

Development and Application of Interactive Teaching Systems for Online Design Courses

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ABSTRACT

Digital education has recently become a mainstream education model. Despite digital education's increasing popularity, there remain issues when it comes to teacher-student interactions in digital space, which have made it impossible for this model to achieve the same teaching quality as traditional in-person education. Compared with other academic subjects, online courses in design practice have even more severe problems with teacher-student interaction. This study proposes a new teaching interaction assistance model in online design practice courses. The model uses the TAPs method to establish evaluation codes based on students' design thinking as well as through feedback-thinking related codes. This teaching interaction assistance model is established by combining these thinking codes and the LSTM model. This study takes an online design practice course as a case study, and the results have shown that this model can help teachers and students communicate more effectively and improve the teaching quality of online design practice courses.

KEYWORDS

Digital Education, Interaction Mode, LSTM Model, Teaching Practice, Think-Aloud Protocols

INTRODUCTION

Rapid development of digital education in the post-pandemic era has initiated a digital transformation at all levels of education—the education system has undergone a subversive change. In the wake of the COVID-19 pandemic, many studies have shown that a sustainable demand for digital education has appeared within the education system—online education has changed from a supplementary to a primary teaching method (Alraimi et al., 2015; Sandrone et al., 2021; Saw et al., 2020). The market size

DOI: 10.4018/ijdet.317365

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of online education grew 35.5% year-over-year in 2020 compared with 2019 (Haroony et al., 2020). Online education has also grown rapidly, with more than \$16 billion in venture capital having been invested recently in the education technology domain (Rajab et al., 2020). While the market capacity of online education is expanding, the technology, design, and user interfaces which accompany it have not seen a corresponding transformation. This tremendous shift in purpose and usage poses obvious difficulties and challenges for online tutoring platforms (OTPs). Educational research shows that the relationship between teaching and learning is a dynamic process of knowledge exchange and relationship building, rather than a one-way transfer of knowledge (Craig & Savage, 2014). Related studies have found that student-teacher and student-student interactions are hindered by online education, with 60% of students believing that online instructors lack clear communication and offline face-to-face interactions are more effective (Biggs & Tang, 2011; Zhao et al., 2020). A survey conducted by Missouri University of Science and Technology revealed, compared with traditional in-person education, online education often lacks both teacher-student and student-student interactions (Hokayem & Gotwals, 2016). In addition, most teaching orientations are teacher-centered in formulating teaching strategies, making it difficult to respond to the needs of students and receive their feedback. Some studies have shown interaction has a positive impact on students' academic performance and satisfaction (Beauchamp & Kennewell, 2010; So et al., 2010), and teacher-student and student-student interactions can help students gain a better understanding of the curriculum, improving the quality of both teaching and learning (Sousa et al., 2022). Despite awareness of the benefits of interaction, studies have also found the current norms of digital teaching cannot achieve the same quality as traditional classrooms due to differences in online and in-person teaching strategies, concepts, and methods (Dost et al., 2020; Williamson, 2021). There is often a discernible gap in the quality of online teaching in many disciplines compared with in-person teaching, which is especially significant among design courses owing to their usage of a one-module multistage teaching method. In design courses, it is necessary to establish evaluation points for each design stage and its corresponding product to offer a comprehensive evaluation of the project as a whole. It is also necessary to allow students to demonstrate their mastery of the material through real-time evaluation of their design ideas throughout each design stage. This method helps teachers to adjust their instruction strategies, students to develop their abilities effectively (e.g., collaboration ability, knowledge-to-skill transformation ability), and the teacher and student to clarify each other's thinking; therefore, online design courses require more frequent, more efficient, and higher quality platforms for teacher-student interaction compared with other disciplines (He, 2019; Sun et al., 2014). To reach this goal, however, there are two primary issues that need to be resolved in the current online design course framework.

ONLINE DESIGN COURSES SUFFER FROM SEVERE INTERACTION DIFFICULTIES

Online education interaction provides a variety of functions and is an important cornerstone of online learning (Shanshan, 2014; Yan & Zhong-Wen, 2020). Online design courses are unique in that the format is not based on a strict logical system following a few prerequisites; but a more subjective, empirical, emotional, and personalized reasoning. Therefore, interaction plays a significant role in the teaching process. The teacher usually discusses all aspects of the design and then reaches a unified consensus with students. Nonverbal cues such as facial expressions and postures, which serve as expressions of personal thinking, help teachers and students understand one another's thought processes. Online courses still only create a facsimile of the interactions found in traditional teaching methods through the technical design, which is not conducive to the construction of an inquiry-based learning environment or for facilitating teacher-student interactions—ultimately reducing the efficiency of knowledge-to-skill transfer (Craig & Savage, 2014, Da-Guang & Wen, 2020). In order to confirm the importance of nonverbal cues, Craig (2014) conducted a study on the influence of teachers' attire on students. The results showed that compared with teachers wearing casual attire, students' grades and attendance improved when teachers wore formal attire (Craig & Savage, 2014). Cheng and Jiang (2015) show that online courses have

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