Computer Assisted Language Learning Electronic Journal (CALL-EJ), 26(2), 1-28, 2025

A Conceptual Model for Inclusive Computer-Assisted Language Learning: A Collaborative Ethnography

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Abstract

This study addresses critical gaps in the understanding of inclusivity within computer-assisted language learning (CALL) environments. Employing a collaborative ethnographic approach, the study incorporates diverse perspectives from seven early-career CALL teachers and researchers to investigate the influential factors shaping inclusive CALL practices. The proposed conceptual model of inclusive CALL advances both theoretical and practical understandings of this area by highlighting the interconnectedness of key factors and providing insights into designing and working in accessible, adaptable CALL environments. Furthermore, the study emphasizes the significance of ongoing professional development, equitable institutional policies, and societal advocacy to foster inclusive education. By facilitating dialogue among scholars, educators, and policymakers, this study enriches the growing discourse on inclusivity in CALL and lays the groundwork for future studies and practical implementations across diverse educational contexts.

Keywords: Computer-Assisted Language Learning (CALL), Inclusive education, Inclusive CALL, Collaborative ethnography, Conceptual model

Introduction

The rapid advancement of digital technologies has significantly transformed the field of language education, particularly through the development of computer-assisted language learning (CALL) environments. CALL provides learners with innovative tools and resources

to enhance their language acquisition, offering benefits such as personalized learning, immediate feedback, and multimodal interaction (e.g., Li., 2023; Shadiev & Yu, 2024). However, despite its growing adoption, inclusivity in CALL remains underexplored. While technology has the potential to support diverse learners, its implementation varies considerably, raising questions about accessibility and equitable learning opportunities (Andujar & Nadif, 2022; Kim et al., 2022; Pitura, 2024).

Inclusivity in CALL extends beyond technological affordances to encompass pedagogical, institutional, and societal factors. The notion of inclusive CALL aligns with broader frameworks of inclusive education (UNESCO, 2016; United Nations, 2015), which advocate for equitable learning opportunities regardless of learners' linguistic, cognitive, or socio-economic backgrounds. Scholars have emphasized the importance of designing CALL environments that are accessible, adaptable, and responsive to learners' diverse needs (e.g., Kim et al., 2022). However, existing research tends to focus on either technical solutions (e.g., assistive technologies and adaptive interfaces) or pedagogical strategies (e.g., differentiated instruction and scaffolding) without a comprehensive model that integrates multiple dimensions of inclusivity (Hsu, 2024; Prado & Warschauer, 2024).

Despite their parallel development, CALL and inclusive education have not always been seen as interconnected fields. Only recently has there been recognition that CALL educators can 'borrow' inclusive education principles to enhance teaching practices (e.g., Andujar & Nadif, 2022). Likewise, it has only recently been acknowledged that CALL can also contribute theoretical and empirical support to the development of inclusive education and its principles (Bešić et al., 2024; Gamage, 2022). At the same time, studies have explored how inclusion principles can be 'borrowed' to fit the CALL classroom; as highlighted in the former point, a dearth of empirical research has been conducted to demonstrate how CALL contributes to inclusive education. Additionally, most theoretical frameworks, such as Universal Design for Learning (UDL), provide valuable guidance but are not fully adapted to the affordances and constraints of digital language learning platforms (Bray et al., 2024; Vasinda & Pilgrim, 2023).

Moreover, despite growing interest in inclusive education, the specific constraints and opportunities associated with fostering inclusivity in CALL remain under-theorized. Previous studies have primarily examined CALL through the lens of technological advancements, often neglecting the structural and social barriers that impact equitable access to digital language learning (Kim et al., 2022). Additionally, research on accessibility in CALL has largely focused on learners with disabilities (e.g., Kamalı-Arslantaş et al., 2023; Mavrou et al., 2010), with less

attention paid to broader inclusivity concerns, such as linguistic diversity, cultural representation, and socio-economic disparities (see McCallum & Tafazoli, 2025).

This study addresses these critical gaps by employing a collaborative ethnographic approach to explore inclusivity within CALL. Drawing on insights from seven early-career CALL teachers and researchers, we examine the influential factors shaping inclusive CALL practices and propose a conceptual model that integrates key theoretical and practical dimensions of inclusivity. The research contributes to the growing body of literature on inclusive education and CALL by answering the following research question: What are the influential factors in inclusive CALL?

In doing so, the study fills a significant gap in the literature and highlights how CALL itself may align with global educational priorities. It also offers actionable insights to enhance accessibility and equity in language learning. These findings then feed into the development of a framework for inclusive CALL.

Review of Literature

The successful integration of CALL into educational settings is influenced by several key areas. These areas include design principles for effective CALL tools, teacher education and professional development, and institutional and social dimensions. Each component plays a critical role in ensuring that CALL platforms are accessible, user-friendly, and impactful for diverse learners.

Design Principles for Effective CALL Tools

The success of CALL platforms largely hinges on their usability and accessibility. Usability, defined as the ease with which a system can be used efficiently and effectively (Nami, 2023), encompasses features such as low error rates, learnability, didactic efficiency, feedback, and consistent functionality. Research highlights that usability in digital educational platforms should offer simplicity, enjoyment, and adaptability for users (e.g., Heller, 2005; Lim et al., 2012). These principles ensure that users, whether language learners or teachers, can seamlessly interact with the system. Similarly, accessibility extends beyond technical usability to include content that accommodates learners with different cognitive, physical, and linguistic abilities (Ketterlin-Geller et al., 2007; Mohid & Zin, 2010). Accessibility ensures that all users, regardless of background, can navigate and engage with the platform effectively.

In addition to usability and accessibility, the principles of system adaptability and diversity play a crucial role. Systems that offer customizable and adaptive features enhance user satisfaction by catering to individual learning preferences and providing flexibility in interaction (Lim et al., 2012). For instance, platforms that offer self-paced discovery learning, as highlighted by Heller (2005), foster a more engaging and autonomous learning experience. Furthermore, Nami's (2023) exploration of essential usability features (i.e., visibility, satisfaction, feedback, and effectiveness) underscores the importance of a user-friendly interface that guides learners through their learning journeys with minimal frustration.

CALL Teacher Education and Professional Development

The integration of CALL into language learning contexts is increasingly dependent on the professional development of teachers (Tafazoli & Picard, 2023). The research underscores that CALL training equips educators with both technical and pedagogical skills necessary for effective teaching (Mpuangnan, 2024; Stockwell, 2009; Tafazoli & McCallum, 2025). Teachers play a pivotal role in the successful implementation of CALL, particularly in inclusive settings where diverse learners require tailored instruction. Inan and Lowther (2010) highlight that targeted training enhances teachers' confidence in using CALL tools, thereby fostering a more inclusive learning environment. However, the reality remains that a significant proportion of educators lack access to such training, leaving them to self-learn and adapt technologies for their classrooms (Kusuma, 2022).

Effective CALL practice involves more than just technical proficiency - it requires a deep understanding of pedagogical strategies that meet the diverse needs of learners. This dual focus on technical and pedagogical elements is essential for ensuring that CALL platforms are inclusive and impactful. For instance, teacher anxiety and lack of support in adopting technology can hinder the effective use of CALL tools (Ertmer & Ottenbreit Leftwich, 2010; Taghizadeh & Hasani Yourdshahi, 2020). As such, professional development programs should be designed to address these challenges, providing not only technical expertise but also strategies for managing classroom diversity.

Institutional and Social Dimensions of CALL

CALL is not only shaped by technical design and teacher competence but also by broader institutional and social factors. Institutional support plays a crucial role in the adoption and effective use of CALL tools. Research by Joo et al. (2011) and Jiang et al. (2022) illustrates that administrators and policymakers must provide the necessary resources and infrastructure

to support teachers and learners in integrating CALL into their educational practices. This includes not only funding but also ongoing technical support and access to flexible partnerships that facilitate inclusive learning environments.

Moreover, societal factors such as technological accessibility, cultural context, and educational policies influence the inclusivity of CALL. Warschauer's (2004) work on digital divides highlights how socioeconomic disparities impact access to technology, affecting learners' ability to engage with CALL platforms effectively. In contexts with limited internet connectivity and insufficient resources, CALL initiatives may fail to provide equitable learning opportunities for disadvantaged groups (Husniyah, 2024). Additionally, the cultural context shapes the adoption and effectiveness of CALL tools, with traditional pedagogical methods sometimes hindering the integration of technology (Assassi & Chenini, 2023). Thus, CALL platforms must account for cultural diversity and incorporate contextually relevant content to ensure inclusivity.

In summary, the integration of CALL into educational settings must consider technical usability, teacher preparation, and the socio-institutional landscape. By addressing these interconnected dimensions (i.e., usability, accessibility, professional development, and social inclusiveness), CALL systems can more effectively support diverse learners and foster an engaging, equitable learning environment.

Methods

Methodological Framework

This study aims to explore the concept of inclusivity in CALL practices through a collaborative ethnographic lens, answering our research question: What are the influential factors in inclusive CALL? Specifically, it seeks to examine the lived experiences, critical reflections, and scholarly practices of seven early-career researchers. Focusing on our nuanced experiences and juxtaposing our narratives where fitting, we aim to identify influential factors shaping inclusive CALL practices, conceptualize their broader sociocultural and socio-political implications, and contribute meaningful insights to the discourse on inclusivity in CALL. Ultimately, the study aspires to foster dialogue among scholars, teachers, and researchers, encouraging reflexivity and informed practices in the field while also proposing a useful conceptual model to guide inclusive practice implementation in the future.

As an emerging research methodology in TESOL and applied linguistics (Kennedy et al., 2024; Starfield, 2020; Yazan et al., 2023), collaborative ethnography enables researchers to

critically evaluate, reflect upon, and share their sociocultural and individual experiences. Drawing on William Pinar's (1975) concept of *currere*, this framework allows us to unpack and reconstruct our learning processes about inclusive CALL, situating them within our professional practices.

This approach provides a flexible, dialogic, and emic means to investigate and narrate insider stories (Norris & Sawyer, 2012), ensuring that the study is grounded in the authentic lived experiences of its participants. Furthermore, it enables us to situate our individual reflections within broader sociocultural and socio-political contexts, allowing for a nuanced understanding of the forces and ideologies shaping our inclusive CALL practices.

Participant Recruitment and Data Collection

The principal investigator (PI) initiated the study by approaching seven co-researchers (four women and three men) to request their participation and informed consent. The participants were provided with detailed information about the study's purpose, their expected roles, and the contributions they would make. Each co-researcher was invited to reflect on their experiences with inclusive CALL and draft written narratives based on guiding questions provided by the PI.

The data for this study comprised the co-researchers' reflective narratives, which served as the foundation for the analysis. These narratives explored the constraints, influential factors, and strategies employed in their inclusive CALL practices. The reflections were framed around the conceptualization processes that shaped the participants' realities, the broader implications of their practices, and insights relevant to other early-career scholars.

Collaborative ethnography does not prescribe a fixed number of data collection tools or sources, as it primarily focuses on rich, personal, and reflective viewpoints (Starfield, 2020). In this study, notes complemented reflective narratives and inductive, reflexive thematic analysis, which was chosen due to its flexibility and simplicity (Perkins & Roe, 2024), making it suitable for this type of rich qualitative data in an exploratory, collaborative ethnographic study.

Reflexivity and Data Analysis

Reflexivity formed a critical component of this collaborative ethnographic study. The PI guided the co-researchers in reflecting on their construction of reality, the humanistic impact of their practices, and the connections between their experiences and theoretical principles of inclusive

CALL. This reflexive process was facilitated through a set of guiding questions designed to encourage critical engagement and deeper self-awareness.

The co-researchers' narratives were subjected to thematic analysis, whereby the PI synthesized the data into a theme-based list of influential factors shaping inclusive CALL practices. These themes were subsequently used to develop a conceptual model that reflects the interconnected dimensions of inclusivity in CALL. Throughout this process, the PI maintained a dialogic relationship with the co-researchers, encouraging ongoing collaboration and mutual reflection.

Positionality of Researchers

We recognize the importance of declaring our positionality and reflexivity as researchers (Norris & Sawyer, 2012). This study is conducted by seven early-career scholars from diverse backgrounds, encompassing sociocultural, linguistic, and academic experiences across fields such as applied linguistics and educational technology. Representing countries of Algeria, Australia, Indonesia, Iran, and the UK, we bring varied professional trajectories and personal identities that influence and shape our engagement with inclusive CALL.

Currently, we are situated across universities worldwide, spanning regions such as Algeria, Australia, Indonesia, Iran, Oman, and the UK. This global positioning allows us to bring unique perspectives to our collaborative ethnography, critically examining inclusivity in CALL. By exploring the interplay between local and global influences on our practices, we adopt a reflexive approach that contributes authentic, context-sensitive insights, aiming to resonate with a broad audience of CALL scholars.

In summary, the methodological design of this study emphasizes collaboration, reflexivity, and context sensitivity. By drawing on our shared and individual narratives, we aim to critically engage with the complexities of inclusive CALL and contribute to a richer understanding of its theoretical and practical dimensions.

Findings

The findings from this study are based on inductive and reflexive thematic analysis of the insights shared by the co-researchers, each of whom brought their unique perspectives and experiences to the exploration of inclusive CALL. The analysis revealed six key themes that significantly influence the successful implementation of inclusive CALL: 1) language learners and teachers, 2) CALL tools affordances and constraints, 3) CALL design, 4) CALL teacher education and professional development, 5) institutional policies and supports, and 6) societal

and cultural factors. Each of these themes highlights critical considerations and constraints in fostering inclusivity within CALL environments, providing a comprehensive understanding of the dynamic interplay between technology, pedagogy, and context. The following sub-sections delve into these themes, offering nuanced reflections and practical insights from the co-researchers.

Language Learners and Teachers

In the context of inclusive CALL, both teachers and learners face a range of challenges that influence the effectiveness of technology in the language learning process. Fatemeh R. highlights several key issues that arise when integrating CALL tools into the classroom. She explains, "Teachers often struggle to meet the various needs of students, particularly those with learning difficulties. Traditional CALL tools may not provide the necessary adaptability to cater to different learning styles and paces, which can hinder effective teaching." Furthermore, Fatemeh R. points out that a significant challenge for teachers is overcoming technical difficulties, as many lack the requisite digital competence to fully utilize CALL resources. She reflects, "Some teachers may lack the technical skills required to effectively utilize CALL tools. This gap can lead to underutilization of available resources and a failure to fully engage students in the learning process."

Fatemeh R. also addresses the growing digital divide, a pressing concern in modern education systems. She states, "The real challenge for language teachers in CALL environments lies in the need to be both technically proficient and empathetic. Teachers must recognize that while technology can be a powerful ally in the classroom, it is not a cure-all." This reflects her understanding that while technology provides powerful opportunities for learning, it cannot replace the nuanced needs of diverse learners. Additionally, Fatemeh R. acknowledges the rapid evolution of AI-powered tools and digital platforms, which adds another layer of complexity. She mentions, "With the rapidly evolving landscape of digital tools, especially generative AI, I have been faced with a unique set of challenges and anxieties as a language teacher. One of my primary concerns is keeping up with the pace of change, which seems to be constantly happening at an unhinged pace." The constant influx of new technologies, coupled with the pressure to adapt curricula, requires not only technical proficiency but also creativity and flexibility to meet diverse student needs.

On the learner side, Fatemeh R. highlights several significant constraints. She states, "Not all learners have the same learning styles and preferences. Some learners may feel overwhelmed by technology, particularly if they have had negative experiences in the past."

Learners with disabilities, in particular, face difficulties navigating CALL platforms that are not designed with accessibility in mind, as emphasized by Fatemeh R. This can include issues with screen readers, text-to-speech functionalities, or user interface design that does not accommodate various needs." Additionally, cultural and linguistic barriers may arise when CALL tools do not support native languages or the unique needs of diverse learners, impeding the learning process.

Jasper shares a similar experience of the constraints posed by technology access and literacy. He recalls a particular instance involving scholarship students from a remote region, where many lacked basic computer skills. Jasper explains, "I once had a class which had scholarship students from a very remote region. The students had English proficiency, yet were unfamiliar with personal computers or desktop applications such as Microsoft Word." This gap in technological literacy created difficulties for these learners in participating fully in CALL activities. Jasper emphasizes the need for institutional flexibility, stating, "This was extremely challenging for me to navigate and requires institutional flexibility to provide additional workshops and personal tutoring to these students to enable them to engage in the CALL activities we had planned."

Both Fatemeh R.'s and Jasper's reflections underscore the complexity of integrating CALL in diverse educational settings. From the need for technical proficiency and empathy on the teacher's side to addressing accessibility and digital literacy barriers for learners, the journey towards inclusive CALL remains multifaceted and requires thoughtful consideration of individual learner needs.

CALL Tools Affordances and Constraints

Indra and Katie reflect on the affordances and constraints of using CALL tools to foster an inclusive and engaging learning environment for their students. Since 2014, Indra has integrated various technological tools to support diverse learners and enhance communication. He explains, "I have been teaching English using technology since 2014, leveraging the social affordances of CALL to create an inclusive learning environment. Schoology was the very first technology that I adopted in my English language instruction, allowing me to organize materials and assignments in a centralized platform, providing students with equitable access to resources." This approach enabled him to provide flexible, accessible learning experiences that accommodate the unique needs of his students. Indra highlights how platforms like Schoology, YouTube, and WhatsApp have supported students by providing flexible, self-paced learning and collaborative engagement. He explains, "I also employed YouTube and websites

to support Schoology to deliver supplementary materials, enabling students to learn at their own pace and revisit lessons when needed." He also emphasizes the role of informal communication tools, noting, "To foster communication and interaction, I created a WhatsApp group chat for my classes, allowing my students to ask questions and engage in discussions in a less intimidating, more informal setting." Through these digital affordances, he has been able to engage students in active learning and provide a more inclusive learning environment, regardless of their location or individual needs.

Katie agrees that flexibility and accessibility are key strengths of CALL, particularly in allowing students to engage beyond the traditional classroom. She also notes some constraints, "In my experience, access alone does not guarantee inclusivity, some students struggle with unreliable internet, limited devices, or lack of digital literacy skills, which limits their ability to fully engage with CALL tools." She suggests that institutional support is needed to ensure that CALL does not unintentionally exclude those with fewer resources.

During the COVID-19 pandemic, Indra adapted his use of CALL affordances to counteract technological disruptions. He shares, "In my most recent classes, I have been employing these fundamental CALL affordances. Nevertheless, the COVID-19 pandemic has had a substantial impact on my teaching, as I have implemented some innovative CALL affordances as a result of technological disruptions." To maintain student engagement and foster independent learning, he leveraged tools like WhatsApp voicenotes to facilitate pronunciation practice and sentence construction. "I utilized the voicenote feature of WhatsApp to practice pronunciations and construct sentences using specific tenses. This allowed students to continue practicing from home while also learning from their peers' sentences, fostering collaborative improvement."

Katie acknowledged the value of such innovations in her responses, particularly for maintaining engagement in remote learning. She also utilized voice features and found that "Not all students are comfortable with recording their voices or sharing videos in public forums like YouTube. The pressure of permanent digital footprints, peer scrutiny, and lack of clear privacy protections make some learners extremely uncomfortable." She suggests that offering alternative participation methods could help students who experience digital anxiety.

Indra also used YouTube for speaking tasks and peer feedback, explaining, "I employed YouTube for the students to submit individual or group speaking clips. I also employed the YouTube commenting feature to request that students provide feedback on their peers' speaking clips, asked them to read the feedback, and took notes on constructive feedback." To balance

openness with privacy, he had students submit self-reflections on Google Docs, ensuring confidentiality, which only he could access.

While Katie adds that structured reflection is a crucial component of CALL, she also highlights that for deeper discussions and respectful feedback to occur, there is the additional time and burden of monitoring such discussions, often falling back onto teachers, making CALL implementation time-intensive. "One constraint I've faced is the increased administrative burden on teachers. Monitoring student discussions, ensuring constructive feedback, and addressing anxieties about online visibility require extensive teacher intervention." She suggests that clearer guidelines and institutional support could help sustain these practices without overwhelming educators.

Despite the affordances of CALL, Indra also acknowledges the constraints of facilitating online discussions. "While implementing inclusive education through CALL affordances, I encountered several constraints." He notes that some students hesitated to give peer feedback out of concern for offending their classmates, and others struggled with anxiety over submitting speaking videos online, fearing negative comments. "Students often struggled to identify specific areas for constructive comments or hesitated to give feedback out of concern for hurting their classmates' feelings." Katie concurs, adding that "digital spaces require careful moderation to ensure that students feel safe and supported in their participation." She believes these constraints can be addressed through structured scaffolding, explicit feedback training, and teacher guidance rather than abandoning CALL-based assessments altogether.

Indra and Katie's combined experiences demonstrate the transformative potential of CALL in creating flexible, accessible, and interactive learning environments. They emphasize that successful implementation depends on addressing systemic constraints, such as accessibility gaps, student anxieties, and teacher workload. Moving forward, both educators advocate for stronger institutional policies, privacy protections, and professional development to ensure that CALL remains a sustainable and truly inclusive tool for language learning.

CALL Design

Fatemeh N. emphasizes the importance of inclusive design principles in CALL platforms, which aim to provide equitable learning experiences for users with diverse linguistic, cognitive, and physical abilities. She explains, "Design principles are critical for inclusive CALL platforms. Such platforms enable users at different levels of linguistic, cognitive, and physical abilities with different learning styles and needs to benefit equally well from the environment

or material." For this inclusivity to be achieved, technical and pedagogical considerations must be thoughtfully integrated into the design.

One of the key aspects of inclusive CALL design is the learnability of the user interface (UI). Fatemeh notes, "The UI needs to be learnable, meaning that users can simply and smoothly use it without intricacies." She stresses that platforms should grant more control to users, especially in interactive and adaptive learning contexts, where learners are engaged in self-directed or personalized learning. Fatemeh reflects, "The more interactive and adaptive the content becomes, the higher would be the degree of users' control of interactions and user/system performances."

Another important feature in inclusive CALL design is diversity in display features and customization options. Fatemeh N. highlights, "Inclusive materials and platforms offer diverse learning options and potentials to learners. In other words, the content is sectioned and customized to learners' learning needs." This customization ensures that the platform can cater to different learning styles and levels of ability. However, Fatemeh notes that achieving inclusivity in CALL platforms goes beyond a purely technical perspective. She explains, "The principles for designing inclusive CALL platforms are not exclusive when being discussed from a technical lens. Depending on the type of content included in the design of such platforms and courseware, the nature and type of standards for achieving inclusiveness might vary."

In evaluating CALL tools for diverse learners, Fatemeh N. divides them into two primary groups: those developed by academic institutions and well-known publishers and those created by ordinary teachers. She observes, "Looking at the content of CALL platforms, tools, and materials developed by the former group, one clearly notices some degree of attention to different aspects of usability and accessibility so that the content would be of use for learners at different levels of linguistic, cognitive, and physical abilities." This is often due to the collective expertise involved in the development process, comprising linguists, software developers, and content designers, who can afford sophisticated content production. However, when it comes to teacher-generated content, the quality of inclusivity is often lower. Fatemeh explains, "When it comes to ordinary teachers, developed CALL content, platforms, and materials might not demonstrate the learnability, accessibility, persuasiveness, efficiency, or generally the inclusiveness that one expects from digital content."

Fatemeh N. identifies several constraints and gaps in the current CALL design concerning accessibility and inclusivity. She notes, "CALL content and materials which are designed by ordinary teachers usually do not encompass the requirements of inclusive CALL designs." Additionally, she highlights a significant issue with the separation between

technology-driven and pedagogy-oriented designs in CALL. She observes, "There appears to be a divorce between technology-driven and pedagogy-oriented designs in CALL. That is, technology-driven models and designs have largely informed the development of CALL platforms and content. The pedagogical considerations, however, are not widely attended to." She adds that "pedagogy-driven design considerations are more context-specific, a quality which can increase the applicability of materials for different groups of learners and learning contexts. In other words, pedagogy-driven design can yield more inclusive content."

In summary, Fatemeh N. underscores that while there are many positive developments in CALL design, achieving true inclusivity requires a balanced integration of both technical and pedagogical principles to ensure diverse learners are supported effectively.

CALL Teacher Education and Professional Development

Together, Fatemeh R.'s and Dara's reflections highlight the critical role of comprehensive teacher training and professional development in fostering inclusive CALL practices.

Fatemeh R. emphasizes the growing recognition of the importance of teacher education in CALL, noting that while some institutions provide training, many teachers are left to navigate the complexities of integrating technology into their classrooms on their own. She reflects, "While the issue of teacher education in CALL has been receiving an increased amount of attention in the literature over the past few years, this attention is indicative of greater recognition of the importance of CALL practitioners having sufficient competencies of CALL theory and practice." According to Fatemeh R., teachers must possess both technical and pedagogical skills to effectively implement CALL, especially in inclusive settings.

Beyond technical proficiency, pedagogical training is essential. Fatemeh R. highlights that teachers need to be adept at tailoring activities to meet the diverse needs of learners, including those with learning difficulties. She states, "Beyond technical training is pedagogical training, where teachers are familiarized with inclusive teaching practices for effective integration of CALL." Furthermore, the importance of providing scaffolding, feedback, and guided support for students with special needs is emphasized, ensuring they can thrive in CALL environments. She explains, "Teachers should also be trained to provide adequate scaffolding, feedback, and guided support with CALL environments in order to help learners with special needs flourish."

Dara, a CALL teacher educator, reflects on the multifaceted constraints that hinder the effective preparation of teachers for inclusive CALL. He begins by acknowledging the complexity of equipping teachers with both the technical and pedagogical skills needed to

implement inclusive CALL successfully, stating, "The biggest challenge I see is striking a balance between teaching the technical aspects of CALL tools and fostering an understanding of how to use these tools to support diverse learners." This dual focus can be overwhelming for teachers, especially those with limited exposure to inclusive practices or new technologies.

Dara notes the variability in teacher readiness as a key issue, explaining, "Some teachers come to professional development with strong technical skills but limited understanding of inclusive pedagogies, while others have deep knowledge of inclusive teaching but struggle with technology." This uneven starting point makes it difficult to design one-size-fits-all training programs. He advocates for differentiated professional development that meets teachers where they are, providing foundational skills for beginners while offering advanced sessions for those ready to explore innovative practices.

Another constraint Dara identifies is the lack of sustained support and follow-up after initial training sessions. He reflects, "Many professional development programs are structured as one-off workshops, which is not enough for teachers to internalize and apply what they have learned." Without ongoing mentoring or opportunities to practice and refine their skills, teachers may struggle to integrate CALL tools effectively into their classrooms.

Collaboration plays a significant role in professional development, as educators, technology experts, and technical support staff come together to design and implement inclusive CALL tools. Fatemeh R. highlights the benefits of this approach, stating, "Collaboration among educators, technology experts, and technical support staff should be emphasized in teacher training programs." This shared effort helps teachers overcome the constraints and ensures the effective use of CALL in inclusive settings. Dara emphasizes the importance of establishing long-term support networks, such as CoPs, where teachers can share experiences, troubleshoot the constraints, and collaborate on inclusive CALL strategies.

Resistance to change is another challenge Dara has observed, particularly among more experienced educators. He explains, "Some teachers view technology as a disruption to traditional teaching methods and are hesitant to embrace it, especially when it comes to inclusive practices, which they may see as an added layer of complexity." This resistance often stems from a lack of confidence in their ability to learn and use new tools effectively. Dara stresses the need for professional development programs to build teachers' confidence by providing hands-on, practical training that demonstrates the value of CALL for all learners.

Institutional Flexible Policies and Support

Jasper, Fatemeh R., and Dara highlight how institutional flexible policies and supports play a pivotal role in supporting inclusive CALL, fostering environments where both students and teachers can thrive.

Jasper highlights the importance of institutional flexible policies in fostering inclusivity through technology-enhanced learning environments. He explains, "Institutional policies are vital for providing frameworks within which inclusivity can flourish. Such policies may also include targets and performance indicators to measure progress." However, he acknowledges the challenge posed by the ambiguity of inclusivity as a concept, stating, "Inclusivity has been described as an unclear concept, making measurement difficult." Jasper underscores the necessity for CALL policies to move beyond a standard, mainstream approach, advocating for a more diverse and inclusive framework that reflects the needs of all learners. He warns against a simplistic view of technology's role in learning, stating, "Institutional policies must be undertaken from a thoughtful, considered position, and institutions should be careful of the 'standard view' of technology which posits that technology benefits learning by virtue of being technology alone."

Furthermore, Jasper emphasizes the importance of institutional support for inclusive CALL. He elaborates on Joo et al.'s (2011) definition of institutional support, which includes superior and colleague support, fostering a positive atmosphere. He reflects, "Institutional support is defined by Joo et al. (2011) as comprising superiors' support, colleagues' support, and a positive atmosphere within the organisation." Jasper highlights the critical role of supportive environments, stating, "If an institution is flexible, positively focused, and supportive, then it is possible for inclusive CALL to thrive." However, he also stresses the need for institutions to extend support not only to students but also to teachers, recognizing that inclusive practices require the collaboration and motivation of educators. He notes, "If teachers are compelled by institutional requirements to engage in technology-assisted pedagogy, they may feel guilt, fear, or shame for not engaging. This highlights why Joo et al.'s (2011) observation that colleagues' and superiors' support is vital for inclusive CALL to be adopted."

In his practice, Jasper is experimenting with innovative methods to enhance inclusivity through technology. He uses multimodal media, including text, audio, and video, alongside features like adaptive learning and accessibility tools. He shares, "CALL platforms can include both synchronous and asynchronous activities alongside self-paced content through multimodal media." Additionally, Jasper is exploring the use of personalized avatars and deepfake technologies to create more engaging and accessible learning experiences. He

reflects, “New technologies such as deepfake and synthetic media production can help CALL inclusivity by allowing for delivery of material via personalized avatars, in multiple languages and delivery styles.” He further highlights the importance of accessibility tools like screen readers and captions to provide multiple pathways for achievement.

To support inclusive CALL, Jasper emphasizes the role of institutional flexibility. He sees value in fostering COP, where teachers can share knowledge and experiences. He states, “Having an online COP is extremely valuable – it not only enables the teacher to become proficient at using online technological tools to develop knowledge on inclusive practice but allows them to gain experience from the learners’ perspective.” Moreover, Jasper believes institutions should explore non-traditional methods of course delivery, such as reducing in-class time and focusing on asynchronous learning or experimenting with initiatives like hyflex learning. He concludes, “Institutional flexibility can include being willing to explore new methods of course delivery, even if they are non-traditional.”

Jasper adds another layer to the conversation, highlighting the constraints posed by rapidly evolving technologies like Generative AI. He explains, “I think one of the key issues that we see with new technology, for example Generative AI, is that there is always a push to integrate new tools for CALL as soon as they are released or available.” However, he stresses the importance of caution, pointing out the lack of evidence regarding how these tools may disadvantage or exclude certain groups. Jasper warns, “Right now there is a lot of focus on how GenAI can personalize language learning through a CALL lens, but we simply don’t yet have the evidence on how this might exclude or disadvantage some groups.” Given this, ongoing professional development and conversations are crucial for teachers to understand the nuanced impact of technology and ensure it aligns with inclusive practices. Jasper concludes, “It’s so important to have ongoing conversations, PD, and training to alert teachers to the fact that technology is nuanced and can affect learners in different ways.”

Dara also highlights systemic constraints within institutions as a significant obstacle. He notes, “Even when teachers are enthusiastic about adopting inclusive CALL, institutional constraints like limited budgets, outdated technology, or lack of administrative support can make it difficult to put their learning into practice.” He recalls instances where teachers felt frustrated because they lacked access to the tools or resources needed to implement what they had learned in professional development programs.

Societal and Cultural Factors

Lee highlights the importance of national and local policies in shaping the use of technology in education, particularly in CALL. She reflects, "For me, at a national level, policies should specify specific technology standards so that learners and teachers can benefit from minimum working equipment and software." However, she emphasizes the need to consider learners from disadvantaged backgrounds who may struggle to access and afford the latest technology, ensuring that technology serves to enhance learning rather than hinder it. Lee also raises concerns about ethical considerations, stating, "At both levels of policy adoption, I feel there is also a need to address ethical CALL considerations." She points out instances where technology is used irresponsibly in research, potentially compromising students' anonymity and learning experiences.

Lee also touches upon societal beliefs about technology in education, mentioning how, in her own experience, her technical literacy has sometimes led to assumptions about students' abilities with technology, which have not always been accurate. She reflects, "I consider myself to be highly literate when it comes to technology and it is something I'm very passionate about but I have been guilty in the past of not appreciating that my students do not share the same level of literacy nor the same level of passion." This illustrates the societal belief that technology is universally accessible, which is not always the case, especially for disadvantaged learners.

Indra provides a perspective on how societal factors influence technology adoption in CALL in Indonesia. He notes, "In Indonesia, the introduction of Curriculum 2013 marked a national policy mandating teachers to integrate technology into teaching." Despite these efforts, challenges such as teachers' reluctance and lack of technological proficiency have hindered the successful implementation of CALL. Indra explains, "Many teachers, particularly those with traditional teaching backgrounds, view technology as overly complex and time-consuming, which limits their willingness to embrace CALL practices." This, coupled with large class sizes and systemic barriers, makes inclusive CALL implementation difficult.

However, Indra highlights how the COVID-19 pandemic acted as a catalyst for CALL adoption, driving massive technology training programs and embedding simple tools like video conferencing into regular teaching practices. He emphasizes the importance of sustained support, explaining, "The government selected teacher leaders, trained them, and tasked them with influencing their peers through workshops." Despite these efforts, inclusive CALL remains challenging in national schools, where larger class sizes and teacher-centered instruction are the norm.

Additionally, Indra underscores the role of international schools in promoting inclusive CALL practices. He observes that smaller class sizes and supportive policies enable more effective use of technology, stating, "International schools often benefit from smaller class sizes, help from teaching assistants, and policies that mandate the use of technology to align with 21st-century learning goals." He suggests that national schools could benefit from adopting similar models and encourages policies that provide regular training, incentives, and peer networks to ensure the smooth integration of inclusive CALL practices.

Finally, Dara reflects on the broader cultural and societal attitudes that influence CALL teacher education. He observes, "In many contexts, there's still a perception that inclusive education is primarily about physical accessibility, rather than addressing diverse learning needs through technology." This narrow understanding limits the potential of CALL to support learners with varying abilities, preferences, and backgrounds. Dara believes that shifting this mindset requires a concerted effort to raise awareness about the role of CALL in promoting inclusivity and to showcase successful examples of inclusive CALL in action.

Discussion

This study aimed to explore the key factors influencing the successful implementation of inclusive CALL and propose a conceptual model of them. By analyzing the reflections of co-researchers, the study highlights critical considerations that affect inclusivity in CALL and bridges these findings with existing literature. The themes identified underscore the multifaceted nature of inclusivity in CALL and its interdependence on technological, pedagogical, institutional, and societal systems.

The findings emphasized the pivotal role of learners and teachers as primary stakeholders in CALL environments. Inclusive CALL must prioritize the diverse needs, cognitive and physical abilities, and preferences of learners, as well as the preparedness and attitudes of teachers. This aligns with previous research (Stockwell, 2009), which highlights the necessity of tailoring CALL tools to accommodate diverse learners, including those with disabilities and varying levels of digital literacy. Additionally, teachers require robust training to bridge gaps in technological literacy and to adopt inclusive pedagogical approaches (Jiang et al., 2022).

The study reaffirms that the inherent capabilities of CALL platforms, such as adaptability, multimodal content, and accessibility tools, play a central role in fostering inclusivity. These affordances, when effectively implemented, allow learners to engage with content in ways that suit their individual needs. This finding resonates with Chapelle's (2009)

assertion that well-designed CALL tools can cater to diverse learner profiles. While CALL affordances offer opportunities for inclusive and flexible learning, constraints such as unequal access to technology, increased teacher workload, digital literacy gaps, and student anxiety present significant constraints. A balanced approach requires educators, institutions, and policymakers to actively address these constraints by providing infrastructure support, privacy protections, professional development, and clear implementation guidelines.

The co-researchers highlighted that inclusive CALL design must prioritize learnability, accessibility, usability, and customizability. Indeed, it should be noted that "there is sometimes a trade-off between the functionality and the usability of a system" (Nami, 2023, p. 128). In other words, while features such as multimodality, interactivity, and adaptability (or diverse functionalities) can make technology-enhanced content and platforms more inclusive, they might decrease the usability of these systems by adding another level of intricacy to their application. These design principles ensure that users at all levels of linguistic, cognitive, and physical abilities can benefit from CALL environments. This finding expands on existing literature (Nami, 2022) by emphasizing the importance of adaptive and interactive design features in promoting learner autonomy. Moreover, the study underscores the need for culturally and linguistically responsive design, such as supporting right-to-left scripts or providing alternative content formats for learners with impairments.

Teacher training emerged as a recurring theme, highlighting its critical role in ensuring that CALL practices are both inclusive and effective. While prior research (Mpuangnan, 2024; Stockwell, 2009) has acknowledged the importance of teacher training, this study reveals persistent gaps in access to professional development opportunities and emphasizes the need for ongoing support. Additionally, the findings stress the importance of fostering collaboration among teachers, technology experts, and support staff to co-create inclusive CALL practices.

Institutional flexible policy and support were identified as essential for creating an enabling environment for inclusive CALL. The findings echo Joo et al.'s (2011) view that institutional support - through policies, resources, and a culture of collaboration - can significantly impact the adoption of inclusive CALL. However, this study also highlights the tension between technology-driven approaches and pedagogy-oriented designs, as well as the constraints posed by disparities in access to resources and training.

The societal context in which CALL is implemented also plays a significant role in shaping inclusivity. The study highlights the importance of addressing systemic inequities, such as the digital divide and cultural barriers, which can hinder access to CALL tools for marginalized groups. Furthermore, attitudes toward technology and inclusivity influence both the willingness of educators to adopt CALL and the effectiveness of its implementation. This finding builds on previous research (Berlach & Chambers, 2011; Young et al., 2019) by emphasizing the need for policies and practices that address societal disparities.

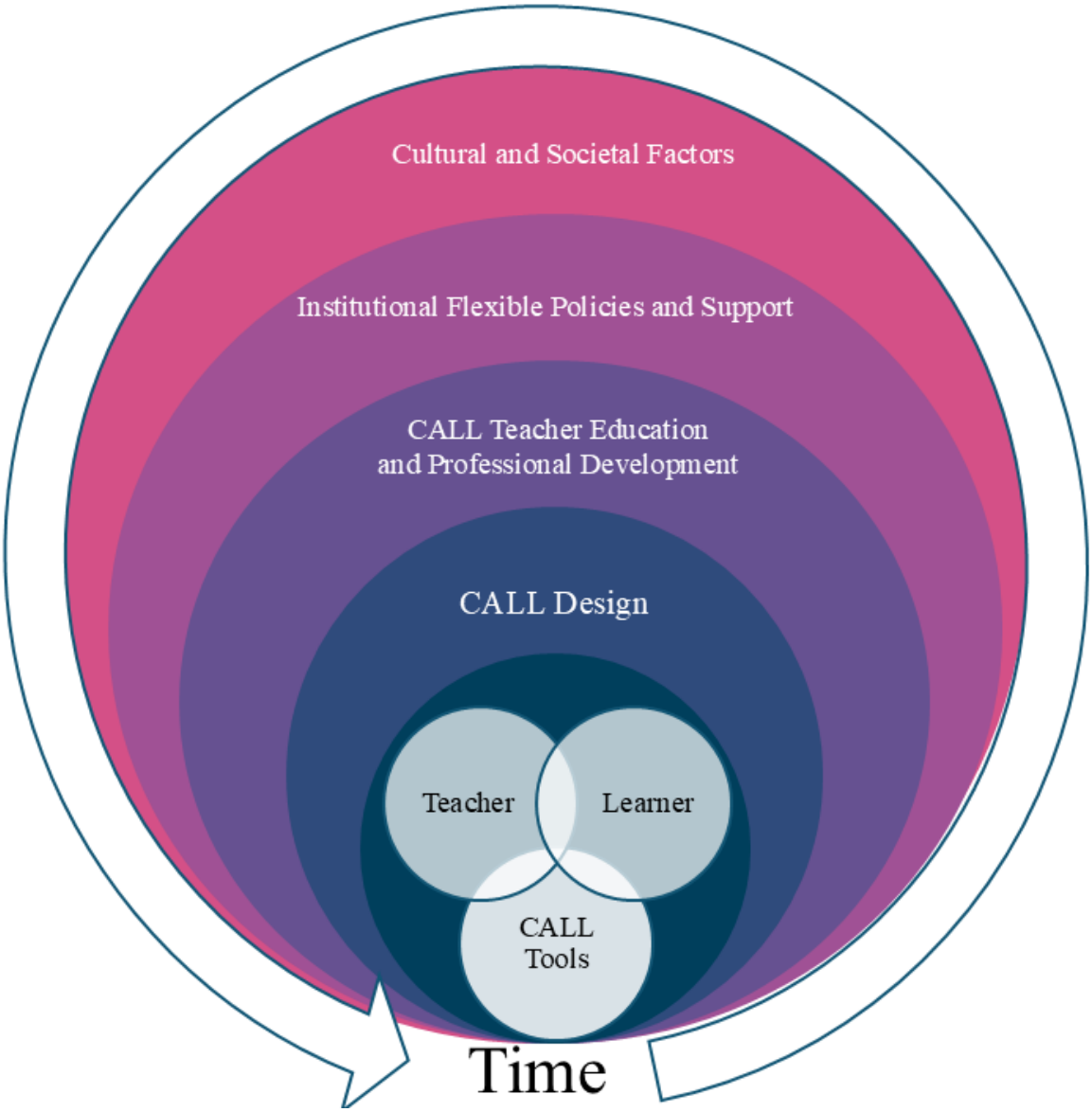
Building on these findings, this study proposes a conceptual model of inclusive CALL grounded in ecological systems theory (Bronfenbrenner, 1979). This model emphasizes the interactive and interwoven relationships between individuals and societal systems, illustrating how inclusivity in CALL emerges from the dynamic interplay of multiple factors across different levels of influence (see Figure 1).

The model consists of interconnected layers. The first layer represents the interactions between learners, teachers, and CALL tools. This layer focuses on individual learners and teachers, including their unique needs, abilities, attitudes, and interactions with CALL tools. It highlights the importance of personalized support and inclusive pedagogical practices. The second layer underscores the importance of CALL design and the need for well-designed, accessible, and adaptive CALL platforms that facilitate meaningful learning experiences. The third layer highlights the significance of CALL teacher education and professional development. The fourth layer, institutional flexible policies and support, reflects the role of institutions in creating an enabling environment for inclusive CALL. The fifth layer includes cultural and societal factors, such as cultural attitudes toward technology, systemic inequities, and national policies on education and technology. It emphasizes the need for societal-level interventions to promote equity and inclusivity. Finally, time or chronosystem, shown as an arrow, accounts for the temporal dimension, recognizing that inclusivity in CALL evolves over time as technology, pedagogical practices, and societal attitudes change.

The proposed model provides a holistic framework for understanding and addressing the complex factors that influence inclusivity in CALL. By integrating insights from this study with existing literature, the model underscores the need for a coordinated and systemic approach to fostering inclusive CALL practices.

Figure 1

A Conceptual Model of Inclusive CALL



This study contributes to the field of CALL by providing a comprehensive understanding of the factors that influence inclusivity and proposing a conceptual model that emphasizes the interconnectedness of these factors. Future research could further explore the practical application of this model in different educational contexts and examine its effectiveness in addressing the constraints identified in this study.

From a practical perspective, the findings underscore the importance of a) designing CALL tools that prioritize accessibility, usability, and adaptability, 2) providing ongoing professional development and collaborative opportunities for teachers, 3) implementing institutional policies that address disparities in access to resources and training, and 4)

advocating for societal-level interventions to reduce systemic inequities and promote inclusive education. By addressing these considerations, educators, policymakers, and technology developers can work together to create more inclusive and equitable CALL environments.

Conclusion

This study advances the understanding of inclusive CALL by proposing a conceptual model that integrates technological, pedagogical, institutional, and sociocultural dimensions into a cohesive and unified framework. Grounded in collaborative ethnography, the research highlights the interconnectedness of six key factors: learners and teachers, CALL affordances, design principles, teacher education, institutional policies, and societal influences, collectively shaping inclusivity in the modern digital language learning environments. By situating these factors within Bronfenbrenner's (1979) ecological systems theory, the model emphasizes the dynamic interplay between individual needs and broader systemic forces, addressing a critical gap in existing literature that often treats inclusivity as an abstract ancillary concern rather than a foundational design principle. This proposed holistic approach not only bridges theoretical and practical divides but also aligns with global imperatives for equitable education, offering actionable insights for educators, policymakers, and technology developers.

While the study provides a comprehensive exploration of inclusive CALL, certain limitations must be acknowledged. The collaborative ethnographic methodology, though rich in reflexive, context-sensitive insights, relies on a small sample of seven early-career educators and researchers from specific sociocultural contexts (i.e., Algeria, Australia, Indonesia, Iran, the UK), which may limit the generalizability of findings. Additionally, the qualitative nature of the study prioritizes depth over breadth, and the proposed conceptual model, while theoretically robust, has yet to be empirically validated across diverse educational settings, most notably through different sociocultural contexts. Future research could address these gaps by testing the model's applicability in varied settings, expanding participant diversity to include veteran educators and marginalized learner populations from under-represented contexts, and employing mixed-methods approaches to quantify the impact of inclusive CALL practices.

Ultimately, this study emphasizes the transformative potential of inclusive CALL in fostering equitable language learning experiences. As digital technologies continue to evolve, the need for systemic, human-centered approaches rooted in collaboration, adaptability, and cultural responsiveness, becomes increasingly urgent. By prioritizing inclusivity as both a pedagogical ethos and a design imperative, stakeholders can mitigate barriers to access,

empower diverse learners, and reimagine language education as a catalyst for global equity. The journey toward truly inclusive CALL is complex, but this research marks a pivotal step forward, inviting continued dialogue and innovation in the field, and openness towards concrete inclusivity in education.

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