Successful Practices for Avatars in Virtual World Learning: Perspectives from Experienced Educators

Arghavan (Nova) Ebrahimi, Harini Ramaprasad
Software and Information Systems
University of North Carolina at Charlotte
Charlotte, NC, USA
{aebrahi1, hramapra}@charlotte.edu

***Abstract*—Desktop Virtual Worlds (DVWs) can enhance learning experiences by allowing students to use avatars for embodied learning, identity exploration, and collaborative activities. While the use of DVWs in education is expanding, more research is needed to identify and understand the specific avatar practices that can enhance learning experiences across different contexts. To address this gap, we conducted semi-structured interviews with 14 experienced educators from the Virtual World Education Consortium in Second Life to answer the following research question: What successful avatar implementation practices do experienced educators use to enhance student learning experiences in DVWs? Through thematic analysis, we identified four distinct approaches. Our first finding revealed how educators strategically leveraged avatar-mediated identity to create what one educator called a "protective layer" between students and their academic environment, facilitating a progression from structured anonymity to authentic identity disclosure. Second, we identified context-adaptive avatar representation practices where educators customized avatar guidelines based on educational context, ranging from block-style avatars for younger students to photorealistic representations for professional environments. Third, our analysis distinguished between task-oriented and identity-oriented avatar approaches, with the former suitable for individual asynchronous activities and the latter better supporting community building. Finally, we identified instructional avatar duality practices where educators maintained multiple instructor avatars for different teaching functions, enabling simultaneous content delivery and student support during complex activities. This dual-avatar approach created enhanced instructional capabilities through strategic role-modeling and presence techniques. These findings provide valuable insights for educators seeking to create meaningful student experiences in DVWs.**

***Index Terms*—Desktop Virtual Worlds, Virtual Learning Environments, Avatars, Educational Technology, Digital Education, Digital Identity, Embodied Learning, Interaction Design, Affordances, Signifiers, VWEC, Second Life**

I. Introduction

Desktop Virtual Worlds (DVWs), while primarily developed for social or gaming purposes, are used in educational contexts due to their immersive environments and interactive affordances that support diverse learning methodologies [1]. Compared to virtual reality (VR) systems, they provide broader availability through lower equipment costs for students and enable extended learning sessions without the physical constraints that VR headsets impose, including motion sickness and limited session duration due to headset weight and discomfort [2]. One of the main affordances of DVWs is avatar representation, which refers to the digital representations of users that function as their agents and means of embodied interactions. In educational contexts, these avatars go beyond simple visual representation by mediating students' learning experiences. They facilitate engagement with educational content, agency, self-expression, and social interactions with peers in embodied, experiential ways that promote deeper learning and retention [3]. The psychological and social dimensions of avatar-mediated learning are particularly significant, as they can influence students' willingness to participate, take risks, and overcome social barriers to learning [4].

While research recognizes the importance of avatars in education in DVWs, existing studies have primarily examined avatar design features, identity representation, and embodiment effects [5]. However, our understanding of best practices across educational contexts remains limited, with less attention paid to synthesizing practical knowledge from educators who have successfully integrated avatars into their pedagogical approaches. Understanding these practices is increasingly important as educational institutions continue to adopt and expand DVW learning environments.

To address this research gap, we conducted a qualitative study focusing on the experiences and practices of seasoned educators in the Virtual World Education Consortium (VWEC) in Second Life (SL). Through semi-structured in-depth interviews and thematic analysis, we sought to answer the following research question: What successful avatar implementation practices do seasoned educators employ to enhance student learning experiences in DVWs?

Our analysis contributes novel insights by identifying four distinct approaches to avatar implementation that balance psychological safety with accountability, align representation with educational objectives, differentiate between task and identity orientations, and leverage instructional avatar duality. These findings provide actionable, experience-based insights that can guide educators new to DVWs in implementing successful avatar practices.

II. Background

Avatars enhance student engagement, agency, and presence in virtual classrooms [6]. These digital representations promote educational elements through self-identification, self-expression, collaborative interactions, and inclusion, all con-

tributing to improved learning experiences [7]. Through visual components and real-time modification affordances, avatars enrich students' creativity while simultaneously improving their short-term memory retention [8]. DVW avatars deliver these experiences through virtual movements and interactions that create a sense of embodiment for the students [9]. When entering DVWs, they can usually choose avatars from available libraries and navigate their environment by switching between first-person and third-person views, altering their sense of perspective and embodiment [10]. Such embodiment acknowledges student agency, which subsequently improves affect and motivation, ultimately driving greater engagement in learning activities [11].

Beyond navigation and engagement, avatars enable students to express their identity, thoughts, and feelings using outfit customization or gesture affordances [12]. Self-identification, defined as the feeling of identifying with a body [13], is facilitated as students use avatars as identification agents. Through these digital representations, students can present themselves with preferred identities, aliases, or nickname usernames, creating a unique presence within the virtual world [14]. This distinctive identity establishes accountability and trust in virtual learning environments [15], forming a foundation for meaningful educational interactions.

Research demonstrates that students often form empathetic connections with their avatars, which can impact their cognitive processes and overall learning experiences [16]. These connections go beyond mere representation to influence actual behavior. In what researchers have termed the "Proteus effect" [17], individuals unconsciously modify their behavior to conform to characteristics associated with their digital self-representation [18]. For instance, students assigned avatars with aggressive visual signifiers demonstrated more negative thoughts and behaviors compared to peers assigned avatars with positive signifiers [19]. Notably, these behavioral changes occur without conscious awareness [20]. The effect extends to educational contexts, where avatar customization options impact students' ability to engage, collaborate, and communicate effectively with peers and instructors [21].

In addition to identification, avatars support self-expression, which is the capacity to communicate one's feelings or intentions [7]. This ability to express oneself contributes to improved sociability and interpersonal skill development, making it a key element of socialization in both physical and virtual contexts [22]. Although developing self-expression is considered one of education's ultimate objectives [23], educational institutions frequently prioritize cognitive learning components while neglecting students' self-expression during class activities. This imbalance can leave shy or introverted students with diminished confidence and underdeveloped social skills, which impacts their entire learning experience [24].

Recognizing these challenges, educators who implement DVWs use avatar-based interactions to facilitate an 'open culture' that encourages student creativity and self-expression. The flexible nature of avatars provides students with opportunities to develop multidimensional communication skills. In these DVWs, despite limitations in conveying physical body language, avatar impressions, expressions, and programmed gestures, and customizable appearances serve as alternative communication channels between students and instructors. These visual and behavioral elements convey information about students' identities and intentions, creating opportunities for personalized educational interactions that complement traditional communication modes [25].

III. Methods

We conducted qualitative research to investigate successful avatar implementation practices developed by experienced DVW educators. We carried out semi-structured interviews with 14 educators from the VWEC community in SL.

Participants were selected based on their extensive experience in teaching in DVWs. The sample included eight active full-time professors and six retired faculty members, primarily affiliated with four-year public institutions. These educators represented diverse academic disciplines including STEM, humanities, education, and arts, with varying approaches to virtual instruction. Some conducted synchronous courses while others facilitated asynchronous learning experiences. The demographic profile reflected seasoned educators, with nine participants aged 55 or older, corresponding with their substantial teaching experience. Seven had over 15 years of DVW teaching practice. While SL was the predominant platform (used by 13 participants), many also used OpenSimulator (6 participants) and emerging platforms like Spatial. Most participants (8) developed their expertise through practical implementation rather than formal training, and collectively they taught across multiple educational levels with the highest concentration in undergraduate education.

Data collection used concurrent sessions via Zoom for audio recording and automatic transcription, alongside SL for in-world demonstrations. Interviews ranged from 60-150 minutes in duration. While our interview protocol addressed multiple dimensions of virtual teaching practice, this paper specifically focuses on analyzing data pertaining to successful avatar practices.

We employed thematic analysis following Braun and Clarke's [26] approach to identify patterns across the dataset. This methodological framework allowed us to inductively examine educators' avatar-related practices within our corpus. The analysis process began with transcript verification against audio recordings to ensure accuracy, followed by data familiarization, initial coding, theme development, theme refinement, and final theme definition.

The analytical procedure generated several hundred initial codes that were subsequently consolidated into four primary themes representing successful practices for avatar implementation. Within each thematic category, we identified specific approaches that demonstrably enhance the success of digital education delivery through avatar implementation.

IV. Findings

Our thematic analysis of educator interviews revealed four major themes representing successful approaches to avatar

implementation in DVWs. The following sections elaborate on these key findings.

A. Avatar-Mediated Identity Dynamics Between Psychological Safety and Community Development

Our research identified how educators strategically leveraged avatar-based identities to create both psychological safety and meaningful learning community development. This process followed a deliberate progression that balances anonymity with accountability.

In practice, educators implemented structured anonymity approaches that protected students psychologically through targeted identity management. Some educators required students to use real names to build trust, whereas others implemented avatar requirements to use just pronounceable usernames or others required code names (e.g., "ABC20") that prevent peer identification yet allow instructor recognition. This structured anonymity created what one educator described as a *"protective layer"* between students and their academic environment: *"The avatar is sort of a protective layer... avatars don't get embarrassed. It's like a barrier between them and others; so their avatar can ask a stupid question."*

This approach is particularly valuable when impostor syndrome negatively affects student participation. As one educator explained: *"Because of the relative anonymity that's provided by the avatar, they feel much less fear to ask whatever they want. So they do. They ask all kinds of goofy questions. And we answer them... so we don't discourage them."*

The resulting psychological safety enhanced student participation, especially for typically reserved students. One educator observed a dramatic shift in behavior: *She was very shy. She never spoke up in class... but she was one of the leading contributors in the second life class."* This facilitated what another educator called a *disconnection from their normal behavior patterns"* that allowed students to *"engage on a different level"* while maintaining necessary accountability.

Building on this psychological safety, some of the educators strategically managed the progression from initial anonymity toward authentic identity sharing. Rather than requiring immediate connections between avatars and physical identities, some experienced educators initially requested students not to reveal their real-world identities: *"At the beginning of the class, I would want students not to reveal who they are in the physical world."* While educators established this starting point, students gradually revealed their identities as comfort and trust developed within the virtual community.

The progression toward identity disclosure is managed to maximize students' community development benefits and develop a sense of community. While educators acknowledge that identity revelation happens naturally (*"they're going to do [reveal their identities] later. I can guarantee that"*), the initial separation creates what one educator called *"an identity and cultural moment... so it really provides some opportunities to open up and kind of be free of the constraints of the physical world that many people feel, even though that they are not really real, they are just in our minds. But, these virtual worlds really provide the opportunity to free from those constraints, towards ourselves."*

This management of avatar-mediated identity, from protective anonymity to gradual authentic disclosure, created opportunities for both individual expression and learning community formation. The process followed a clear progression: students initially participate more freely without fear of judgment, then gradually reveal their identities as trust develops within the virtual community. This dual-phase approach enabled students to establish new social dynamics that potentially overcome physical-world social constraints and develop meaningful connections within virtual learning environments.

B. Context-Adaptive Avatar Representation

We identified educators' approach to context-specific avatar representation as another significant theme in our analysis. This approach considers how avatars should adapt to multiple educational factors, including student age, learning objectives, and course context.

Educators described a clear developmental progression in appropriate avatar representation. As one educator explained regarding age-appropriate avatars: *"Different types of avatars are suitable for different student age groups. The blocking nature of Minecraft avatars is elementary and middle school students' favorites... older students like more realistic and human-like avatars."* Avatar policies varied among educators. Some prohibited non-human avatars to minimize distractions, while others allowed more flexibility. One professor specifically permitted non-human avatars to accommodate students who might not identify with binary gender categories.

In addition to identity considerations, some educators implemented innovative embodied learning practices where students represented their subject matter through avatar embodiments. A biology professor incorporated this approach when teaching about Osimal bunny breeding for genetics analysis and during animal research presentations where students embodied their studied organisms. As the educator explained: *"They would get extra credit if they actually showed up as the avatar for that animal."* This approach enhanced traditional content delivery by having students choose an animal avatar and present its characteristics rather than simply lecturing about them: *"They are trying to find an animal like what would be an interesting animal [for them] to be, in addition to just 'for me I'm going to talk [lecture] about an animal' like because then they could represent it as their person."* These avatar embodiments facilitated successful forms of embodied learning where students visually represented the knowledge they were acquiring.

However, while effective for learning, avatar representation was identified as more challenging and occasionally became a barrier to virtual world adoption. One educator cautioned: *"One big objection to the use of Lego-like characters, avatars, in a virtual world is that sometimes you can suggest that those cartoonist characters mean that we should not take what we're doing, the academic enterprise, seriously."*

The developmental spectrum ranged from block-style avatars for younger students to increasingly realistic avatars for professional environments. Several educators advocated for photorealistic avatars in formal educational settings, with one noting: *"Surely, if you're going into a virtual world in your leisure time to let off steam, and to play, you may not want to go as yourself. But if you're using virtual worlds for work purposes or for study purposes or for any formal engagement, because you can't do that for engagement in real life, then yes of course, you need to actually be going in as yourself."*

This finding highlighted how successful educators carefully consider the educational context when establishing avatar representation policies. They adapted avatar requirements based on student developmental needs, learning objectives, and course formality, creating appropriate environments that balance engagement with educational credibility. The consistent pattern across these varied approaches was intentional alignment between avatar representation and specific learning goals, ensuring that avatar design served rather than distracted from the educational purpose.

C. Task-Oriented vs. Identity-Oriented Avatars

Our research identified a fundamental distinction between task-oriented and identity-oriented approaches to avatar implementation in learning environments in DVWs. These approaches corresponded to different class structures and student engagement patterns. In asynchronous classes, educators observed that students entered DVWs primarily to complete assignments during limited time periods. This task-oriented approach typically led to minimal avatar customization. As one educator explained: *"My students don't mess around with their avatars a lot. They don't seem to care a lot about what their avatars look like. They just wanna get the work done."* Another educator explained: *"When I was teaching in [university name], my students selected their avatars and rarely made changes to them. I gave them all a link to a freebie store where they could get new clothing or hair, etc, but they mostly didn't make any changes."*

This pattern appeared most prominently among non-major students completing required courses. These students demonstrated task-focused behavior that prioritized assignments over avatar personalization, essentially viewing their avatars as functional tools rather than personal representations.

In contrast, synchronous courses emphasizing student collaboration, team work, social interaction, and community building showed distinctly different patterns. In these contexts, avatar customization emerged not only as an indicator of student engagement but also as a factor in peer acceptance. The social dimension became particularly evident, as one educator observed: *"There is a social pressure in personalizing the avatars"* where *"students use 'defaults' as an insult when referring to those who have not personalized their avatars."*

This distinction between task-oriented and identity-oriented implementations provided valuable insights for educational design. Task-oriented approaches may be sufficient for individual, asynchronous learning activities, while identity-oriented implementations better support community building and sustained engagement in synchronous learning environments.

D. Instructional Avatar Duality - Educator Role-Modeling and Presence Techniques

Our research revealed how experienced educators strategically used their own instructor avatars as pedagogical tools. Educators strategically managed their avatar presentation and behaviors to establish teaching presence and demonstrate meaningful virtual world engagement. Some of the interviewed professors maintained a specific teaching avatar to establish a presence with students: *"a consistent avatar to ensure students could easily recognize me."* This created what one educator called *"identity verification cues"* that established clear instructional presence.

A particularly insightful finding was that many educators maintained multiple instructor avatars for different teaching functions. One educator described: *"I basically had a teaching assistant avatar that was me... of course I had a completely separate second computer, so that the TA would be running on, while I was running my class."* Another explained: *"Now you'll notice there's another person in the room. Her name is [avatar's name]. She's sitting over at a staff desk. I actually control [avatar's name]."* This dual-avatar approach enabled simultaneous instruction and student support.

These multiple teaching avatars created enhanced instructional capabilities through dual-location coordination. The primary avatar could focus on content delivery while the secondary avatar handled logistical issues: *"I had to make sure that I as the teacher was there. So that I could receive students, but then I'd be there and be like, 'well, okay, this person's missing or that person's missing.' And then what am I gonna do about that, right? And so, the advantage of this was having the avatar stay where we were to see who was still there. And then to use the teaching assistant avatar to instant message or capture or teleport request as I was trying to do the instruction and get the field trip moving."* This solution created continuity during virtual field trips that are usually hard to manage in DVWs, especially when students are unfamiliar with navigating virtual environments.

Professional self-presentation was identified as another important consideration in instructor avatar design, reinforcing the context-adaptive principles discussed earlier. One educator explained: *"If they're my students, I have an avatar that looks like me, has my face. And so they can recognize me, as their professor, because they met me in the classroom [in the physical world]."* This visual consistency between physical and virtual identities reinforced the instructor's presence. Several educators emphasized that professional academic environments benefit from realistic self-representation: *"when you have an avatar that looks like yourself that creates a formal environment and having a realistic avatar or avatars with the educators' or students' own faces creates trust in the virtual class rather than fantasy avatars."* This formality in avatar presentation helped establish the educational tone and build trust with students.

Beyond static representation, educators also developed creative applications for their avatars. One geography professor used avatars as instructional delivery vehicles: *"I use avatars as prompts that I insert into my PowerPoint slides. And I have 2 in particular who are talking to each other like a husband and wife might talk to each other... illustrating the points that I tried to make in class."* This avatar-based dialogue approach made abstract geographic concepts more accessible through relatable character interactions.

These findings demonstrated how successful DVW education involved strategic management of instructor avatar presence, with educators designing and using their own avatars as pedagogical tools that modeled appropriate behavior, demonstrated technical skills, maintained instructional continuity, and created unique teaching techniques.

V. Discussion and Conclusion

This study contributes experience-driven insights into successful avatar implementation practices in education within DVWs. The four identified approaches (strategic identity management, context-adaptive representation, the task versus identity orientation, and instructional avatar duality) offer important considerations for educators designing virtual learning experiences. These findings provide practical guidance for educators seeking to maximize the educational potential of avatars in DVWs.

The progression from structured anonymity to identity disclosure that educators described aligns with and extends existing research on psychological safety in educational environments. While previous studies have noted avatars' role in promoting self-expression and reducing social anxiety [27], our findings illuminate the deliberate processes through which experienced educators managed this transition. The *"protective layer"* metaphor articulated by one of the participants provides a conceptual framework for understanding how avatars can simultaneously shield students from the fear of social evaluation while maintaining necessary academic accountability.

This finding has significant implications for supporting diverse student populations. The observed participation increases among typically reserved students suggests that avatar-mediated identity management could be particularly valuable for addressing educational equity concerns. By creating conditions where students feel free to participate without immediate social assessment, educators can potentially mitigate barriers related to social anxiety, impostor syndrome, and status differences that often limit full student participation in traditional classroom environments.

The transition from initial anonymity to eventual identity disclosure also offers insights into community formation processes in virtual environments. Unlike physical classrooms where visual identification is immediate, the gradual identity revelation described by our participants allows for the development of interaction patterns based initially on ideas and contributions rather than preexisting social dynamics. This sequencing may help disrupt established social dynamics and create more equitable participation opportunities, particularly for students who experience marginalization in traditional educational settings.

Our finding regarding context-adaptive avatar representation extends beyond simple age-appropriate guidelines to include a deeper understanding of how educational objectives shape representational choices. The developmental progression identified by participants, from block-style avatars for younger students to increasingly realistic representations for professional contexts, suggests that avatar policies should be calibrated not only to student preferences but also to specific learning objectives and disciplinary norms.

This finding provides important nuance to the Proteus effect literature [18, 28], which has predominantly focused on how avatar characteristics influence user behavior. Our research suggests that educators should consider not only how avatars affect individual students but also how different representational approaches shape classroom dynamics and disciplinary learning. The balance between formal credibility (enhanced by realistic avatars) and creative expression (facilitated by fantasy avatars) represents an important design consideration that educators need to navigate based on their specific educational objectives and contexts.

The avatar-based embodiment practices, where students represented subject knowledge through their digital bodies, emerged as a particularly innovative approach. This practice exceeds mere visual representation to use the representational and experiential dimensions of avatar embodiment in ways that potentially enhance conceptual understanding. As Beaufils and Berland [29] noted, self-identification with a body can impact cognitive processes. The animal embodiment example suggests that representing knowledge through avatar form may create stronger associative connections than traditional presentational approaches.

The differentiation between task-oriented and identity-oriented avatar implementations offers important insights for instructional design decisions in virtual environments. This finding indicates that the extent of avatar customization and identity expression should correspond with both the social dynamics of courses and the time frame of the learning experience. For short-term, asynchronous courses where individual task completion is important, extensive avatar customization may be unnecessary or even distracting. Conversely, for sustained, community-oriented learning experiences, supporting identity expression through avatars appears important for facilitating engagement and social cohesion. This finding connects to broader theoretical frameworks regarding the relationship between identity investment and learning community development [30].

The social pressure observed in synchronous environments, where non-customized "default" avatars become stigmatized, demonstrates how avatar customization can function as a visible marker of community membership and engagement. This dynamic suggests that in community-oriented learning contexts, providing resources and opportunities for avatar personalization may be as important as designing the learning activities themselves.

Our fourth theme on instructional avatar duality revealed practices that experienced educators employed to enhance teaching presence and functionality. The practice of maintaining multiple instructor avatars for different teaching functions extends beyond simple avatar design to create new instructional capabilities. This finding challenges conventional approaches to online instructor presence by demonstrating how educators can strategically manage multiple representations to simultaneously fulfill different teaching roles.

The dual-avatar approach described by participants connects to research on teaching presence in online environments [31], but takes this concept in novel directions by physically manifesting different aspects of teaching presence through separate avatars. This strategy allowed educators to maintain both the social presence necessary for teaching a class and the logistical student support required for sometimes complex virtual activities. The observation that some educators maintained separate computers to operate these multiple avatars simultaneously highlights both the technical challenges and the pedagogical value they placed on this approach.

This finding also provides insights into how educators modeled effective DVW behaviors through their own avatar presentations. By demonstrating professional self-presentation, navigation skills, and appropriate virtual social behaviors, educators created important learning opportunities beyond explicit content delivery. This modeling function appears particularly important for students new to virtual environments, who benefit from seeing these behaviors demonstrated rather than just described.

A. Practical Implications for Educators

Our findings offer several practical implications for educators implementing avatars in educational contexts. First, they suggest that successful avatar policies should evolve over time rather than remaining static throughout a course. Beginning with structured anonymity and gradually transitioning toward identity disclosure may maximize both psychological safety and learning community development. Second, avatar representation requirements should align with specific educational objectives rather than applying universal standards across all contexts. Third, the level of emphasis placed on avatar customization should correspond to the degree of community building and social interaction central to the learning experience. Finally, educators should consider how their own avatar implementation strategies can enhance teaching presence and functionality, potentially including the strategic use of multiple instructor avatars for different pedagogical purposes.

For novice DVW educators, these findings provide valuable guidance regarding common implementation challenges. Rather than treating avatars as simply incidental to DVW learning, our research suggests that thoughtful avatar implementation represents a key pedagogical decision that can significantly impact student engagement and learning experiences. The successful practices identified by experienced educators offer transferable strategies that can be adapted across various educational contexts and disciplines.

B. Limitations and Future Research

While this study provides valuable insights into educators' avatar implementation practices, our analytical approach focused primarily on identifying successful practices rather than comparing effectiveness across different implementation strategies, which presents opportunities for future comparative research. Future research could build on this foundation by examining how these identified practices impact measurable learning outcomes across different educational contexts. Studies integrating both educator and student perspectives would be particularly valuable, especially as we have explored student experiences in a separate study. Comparative investigations of avatar implementations across various virtual platforms would also enhance understanding of platform-specific considerations. Furthermore, research on the effectiveness of instructor avatar duality strategies across different educational contexts would provide valuable guidance for educators seeking to implement these approaches. These approaches represent useful pedagogical strategies that require further research and implementation as DVW learning environments continue to evolve.

Acknowledgment

We extend our sincere gratitude to educators of the Virtual World Education Consortium (VWEC) in SL, whose generous sharing of time, expertise, and support made this work possible.

During the preparation of this paper, the authors used Claude 3.7 Sonnet [32] to enhance clarity and improve writing quality.

References

[1] A. Ebrahimi, "Empowering online learning: Ai-embedded design patterns for enhanced student and educator experiences in virtual worlds," in *Companion Proceedings of the 2023 Conference on Interactive Surfaces and Spaces*, 2023, pp. 84–88.

[2] Y. Chen, X. Wang, and H. Xu, "Human factors/ergonomics evaluation for virtual reality headsets: a review," *CCF Transactions on Pervasive Computing and Interaction*, vol. 3, no. 2, pp. 99–111, 2021.

[3] G. Burnett and C. Harvey, "An investigation of the advantages and disadvantages of university students as avatars in virtual learning spaces," *International Journal of Emerging and Disruptive Innovation in Education: VISIONARIUM*, vol. 1, no. 1, p. 2, 2023.

[4] C. Hoang, J. D. Miles, and K.-P. L. Vu, "Effectiveness of digital avatars in student engagement and learning," in *International Conference on Human-Computer Interaction*. Springer, 2024, pp. 44–58.

[5] D. Hepperle, C. F. Purps, J. Deuchler, and M. Wölfel, "Aspects of visual avatar appearance: self-representation, display type, and uncanny valley," *The visual computer*, vol. 38, no. 4, pp. 1227–1244, 2022.

[6] S. Nocchi, "The affordances of virtual worlds for language learning," Ph.D. dissertation, Dublin City University, 2017.

[7] A. Ebrahimi and M. L. Maher, "Designing presence and place: A framework for engaging student interaction in desktop virtual world learning environments," in *2024 IEEE Frontiers in Education Conference (FIE)*. IEEE, 2024, pp. 1–9.

[8] J. Díaz, C. Saldaña, and C. Avila, "Virtual world as a resource for hybrid education," *International Journal of Emerging Technologies in Learning (iJET)*, vol. 15, no. 15, pp. 94–109, 2020.

[9] T. T. De Back, A. M. Tinga, and M. M. Louwerse, "Learning in immersed collaborative virtual environments: design and implementation," *Interactive Learning Environments*, vol. 31, no. 8, pp. 5364–5382, 2023.

[10] N. Najjar, A. Ebrahimi, and M. L. Maher, "A study of the student experience in video conferences and virtual worlds as a basis for designing the online learning experience," in *2022 IEEE Frontiers in Education Conference (FIE)*. IEEE, 2022, pp. 1–8.

[11] M. J. Lee, S. Nikolic, P. J. Vial, C. H. Ritz, W. Li, and T. Goldfinch, "Enhancing project-based learning through student and industry engagement in a video-augmented 3-d virtual trade fair," *IEEE Transactions on Education*, vol. 59, no. 4, pp. 290–298, 2016.

[12] Q. Yuan and Q. Gao, "Being there, and being together: Avatar appearance and peer interaction in vr classrooms for video-based learning," *International Journal of Human–Computer Interaction*, vol. 40, no. 13, pp. 3313–3333, 2024.

[13] D. Romano, C. Pfeiffer, A. Maravita, and O. Blanke, "Illusory self-identification with an avatar reduces arousal responses to painful stimuli," *Behavioural brain research*, vol. 261, pp. 275–281, 2014.

[14] N. M. Yusof and W. N. J. W. Ariffin, "From avatars to e-personalities: Understanding the social dynamics and identity exploration in virtual world platforms among university students," *International Journal of Academic Research in Business and Social Sciences*, vol. 13, no. 7, pp. 1033–1047, 2023.

[15] H. Lin and H. Wang, "Avatar creation in virtual worlds: Behaviors and motivations," *Computers in Human Behavior*, vol. 34, pp. 213–218, 2014.

[16] A. N. Ebrahimi and H. Ramaprasad, "Interaction design strategies for socio-spatial embodiment in virtual world learning," *Virtual Worlds*, vol. 4, no. 3, 2025. [Online]. Available: https://www.mdpi.com/2813-2084/4/3/30

[17] N. Yee and J. Bailenson, "The proteus effect: The effect of transformed self-representation on behavior," *Human communication research*, vol. 33, no. 3, pp. 271–290, 2007.

[18] D. Beyea, R. Ratan, Y. Lei, H. Liu, G. E. Hales, and C. Lim, "A new meta-analysis of the proteus effect: Studies in vr find stronger effect sizes," *Presence: Virtual and augmented reality*, vol. 31, pp. 189–202, 2022.

[19] B. L. Schnitzer, S. Gampe, A. Bieberstein, I. Hoffmann, D. Görlich, and O. Korn, "Language learning in virtual reality: Enhancement of long-term vocabulary recognition and understanding through full-body avatars," in *Proceedings of the Extended Abstracts of the CHI Conference on Human Factors in Computing Systems*, 2025, pp. 1–9.

[20] A. Martin Coesel, B. Biancardi, and S. Buisine, "A theoretical review of the proteus effect: understanding the underlying processes," *Frontiers in Psychology*, vol. 15, p. 1379599, 2024.

[21] J. Kerac, G. Golubović, N. Milić Keresteš, and T. Ilić, "The effects of avatar design on e-learning: A review," in *International Conference on Design and Digital Communication*. Springer, 2024, pp. 673–686.

[22] S. Lee, "Can speaking activities of residents in a virtual world make difference to their self-expression?" *Journal of Educational Technology & Society*, vol. 16, no. 1, pp. 254–262, 2013.

[23] M. Salam and M. S. Farooq, "Does sociability quality of web-based collaborative learning information system influence students' satisfaction and system usage?" *International Journal of Educational Technology in Higher Education*, vol. 17, no. 1, pp. 1–39, 2020.

[24] M. E. Martinez and V. Gomez, "The importance of social-emotional learning in schools," *Acta Pedagogia Asiana*, vol. 3, no. 2, pp. 101–112, 2024.

[25] P. K. S. Dhillon and H. Tinmaz, "Academic augmentation: Analyzing avatar design in educational metaverse," *Journal of Metaverse*, vol. 4, no. 1, pp. 54–70, 2024.

[26] V. Braun and V. Clarke, "Thematic analysis: A practical guide," 2021.

[27] X. You, J. O. Bailey, A. S. Won, S. J. Ahn, and B. MacIntyre, "Social vr: A promising platform for enhancing mental wellness among college students," *Proceedings of the Association for Information Science and Technology*, vol. 60, no. 1, pp. 479–491, 2023.

[28] Y. Liu, "The proteus effect: Overview, reflection, and recommendations," *Games and Culture*, p. 15554120231202175, 2023.

[29] K. Beaufils and A. Berland, "Avatar embodiment: from cognitive self-representation to digital body ownership," *Hybrid. Revue des arts et médiations humaines*, no. 9, 2022.

[30] B. Truman and J. M. Truman, "Advancing personal learning and transdisciplinarity for developing identity and community," in *Recent Advances in Applying Identity and Society Awareness to Virtual Learning*. IGI Global, 2019, pp. 282–305.

[31] R. A. Stumpf, "The significance of teaching presence and social presence on knowledge authority in the k-12 virtual learning environment," Ph.D. dissertation, Southeastern Louisiana University, 2023.

[32] Anthropic, "Claude 3.7 sonnet," AI system, 2025. [Online]. Available: https://www.anthropic.com/claude