How the Use of Software Visual Feature Affects Students' Ability to Stay Connected in Online Design Education

Xiaolin Zhang[1], Younghuan Pan[2]

colleenzhang@gdut.edu.cn

[1]College of Art and Design Guangdong University of Technology Guangzhou, China

[2]Interaction Design Lab Kookmin University Seoul, Korea

Abstract—COVID-19 threatens higher education's sustainability. Online courses lack connectivity and engagement, two key elements of design education. Design online education has less research than STEM fields. This study used emoticons to improve design students' connectivity and engagement in online environment. 91 Chinese design students were analyzed in a quasi-experiment. They tested emoticons in three different teaching situations. The data analysis found a positive correlation between online emoticon use and design students' connectivity and engagement. Students who used many personified emoticons felt more connected and engaged. increased connectivity and engagement. We suggested the development of online teaching software as well as online design instruction in order to strengthen the long-term viability of design education.

Keywords- connectivity; engagement; online design education; visual cognition; software design

1 INTRODUCTION

The COVID-19 pandemic has heightened the importance of educating for a sustainable future, posing a challenge to the education sector and wider society. Distance learning has a long-term future [1]. Students and instructors alike have had to quickly adjust to the new paradigm of online and computer-based instruction [2, 3]. Despite learning online, students face practical challenges [4]. Better communication is needed to improve online education. This shift in education poses problems for many fields and norms, but it is especially noticeable in art and design. In today's online synchronous learning environments, there are a number of barriers to classroom communication that continue to exist. Some of these barriers include a lack of information loss through the use of facial expressions and body language, a lack of access to timely feedback from teachers and peers, and technical issues with online software [5, 6]. Reduced student creativity, exploratory skills, and social engagement [7].

Teaching communication depends on the software platform used [8, 9]. Tencent Meetings, a popular piece of synchronous teaching software, was originally intended for business meetings but has since found a home in the classroom and the business world [10]. Learning platform and software function are of interest to some designers and teachers [11]. There hasn't been a

ITEI 2022, December 23-25, Harbin, People's Republic of China

DOI 10.4108/eai.23-12-2022.2329146

lot of study into how the planning and testing of these tools influences online classroom communication amongst students. Communication and behavior patterns in design students are also poorly understood. In this article, we'll look at the benefits of online communication and the various online design education activities available today. Second, the communicative cognitive traits of design students will be examined. Third, a quasi-experimental approach to instruction will investigate how emoticon use affects students' interest.

2 LITERATURE REVIEW

2.1 Education Method and Design

Design activities are always shaped by participants' communicative resources. Design education can be complex [12]. Team-based learning, a design education staple for nearly a century, exposes students to complexities [13]. Because creative disciplines are based on interpersonal structures, team-based learning is especially useful. Design learning requires students to develop information-sharing, negotiation, and consensus-building skills [14]. Students learn better in groups than alone [15-17]. Design student success is linked to smooth communication [18].

2.2 Synchronous Online Education

Sustainability in higher education can be aided by web-based methods [19, 20] because they eliminate geographical barriers and provide links to in-depth information. Barriers to effective classroom communication in today's online learning environments include delayed responses from instructors, students' inability to read facial expressions and body language, and software bugs [5, 6]. Reduced exploration, connectivity, and engagement [7]. Various research studies support the importance of online course interactions. Instructor feedback is key to online learning. Smooth communication increases student success [18]. Interaction is vital to identity formation and learning [21]. Depersonalization and isolation hurt persistence [22].

2.3 Connectivity and Engagement

connectivity is students' coherence, essence, belief, and inter connectivity [23-25]. Developing connections and pedagogical endeavors both benefit from the use of well-suited software. The level to which students actively participate in classroom activities through their thoughts, feelings, and actions is referred to as "student engagement," and it is measured using the term "student engagement" [26]. Connectivity and engagement are positive predictors of online learning effectiveness, grades, and course completion.

2.4 Online Environment and Dual Coding Theory

According to dual coding theory, the human brain has two distinct systems for handling verbal and nonverbal data [27]. In the same way that the auditory channel processes sound, the visual channel processes visual content such as animations and illustrations. Learning is facilitated by educating all avenues [28-30]. In a traditional classroom, students learn both verbal and nonverbal cues from their instructors and classmates through listening, watching, and touching.

All forms of communication are incorporated into offline lessons. Online courses divide up their responsibilities. Language data for conversational interaction is provided by the live call. The elements of the learning platform's functionality and interactivity are the online environment factors. To be effective, online education must provide a positive learning environment [31]. Online, environmental factors cause little language loss. Students can have a live conversation with one another thanks to web technology and voice capabilities. It's possible that nonverbal cues are different. Using cameras in online classrooms worries some students [32]. Students' privacy concerns and reluctance to participate in any sort of monitoring are examples of personal reasons. It's possible that in economically depressed areas, network delays could result from a high concentration of users all using their cameras at once. Without visual connections, classroom speakers didn't always know if others were listening or what they thought of their ideas. Finally, brief contact with instructors and peers can dampen a student's inspiration [33].

3 THE FOCUS OF THE PRESENT STUDY

Key terms were established at the outset of this research. It has been shown through research that non-verbal information is essential for interaction in synchronous online courses. The online environment could benefit more from the use of features other than cameras to provide visual information. Emoticons are used to convey nonverbal emotions [34]. Emoticons' complexity and concreteness affect users' performance. Form and status may affect the usefulness of emoticons [35]. Several studies combine abstract and shape properties. Emoticons are also personified [36]. Researchers examining the expressive form and status of graphic emoticons in synchronous online courses. The following hypothesis is put forth by us:

- Ha: Students in a synchronous online learning environment who use emoticons with abstract expressions report feeling more connected to their peers and more invested in their learning.
- Hb: Synchronous online learning environments where plentiful personified form emoticons are used report higher levels of perceived connectivity and engagement.

4 METHOD

This study involved Chinese design undergraduates. Before being officially distributed, the questionnaire was expert-reviewed and pilot-tested. Convenience sampling determined the participants. Fall 2021 saw the quasi-teaching experiment. Spring 2022 saw data collection and variance analysis.

4.1 Participants

91 Chinese design undergraduates participated in the survey. All project participants received an anonymous online survey. The final sample had 53.28% female and 46.72% male. The average age of participants was 20.

4.2 Procedures

Connectivity and learning engagement was measured by 19 items. The survey used a five-point Likert scale, from strongly disagree to strongly agree. The connectivity sub-scale measures students' connectivity, cohesion, spirit, trust, and interdependence. Learning engagement sub-scale measured online learning engagement. The study used a quasi-experimental design to compare emoticons and online teaching. The outcome variables were connectivity and engagement. There were no changes to the teacher, curriculum, or grading system. Differences in mean outcomes between treatment and control groups in randomized controlled trials are always attributable to treatment. The current study compared the efficacy of three different types of emoticon-based learning environments (pure online, abstract/geometric, and personified). Tencent's teleconferencing software was used in the classroom. The only form of communication between the teacher and the P-O students was through live video conferences. During the online video session, the teacher used abstract/geometric form emoticons (A-E) to express emotions or provide feedback. In the personified emoticons (P-E) group, the instructor still used the same number and semantics of emoticons, but the visual design was more humanistic and figurative. Due to the random nature of the participant assignment, no consideration was given to the participants' backgrounds. All students were given an anonymous survey to fill out after each teaching experiment. The poll was conducted in an online format. The survey results would not be used to determine students' grades.

5 DATA ANALYSIS AND DISCUSSIONS

The questionnaire data were then analyzed for validity and reliability. Total and sub-scale, connectivity and engagement were analyzed with Cronbach's alpha and correlation analyses. Total and sub-scale Cronbach's alpha were .92, .72, and .93, indicating adequate inter-item reliability. Each group was analyzed descriptively. Levene's statistic tests variance homogeneity. The learning methods were compared using a one-way ANOVA. The Tukey HSD test was utilized to examine the significance of differences between means of different pairs. Table 1 shows ANOVA results. In terms of total ($F = 6.50$, $p < 0.001$), connectivity ($F = 5.33$, $p < 0.01$), and engagement ($F = 5.93$, $p < 0.01$). It turns out that there are noticeable distinctions between the three categories. Each group has different levels of connectivity and engagement.

Table 1 Results of one-way ANOVA test

Variable	Comparison	Sum of Squares	Mean Square	F	Sig.
Total	Between Groups	1875.40	625.13	6.50***	.000
	Within Groups	11342.31	96.12		
Connectivity	Between Groups	262.87	87.63	5.33*	.002
	Within Groups	1941.65	16.46		
Engagement	Between Groups	779.33	259.78	5.93**	.001
	Within Groups	5170.24	43.81		

Table 2 compares the three data sets. Compared to online education and abstract/geometric form emoticons, those with a more personified form proved more effective in persuading design students of the benefits of connectivity. The online connectivity of students studying pure design did not differ from that of students learning abstract/geometric form emoticons. There was significantly more participation from the personified emoticons group than from the purely online group.

Table 2 Results of post hoc tests (Tukey HSD)

					95% Confidence interval	
Variable	**Comparison**	**MD**	**Std. error**	**Sig.**	**Lower bound**	**Upper bound**
connectivity	P-O vs. A-E	-1.23	1.047	.642	-3.96	1.50
	P-O vs. P-E	-3.99**	1.039	.001	-6.70	-1.28
	A-E vs. P-E	-2.76*	1.039	.044	-5.46	-.05
Engagement	P-O vs. A-E	-3.93	1.709	.104	-8.39	.52
	P-O vs. P-E	-7.09***	1.695	.000	-11.51	-2.67
	A-E vs. P-E	-3.16	1.695	.250	-7.574	1.262

There was a statistically significant rise in student involvement and communication after implementing this strategy. We found that using many personified emoticons increased students' online learning connectivity and engagement. The above analyses add to the literature on emoticons in online design courses and allow us to investigate visual information more thoroughly.

6 LIMITATIONS AND FUTURE RESEARCH

All students came from the same Chinese university. The university and student body may affect the study's results. This study must be replicated to be generalized. We also need to improve the emotion function's usability. This study ignored software usability. Easy-to-use interfaces encourage online instructor-student communication, improving online education effectiveness. Lee et al. These results will inform future studies that are tasked with designing and developing instructional software in accordance with interaction design theories like usability and ease of use, and testing and vetting the software to ensure its long-term viability in the classroom.

7 CONCLUSION

Online design education challenges synchronous online teaching sustainability. This paper uses dual coding theory to provide cognitive insights for enhancing the effectiveness of teaching and learning in virtual classrooms. In this study, we used a quasi-teaching experiment to look at how students' access to and use of visual information in a real-time online design course relates

to their overall connectivity and interest in the material. Emoticons were studied quantitatively. Based on our findings, it appears that design students who use personified form emoticons in their online classes report the highest levels of desirable connectivity and engagement outcomes. Nonverbal features of synchronous online education software can help students connect with classmates and teachers. The results of this research offer important suggestions for improving the long-term health of colleges and universities, instructors trained in the practice of teaching by design, and interactive designers' tools for delivering online instruction.

REFERENCES

[1] Afzal, F., & Crawford, L. (2022) 'Student's perception of engagement in online project management education and its impact on performance: The mediating role of self-motivatio', Project Leadership and Society, 3, 100057.

[2] Basantes-Andrade, A., Casillas-Martín, S., Cabezas-González, M., Naranjo-Toro, M., & Guerra-Reyes, F. (2022) 'Standards of Teacher Digital Competence in Higher Education: A Systematic Literature Review', Sustainability, 14(21), 13983.

[3] Cabezas-González, M., Casillas-Martín, S. and García-Peñalvo, F.J. (2021) 'The Digital Competence of Pre-Service Educators: The Influence of Personal Variables', Sustainability, 13(4), p. 2318.

[4] López-Meneses, E. et al. (2020) 'University students' digital competence in three areas of the DigCom 2.1 model: A comparative study at three European universities', Australasian Journal of Educational Technology, pp. 69–88.

[5] Li, S., Craig, S. D., & Schroeder, N. L. (2022). Lessons Learned from Online Learning at Scale: a Study of Exemplar Learning Organizations. TechTrends, 1-14.

[6] Regmi, K., & Jones, L. (2020). A systematic review of the factors–enablers and barriers–affecting e-learning in health sciences education. BMC medical education, 20(1), pp. 1-18.

[7] Sum, M., & Oancea, A. (2022). The use of technology in higher education teaching by academics during the COVID-19 emergency remote teaching period: a systematic review. International Journal of Educational Technology in Higher Education, 19(1), 1-39.

[8] Díaz-Noguera, M.D. et al. (2022) 'Autonomy, Motivation, and Digital Pedagogy Are Key Factors in the Perceptions of Spanish Higher-Education Students toward Online Learning during the COVID-19 Pandemic', International Journal of Environmental Research and Public Health, 19(2), p. 654.

[9] Torkzadeh, M., Norouzi Zad, Z., & Dehghani, F. (2022). Phenomenological analysis of the factors affecting the teachers' life quality during virtual learning.. Information and Communication Technology in Educational Sciences, 12(47), 83-102.

[10] González-Zamar, M.-D. et al. (2020) 'Managing ICT for Sustainable Education: Research Analysis in the Context of Higher Education', Sustainability, 12(19), p. 8254.

[11] Fernández-Batanero, J.M. et al. (2021) 'Digital Teaching Competence in Higher Education: A Systematic Review', Education Sciences, 11(11), p. 689.

[12] Pengfei, W. (2022). Hotspots and Evolution Visualization Analysis of Innovation and Entrepreneurship Education Based on SKM. Science, 10(5), 144-152.

[13] Lilley, D.D. and Lofthouse, D.V. (no date) 'Teaching Ethics for Design for Sustainable Behaviour: A pilot study', p. 16.

[14] Brosens, L., Raes, A., Octavia, J. R., & Emmanouil, M. (2022). How future proof is design education? A systematic review. International Journal of Technology and Design Education, 1-21.
[15] Russ, R., & Dickinson, J. (1999). Collaborative design: “Forming, storming, and norming”. Journal of Interior Design, 25(2), pp. 52-58.
[16] Ettington, D. R., & Camp, R. R. (2002). Facilitating transfer of skills between group projects and work teams. Journal of Management Education, 26(4), pp. 356-379.
[17] Kanuka, H., & Garrison, D. R. (2004). Cognitive presence in online learning. Journal of Computing in Higher Education, 15(2), pp. 21-39.
[18] Toetenel, L., & Rienties, B. (2016). Analysing 157 learning designs using learning analytic approaches as a means to evaluate the impact of pedagogical decision making. British Journal of Educational Technology, 47(5), pp. 981-992.
[19] Lilley, D., & Lofthouse, V. (2009). Sustainable design education–considering design for behavioural change. engineering education, 4(1), pp. 29-41.
[20] Basantes, A. V., Naranjo, M. E., & Ojeda, V. (2018). Metodología PACIE en la Educación Virtual: una experiencia en la Universidad Técnica del Norte. Formación universitaria, 11(2), pp. 35-44.
[21] Trespalacios, J., Snelson, C., Lowenthal, P. R., Uribe-Flórez, L., & Perkins, R. (2021). Community and connectivity in online higher education: A scoping review of the literature. Distance Education, 42(1), pp. 5-21.
[22] Terrell, S. R., Snyder, M. M., & Dringus, L. P. (2009). The development, validation, and application of the Doctoral Student connectivity Scale. The Internet and Higher Education, 12(2), pp. 112-116.
[23] Rovai, A. P. (2001). Building classroom community at a distance: A case study. Educational technology research and development, 49(4), pp. 33-48.
[24] Rovai, A. P. (2002). Development of an instrument to measure classroom community. The Internet and higher education, 5(3), pp. 197-211.
[25] Rovai, A. P. (2002). Sense of community, perceived cognitive learning, and persistence in asynchronous learning networks. The Internet and Higher Education, 5(4), pp. 319-332.
[26] Gunuc, S., & Kuzu, A. (2015). Student engagement scale: development, reliability and validity. Assessment & Evaluation in Higher Education, 40(4), pp. 587-610.
[27] Ye, L., Su, H., Zhao, J., & Hang, Y. (2021). The impact of multimedia effect on art learning: Eye movement evidence from traditional chinese pattern learning. International Journal of Art & Design Education, 40(2), pp. 342-358.
[28] Driscoll, M. P. Gagne’s Theory of Instruction. In Psychology of Learning for Instruction, 3rd ed.; Pearson: Boston, United States, 2005; Volume 10, pp. 342-372
[29] Murphy, P. K., & Benton, S. L. (2010). The new frontier of educational neuropsychology: Unknown opportunities and unfulfilled hopes. Contemporary Educational Psychology, 35(2), pp. 153-155.
[30] Tokuhama-Espinosa, T. (2010). Mind, brain, and education science: A comprehensive guide to the new brain-based teaching. WW Norton & Company.
[31] Cabezas, M., Casillas, S., & Hernandez, A. (2016). A case study on computer supported collaborative learning in Spanish schools. Journal of Information Technology Research (JITR), 9(2), pp. 89-102.
[32] Park, T., & Lim, C. (2019). Design principles for improving emotional affordances in an online learning environment. Asia Pacific Education Review, 20(1), pp. 53-67.

[33] Castelli, F. R., & Sarvary, M. A. (2021). Why students do not turn on their video cameras during online classes and an equitable and inclusive plan to encourage them to do so. Ecology and Evolution, 11(8), pp. 3565-3576.
[34] Wong, S. C. P., & Wong, A. T. (1979). The relationship between assignment completion and the attrition and achievement in correspondence courses. The Journal of Educational Research, 72(3), pp. 165-168.
[35] Hudson, M. B., Nicolas, S. C., Howser, M. E., Lipsett, K. E., Robinson, I. W., Pope, L. J., ... & Friedman, D. R. (2015). Examining how gender and emoticons influence Facebook jealousy. Cyberpsychology, Behavior, and Social Networking, 18(2), pp. 87-92.
[36] Jibril, T. A., & Abdullah, M. H. (2013). Relevance of emoticons in computer-mediated communication contexts: An overview. Asian Social Science, 9(4), p. 201.