DESIGN EDUCATION & TOMORROW'S DISTANCE LEARNING: FROM BEHIND TO BEYOND.

Nuno Bernardo[1]*, Emilia Duarte[2], Gonçalo Pires[2]

[1]Xi'an Jiaotong-Liverpool University

[2]IADE Universidade Europeia

*nuno.bernardo@xjtlu.edu.cn

Keywords

Design; Education; Distance Learning; Technology; Virtual-Reality.

1. Education and Technology

Technological advancement has transformed Higher Education (HE) in multiple ways. Among others, it enabled the online growth and expansion of the learning environment, empowered the appearance of new teaching and learning modalities or forms, made geographic barriers inconsequential and time zone distances an accommodable inconvenience. All contributed to a more accessible and inclusive learning experience for a broader range of learners

* Corresponding author

worldwide. The modality proved critical amid the COVID-19 pandemic, allowing HE to pivot online and keep going uninterrupted (Bernardo & Duarte, 2020). However, when the precautionary measures eased, institutions did not rush back to the old “normal”. Some remained online as a safeguard, while others favoured a phased hybrid return. In both cases, the online modality would maintain its status as a reliable medium for teaching and learning, in both synchronous and asynchronous forms.

Nonetheless, the conditioning imposed by the use of display-based systems during this period accentuated feelings of distance in participants and magnified their perceptual sense of isolation. Furthermore, it bottlenecked expressiveness, impaired social-emotional development and personal sense of meaning or belonging otherwise natural to co-located contexts, characteristic of design-related fields (Bernardo & Duarte, 2021). In an HE industrial design studio context, where multimodal interaction, diverse social-cultural environments and experiential learning, among others, play a significant role in developing design proficiency (Davis, 2017), the inability to reproduce some of these virtually (at similar levels) heeded the transition to online detrimental by comparison.

2. From Behind to Beyond

The fitness to digitally move from the narrowness of a two-dimensional (2D) display-based human-computer interaction (HCI) while countering feelings of distancing or isolation is an expectancy behind the use of immersive Virtual Reality (VR) in education and one that gains renewed strength in the fallback of the pandemic (Bernardo & Duarte, 2023). The future use and integration of VR aims to break the inelasticity of the 2D interaction model by opening access to simulation platforms that can afford multimodal interaction in three-dimensional (3D) virtual space, which are likely to redefine current educational paradigms (Serna-Mendiburu & Guerra-Tamez, 2024). Ongoing research and development include projects such as MIT's Media Lab CocoVerse that is exploring constructivist and exploratory learning (*Project Overview ‹ CocoVerse: A Playground for Co-Creation and Communication in Virtual Reality – MIT Media Lab*, 2024), or NVIDIA's Holodeck and OmniVerse platforms which are attempting to reframe remote collaborative work by bringing designers and stakeholders together in shared 3D virtual spaces. Mark Zuckerberg's, who foresees a paradigm shift in education towards immersive learning (Newton, 2021), is also branching Meta into this space with the release of Horizon Workrooms. Common to these and other ongoing developments seeking similar outputs is the emphasis on the critical role that Extended Realities (XR) technologies will play in the future of work and education, alluding to a plausible near-future online experience that moves beyond the 2D window display into reality-virtuality threshold.

3. Tomorrow’s Distance Learning

To better understand the role that VR may play in remote design education in the near future, this study proposes a comparative investigation against the current existing baseline. The aim is to evaluate and assess its potential impact on:

1. Augmenting the range of interaction and communication
2. Alleviating sentiments of physical distancing and/or isolation

The study takes place in Lisbon, Portugal, at IADE - Faculty of Design, Technology e Communication, Universidade Europeia. Participants are randomly picked from a pool of student volunteers who chose to participate in the study by responding to an open call. Participation is open to currently enrolled students active at the undergraduate level and operating within the same course level. The study employs a mixed-methods approach to gather primary data, which derives from a series of experiments with two groups of participants (control: CRTL; experimental: EXPR), questionnaires (pre- and post-) and group interviews. Each group is comprised of six participants who are split into two teams of three.

All participants undergo two VR training sessions to develop familiarity with the equipment and system, tools, and interaction in collaborative, shared 3D virtual spaces. The training sessions intend to acclimatize them to system use and cancel, through anticipation, the influence or effect that novelty could play during the experiment and later data

capture.
The study comprises a total of four separate experiments; all take place in the week after training and on the same day. One team from CRTL and one from EXPR undergo the experiment simultaneously during the morning, and the two remaining do it in the afternoon. Twenty minutes before the start, each participant is led to an empty classroom equipped with a video-conference-enabled computer system and a pre-installed set of digital tools. Teams in the CRTL group are conditioned to the baseline online communication toolset used during the COVID-19 pandemic at XJTLU (Learning Management System, Zoom or Microsoft Teams, Miró) but free to use any design software (e.g., Adobe Creative Cloud, Rhinoceros, KeyShot). Teams on the EXPR group are subject to the same baseline setup plus access to an HTC VIVE VR headset and Meta's Horizon Workrooms platform. The primary intent is to observe if and how the addition of a VR system and platform to the baseline influences (or not) the dependent variable: the level of communication and perceptual sense of distance between remotely located team members when collaborating online on an industrial design project in a HE context.

For the experiment, both groups undergo a one-hour design sprint. At the start, participants answer a pre-questionnaire that records their physical and emotional baseline; upon completion, they gain access to the project briefing, connect with their team members online and conjointly address the task. All physical and digital interactions are recorded for later review; these include video-recording participants in-location, using a digital video camera, and their computer displays with screen-capturing software. One hour later, participants upload their work to a cloud folder and complete a new questionnaire that asks the same questions as the pre-questionnaire. The intent behind having identical pre- and post-questionnaires is to have a measure of contrast between the beginning and end of the experiment to understand what changes occurred throughout and gain insight into what kind or type of impact the conditioning may have had on participants. Some of the questions were retrieved and adapted from previous existing questionnaires, including Brooke's (1995) System Usability Scale, Lewis's (1995) Usability Satisfaction, Kennedy et al. (1993) Simulator Sickness Questionnaire, and Witmer and Singer's (1998) Presence Questionnaire, while others built explicitly to explore other dimensions of the study. These aimed to gather participant input concerning screen-mediated interactions, digital expressivity, personal connectivity, and engagement. Group interviews occur later, after primary data analysis, and aim to add clarity and depth to questionnaire results and user observations.

In both groups, CRTL and EXPR, the environmental setting intends to emulate a context of social isolation, similar to what occurred during the COVID-19 pandemic — participants are isolated in separate rooms, adequately equipped for the experiment, and all interactions occur through web-mediated devices. This first initial study limits the time variable to one hour; however, in many cases during the COVID-19 pandemic, students were subjected to far more extended periods online. In this sense, conducting additional future experiments with different durations and participants would be pertinent to stress the time variable. This post-work would enable the measuring and evaluation of digital fatigue, performance, attention spans, and cognitive saturation, among others, as participants' time online increases and while using different digital toolsets.

References

1. Bernardo, N., & Duarte, E. (2020). Design, education, and the online tech-pandemic. Strategic Design Research Journal, 13(3), 577–585. https://doi.org/10.4013/sdrj.2020.133.22

2. Bernardo, N., & Duarte, E. (2021). Immersive Virtual Reality in an Industrial Design Education Context: What the Future Looks Like According to its Educators. Computer-Aided Design and Applications, 19(2), 238–255. https://doi.org/10.14733/cadaps.2022.238-255

3. Bernardo, N., & Duarte, E. (2023). Industrial Design Education and Immersive Virtual Reality: Perceptions on Utility and Integration. Lecture Notes in Computer Science, 371–387. https://doi.org/10.1007/978-3-031-35696-4_27

4. Brooke, J. (1995, November). SUS: a Quick and Dirty Usability Scale. ResearchGate. https://www.researchgate.net/publication/228593520_SUS_A_quick_and_dirty_usability_scale

5. Davis, M. (2017). Teaching design : a guide to curriculum and pedagogy for college design faculty and teachers who use design in their classrooms. Allworth Press.

6. Kennedy, R. S., Lane, N. E., Berbaum, K. S., & Lilienthal, M. G. (1993). Simulator Sickness Questionnaire: An Enhanced Method for Quantifying Simulator Sickness. The International Journal of Aviation Psychology, 3(3), 203–220. https://doi.org/10.1207/s15327108ijap0303_3

7. Lewis, J. R. (1995). IBM computer usability satisfaction questionnaires: Psychometric evaluation and instructions for use. International Journal of Human-Computer Interaction, 7(1), 57–78. https://doi.org/10.1080/10447319509526110

8. Newton, C. (2021). Interview: Mark Zuckerberg on Facebook's metaverse [Broadcast]. Retrieved 22 July 2021, from https://www.theverge.com/22588022/mark-zuckerberg-facebook-ceo-metaverse-interview

9. Project Overview ‹ CocoVerse: A playground for co-creation and communication in virtual reality – MIT Media Lab. (2024). MIT Media Lab. https://www.media.mit.edu/projects/cocoverse/overview/

10. Serna-Mendiburu, G. M., & Guerra-Tamez, C. R. (2024). Shaping the future of creative education: the transformative power of VR in art and design learning. Frontiers in Education, 9. https://doi.org/10.3389/feduc.2024.1388483

11. Witmer, B. G., & Singer, M. J. (1998). Measuring Presence in Virtual Environments: A Presence Questionnaire. Presence: Teleoperators and Virtual Environments, 7(3), 225–240. https://doi.org/10.1162/105474698565686

Author

Nuno Bernardo, MSc is an industry-experienced industrial designer and maker, educator and researcher, with a background in design engineering. He currently works as an Associate Professor in the Department of Industrial Design at the Xi'an Jiaotong-Liverpool University (Suzhou, CH) and is an affiliate Fellow of the Chartered Society of Designers (UK).