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Social Connectedness and Online Design Learning Experience in the Indian Context

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Abstract

The rise in online courses and virtual learning avenues in the last few decades, and more recently the Covid-19 pandemic has seen traditional design schools imparting learning seamlessly by transitioning to the virtual realm partially or completely. This study helps understand the perspective of students from various design schools across India regarding their learning experience in online courses, virtual classrooms and their perceived social connectedness with peers and educators. We report findings from a mixed-methods study, which combined both quantitative and qualitative data collection and analysis, wherein ninety-five students from five design schools across India responded anonymously to the online questionnaire survey. We assessed the factors that impacted perceived social connectedness of the students with their educators and peers in online classes. We also discuss some of the reasons for this perception, as articulated by the participants, and report a significant correlation found between felt connectedness and various factors in online learning, such as visibility of participants, level of interaction during class, interest in course and understanding of the subject. It was observed that while the target student group seemed adept in online interaction and exchange of information, their feedback on online learning revealed unique insights into aspects that affect overall experience of design education. In addition, we submit some of the features or elements of traditional face-to-face (F2F) classrooms that students miss the most in the current online setting and some of the measures taken by students and educators to stay connected and overcome the virtual gap in learning.

Keywords

Online design learning, social connectedness, design education, virtual learning, online class behaviour, behaviour design

Introduction

Social interactions are essential for human physical and psychological well-being. Social connectedness, which has been characterized as one of the main motivating principles behind social behaviour, is usually considered as a predictor of a successful life and it has been associated with many social and health-related benefits (Riedl, Köbler, Goswami, & Krcmar, 2013; Smith & Mackie, 2000). Van Bel, et al. arrived at the concept of Social Connectedness and defined it as ‘a short-term experience of belonging and relatedness, based on quantitative and qualitative social appraisals, and relationship salience’ (Bel, Smolders, Ijsselsteijn, & De Kort, 2009). The social connectedness construct has evolved out of the study of belongingness (Baumeister & Leary, 1995; Lee & Robbins, 1995). According to belongingness theory, people tend to develop and continue positive social relationships so as to experience a sense of belongingness. Social connectedness is also defined as a personal sense of belonging to a group, family, or community. For the purposes of their doctoral research, the author would like

to define Social Connectedness as 'the experience of belonging and relatedness between people'.

While the concepts, effects and benefits of social connectedness have been well researched in the social sciences and psychology scholarship, there is a lack of published research regarding social connectedness of students in traditional face to face college environments, which is instrumental in their learning and deep comprehension (Nortvig, Petersen, & Balle, 2018; Anastasiades, Filippousis, Karvunis, Siakas, Tomazinakis, Giza, Mastoraki, 2009). More so for design education which thrives on group work, collaboration, peer critique, building on each other's ideas, etc. The design process itself is highly collaborative in nature, involving not just designers but specialists from multi-disciplinary backgrounds.

Empathy is a vital trait for a designer as understanding the user and their experience has a central place in user-centred design (Koskinen & Battarbee, 2003; Visser, Stappers, van der Lugt, & Sanders, 2005). 'Empathic design' (Koskinen et al., 2003) nudges designers to get closer to the lives and experiences of probable users, to increase the possibility of the product or service being designed to fulfil the user's needs. Several tools and techniques have been suggested (Fulton Suri, 2003) to help support designers to 'step into the user's shoes' so as to design products that meet the user's needs. Research shows that social connectedness can enhance empathy (and vice versa) towards strangers and therefore can be learnt (Hutcherson, Seppala, & Gross, 2008). Therefore, a design learning environment that promotes perceived social connectedness can aid future designers to be trained in developing empathy that is essential for a more user-centred approach to designing.

With the increase in online education, it is imperative that design schools look for avenues to bring design education to their online recipients. Design practices have evolved over the years with the advancement in information technology and computer know-how. It is necessary to develop a new approach to teach and train students to adapt to the new design tools and methods (Chen & You, 2003). While online learning has been around for a few decades, design education is still not readily available online (Kumar, Kumar, Palvia, and Verma, 2019). Researchers have provided experimentally established guidelines for creating and maintaining social connectedness online which consist of strategies designed to facilitate status assessments, norm development, and role differentiation in computer-mediated communication channels that often lack the subtle social cues people use in face-to-face (F2F) interactions (Slagter van Tryon, 2007; Slagter van Tryon & Bishop, 2009). Laffey, Lin, and Lin (2006) claim education and various learning interactions, whether traditional F2F or virtual, to be social practices which is definitely true for a design education and practice. The extent to which students in online learning environments perceive themselves as being socially connected to their peers appears to be a key factor in predicting the success of online courses (Kreijns, Kirschner, Jochems, and van Buuren, 2004). While fruitful social interactions happen relatively effortlessly in F2F learning settings, creating, and maintaining these social connections in online learning environments require active support and, often, educator facilitation (Reisetter & Boris, 2004).

Design uses extensive studio-based exercises which makes it challenging for design educators to transition to technology-driven changes into an online teaching and learning environment (Bender, 2005; Fleischmann, 2018). With Studio-based learning being at its core, design courses

usually have small class sizes and use project work and collaborative creative problem solving with many possible solutions (Blair, 2006). Research shows that online collaboration in design can be successfully done only if student participation is high and instructor feedback is instantaneous (Bender & Vredevoogd, 2006). Peer learning and group discussion form an integral part of the learning process (Park, 2011; Blythman, Orr & Blair, 2007).

Since 1993, numerous models of virtual design studios (VDS) have been introduced to design departments and schools all over the world, especially the architecture schools. This approach has gradually become part of IT supported design education. The organization and size of the VDS depends on the number of the projects, the number of participants, the types of digital media and tools applied, and duration of the project. The purposes and objectives of these VDS have slight differences, which can be divided into three categories: campus usage which provides support to design courses and design information communication (Budd, Vanka & Runton, 1999; Latch Craig & Zimring, 2000); design collaboration usage which provides the platform for school-to- school/country-to-country design collaboration in order to provide an opportunity for the students/teachers to work with other students or experts in other environment (Dave & Danahy, 2000; Russell, Stachelhaus, and Elger, 2003) and multidisciplinary collaboration which focuses on interdisciplinary design collaboration and provides a platform to integrate students with experts from different fields (Žavbi & Tavčar, 2005).

In design education, there has been some research done to inquire into the effectiveness and success of these courses but not sufficient to fully understand the impact on learning in online platforms (Turner, Rieger and Barrick, 2011). The characteristics of studio-based teaching in design have been identified as supporting interaction, active learning, as well as social engagement (Crowther, 2013), thereby involving high social connectedness amongst students and educators. Keeping all these in mind, blended learning is seen as a possibility where certain courses are taken online while others are studio based (Fleischmann, 2018).

This study aims at understanding student experiences that affect perceived social connectedness in online design courses and ultimately assess the impact, if any, of social connectedness on the students' course understanding, interest, and motivations.

Method

An inductive research approach was adopted to make observations and investigate thereby arriving at conclusions (Morse & Niehaus, 2009). Data was collected from ninety-five graduate and postgraduate level design students doing a combination of theory and practical courses in various branches of design, such as Product Design, Transportation Design and UX Design. The respondents were from five design schools in India, viz. Department of Design IIT Delhi, Pearl Academy Delhi, UPES School of Design Dehradun, United World Institute of Design Gandhinagar, and ISDI Mumbai. The online questionnaire survey, consisting of closed and open-ended questions to gain a wholesome understanding of student behaviour and responses with respect to online design courses, was considered to be the most suitable method to gather students' feedback for many reasons. Online surveys had the advantage of reaching a greater number of participants in a short amount of time, without any geographical constraints, especially during the pandemic related lockdowns. They were used to collect both quantitative and qualitative data simultaneously. They gave students the flexibility to participate as per their convenience of place and time. They also support the anonymity of respondents, allowing

greater transparency and higher participation when well-designed, fast, and easy to complete (Gray & Malins, 2004).

For the quantitative data collection, a 5-point Likert scale was employed and students picked from a range of responses such as Always, Often, Sometimes, Occasionally, and Never (Robinson, Shaver, and Wrightsman, 1991), to help answer the 'what?', 'when?', 'how much?' or 'how often?' questions while the open ended questions allowed the respondents to give more in-depth, reflective responses in answering the 'why?' questions related to their online learning experiences (Fribourg & Rosenvinge, 2013). Ninety-five students from five design schools across India responded anonymously to the survey. These students had spent a part of their design course time in traditional F2F classes and had experienced the online classes for a few months prior to the survey.

To analyze the quantitative data obtained using the online surveys existing tools from the survey platform, Google forms and Google sheets were used. This data was also statistically analyzed to find any possible correlation between the critical variables and perceived social connectedness. The qualitative data obtained from the open-ended questions were coded and categorized into themes and subthemes, combining similar codes into subcategories and their frequency of occurrence or mentions was summed up to evaluate and assign significance. The findings and analysis are presented in the subsequent section, followed by a detailed discussion of some implications of the findings, future scope, and conclusions.

Results and Analysis

The results and analysis of the data collected during the study is shown through the following tables.

Online class hours and platforms used

Tables 1 and 2 show the no. of hours spent online and the online platforms used by the respondents for the design courses, respectively.

Table 1. Online design class hours

Online class hrs per week	<5	6-10	11-14	15-19	>20
No. of students	59	20	6	2	8

Table 2. Online platforms used for classes

Online class platform	Zoom	BB Collaborate	Google Meet	MS Teams	Others
No. of students	68	11	21	29	5

It may be noted that some students used more than one platform for various online classes. Hence, it was seen that a majority of students spent not more than an hour each day in online classes and the most popular (or preferred) platform was Zoom. It was essential to note that most students also used social media and other online platforms like WhatsApp, Miro, and

Mural to connect outside their formal online class time to collaborate with their classmates and work on projects or do assignments.

Online behaviour and class participation

The following figures in Table 3 indicate how often the students displayed certain behaviour online.

Table 3. Virtual behaviour in online classes

Virtual behaviour	Always (5)	Often (4)	Sometimes (3)	Rarely (2)	Never (1)	Mean	Var.
Video ON	2	10	28	34	21	2.36	1.02
Verbal interaction	9	29	23	28	6	3.08	1.26
Course interest	13	31	11	5	3	3.70	1.10
Chat messaging	4	21	39	25	6	2.9	0.91
Course understanding	9	44	29	9	4	3.46	0.89

The 'virtual behaviour' terms used in Table 3 are described further to gain a more comprehensive understanding of the questions asked in the survey. 'Video ON' corresponds to 'how often the students kept their video camera turned ON during classes'; 'Verbal interaction' corresponds to 'how often the students interacted with the educator or peers during the classes'; 'Course interest' corresponds to 'how often the students were interested in the course they were attending'; 'Chat messaging' corresponds to 'how often the students used the messaging or chat feature of the online platform during class'; while 'Course understanding' corresponds to 'how often the students understood everything that was being taught in online classes'. The respondents marked the frequency on a scale of 1 to 5, where 1 stood for 'never' and 5 for 'always'.

Similarly, student respondents marked the level of connectedness they experienced with their educator and peers on a 5-point Likert scale ranging from feeling 'extremely connected' to 'not at all connected'. The results are as shown in Table 4.

Table 4. Experience of connectedness in online classes

Virtual experience	Extremely (5)	Very (4)	Neutral (3)	Not really (2)	Not at all (1)	Mean	Var.
Connectedness with educator	7	18	32	27	11	2.75	1.31
Connectedness with peers	3	12	29	35	16	2.47	1.04

It would be appropriate to note here that the students/respondents were not given any definition of the terms 'social connectedness' or 'connectedness', instead they were expected to use their own interpretation/perception of the term 'connectedness' according to their life and language experiences.

In the sections that follow, we see more analyses to better understand the various relationships between 'Connectedness with educators/peers' and other variables/ factors/ behaviours.

Correlation between variables and connectedness

Pearson's correlation was applied to analyze the reciprocal impact of some of the prominent variables in online courses and student behaviour on the perceived social connectedness and the impact of this perceived connectedness on the course interest and understanding among students. Firstly, the three prominent variables in online courses were taken as 'frequency of keeping video ON', 'verbal interaction in class' and 'using of chat/messaging feature' as impacting the perceived social connectedness of students with their peers and educators. Secondly, the perceived social connectedness of students impacting their 'interest in courses' and 'course understanding'. Significant correlations were found as shown in Table 5.

Table 5. Correlation between variables and connectedness

Correlation with connectedness (r.)	With educator	With peers
Video ON	-	0.251
Verbal interaction	0.291	-
Chat/messaging	-	-0.23
Course interest	0.419	0.255
Course understanding	0.27	-

A significant positive correlation is seen especially between 'connectedness with the educator' and 'course interest'. This indicates that the students were more interested in the course when they felt higher levels of connectedness with the educator. Further, when students kept their videos ON more often, they felt more connected with their peers. Similarly, higher verbal interactions during class led to higher felt connectedness with the educator. Significant correlation was also seen between the level of connectedness felt with the educator and the understanding of the course taught. Contrary to expectation, a negative correlation was found between the frequency of chat/messaging options used in the class and the felt connectedness between peers. This will need further investigation to understand and establish as a phenomenon.

Self-evaluation of performance

The students were asked to evaluate themselves for their performance in online classes compared to that in in-person classes on a scale of 1 to 5, where 1 was 'much worse than in-person' and 5 was 'much better than in-person'. The results are shown in the table below:

Table 6. Self-evaluation of performance

Self-evaluation of performance in online vs. in-person	Much worse than 1	Worse than 2	Same as 3	Better than 4	Much better than 5	Mean	Var.
Frequency	14	41	17	14	9	2.64	1.5

Table 7. Self-evaluation, connectedness, and course understanding

Correlation	Connectedness with educator	Course understanding
Self-evaluation	0.398	0.629

A significant correlation was also found between the students' self-evaluation of class performance and their felt connectedness with the educator and the course understanding. Further, the qualitative data obtained from the responses to the open-ended questions in the survey were tabulated based on the frequency of common themes that emerged from coding them. These tables help us gain some understanding of the 'why' behind the 'what', the reasons that made the students feel or not feel a sense of connectedness during the online classes.

Reasons for video ON/OFF behaviour

In the open ended (qualitative) questions, the respondents were asked to list some of the reasons why they kept their video camera ON/OFF during online classes. The reasons given(often more than one) are listed in tables 8 and 9 below, with the number of mentions of the same reason by multiple students.

Table 8. Reasons for video OFF behaviour

Reasons for keeping video OFF	No. of mentions	Sample responses
Technical Poor internet, no webcam	41	'Internet Connectivity/Bandwidth issues'
Self-image Not dressed appropriately, not looking good, Feel conscious	18	'Reluctance to show myself', 'I usually feel conscious when I keep my video on', 'It is difficult to maintain proper professional attire throughout the day at home'
Peer behaviour No one keeps it ON	5	'Nobody else was keeping their video on', 'I don't want to be the only one visible'

Home situation Workspace setup not suitable, lighting, visual disturbance	35	'My workplace doesn't have "Workplace" look', 'other family members in the house', 'don't have great lighting at my place', 'to avoid background interruptions due to home environment'
Comfort Still in bed, multitasking, not interested/needed	16	'If it's morning class I'm usually still in bed when I attend', 'Ability to multitask (have lunch, sketch, etc.)'

Table 9. Reasons for video ON behaviour

Reasons for keeping video ON	No. of mentions	Sample responses
Technical Good internet/bandwidth	7	'Good internet speed', 'strong network'
Self-image Well-Dressed, feeling confident	5	'Felt Confident to show myself that day'
Peer behaviour Helps in interaction, other students' behaviour, able to express/converse better	12	'To express something properly. And to have livelier conversations'
Concern for Educator Someone must keep the video ON, requested by Prof	6	'Will be difficult for the faculty to teach looking at a screen where everyone has turned off their camera', 'As requested by professor'

Reasons for perceived connectedness

After rating the perceived level of connectedness with their educators, the students answered open-ended questions to explain what made them feel connected with the educators and the responses (often multiple reasons) are listed below in Table 10.

Table 10. Reasons for connectedness with educators/peers in online classes

Reasons	No. of mentions	Sample responses
Interactions Discussions/teamwork, chat options, breakout room, express oneself, interactive presentations, fun interactions, social media	46	'Having similar doubts, sharing work', 'A lot of students live in different cities and family environments which impact thoughts and ideas. It was interesting to see and hear the variety of ideas that

		came from other students while at home', 'We used to meet informally too'
Presence Being able to see others, video on, knowing my classmates are there, hearing their voices, togetherness	18	'If their videos were on and verbal communication ensued', 'The feeling of nostalgia that we mutually shared'
Instructor input Voice/video/feedback, course content, guidance, effort taken, personal attention, questioning	22	'Getting timely feedback from mentor', 'The course curriculum requirements', 'Faculty kept their video ON... tried to continuously connect with students, engage them in various activities including short assignments', 'Sharing real world stories, examples', 'hearing familiar voices', 'presentations'
None/not sure	17	'It's really hard.', 'Required lots of effort.', 'Nothing ever really helped'

The most common factor that helped students feel a sense of connectedness in online classes was having interactions with the educators or students and doing collaborative work as part of class. The chat option in some of the platforms also aided in connectedness. More than a sixth of the respondents felt there was nothing that helped them feel connected in online classes.

Reasons for perceived lack of connectedness

The students also gave reasons as to why they felt a lack of connectedness or disconnectedness with their educator and peers. The responses are listed in Table 11.

Table 11. Reasons for lack of connectedness in online classes

Reasons	No. of mentions	Sample responses
Lack of Interaction No discussions, monologues, session too long, limited online time, fun is missing	57	'When the session went on for a long duration and got monotonous', 'Some ideas are better communicated through in person interactions and ideation sketches are more difficult', 'no physical interaction', 'everyone is very formal'
Physical/Visual absence Can't see others/video OFF, not there physically	31	'Videos are OFF', 'only instructor was talking'

Technical issues Internet connection, audio issues	23	'Poor internet connection...', 'The confusion when everyone talked at the same time', 'video not visible, when someone shares screen'

In attempting to find the reasons for the respondents' lack of felt connectedness in online classes, it was found that most of them felt that the lack of interaction of students in the classroom or college campus was a key reason followed by physical and/or visual absence. Attending classes from home also added domestic distractions and made it difficult to be motivated and focused enough to work well. Students also missed out on peer-learning and building on each other's ideas.

Advantages of online classes

The main advantage of the online courses, according to the study, was the convenience and flexibility it afforded the students to connect from the comfort of their homes or anywhere else, eliminating time and effort taken to commute. Ease of access to online resources and features like breakout groups and recording options were found beneficial, especially for theoretical courses. Students often used social media or online platforms like WhatsApp, Miro and Mural to connect outside of class time to connect, collaborate and work on group projects.

Elements missing in online classes

In attempting to understand aspects of F2F classes that the design students missed the most during online classes, the students responded descriptively, as summarized in Table 12, with a few sample responses.

Table 12. Elements missing in online classes

Elements	No. of mentions	Sample responses
Interactions Discussions/teamwork, conversations/sharing ideas, debates/critique/feedback/ clarification, accountability, more focus, easier/faster learning	51	'Having similar doubts, sharing work' 'The instant feedback while doing a work, project or assignment to correct the mistakes and easily move on', 'A very small but crucial element missing for me was the little discussions we would have with the other students about the same topic while it was being taught 😊. It added to the understanding of the subject matter.'
Physical presence Being with/seeing each other, body language/expression, movement, hands-on work	28	'Meeting friends, having fun in class, proper discussions, looking at faces' 'The fact that we could see each other physically and have a lot of fun as well as learn in a much more effective way compared to online classes.'

Ambience Classroom/studio, college/school, learning/work environment	19	'Learned more in two months of offline classes then six months of online classes', 'The atmosphere is different. It is after all a place not dedicated to learning, when studying from home or from other places doesn't have the same effect.' 'The workspace and people which made the aura of a good working environment' 'The atmosphere is different. It is after all a place not dedicated to learning, when studying from home or from other places doesn't have the same effect', 'The workspace and people which made the aura of a good working environment'
Fun aspect Laughter/fun activities, energy, attachment	13	'The energy of the class sessions, with a lot of back-and-forth interaction', 'Human interaction that is organic and the laughter that came with studying'
Everything	9	'Every single moment'

Affirming their previous responses, almost 80 percent of the respondents said they missed the animated discussions and organic interactions the most in the online setting. They explained how these discussions helped them get a better grasp of topics being taught in class or clear any doubts they had with their educators. These interactions also helped them learn from their peers.

Changes suggested in online classes

Finally, the students were asked that if given a change, what would they like to change about the online classes. Their responses are recorded in Table 13 below.

Table 13. Changes suggested for online classes

Suggested changes	No. of mentions	Sample responses
More interaction short lectures, more interaction, group assignments/activities, time for chit-chat during class, online avenues to meet with faculty members, mandatory camera ON time in each class, 2-way communication	11	'Proper one-to-one conversations by the instructors as everyone's not able to concentrate properly in online classes', 'classes with active communication (both-way)', 'n the beginning of the lecture, compulsory 10 mins of free time discussion with faculty and all the students, with their cameras on, so that it would be easy for everyone to get comfortable at first and attentive throughout the lecture', 'There should be different channels where we can meet all

		professors separately based on their available time slots, similar to the way we do in faculty offices.'
More like in-person Holograms, VR,	4	'I would definitely make the class appear more like an in-person class (Holograms may be)', '3D or VR lecture so we can at least have vibe to feel like in the actual classes'
Recorded lectures Can be heard anytime, multiple times, while working on hands-on learning, more presentations	4	'Emphasis on shorter durations and availability of recorded lectures', 'More presentations, less class time'
Hybrid classes Theory online, practical in-person	2	'I would prefer 50-50% setup where half the classes would be offline (including lab sessions)'
Small class size Efficient communication, less isolation, better understanding, better connected	4	'Short sessions with few students at once, say half a class - 10-15 students, might bridge the gaps between the instructor and the student', 'It might also not create a sense of isolation that is there when it comes to online classes'
No online classes	3	'Nothing. I would rather avoid online classes'

Discussions

Highlighted through the results and analysis is the importance of being able to see each other and interact with people in physical or virtual space. Although the internet can be a great space to meet and connect with people, it has its limitations due to the visual and physical gap that can be closed only by physical presence and interaction, especially in online design education. And yet, we see many design educators and students successfully exchanging knowledge and ideas to impart and receive design education. We can get a more holistic understanding of the experiences design educational setups by also considering the perceived social connectedness of design educators and its effect on pedagogy, which has been studied as precursor to this study and reported earlier (Gogu & Kumar, 2021) wherein educators talk about the challenges they face, and measures taken by them to connect with students better in online education. However, this study focused on gathering insights on how the students were responding to online design education and taking initiative to bridge the digital divide. It reinforced the fact that it was more natural and intuitive to create bonds and work collaboratively when meeting peers in person rather than online. While it is possible to form collaborations online, it took more effort and initiative on the part of students and instructors alike.

The significant correlation seen between the students' perceived connectedness with educators and their interest in the course, verbal interaction in class and understanding of the course,

emphasizes the fact that students need to feel a sense of connectedness with their educators in order to take more interest in the course and participate more in the class, leading to a better understanding of the course matter. The correlation found between connectedness with peers, visible faces, and verbal interaction in class indicates that being able to physically see each other and talk to and interact with each other plays a key role in feeling a sense of connectedness between peers.

It needs to be further investigated whether an increase in interest in a course could presumably result in better learning and performance of a student in the course. Though the study shows that higher perceived connectedness of students with educators was also related to higher understanding of the course and self-evaluation of students.

The students in this study also mentioned that while in in-person classes, giving/ receiving feedback was intuitive and fast, it was also easier to clarify doubts and make quick changes in the design process, something they missed tremendously in online classes. This suggests that further investigation is required to study and compare the current LMS platforms to identify specific improvements that can be done to make them more intuitive when it comes to receiving feedback or clarifying doubts.

Even though there is (and most likely, always will be) a clear preference for in person or F2F learning experience, we saw that students found ways to stay connected outside of online class hours, discovering and adapting to new platforms to collaborate for team projects by finding avenues to replicate in-person interactions and exchange of ideas. Interestingly, the self-evaluation done by students seems to show that higher perceived connectedness with educators resulted in greater understanding of the subject and thereby higher self-evaluation of performance in the online mode. Therefore, there is a need for design educators to constantly encourage visibility, verbal interaction, and participation in online settings. Further, they could incorporate collaborative tools as add-ons to the online platforms they are already using to encourage in-class participation and interaction, thereby heightening the learning experience for both the students and themselves.

Conclusions

This article reports that, as expected, design students preferred traditional F2F learning environments rather than the online option. They felt the in-person environment gave them a more holistic learning that happens due to focused learning and higher interest generated just by the experience of creative and curious minds learning and interacting together. Since these students were suddenly moved to online mode of learning due to the pandemic-imposed lockdown, they didn't have much choice. Perhaps once things normalize, they would see that having an option to do certain courses (or parts of a course) online, while others in person might also have its benefits as suggested in literature on blended learning.

The study reiterates that the primary drawback of online classes in design education was immediate critique during ideation, the lack of perceived social connectedness resulting in lack of organic group interactions and collaborative work. Whereas the primary advantage of an online learning mode was found to be the flexibility it grants in terms of attending from any location and time. Some students also mentioned that thanks to online mode they could

continue their education without wasting precious weeks, which later had turned to months and years.

Considering the feedback from the survey participants, it may be concluded that:

1. Significant correlation was seen between the students' perceived connectedness with educators and their interest in the course, verbal interaction in class and understanding of the course. Correlation was also found between connectedness with peers, visible faces, and verbal interaction in class. This could mean that being able to see their instructor and peers, greater interaction in class made the students feel more connected with their instructors and peers and increased their interest in their course.
2. The increase in interest in their course could presumably result in better learning and performance of the students, which needs to be further investigated. The study shows the perceived connectedness with educators also related to the understanding of the course and self-evaluation of students.
3. The current online platforms need improvement to make them more intuitive when it comes to receiving feedback or clarifying doubts as also found in another research (Pratap, Dahiya & Kumar, 2021).
4. The study confirmed earlier findings that students found it difficult to do collaborative work and group projects online, which is an integral part in traditional F2F classrooms (Fleischmann, 2018).
5. Lack of proper Internet and power connectivity are practical problems still faced by students in many parts of developing India. Also, studio/workshop facilities and classroom environment are missing in online setups.

Most of these students had experienced online classes only for a few months at the onset of lockdowns imposed due to the Covid pandemic. Therefore, further research is warranted to be carried out over a longer duration to understand and compare the deeper impact of online courses on the perceived social connectedness and ultimately design learning. Technology focused research could help identify features that can help make the online learning experience a more rewarding one. Conducting neurophysiological studies on student experiences is another possibility for future studies.

References

Anastasiades, P.S., Filippousis, G., Karvunis, L, Siakas, S., Tomazinakis, A., Giza, P., Mastoraki, H. (2009.) Interactive Videoconferencing for collaborative learning at a distance in the school of 21st century: A case study in elementary schools in Greece, *Computers & Education,* Volume *54*, Issue 2, Pages 321-339, ISSN 0360-1315, https://doi.org/10.1016/j.compedu.2009.08.016.

Baumeister, R. F., & Leary, M. R. (1995). The need to belong: Desire for interpersonal attachments and fundamental motivation. *Psychological Bulletin, 117,* 497–529.

Bel, D., Smolders, K. & Ijsselsteijn, W. & De Kort, Y. (2009). *Social connectedness: Concept and measurement.* 67-74. 10.3233/978-1-60750-034-6-67.

Bender, D. M. (2005). Developing a collaborative multidisciplinary online design course. *The Journal of Educators Online, 2*(2), 1-12. doi:10.9743/jeo.2005.2.5

Bender, D. M. and Vredevoogd J. D. (2006). Using Online Education Technologies to Support Studio Instruction. *Educational Technology & Society, 9* (4), 114-122.5.

Blair B. (2006). 'At the end of a huge crit in the summer, it was "crap" – I'd worked really hard but all she said was "fine" and I was gutted.'. *Art, Design & Communication in Higher Education, 5*(2), 83-95. doi:10.1386/adch.5.2.83_1.

Blythman, M., Orr, S., Blair, B., (2007). Critiquing the Crit: University of the Arts London. Retrieved from https://www.academia.edu/586074/Critiquing_the_Crit

Budd, J., Vanka, S. & Runton, A. (1999). The ID-Online Asynchronous Learning Network: a 'Virtual Studio' for Interdisciplinary Design Collaboration, *Digital Creativity*, *10*:4, 205-214, DOI: 10.1076/digc.10.4.205.3233

Chen, W. and You, M. (2003). A framework for the development of online design learning environment, *The proceeding of the 6th Asian Design International Conference (CD ROM), Integration of Knowledge*, Kansei, and Industrial Power, October 41-17, 2003, Tsukuba International Congress Center, Japan, No. 584.

Crowther P. (2013). Understanding the signature pedagogy of the design studio and the opportunities for its tech. enhancement. *Journal of Learning Design, 6*(3), 18-28.

Dave, B. & Danahy, J. (2000). Virtual study abroad and exchange studio, *Automation in Construction, Volume 9*, Issue 1, 2000, Pages 57-71, ISSN 0926-5805, https://doi.org/10.1016/S0926-5805(99)00048-5.

Fleischmann, K. (2018). Online design education: Searching for a middle ground. *Arts and Humanities in Higher Education,* 1-22. doi:10.1177/1474022218758231

Fribourg O. and Rosenvinge J. H. (2013). A comparison of open-ended and closed questions in the prediction of mental health. *Quality and Quantity, 47* (3):1397-1411.

Fulton Suri, J., (2003). The experience evolution: developments in design practice. *The Design Journal*, *6* (2), 39–48.

Gogu C. V. and Kumar J. (2021) Social Connectedness in Online versus Face-to-Face Design Education: A comparative study in India. In *Design for Tomorrow-Volume 2*, Smart Innovation, Systems and Technologies 222, https://doi.org/10.1007/978-981-16-0119-4_33.

Gray C. and Malins J. (2004) *Visualizing Research: A Guide to the Research Process in Art and Design.* New York, USA: Burlington Ashgate.

Hutcherson, C. A., Seppala, E. M., & Gross, J. J. (2008). Loving-kindness meditation increases social connectedness. *Emotion, 8*(5), 720–724. https://doi.org/10.1037/ a0013237

Koskinen, I. and Battarbee, K. (2003). Introduction to user experience and empathic design. *In*: I. Koskinen, K. Battarbee, and T. Mattelmäki, eds. *Empathic design, user experience in product design.* Helsinki: IT Press, 37–50.

Kreijns K., Kirschner P. A., Jochems W., and van Buuren H. (2004). Determining sociability, social space, and social presence in (a)synchronous collaborative groups. *Cyber Psychology & Behaviour, 7*, 155–172. doi:10.1089/109493104323024429.

Kumar P., Kumar A., Palvia S., and Verma S. (2019). Online business edu research: Sys. analysis and a conceptual model. *The Intl Journal of Mgmt Edu, 17*, 26-35.

Laffey J., Lin G. Y., and Lin Y. (2006). Assessing social ability in online learning environments. *Journal of Interactive Learning Research*, *17*(2), 163 – 177.

Latch Craig, D. & Zimring, C. (2000). Supporting collaborative design groups as design communities, *Design Studies, Volume 21*, Issue 2, 2000, Pages 187-204, ISSN 0142-694X, https://doi.org/10.1016/S0142-694X(99)00041-1.

Lee, R. M., & Robbins, S. B. (1995). Measuring belongingness: The Social Connectedness and the Social Assurance scales. *Journal of Counseling Psychology, 42*(2), 232–241.

Morse J. M. and Niehaus L. (2009) *Mixed Method Design: Principles and Procedures*. Walnut Creek, CA: Left Coast.

Nortvig, A. M., Petersen, A. K., and Balle, S. H. (2018). A Literature Review of the Factors Influencing E Learning and Blended Learning in Relation to Learning Outcome, Student Satisfaction and Engagement. *The Electronic Journal of e-Learning, 16*(1), pp. 46-55

Park, J. Y. (2011). Design education online: Learning delivery and evaluation. *International Journal of Art & Design Education, 30*(2), 176-187. doi:10.1111/j.14768070.2011.01689.x

Pratap S., Dahiya A., Kumar J. (2021) From Studios to Laptops: Challenges in Imparting Design Education Virtually. In: Zaphiris P., Ioannou A. (eds) *Learning and Collaboration Technologies: New Challenges and Learning Experiences.* HCII 2021. Lecture Notes in *Computer Science, vol 12784*. Springer, Cham. https://doi.org/10.1007/978-3-030-77889-7_35

Reisetter M. and Boris G. (2004). Student perceptions of effective elements in online learning. *Quarterly Review of Distance Education, 5,* 277–291. Retrieved from http://www.aect.org/intranet/publications/qrde/subguides.html.

Riedl C., Köbler F., Goswami S., and Krcmar H. (2013). Tweeting to feel connected: A model for social connectedness in online social networks. *International Journal of Human-Computer Interaction*, 29, 670–687.

Robinson J. P., Shaver P. R., and Wrightsman L. S. (Eds.). (1991). *Measures of social psychological attitudes, Vol. 1. Measures of personality and social psychological attitudes.* Academic Press.

Russell, P., Stachelhaus, T. and Elger, D. (2003). CSNCW: Computer Supported Non-Cooperative Work Barriers to Successful Virtual Design Studios*. Digital Design* [21th eCAADe Conference Proceedings / ISBN 0-9541183-1-6] Graz (Austria) 17-20 September 2003, pp. 59-66.

Slagter van Tryon P. J. (2007). E-mmediacy strategies for online learning: An instructor's guide and instrument for the design and evaluation of social connectedness in web-based courses. Lehigh University.

Slagter van Tryon P. J. and Bishop M. J., (2009). Theoretical Foundations for Enhancing Social Connectedness in Online Learning Environments. *Distance Education 30*(3):291-315. DOI: 10.1080/01587910903236312.

Smith E. and Mackie D. (2000). *Social psychology (2nd ed.),* Psychology Press, New York, NY

Turner R. E., Rieger M., and Barrick R. K. (2011). Student Evaluation Scores for Courses Delivered by *Interactive Videoconferencing NACTA Journal, Vol. 55*, No. 1, pp. 16-20.

Visser, F.S., Stappers, P. J., van der Lugt, R. & Sanders, E. B-N. (2005) Context mapping: experiences from practice, *CoDesign, 1*:2, 119-149, DOI: 10.1080/15710880500135987

Žavbi, R., and Tavčar, J. (2005). Preparing undergraduate students for work in virtual product development teams, *Computers & Education, Vol. 44*, pp. 357-376.