Advantages of Virtual Worlds versus Video Conferencing Platforms for Online Education: A Comparative Study

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

Abstract—Digital education relies on various technologies, including video conferencing and desktop virtual world (DVW) platforms. Although these platforms have been studied extensively in educational contexts, comparisons of their educational benefits remain underexplored. This research presents a comparative study addressing this gap by exploring: What are the comparative advantages of DVWs versus video conferencing platforms for online education? To address this question, we conducted in-depth, semi-structured interviews with 14 educators from the Virtual Worlds Education Consortium. Participants included professors from diverse academic disciplines with extensive experience in both environments. Seven had over 15 years of DVW experience using primarily Second Life, OpenSimulator, and Spatial, while Zoom was their main video conferencing platform. Our thematic analysis revealed three major themes. The first theme identified DVW advantages: enhanced spatial presence creating shared environments, environmental interactions enabling manipulative and experiential learning, and identity expression through avatars addressing privacy concerns. The second theme revealed video conferencing platform advantages: streamlined usability with minimal technical barriers, and enhanced non-verbal communication capabilities, including facial expressions and visual signifiers. The third theme identified integration approaches that use complementary strengths across platforms, including technical solutions for cross-platform access and compatibility, and managing engagement disparities in integrated environments. These findings offer insights for educators to make informed platform decisions based on their pedagogical goals and technical constraints. This research contributes to successful digital education by highlighting how different environments enable distinct pedagogical possibilities and their potential for enhanced educational outcomes.

Index Terms—Desktop Virtual Worlds, Virtual Learning Environments, Video Conferencing, Educational Technology, Spatial Presence, Human-computer Interaction, Avatar-based Interaction, Affordances, Signifiers, Online Learning, Interaction Design, Digital Education

I. INTRODUCTION

Digital education increasingly relies on diverse technological platforms to support online learning, with video conferencing and desktop virtual worlds (DVWs) representing two prominent but different approaches. Despite the spatial affordances of DVWs [1], video conferencing platforms have emerged as the dominant technology for synchronous online education [2]. This disparity between potential benefits and actual adoption patterns points to a need for a clearer understanding of the comparative advantages each platform offers. Without this understanding, institutions risk missing educational opportunities, inefficient resource allocation, and most importantly, failing to provide students with meaningful learning experiences that effectively use the unique strengths of each medium.

To develop this comparative understanding, our study addresses this knowledge gap by examining: What are the comparative advantages of DVWs versus video conferencing platforms for teaching in online education? Drawing on affordance theory, we conducted semi-structured interviews with 14 educators from the Virtual Worlds Education Consortium (VWEC), all of whom had extensive experience in both environments. These educators represent a valuable resource of expert knowledge, and their practical insights into platform-specific advantages can help bridge the gap between theoretical affordances and practical implementation challenges that influence educational adoption decisions. We focused specifically on desktop virtual worlds rather than VR headset-based environments, as DVWs are more affordable for students and suitable for extended learning sessions.

To capture these educators' expertise, we selected semi-structured interviews as our methodology to allow for both systematic comparison across participants and the flexibility to explore emerging themes unique to each educator's experience. Participants from diverse academic disciplines had extensive teaching experience in DVWs, primarily using Second Life, OpenSim, and Spatial platforms, alongside Zoom as their main video conferencing environment.

Through thematic analysis, we identified patterns in how these platforms support different aspects of online learning. This analysis revealed that DVWs offer advantages in creating enhanced spatial presence, enabling rich environmental interactions, and facilitating identity expression through avatars. Video conferencing platforms, by contrast, excel in streamlined usability with minimal technical barriers and preserving non-verbal communication cues. Beyond these platform-specific strengths, we discovered that many educators developed integration strategies that used complementary

affordances across platforms, including technical solutions for cross-platform access and compatibility, while managing engagement disparities in integrated environments.

These findings contribute to educational technology and interaction design research by providing a practitioner-informed understanding of the distinctive advantages each platform type offers for online education. More significantly, our analysis revealed integration strategies that educators used to employ complementary strengths across platforms, demonstrating that the relationship between these technologies need not be competitive but can be collaborative. These insights can inform both teaching practice and the design of future educational technologies that better address the full spectrum of online learning needs and enhance the opportunities for successful digital education.

II. BACKGROUND

Current online education employs various technological approaches for synchronous learning, with DVWs and video conferencing platforms representing two well-known options that operate on multiple principles of presence and interaction [3]. Understanding these approaches requires examining both their distinctive characteristics and the theoretical frameworks that explain their educational affordances.

The concept of affordances—the relationship between action possibilities that technologies make available to users and users' understanding of how these possibilities can be used—provides a foundational framework for analyzing how these platforms shape educational experiences [4]. This perspective emphasizes that technologies do not determine educational outcomes directly but rather create environments with particular constraints and possibilities that influence teaching and learning activities. Understanding these affordances therefore becomes crucial for educators seeking to enhance their pedagogical practices within different technological contexts [5].

Building on this theoretical foundation, DVWs are characterized by their spatial nature, creating environments where students navigate and interact within defined two or three-dimensional spaces [6]. These environments create presence through spatial design and environmental signifiers that offer students a sense of place [7]. This approach to digital presence emphasizes embodiment and environmental context as basic elements of the educational experience [8]. Research in DVW education has primarily focused on how these spatial qualities enable various types of learning activities and outcomes in disciplines ranging from chemistry to cultural studies [9].

Operating from different affordance principles, video conferencing technologies prioritize direct interpersonal communication and face-to-face interaction, with research focusing on their demonstrated capacity to facilitate communication across distance [10]. These platforms have been studied extensively in terms of their communication affordances, usability factors, and ability to support various educational practices—from lectures to small group discussions—as video conferencing has

become a standard method for synchronous online education across diverse contexts and disciplines [11].

However, widespread adoption has highlighted limitations in both approaches. Video conferencing platforms have shown significant constraints in sustained educational use. Researchers have identified a phenomenon known as "Zoom fatigue" or "video conference fatigue," characterized by increased mental exhaustion associated with extended platform use [12]. Aagaard [13] identified five specific videoconferencing dynamics that contribute to this fatigue: awkward turn-taking, inhibited spontaneity, restricted motility, lack of eye contact, and increased self-awareness. DVWs present different challenges, including technical complexity, steep learning curves, and hardware requirements that can limit broader adoption [14]. Despite these respective limitations, there has been exponential growth in recent years since the COVID pandemic in video conferencing adoption rather than DVWs, suggesting that usability factors may outweigh potential advantages in creating more engaging spatial learning environments.

These contrasting limitations and adoption patterns indicate the complexity of understanding how these platforms support educational goals. The prevalence of video conferencing despite documented fatigue effects, and narrow interaction affordances alongside DVWs' spatial advantages but limited adoption, suggests that each platform offers distinct educational affordances that need deeper investigation. Understanding how experienced educators perceive and leverage these comparative advantages can help in using the distinctive educational value each platform type offers.

III. METHODS

This study employed a qualitative approach using semi-structured interviews to investigate the comparative affordances of DVWs and video conferencing platforms through the experiences of educators. We interviewed 14 experienced educators from the VWEC who had substantial experience teaching in both environments.

1) Participants: Our sample included eight active full-time professors and six retired faculty members from primarily four-year public institutions across diverse disciplines. Participants were experienced educators, with seven having over 15 years of experience in DVWs. The majority (13) used Second Life as their primary DVW platform, with some also using OpenSimulator (6) and newer platforms like Spatial. Most developed their expertise through practical experience rather than formal training. Their teaching contexts spanned multiple educational levels, with the highest concentration in undergraduate education.

2) Data Collection: We developed a comprehensive interview protocol with 37 open-ended questions organized into thematic categories including teaching context, platform comparison, design adaptations, and experiential dimensions. This paper focuses specifically on participants' perspectives regarding the comparative advantages of DVWs versus video conferencing platforms. Interviews were conducted via Zoom, lasting 60-180 minutes per participant across one to three

sessions. Prior to interviews, participants completed an online survey for informed consent and demographic information. All interviews were audio-recorded, initially transcribed using automated captioning, then extensively verified manually by the research team to ensure accuracy.

3) Data Analysis: Following Braun and Clarke's [15] methodological framework, we conducted a reflexive thematic analysis using inductive coding strategies. Our initial coding framework was informed by affordance theory and prior research on DVWs and video conferencing platforms. As we engaged with the data, we actively identified and refined themes through an iterative coding process. This approach enabled us to examine how various platform affordances shape educational experiences and to develop a nuanced understanding of the comparative advantages each environment offers for digital education.

IV. FINDINGS

We organized our findings into three major themes that we identified through our analysis: the advantages of DVWs over video conferencing platforms, the advantages of video conferencing platforms over DVWs, and approaches for integrating both platforms to use their complementary strengths.

A. Advantages of Desktop Virtual Worlds over Video Conferencing

Our study identified three DVW advantages over video conferencing platforms: enhanced spatial presence creating shared environments, environmental interactions enabling manipulative and experiential learning, and identity expression through avatars addressing privacy concerns while maintaining engagement.

1) Enhanced Spatial Presence: DVWs created a sense of place and embodied presence that changed how students experienced online learning. As one professor explained: *"I think the sense of place, it did help them feel like they were in a classroom together compared to Zoom."* This spatial presence enabled students to feel physically co-located in a shared environment rather than isolated in *"separate video windows [on Zoom]."* Another educator noted: *"We have social presence where we have our bodies, albeit they are pixel bodies like phonic bodies. But we still have a presence that's been established here and we can interact with each other's presence."*

Educators highlighted how the spatial nature of DVWs created different social dynamics compared to video conferencing platforms. As one professor explained: *"Zoom, everybody is in a different place even if they're not... even if some people are in the same place, you don't get that sense of spatial differentiation that would be helpful."* This absence of spatial presence on Zoom was repeatedly contrasted with the embodied experience in DVWs: *"I never thought of Zoom as having a sense of presence at all. Being present in an environment is not necessarily about being with other people. It's just being present in the environment that you're in."*

The grid-based interface of video conferencing platforms created practical limitations for engagement: *"One problem with Zoom, you've got 16 people in the class, so you've got 16 little pictures. And it's not always easy even to tell who's talking."* In contrast, spatial audio in DVWs provided directional signifiers that enhanced presence: *"Compared to Zoom, you can feel people in different locations in a virtual room. It gives that impression that when you are in a room and people are talking, you can hear them from different locations,"* versus *"Zoom that is completely flat. There is no direction."*

This difference in interface design profoundly affected how students experienced social connection in these environments. The psychological impact of grid layout of video conferencing contrasted with avatar embodiment: *"You can do that to some extent in Zoom. Zoom's 'faces in squares' interface creates limited social presence; because you see people's faces in squares. But I think it's a lot better if we have people in their bodily forms here [DVWs] interacting with each other."* and *"looking at kind of disembodied faces on a video screen, all kind of in serried rows."* DVWs enabled stronger interpersonal connections through spatial proximity: *"Seeing others' avatars gives the impression that you are really talking to the people behind them, versus Zoom, where students need to take turns to speak because they are separated."* This spatial arrangement allowed for more natural conversation patterns that better approximated in-person interactions.

Another significant advantage identified regarding DVW spatial presence involved the persistent nature of these environments, creating opportunities for spontaneous educational encounters that facilitated deeper community development. As one professor explained: *"Here's one thing that's kind of nice about persistent virtual worlds is that that's more like the real world. You can randomly run into somebody else. When you have a Zoom session and the Zoom session ends. You're on your own."* This persistence extended learning communities beyond scheduled instruction, enabling organic interactions that were impossible in time-bounded video sessions.

The persistent nature of DVWs contrasted with the ephemeral nature of video conferencing communities. As another educator reflected: *"When I was teaching using this [Zoom] platform, at the end of the semester, we had a bit of a community. But it just wasn't the same. We didn't interact with each other physically. The sense of community stopped at the screen, the photo, the picture, the image on the screen. In 3D worlds, we're not stopped by the image."* This fundamental difference suggested that while video platforms could create temporary connections, they lacked the environmental persistence that enabled community bonds to develop through ongoing spatial presence and spontaneous encounters.

2) Environmental Interactions: The two or three-dimensional environments in DVWs enabled interaction affordances that were challenging to replicate in non-spatial environments on video conferencing platforms. Educators particularly valued the ability to create and manipulate objects for teaching complex concepts: *"Yeah, I think this is perfectly*

tailored to how I tried to have them use 3D manipulatives to understand chemistry and biological chemistry. There's no way to do that in a Zoom setting." This capability transformed abstract concepts into tangible, interactive learning experiences. Another professor emphasized: "*I think manipulators are a great way to learn for lots of types of topics and you can't really do that in Zoom. You can't pre-make a bunch of objects that they [students] play with.*"

The ability to create and manipulate environments and virtual objects in DVWs represented an important advantage unavailable in video conferencing platforms. As one educator emphasized: "*When you go into a Zoom-type setting, it's nice. But you don't have the building opportunities there that you have in Second Life.*" This environmental construction affordance enabled teaching approaches that were impossible in video conferencing: "*Oh, lots of advantages. You can go into the building part. And I mentioned the tundra climate. We have a prototype upon a platform right now. That's something that's very difficult to replicate in the real world, and impossible on Zoom.*"

In addition to construction capabilities, DVWs also enabled experiential learning through environmental exploration. One educator highlighted field trip capabilities: "*I will say the other thing about 3D virtual worlds that we did very differently than Zoom were the field trips where we could go to [retracted name] island or other places that had biological involvement learning.*" This environmental flexibility allowed for contextualized learning experiences that video conferencing could not provide: "*Well, you can't really do it on Zoom because I've never seen a Zoom setting where you can just walk through a tundra climate for example.*" This environmental exploration created more active learning experiences: "*That's what makes it fun. And that's what's missing in Zoom. You can't do anything like that. You [just] could watch videos.*" Multiple professors noted that virtual environments enabled students to "*do things*" rather than merely observe or talk.

Role-playing and embodied assignments were uniquely suited to DVWs: "*You can really design assignments where people have to act things out and I think that's the biggest thing to leverage. You can't do that in Zoom. There's nothing that video conferencing can do that way.*" This embodied learning approach took advantage of the spatial qualities of DVWs in ways that provided opportunities to enhance educational experiences.

In addition to interactive learning activities, the persistent nature of virtual environments enabled educational approaches that required spatial permanence. Having a stationary place for student poster sessions and inviting the community to judge was identified as impossible in Zoom: "*You can do Zoom breakout rooms of course. But in terms of having a stationary place like a poster session, and having students randomly interact with people who are just passing through, that's something you really can't do, I think, in Zoom.*" Permanent display installations in DVWs specifically enabled persistent learning artifacts that were impossible in temporary Zoom rooms, allowing educational content to remain accessible outside of class sessions.

3) Identity Expression: Our analysis identified Avatar-based identity expression as another significant advantage, particularly for students uncomfortable with video exposure in conferencing platforms. Multiple educators reported that students often perceived video streaming in conferencing tools as intrusive to their personal spaces and domestic environments. One educator shared: "*I was told during the pandemic by one of our University vice presidents, student affairs, said that a lot of students in their physical worlds don't want to show themselves. They may not show themselves because they don't want to show the fact that maybe they're living in a car. They're homeless. They don't want to show the fact that they're having a medical issue.*" This invasion of personal space created psychological barriers for students: "*You're aware that somebody else has a camera on you, and therefore they're looking in at your private personal space... if it's a personal space, they often don't want you to be looking into it.*" This concern for privacy and psychological comfort was identified as a recurring theme across interviews, with educators noting that avatar representation provided a solution that maintained student presence while respecting their privacy.

Educators also noted distinct student engagement signifiers in DVWs: "*What I find is that for the Zoom sessions, you can't really tell if the students are there [with cameras off]. But in the virtual world sessions, it's obvious that students are engaged because they're moving around and they're talking, and they're really engaged.*" This visible participation provided more reliable indicators of student engagement than video conferencing where students could "*go dark,*" referring to the common practice of students turning off their cameras.

B. Advantages of Video Conferencing over Desktop Virtual Worlds

We identified several advantages of video conferencing over DVWs for online education. These advantages centered around two main areas: streamlined usability with lower technical barriers, and enhanced non-verbal communication capabilities that included facial expressions and visual signifiers that supported interpersonal understanding:

1) Streamlined Usability: Most prominently, video conferencing offered practical technical simplicity and ease of setup for educational contexts. As one professor explained: "*It's just like, 'hey, let's have a meeting. Let's have a class.' Boom. You're set up, just as easy as here's my email distribution list, here's the Zoom link. Boom, you're done. So that's a big advantage of Zoom.*" This simplicity removed barriers to participation and reduced time spent on technical configuration, allowing educators to focus immediately on teaching rather than platform management.

Educators acknowledged that the technical complexity of DVWs created significant implementation challenges compared to video conferencing. As one educator noted: "*The challenges are drawbacks to virtual world classroom, it's so much harder [than Zoom]. The technical hurdles to get everybody comfortable with every interaction and every use*

they have, that is a problem." This minimal learning curve for both educators and students represented a significant advantage of video conferencing. The familiar interface affordances of video conferencing leveraged established usability principles of learnability and generalizability, which reduced the student cognitive load associated with platform proficiency. The complexity of DVWs created an implicit agreement with students, who naturally expected benefits proportional to their investment of time and effort. As one educator explained: *"There is an untold student expectation that virtual world classrooms offer something more than a lecture class with all the extra effort students need to make to use virtual worlds versus having that in Zoom. So I think that is an expectation that you're actually taking advantage of the virtual world in a way that a video conference alone can't do."* This perspective highlighted that DVW complexity created implicit expectations about enhanced educational value that should be realized to justify the additional technical investment.

This streamlined approach of video conferencing extended to privacy and security management as well. Video conferencing provided effective access control for educational settings: *"In terms of the ease of setup of having a private classroom, Zoom and [Microsoft] Teams and these things are still best for that."* The streamlined access management through invitation links created a secure learning environment without the complex permission systems needed in DVWs: *"And one of the big drawbacks of second life is that there's a lot of extra levels to make it private."* This simplified security model aligned with institutional privacy requirements while reducing administrative overhead.

Finally, economic considerations further enhanced the adoption advantages of video conferencing. As one educator observed: *"Zoom isn't anywhere nearly as expensive as Second Life is."* This cost difference appeared at both institutional and individual levels, including software licensing, hardware requirements, and technical support needs. The resulting economic advantage made video conferencing more financially feasible for institutions and individual educators with limited budgets, facilitating broader implementation of synchronous online education.

2) Non-verbal Communication: The preservation of facial expressions and non-verbal communication represented another significant advantage of video conferencing: *"One big disadvantage of a virtual world like Second Life is all those nonspoken communications that went on between the professor and the students; the look on the face, the mannerisms; all those things are missing."* Another educator emphasized: *"Non-verbal cues are largely missing in a social virtual world. So you have to accommodate that non-verbal cues are not missing in Zoom."* This direct visual connection enabled more nuanced communication when students enabled their cameras.

Video conferencing also excelled at synchronized media experiences: *"Watch party that would be something like a watch party is much better in Zoom."* The shared screen functionality ensured all participants saw identical content simultaneously, whereas in DVWs, media playback often suffered from synchronization issues and lag: *"You could try and do it where everyone clicks a box [a virtual object with an embedded link to a video] and gets the same YouTube video, but it's not technically synchronous."* This limitation in DVWs created inconsistent viewing experiences that could disrupt educational activities and fragment the shared experience among students, reducing the collective engagement that synchronized content was designed to facilitate.

C. Integration of Desktop Virtual Worlds and Video Conferencing

Rather than choosing exclusively between platforms, many educators adopted integration strategies that used the complementary strengths of both environments. These approaches recognized that each platform offered unique advantages that could be combined to create more meaningful and successful educational experiences. The integration strategies fell into two distinct themes: technical solutions for cross-platform access and compatibility, and managing engagement disparities in integrated environments.

1) Technical solutions for cross-platform access and compatibility: Educators had developed various technical integration strategies to address both connectivity and hardware compatibility challenges that prevented student participation in DVWs. Cross-platform streaming was identified as the most prevalent approach, enabling participation across different access points. This strategy primarily served as a solution for students who occasionally lacked access to DVWs due to technical constraints or hardware limitations. As one professor explained: *"I think that having a way to be able to connect Zoom to Second Life. So that people could hear each other from Zoom and Second Life would be a great benefit for people. Zoom participants to hear Second Life participants and vice versa."* This approach ensured inclusion regardless of temporary access barriers, allowing students to maintain participation in class activities even when unable to enter the virtual environment directly.

Hardware incompatibilities presented similar challenges requiring comparable solutions. As one educator noted: *"Because my classes are online, students, it's not like they come into a lab and use the same equipment, they all have different equipment. So, for example, some of my students have Macs, and some of them have PCs, and some of the platforms don't work on Mac the same. For example, the people on Macintosh computers, when we went into VRChat, couldn't participate, could only just watch us on Zoom. Because VRChat no longer supports Mac. So that makes it harder."* These technical workarounds ensured student participation regardless of hardware limitations or technical capabilities, making specialized learning experiences more widely available.

2) Engagement disparities in integrated environments: Educators consistently indicated significant engagement disparities between students participating directly in DVWs and those observing through video conferencing: *"The ones that are watching us on Zoom, don't participate nearly as much as the ones who are in the world with us; as they just watching*

and not doing anything." This pattern revealed that while technical integration solved access problems and expanded access, it created qualitatively different learning experiences with differing levels of immersion and engagement. The differences in engagement between platforms stemmed from limited interaction design affordances in video conferencing: *"On Zoom, there's not very much interaction. You're just kind of sitting there. You could talk. But it's not very satisfying."*

These engagement disparities highlighted fundamental differences in how each platform enabled student participation. DVW engagement enabled psychological barrier transcendence beyond screen limitations that video platforms could not provide. This finding suggested that while integration provided broader access, it often positioned one platform as primary and the other as secondary, potentially creating inequitable learning experiences. Consequently, effective integration required specific pedagogical attention to ensure comparable learning outcomes across platforms regardless of students' access points.

V. DISCUSSION & CONCLUSION

Our findings identified that DVWs and video conferencing platforms each offered distinct advantages for online education, enabling different types of learning opportunities. This illustrates affordance framework principles [4] in practice, as each platform's design features enabled different educational interactions. The comparative analysis indicated that DVWs excel in creating spatial presence, enabling environmental interactions, and facilitating identity expression through avatars, while video conferencing platforms offer streamlined usability and enhanced non-verbal communication. These affordances are connected with learning benefits in virtual environments and the community of inquiry framework highlighting the importance of social presence in online education [16].

These platform-specific affordances become particularly significant when considering individual learning differences and disciplinary requirements. As one professor explained: *"I think that reaches some people's brains better than other people because we are all wired so differently. It's hard to say this one's better, this one's better, this one's less or whatever because you're not just dealing with people, we're not just all people, we're different people and we learn very differently. So pedagogically, we're so unique in how we receive information."* This perspective resonates with Lippman's [17] findings on how learning environments should be designed to accommodate diverse cognitive and perceptual needs, emphasizing that the affordances of educational spaces should align with the varied ways students engage with and process information.

The disciplinary nature of educational content emerges as a significant factor in determining which platform affordances best support learning objectives. As one educator noted: *"I don't think there are any drawback. I mean I don't like comparing them right in that way or saying one is necessarily better or worse than the other. It depends on what you're doing and what you're trying to do. A virtual world space like this which has building tools is great as I said for art and design students who like to make things. And they like to be involved in doing things. They tend to be active learners. That differs if you're dealing with maybe a very heavily intellectual problem like I say, a program in philosophy or something where it is about thinking. And you know perhaps then the video conferencing piece works better."* This observation extends recent frameworks on digital pedagogies [18] by highlighting how different disciplines may require different forms of technological mediation to support their distinctive knowledge structures and pedagogical approaches. This approach enabled educators to maximize the pedagogical value of each technology.

Rather than viewing these platforms as mutually exclusive, our study demonstrated that many educators developed integration strategies that leveraged complementary affordances across environments. This finding extends Njuguna [19]'s framework by demonstrating how experienced educators blended synchronous platforms to achieve more comprehensive learning experiences. These approaches observed suggested that the most pedagogically valuable strategy involved strategic platform use based on specific learning objectives, content types, and activity structures. The integration approaches observed suggest that future educational platform development could incorporate hybrid design principles. DVW platforms could benefit from adopting the streamlined usability features that make video conferencing accessible, while video conferencing tools could integrate spatial elements that enhance presence and engagement. These educator-developed strategies demonstrate pathways for creating more versatile educational technologies that combine immersive capabilities with improved usability. This finding challenges the tendency toward platform standardization often seen in institutional technology adoption [20] and suggests that educational technology policies should enable flexible, context-sensitive platform selection that prioritizes pedagogical fit over administrative convenience.

However, these advantages should be weighed against implementation barriers. The technical complexity of DVWs creates ongoing costs in training, support, and infrastructure that may outweigh pedagogical benefits in many contexts [21]. Our findings revealed engagement disparities in integrated environments, where video conferencing participants experienced diminished interaction opportunities, potentially creating inequitable learning experiences for students with limited technical access [22]. Based on these findings, we propose a decision framework grounded in recent technology integration research [23]; DVWs suit experiential learning with adequate technical support, while video conferencing serves conceptual learning with limited resources.

Despite these limitations, this research provides experience-grounded insights into how educators perceive the comparative advantages of DVWs and video conferencing platforms. The findings demonstrate that successful online education depends on matching platform affordances to specific pedagogical needs rather than standardizing on single solutions. Future

research should investigate how different affordances support various academic disciplines and develop systematic integration approaches that enhance learning outcomes across diverse learning environments.

ACKNOWLEDGMENT

REFERENCES

[1] 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.

[2] I. C. Tochukwu and O. F. Nonyelum, "Effectiveness of electronic meeting and video conferencing tools and techniques," *IUP Journal of Computer Sciences*, vol. 18, no. 4, pp. 29–55, 2024.

[3] R. Speidel, E. Felder, A. Schneider, and W. Öchsner, "Virtual reality against zoom fatigue? a field study on the teaching and learning experience in interactive video and vr conferencing," *GMS Journal for Medical Education*, vol. 40, no. 2, p. Doc19, 2023.

[4] A. Norman Donald, *The design of everyday things*. MIT Press, 2013.

[5] 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.

[6] S. Mystakidis, E. Berki, and J.-P. Valtanen, "Deep and meaningful e-learning with social virtual reality environments in higher education: A systematic literature review," *Applied Sciences*, vol. 11, no. 5, p. 2412, 2021.

[7] 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.

[8] S. Haar, G. Sundar, and A. A. Faisal, "Embodied virtual reality for the study of real-world motor learning," *Plos one*, vol. 16, no. 1, p. e0245717, 2021.

[9] K. Winkelmann, W. Keeney-Kennicutt, D. Fowler, M. L. Macik, P. P. Guarda, and C. J. Ahlborn, "Learning gains and attitudes of students performing chemistry experiments in an immersive virtual world," in *Cross Reality (XR) and Immersive Learning Environments (ILEs) in Education*. Routledge, 2023, pp. 82–96.

[10] J. Han, L. Cores-Sarría, and H. Zhou, "In-person, video conference, or audio conference? examining individual and dyadic information processing as a function of communication system," *Journal of Communication*, vol. 74, no. 2, pp. 117–129, 2024.

[11] M. A. Camilleri and A. C. Camilleri, "Remote learning via video conferencing technologies: Implications for research and practice," *Technology in society*, vol. 68, p. 101881, 2022.

[12] M. E. Deniz, S. A. Satici, C. Doenyas, and M. D. Griffiths, "Zoom fatigue, psychological distress, life satisfaction, and academic well-being," *Cyberpsychology, Behavior, and Social Networking*, vol. 25, no. 5, pp. 270–277, 2022.

[13] J. Aagaard, "On the dynamics of zoom fatigue," *Convergence*, vol. 28, no. 6, pp. 1878–1891, 2022.

[14] 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

[15] V. Braun and V. Clarke, "Thematic analysis," in *Encyclopedia of quality of life and well-being research*. Springer, 2024, pp. 7187–7193.

[16] D. R. Garrison, "Shared metacognition in a community of inquiry." *Online learning*, vol. 26, no. 1, pp. 6–18, 2022.

[17] P. C. Lippman, "Affordance theory as a framework for twenty-first century learning principles," in *Creating Dynamic Places for Learning: An Evidence Based Design Approach*. Springer, 2023, pp. 195–220.

[18] M. Roblyer and J. E. Hughes, *Integrating educational technology into teaching: Transforming learning across disciplines*. Pearson Education, Incorporated, 2019.

[19] A. Njuguna, "Using videoconferencing to augment blended learning for synchronous and asynchronous teaching in educational emergencies," *International Journal of Computer Applications Technology and Research*, vol. 11, no. 07, pp. 264–271, 2022.

[20] L. H. A. de Andrade, D. A. Thomas, and V. Laterza, "The rise of edtech platforms in higher education: Mapping themes from emerging critical literature," in *Digital Transformations in Nordic Higher Education*. Springer International Publishing Cham, 2023, pp. 27–51.

[21] R. R. Ravichandran and J. Mahapatra, "Virtual reality in vocational education and training: challenges and possibilities," *Journal of Digital Learning and Education*, vol. 3, no. 1, pp. 25–31, 2023.

[22] N. O. Onele, "The role of desktop virtual reality as an accessible and equitable strategy to improve career opportunities for women in technology," *Journal of Computer Assisted Learning*, vol. 39, no. 1, pp. 20–33, 2023.

[23] A. Forkosh-Baruch, M. Phillips, and A. Smits, "Reconsidering teachers' pedagogical reasoning and decision making for technology integration as an agenda for policy, practice and research," *Educational Technology Research and Development*, vol. 69, no. 4, pp. 2209–2224, 2021.

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