

Design, Education, and the Online Tech-Pandemic

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ABSTRACT

Amidst the COVID-19, the use of technology in the learning environment was no longer a matter of choice. Forced by circumstance, educators had to adapt in order to see the academic year through. While for some, already used to an online modality, it was business as always, for others was the start of a journey through unfamiliar territory. This study inserts itself in such context. It presents and discusses results gathered through an online questionnaire about the perceptions and personal experiences of design educators in Higher Education (HE) caught in this move from in-class face-to-face onto online teaching. Objectively, it portrays how this shift impacted their ability to teach, the compromises made or alternatives sought, and views towards a more technologically enabled future in HE. From a more extensive reliance on Learning Management Systems (LMS), changes in the learning environment, and perspectives of near-future uses of Virtual Reality (VR) in distance education, this study covers uses of technology but also the identification of pain points influencing the overall experience, as well as positive perceptions and significant changes made to the learning environment.

Keywords: Design, Higher Education, Online Pedagogy, Technology.

1. OUTLINE

This study involved HE professionals from the broad field of design and their recent experiences with online teaching due to the COVID-19. It begins by identifying and reviewing published literature to determine and clarify the state of the art regarding distance education, specifically in the online form. This first part follows with a brief overview of the ways technology is changing the learning environment, influencing pedagogy, and the teacher's role. Together, these two provide background to the study. Moving forward, past the methodology, and after presenting results, it concludes with a short resume and discussion involving the most relevant findings and their influence on the teaching, learning, and practice of design.

2. TEACHING FROM AFAR

Distance education, online education, and e-learning are common concepts, however, their definition is not entirely consensual. Sun and Chen (2016) faced a similar dilemma in their literature review when the search string "online education" revealed an association with, or being synonymous of, twelve other terms which, for their paper, they accepted as being "sufficiently synonymous" and used interchangeably throughout (p.160). Other authors, such

as Moore, Dickson-Deane, and Galyen (2010), disagree but defining clear boundaries in their work was somewhat challenging. Unclear boundaries are one reason for their non-standardized use in literature, but there are others. The author's country of origin, or local context in which the term is used, is likely to exert influence in the way it is later applied in literature, leading to consequent disparities. For instance, Simonson, Smaldino, and Zvacek (2015) note that online education applies exclusively to HE, e-learning to distance education in the private sector (e-training), and virtual education refers to distance learning in K-12 education (online public schools in the USA and Canada). However, their view on e-learning does not match Hubackova's (2015), whose account makes specific references to its use in HE, in European countries. Another reason may be time; the meaning of each term doesn't remain static to its passage. Variables of different natures (e.g., political, historic, pedagogic, etc.) keep mutating their meaning to keep them aligned with current views. Consequently, this also changes their use, and sometimes denomination; this was the case with the term e-learning, whose origins are rooted in Computer-Based Learning (CBL).

Distance education is the broad, inclusive term. At its heart is the concept of separation of teacher and student, but, for a mode to qualify as such, it has to fulfill three main conditions. The first is distance, which can be of the geographical type, or distance in time; second, it has to enable a channel between teacher and student that allows two-way communication; lastly, it has to integrate an education institution (Simonson, Smaldino & Zvacek, 2015). Online education is then a form of distance education, which utilizes the online medium, and can occur in either synchronous or asynchronous form. The first involves teacher-student interaction in real-time, while the second allows participants to complete self-paced web-based tasks, without live interaction. Asynchronous online education (e.g., a standalone package of instructional material with no face-to-face contact with a teacher or other students) is thought to be the essence of e-learning (Klein & Ware, 2003). The combination of asynchronous online education (hereafter referred to as e-learning) with in-class teaching is known as blended learning. A term also interchanged often in literature with hybrid learning or mixed-mode learning, all of which synonymous (O'Byrne & Pytash, 2015).

3. STAGE PERFORMERS AND LEARNING ORCHESTRATORS

Online education has gained more attention over the years as instruction actively migrates from conventional forms (e.g., books, face-to-face lectures) to computer-based media (e.g., podcasts, educational games) (Mayer, 2019). Several studies have discussed the advantages and disadvantages of online modalities (Hameed, Badii & Cullen, 2008; Hammad, Hariadi, Purnomo, Jabari, & Kurniawan, 2018). Arkorful and Abaidoo (2014) note key factors such as access to a large amount of information, discussion through forums that help eliminate barriers that may hinder participation, and enable self-pacing via e-learning. In contrast, Hameed, Badii, and Cullen (2008) refer to the lack of social interaction, the need for pre-existing digital literacy, and a tendency to be suitable only for students with robust independent learning and motivation skills, which constitute a subset of the student population. Literature supports that a combination of modalities is a better approach and more inclusive of student needs, which has contributed to the rise of blended learning (Wedgwood, 2012).

Merging online components into an existing course, or offering the latter solely online, requires planning. Designing for online means is different from designing for in-class, so what may work in a traditional face-to-face environment won't necessarily do online

(Driscoll & Carliner, 2005). Doing so requires revising the pedagogical framework, — teaching and learning sequence, methods, assessments, etc. as to weave the features of the new medium into a thread leading to the fulfillment of the learning outcomes. In short, integrating online components changes the way instruction is provided by using technology to achieve better learning outcomes, or a more effective assessment of these outcomes, or a cost-efficient way of widening the learning environment (Mayes & de Freitas, 2013).

Learning Management Systems (LMSs) have become central to the day-to-day teaching and learning in many institutions, providing several features that go beyond traditional forms of teaching spaces and standalone technologies (McPherson, 2016). The system is online, available to the community, and enables a multitude of interactions between students, teachers, and support staff. To those who teach, it allows access to tools whose affordances facilitate not only information sharing and subject administration but also task or activity setting for student involvement. The number of resources and features available to both teachers and students, and the tendency for a more technological learning environment, are increasing a move away from lecturing onto more flexible models. Teachers are now having to choreograph content, context, and tools, with both skill and purpose, making them less of stage performers and more of learning orchestrators (Cronje, 2016).

Technology may afford new learning opportunities, but these are still contingent on personal beliefs. The duality, where some see technology as a threat and others as an opportunity, is still common in education (Ertmer & Newby, 2016). Making use of it or not, however, does not influence the ability to teach. Understanding the subject and having the skill to deconstruct a topic into meaningful and manageable concepts is what's genuinely fundamental (Hokanson & Hooper, 2004). Technology is also unable to reproduce the complex teacher-student relationship or effectively transmit all aspects of the proactive, pedagogical engagement of a good teacher (Simonson, Smaldino & Zvacek, 2015). More than technology, and critical to the process, is the capacity of the people involved in orchestrating the learning experience. While these may employ tools technology enables, their use alone will not guarantee the pedagogy or instruction's success.

4. METHODOLOGY

During quarantine, the use of technology in the learning environment was pivotal. Reliance on it has led to a massive experiment involving teachers from broad demographics, who suddenly had to move online to continue teaching. This study aimed to characterize the experience and perceptions derived from this event, particularly from HE academics in areas related to design. Objectively, it sought insight into:

- The level of familiarisation with different forms of technology
- Trade-offs between in-class and online modes; noticeable changes in the learning environment and student learning
- Experience of teaching solely through online means
- VR and perspectives on its applicability to HE

Primary data was gathered through means of a questionnaire, available online during May in 2020. A total of 27 questions, composed of multiple-choice, scaling, and open-end questions, were developed and divided into four parts, as set in the following section. A link to the

questionnaire was distributed by email to an education-related personal contact network and the PhD-DESIGN JISC mail list. It got a total of 74 respondents, from which 39 answered entirely. A summary of results is present in the section that follows, which, although it cannot be generalized, can characterize perceptions on online education and its pedagogy.

5. RESULTS

5.1. Demographics

Respondents are within the 25-70 plus age range; the majority is within the 35-49 threshold (61.5%). Gender wise, female respondents outweigh others (57.89%). In design fields, most are from product or industrial design (22.08%), architecture (14.29%), interaction, and user-experience design (12.99% each). About teaching in HE, only 17.95% indicate 0-4 years of active practice; the largest groups are in the 5-9 and 10-14 interval, each at 25.54%. Most are involved at undergraduate (42.03%) and postgraduate (40.58%) level, with 17.39% at the doctoral level.

5.2. Familiarization With Technology

Familiarity, assumedly, enables a quicker adoption of other existing forms of technology with similar features or workflows. Desktop computers or laptops (84.21%), smartphones, and digital tablets (64.91%) rank highest in confidence levels. Less common are wearables and smart home devices, with 49.12% and 36.54% indicating no experience. The lesser-known is VR or Mixed Reality (MR), where 63.13% indicate no experience, against 3.51% who position themselves at an advanced level. On the software side, respondents are most comfortable with web services such as email or search engines (78.95%) and text editors (80.70%). Data processing, social media, and communication or learning spaces show an average proficiency level across the sample.

5.3. Perceptions of Online Education

Before COVID-19, traditional contact teaching was the standard form of delivery (69.88%), followed by blended (25%), and online (2.74%). Once quarantine and social distancing periods started, online peaked to 88.10%, blended lowered (10.71%), and contact teaching recessed to 1.19%. Although not asked to specify the online form, the choice of the channel provided clues. Zoom.us (34.78%), Microsoft Teams (21.74%), and LMS features (14.49%) were the top picks, and the first two occur in the synchronous form. In the option "others," respondents added: Youtube, Slack, Github, Exam.net, Vimeo, Dropbox, and Jitsi. However, in most cases, the channel was defined by the institution (27.27%), not the practitioner. When the choice was theirs, contributing factors included institutional or colleague endorsement (17.17%), affordances or features such as user-friendly interface (16.16%), and built-in options such as screen-share or record (14.14%). Participants added "choosing channels familiar to students" or not blocked in some countries (e.g., Google applications are blocked in China). 68.95% indicated that their institutions provided training to teach online but only 42.86% attended; 26.19% knew about it but chose not to, and 30.95% indicate having had no training before or after moving online. Regarding prior use of LMS features, to track or assign work online, 61.9% reported active use, against 19.05% who had not considered it before;

4.76% deemed it unsuitable to their subject and did not elaborate. 9.52% indicated no access to an LMS.

Teaching online required changes in the pedagogy. In general, respondents note the development of activities to be accomplished online (22.90%), the redesign of teaching materials and assignments (19.08%), and the development of videos, podcasts, or other resources to share with students (18.32%). The option "None, my subject or materials didn't require adjustment" got 0.76%. In the comments, two respondents added, "I made a list of podcasts and write on how to use podcasts on design education" and "adapted the methodology to assign in-class evaluation moments." The assessment was a general cause of concern; the lack of control over the environment was the most worrying factor (21.51%), followed by technology familiarity and limitation of means (16.13%). Respondents also reported "lack of significant interactions," "difficult to know what students learned," "bad internet connection," "limited means to make and test prototypes and models," "students with caring responsibilities, and other complicated circumstances are at a disadvantage," "explanations of assessment not as easy, text-only means students are challenged by English," "it's far more draining working online / having real-time communication mediated through a screen."

Moving online in limited time led to compromises. Had circumstances been different, and if given time to plan, could each of the taught subjects (assigned to the respondents) be delivered solely online to the same standard as in-class? Respondents were asked to indicate their answer on a 1-12 point scale, where 1 stood for "extremely unlikely" and 12 "extremely likely." The 1-5 interval added to 72.22%, from which scale point 1 alone got 22.22%. Interval 6-10 received no responses, marker 11 got 19.44%, and 12 only 8.33%. All answers are summarized below in Figure 1, and Table 1.

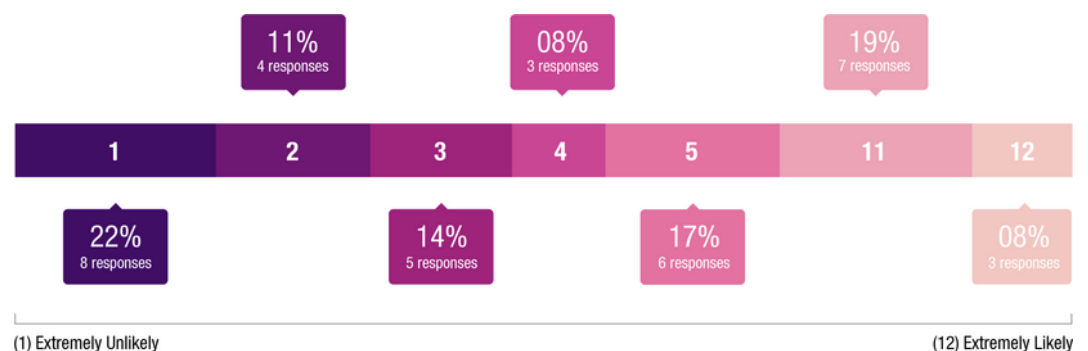


Figure 1. Likelihood of in-class taught subjects being delivered online to the same standard

Table 1. Statistical complement to Figure 1

Field	Minimum	Maximum	Mean	Std Deviation	Variance	Count
(1) Extremely Unlikely:	1.00	12.00	5.47	3.96	15.65	40
(12) Extremely Likely						

Regarding the online learning environment, respondents were provided with a series of statements focused on student behavior changes and perceptions about teaching. They were then asked to classify each as unnoticeable, lower, same, or improved. Each of the eight statements and corresponding results is shown in Figure 2, located on the next page. The most noticeable results show a lower ability to "read" the room when discussing specific topics (77.14%), fewer opportunities for spontaneous in-class teaching (67.5%), difficulty in developing meaningful connections with students (60%), and lower participation or

communication in class (45%). The most prominent “improved” results were 27.5% and 26.47%, with the first referring to student engagement with content, and the latter regarding students providing the practitioner with teaching or module related feedback.

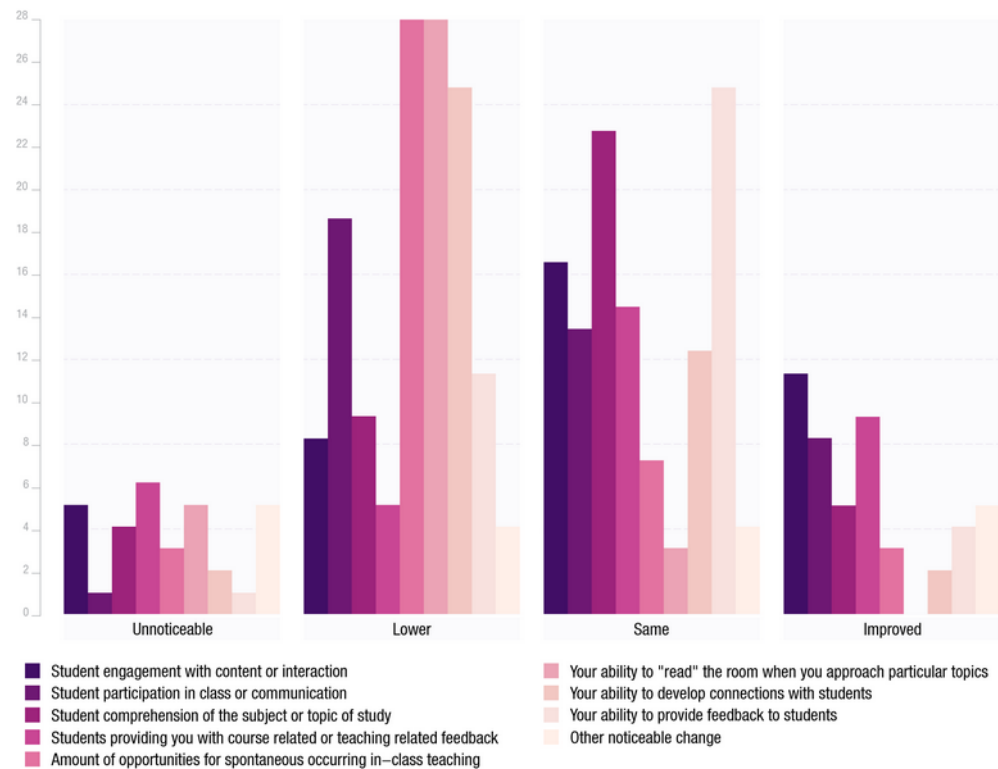


Figure 2. Perceptions about the online learning environment

To further substantiate prior results, respondents were asked to qualify their impressions through a five-point semantic scale composed of 13 polar adjectives or reactions. "Isolating," "separates me from people," and "alienating" scored the highest. "Dull/captivating," "effective/ineffective", or "pleasant/unpleasant" were neutral.

Table 1. Polar adjectives used in the questionnaire five point semantic scale, and results obtained

Polar adjective	++	+	-	+	++	Polar opposite
Active	20.51%	15.38%	28.21%	23.08%	12.82%	Passive
Individualized	17.50%	32.50%	25.00%	20.00%	05.00%	Collaborative
High-level autonomy	20.51%	23.08%	30.77%	15.38%	10.26%	Dependent
Pleasant/attractive	07.69%	05.13%	48.72%	23.08%	15.38%	Unpleasant/Unattractive
Effective	12.82%	15.38%	46.15%	15.38%	10.26%	Ineffective
Motivating	10.26%	10.26%	41.03%	25.64%	12.82%	Demotivating
Engaging	07.89%	13.16%	34.21%	34.21%	10.53%	Unappealing
Isolating	33.33%	23.08%	25.64%	12.82%	05.13%	Connective
Practical	05.13%	23.08%	35.90%	23.08%	12.82%	Impractical
Simple	05.26%	13.16%	42.11%	28.95%	10.53%	Complicated
Brings me closer to people	02.56%	07.69%	23.08%	35.90%	30.77%	Separates me from people
Alienating	10.53%	39.47%	34.21%	13.16%	02.63%	Integrating
Dull	18.42%	10.53%	47.37%	15.79%	07.89%	Captivating

5.4. VR and HE

Enquiring about VR shows that most respondents are only slightly aware of the technology (46.15%), and 33.33% familiarised. When it becomes the discussion subject, 47.37% thinks about it in the semi-immersive class, 34.21% considers fully-immersive, and 18.42% in the non-immersive. The semi-immersive class is also the most interacted with (33.33%), followed by fully-immersive (27.08%). 16.67% have never experienced VR, regardless of purpose.

Concerns about technology are broad. Price and difficulty in implementing are the most significant (20.45%), followed by VR sickness (12.88%), lack of support (12.12%), and content dependency or relevance (11.36%). Four respondents added "workload prep," "I teach physical computing and design studios, so the application is not that relevant," "not effective unless VR is the subject," and lastly, "VR is a display technology and a current and recurrent hype looking for an application; it's not pedagogy or education." When asked about using VR in the future, in any class, integrated into their subjects, responses dwell between "no" (43.59%) and "not sure" (35.90%); "yes, I plan or expect to use VR in the future" obtains 17.95%. One responded highlighted that the choice of using VR may not be personal but institutional instead. However, given the opportunity, most respondents are willing to learn or use VR in teaching (55.88%); 32.35% remain undecided, and 11.76% wouldn't. The follow-up question asked if their department had considered integrating VR into the program, as a tool for teaching and learning; the response was mostly negative (80%); however, few are integrating (11.43%), and others are now discussing it (8.57%).

6. DISCUSSION AND CONCLUSIONS

With an increasing number of educational systems moving online, and at a much faster pace than before, a change in traditional teaching was imminent. In parts of the world where the existing technological infrastructure allowed it, transitioning online meant updating pedagogy and redesigning instruction to ensure learning outcomes. Synchronous teaching was complemented with asynchronous learning. Reliance on LMS increased, and assignments were adjusted to fit the medium; all led to a rise in student engagement with content. Utilizing a combination of venues or channels to provide access to information expanded the learning environment and provided fertile ground to test new possibilities. There were, however, two critical downsides. The first was in the form of human connection; the screen-mediated relationship severs the meaningfulness of a teacher-student relation. This loss has broad ramifications, among which the disabling of functions such as the ability to recognize or identify tell-tale signs of student needs or unrest. The second is assessment, which is equally important as a measure of teaching efficacy and student learning. The lack of control over the environment and limited means is concerning, but other elements influence it and are harder to identify or address. These include the home environment and personal responsibilities of each student (e.g., caring responsibilities), time zone and level of proficiency with the language of instruction (e.g., international students), and access to physical resources or communication channels. These are new challenges tied to particular independent contexts, which are now unique and harder to grasp. So, even though educators could deliver their subjects online during this period, it's hardly the same as before. In-class teaching is still seen as enabling more teaching and learning opportunities and closer human connections; the benefits, both at an academic and personal/social level, are various and unmatched by technology, thus far.

Continuing online will influence and exert change on design education; success derives significantly from a social nature that's now compromised. More responsibility is imposed on the student; learning turns into a lonely experience removed from the benefits of a social environment (e.g., group work, peer-learning), and geographical displacement impairs community building. These, and others above-mentioned, will need consideration as they impact everyday practice, especially among first-year students where bonds or relationships between them have yet to form. Researchers have looked for alternatives, and some have found limited success in interactions through social media networks (Schadewitz & Zamenopoulos, 2009). Other possibilities may include VR and Multi-User Virtual Environments (MUVes). These afford opportunities for embodied social presence, immersive experiences, hands-on activities, and experiential learning (Fedeli, 2011). Features such as these could enable a richer online education experience in design areas but, work in this direction, specific to design and relying solely on distance teaching, is still scarce. The study results suggest an openness to learn and use VR in the future, in the learning environment and, considering the present conditions, the time might just be right for further research and development towards it.

Results and conclusions of this study cannot be generalized. They can, however, provide with an overview of the difficulties and resolve of some HE educators from the broad field of design, in certain contexts, and how they are adapting this new normal as a consequence of the COVID-19 pandemic. This is relevant to note because the responses gathered indicate of a pre-existing and dependable technological infrastructure, with internet access, which is unlikely the case everywhere. Some countries or regions, where also different cultures or teaching and learning practices exist, will likely be dealing with this change very differently. Having this said, it would be exciting to research other solutions taken in effect, in different parts of the world, during this period, and contrast them according to context. Such endeavour would provide a broader and more holistic understanding of how different educational systems around the world reacted during this period, and the adaptations made. Such research would allow to establish a baseline to contrast or relate future changes with, in a post-pandemic future.

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