to participate fully in online learning activities. Addressing these disparities requires targeted interventions to ensure equitable access to technology and support for developing digital competencies among all students (Van Dijk, 2005).

The successful implementation of CHAT in digitally mediated learning environments also hinges on the professional development of educators. Ensuring that faculty members possess the necessary skills and knowledge to integrate digital technologies into their teaching practices is crucial for leveraging the full potential of CHAT (Garrison & Vaughan, 2008). Ongoing professional development initiatives are essential to help educators stay abreast of technological advancements and effective pedagogical strategies. These initiatives should focus on enhancing digital literacy, fostering an understanding of CHAT principles, and providing practical guidance on designing and implementing technology-enhanced learning activities (Baran, Correia, & Thompson, 2011). By equipping educators with the tools and knowledge needed to navigate the digital landscape, institutions can better support innovative teaching practices and improve learning outcomes.

6. Future directions

6.1. Further Empirical Research

Future studies should prioritize empirical research to validate the applicability of Cultural-Historical Activity Theory (CHAT) in digital learning environments. Specifically, longitudinal studies are essential to examine how digital tools mediate educational activities over time, providing insights into their impact on learning outcomes and the development of higher-order cognitive skills. Such research could explore various

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dimensions, including student engagement, knowledge retention, and the effectiveness of different digital tools in fostering collaborative learning. Additionally, experimental and quasi-experimental designs could be employed to compare traditional and digitally mediated learning environments, offering robust evidence on the benefits and challenges of integrating digital technologies within the CHAT framework. This empirical work will be critical in refining theoretical models and informing practical applications in educational settings.

6.2. Integration of CHAT with Emerging Technologies

As technology continues to advance, exploring the integration of emerging technologies within the CHAT framework presents a promising avenue for future research. Technologies such as artificial intelligence (AI), augmented reality (AR), and blockchain hold significant potential for transforming educational practices. AI can provide personalized learning experiences and adaptive feedback, enhancing the mediation process within activity systems. AR can create immersive learning environments that facilitate experiential learning and deeper engagement with educational content. Blockchain technology can ensure the security and transparency of educational records, promoting trust and accountability in digital learning environments. Research should investigate how these technologies can be seamlessly incorporated into CHAT, examining their impact on collaborative learning, knowledge construction, and student engagement. Such studies will help develop innovative pedagogical strategies that leverage the strengths of emerging technologies while adhering to CHAT principles.

6.3. Cross-Cultural Applications

Given CHAT's emphasis on socio-cultural contexts, future research should explore its application across diverse cultural settings. Comparative studies can provide valuable insights into how cultural differences influence the implementation and outcomes of CHAT-based interventions in education. By examining variations in educational practices, values, and norms across different cultures, researchers can identify universal principles and culturally specific adaptations of CHAT. Such studies could involve collaborations between international research teams to conduct cross-cultural analyses, highlighting best practices and contextual challenges in applying CHAT. This approach will contribute to a more nuanced and globally relevant understanding of CHAT, supporting its adaptation to diverse educational contexts and promoting inclusive and equitable learning experiences.

6.4. Evaluation of Interventions and Pedagogical Innovations

There is a pressing need for comprehensive evaluations of CHAT-based interventions and pedagogical innovations in education. Research should not only assess

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the effectiveness of these interventions in achieving educational goals but also evaluate their scalability and sustainability in varied institutional settings. Mixed-methods research designs, incorporating both quantitative and qualitative data, can provide a holistic understanding of the impact of CHAT-based approaches. These evaluations should consider factors such as student and faculty perceptions, institutional support, and resource allocation. Additionally, case studies of successful implementations can offer practical insights and guidelines for other institutions looking to adopt CHAT-based innovations. This evaluative research will be instrumental in refining educational practices, ensuring that CHAT-based interventions are effective, scalable, and sustainable in promoting meaningful learning experiences.

7. Conclusion

Cultural-Historical Activity Theory (CHAT) offers a robust and comprehensive framework for understanding and optimizing educational practices in the digital age. By emphasizing the socio-cultural dimensions of learning and development, CHAT enables educators to harness the transformative potential of digital technologies while addressing pervasive challenges such as digital inequality and faculty development. This systematic literature review has critically examined CHAT's foundational principles, its application in digital learning environments, and the theoretical insights it provides into activity systems and mediated interactions.

The foundational principles of CHAT, rooted in the works of Vygotsky and Engeström, emphasize the importance of cultural artifacts, tools, and social interactions in shaping human activity and learning processes. These principles have been pivotal in analyzing how digital technologies mediate educational practices. Through the lens of CHAT, we observe that digital tools, such as learning management systems, virtual classrooms, and online discussion forums, serve as mediating artifacts that facilitate communication, collaboration, and knowledge sharing among participants. The review of literature and case studies has highlighted CHAT's role in promoting collaborative learning, enhancing student engagement, and fostering innovative pedagogical approaches. By integrating digital tools within the CHAT framework, educators can design more dynamic, interactive, and contextually relevant learning experiences.

One of the significant challenges identified in the integration of digital technologies within educational settings is digital inequality. CHAT provides a framework to address these disparities by emphasizing the socio-cultural context of learners and promoting inclusive practices. The paper has discussed the necessity of ensuring equitable access to digital resources and fostering digital literacy among students and faculty. Professional development and support for educators are crucial for the effective implementation of



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digital technologies and CHAT principles in pedagogical practices. By addressing these challenges, CHAT helps create a more inclusive and equitable learning environment that supports diverse learner needs and promotes success across various socio-cultural contexts.

Moving forward, there is a need for further empirical research to explore the integration of CHAT with emerging technologies such as artificial intelligence, virtual reality, and adaptive learning systems. Cross-cultural applications of CHAT will also deepen our understanding of its versatility and effectiveness in diverse educational contexts. By embracing CHAT, educators can navigate the complexities of digital transformation, ensuring that educational practices remain adaptive, inclusive, and responsive to the evolving needs of learners in a globalized world. The integration of CHAT into educational research and practice represents a promising pathway toward creating enriching and equitable learning environments that prepare students for success in an increasingly interconnected and technology-driven society.

The adoption of CHAT in education holds significant promise for enhancing educational practices, fostering innovation, and addressing the challenges of the digital age. By leveraging CHAT's theoretical insights and practical applications, educators can cultivate learning environments that are not only technologically advanced but also deeply rooted in the socio-cultural contexts of learners, thus preparing them for future academic and professional success.

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