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Instructional Design, Situational Interest, and User Experience: Applications of Learning Experience Design to Promote Children's Online Engagement

Joseph Wong, Natalie Au Yeung, Bella Lerner, Lindsey Richland
joseph.wong@uci.edu, natalie.auyeung@uci.edu, lerneri@uci.edu, l.richland@uci.edu
University of California, Irvine

Abstract: Historically, learning for young students has occurred in formal, in-person classroom environments. But in just a matter of weeks, children were mandated to transition to a completely new mode of learning, facing new learning challenges with heightened anxieties. To this end, we aim to better understand how our learning experience design (LXD) efforts support or hinder children's engagement while participating in an online, video-based math course. This study operationalized LXD through the integration of e-learning instructional design (ID) as a lever for promoting students' situational interest (SI), emphasis on human-centered design to support students' user experience (UX), and the combination of SI and UX to foster student engagement in an online environment. Results provide practical implications for how we can intentionally iterate our designs to sustain children's online engagement as we prepare for future instances of traditional, online and even hybrid models of instruction.

Introduction and theoretical approach towards learning experience design

Currently, one major concern with distance learning is how to best engage and sustain young students' participation throughout the learning experience, given the contextual challenges such as the heightened anxieties caused by the COVID-19 pandemic and the often relatively unsupervised home educational settings (Agarwal & Kaushik, 2020). In this paper, we define engagement as the attention, curiosity, and interest students exhibit during an online video-based math lesson. We then explore how our design choices as researchers, designers and practitioners might support young students' engagement by applying principles of learning experience design (LXD). LXD is the process of creating learning environments to foster learning in a human-centered, goal-orientated method (Floor, 2018; Correia, 2018). In the context of our study, we operationalized LXD by grounding our course in e-learning instructional design (ID) frameworks and ensuring quality user experience (UX) design. We also explored the connection of a third facet: students' situational interest (SI) within a learning environment, as a motivator for sustaining their online engagement. Through this process, we leverage quality ID to support students' SI, strong UX to alleviate technical difficulties related to distance learning, and the combination of the two to facilitate increased engagement. These results provide practical implications for how we can intentionally iterate our designs to sustain young students' online math engagement.

Research in online learning attributes increased student engagement to quality ID (Pappas, 2015), student UX with the interface (Hu, 2008), and student motivational factors (e.g. interest, self-efficacy) that can emerge as a result of the learning environment (Chen et al; Sun et al, 2012). Centered around the notion that "learning" is inseparable from "doing," we adopted the Situated Cognition Theory (SCT) framework so that learners could grasp the concepts and skills that are taught in the context in which they will be utilized (Brown et al., 1989). In practice, SCT emphasizes immersive learning environments, where new information is taught to learners in a way that simulates real-life settings. We operationalized this by using pre-recorded videos of a real-world math lesson being taught by a teacher to students in a real classroom, and embedding interactive opportunities for modeling, coaching, scaffolding, articulation, reflection, and exploration (Pappas, 2015). Leveraging the SCT framework for e-learning course design, we assess students' SI as a result of our ID efforts. Situational interest refers "to the interest activated by the immediate learning environment" or the interest given the novelty aspect of a learning task (Schraw & Lehman, 2001). Past research indicates that SI is a powerful motivator in areas of math, reading, and history, when learner participation and interaction throughout the entire learning process is sustained (Chen et al, 2001). Thus, this study allows us to better understand how our intentional design choices within the online learning environment influence young students' SI to foster online engagement. Lastly, we explore students' UX, as it is considered a key contributor to students' success in online learning environments and has been shown to increase student engagement (Pellas, 2014). A common approach to assess UX in online courses is to measure course usability (Hu, 2008). In an online course, usability refers to the effectiveness of the learning interface and whether or not a student can successfully interact with the course platform to accomplish an intended task. As such, course usability aims to create a positive student UX through content accessibility, a significant predictor of student engagement in online learning environments (Thomson & Lynch, 2003).

To this end, we aim to better understand how our LXD efforts support or hinder young students' engagement while participating in an online, video-based math lesson. This study is guided by the following research questions: (RQ 1) *To what extent do students' SI within an online course influence students' perceived learning engagement (PLE) in math while learning remotely during a worldwide pandemic?* (RQ 2) *To what extent do students' course usability within an online course influence students' PLE in math while learning remotely?* (RQ 3) *Did the ID and course usability support students' online learning experience?*

Methodology

Course design context

The online course modules were hosted on a researcher-designed e-learning platform that was integrated with the teachers' preferred learning management system (LMS) to minimize course flow disruption. Cognizant of the research behind effective UX and ID in self-paced courses, intentional design choices were made to maximize digital interactivity and learner engagement. More specifically, an hour-long video lesson was segmented into ten parts instead of one long continuous stream to reduce fatigue, cognitive load, and opportunities for students to mind-wander (Mayer, 2019). Scaffolded problem sets (worked examples) were placed in between video segments for students to practice problems immediately. These types of problems scaffold novice learners by drawing attention to the structural similarities in the lesson to ensure students attend to the key ideas, concepts, and relationships in practice (Begolli & Richland, 2018). For example, students were first asked to recall strategies they learned from watching the videos. Next, students plugged in the procedural steps to solve the math question. Then, students were asked to compare their procedural steps with model example strategy solutions. After making comparisons across problem types and strategies, students would solve the math problem by assessing their conceptual understanding. Lastly, solution reflections were embedded within each problem scaffold for students to explain, in their own words, how they solved each math problem with their chosen solution strategies. This design choice enabled students to actively engage in their own productive metacognitive judgments and reflect on "how and why" they arrived at their solutions, which has been found to foster learner responsibility, increased test preparation, and review and practice (Tullis & Benjamin, 2011). Careful considerations were made to ensure that the course interface facilitated quality UX design. For example, course roadmaps, course goals, and navigational instructions were clearly "highlighted" and "boxed in" to promote learner ease of use and findability. Additionally, standardized vector icons were utilized before every instructional type, allowing students to differentiate between interface instructions as opposed to lesson-specific instructions. Each video also had instructions clearly stating how to pause, play, and re-watch. These UX design choices were made to mitigate visual complexities, technical difficulties, and allow users to focus on the content most relevant for the task at hand. The ability to click backwards in the course enabled students to freely navigate the course space with more autonomy. Through these iterations, an array of design decisions grounded in LXD principles were implemented to co-develop this online video math course, with the goal of integrating elements of a real classroom and interactive features of an online learning environment in order to maximize students' online engagement.

Data collection and analysis

We recruited 5th and 6th grade teachers from two districts in Orange County. A total of three 5th grade teachers, six 6th grade teachers, and one 5th/6th grade combo-class teacher agreed to be a part of the study. There were a total of 12 classes, each with 26-33 students. Of the ($N = 195$) students who participated, 55.8% identified as female and 44.2% identified as male. Student ages ranged from 10 to 13 years old, with a majority being age 11 (46%) and age 12 (44.9%). This sample consisted of children from a variety of racial/ethnic backgrounds (31.9% White, 2.7% Black, 22.1% Asian, 21.2% Latinx, 22.1% other). The online math lesson was administered to all students during Part 1 of the study. Two days later, four questionnaires were administered to students during Part 2 of the study. This included adapted versions of the Situational Interest Scale (Chen et al., 2001) and the Standardized User Experience Percentile Rank Questionnaire (SUPR-Q; Sauro, 2015). Both measures were 5-point Likert Scales ranging from 1 (*strongly disagree*) to 5 (*strongly agree*). Students' PLE was also measured using an adapted 5-point Likert scale (Rossing et al., 2012). Lastly, we used an adapted version of the Children's Impact of Events Scale (CRIES) developed by the Children and War Foundation (2005), which was a 4-point Likert scale, ranging from 1 (*not at all*) to 4 (*often*). Quantitative data were analyzed using SPSS. Pearson correlations tested the associations between the key variables in our study. Multiple regression analyses were conducted to examine how students' online usability, as well as students' SI, would influence their PLE in math while learning remotely. The SUPR-Q and SI scores were used as predictors on the outcome variable (PLE) to examine research questions one and two, respectively. Students' CRIES score was included in the regression model as the control variable. Qualitative analysis of student evaluation responses were analyzed in Qualtrics

Core XM, which was deductively coded. A codebook was defined and systematically applied. Inclusive and exclusive statements were clearly written to differentiate code applications.

Findings

Descriptive statistics were measured (PLE, SI, CRIES, and SUPR-Q scores). All of the measures were reliable based on the widely accepted recommendation of a Cronbach's alpha of .70 (Nunnally, 1978). Pearson correlations indicated that there was a significant positive moderate correlation between SI and students' PLE ($r = .67$, $p < .001$). Similar significantly positive moderate associations were observed between SI and students' online course usability ($r = .63$, $p < .001$), as well as between students' PLE and students' online course usability ($r = .59$, $p < .001$). However, there was a significantly low and negative association between students' levels of anxiety during the pandemic (CRIES) and their PLE ($r = -.22$, $p < .01$). A similar association between students' levels of anxiety and students' course usability was observed ($r = -.16$, $p < .05$). To estimate the effect of students' SI on their PLE in online math during the pandemic, multiple regressions were conducted with the PLE score as the outcome variable (see Table 1). Results indicate that there is a significant main effect of students' SI score ($\beta = .59$, $p < .001$). In addition, results indicate that there is a significant main effect of students' online course usability score ($\beta = .34$, $p < .001$). On average, students' online course usability and SI explained 51.5% of the variance in the model $F(3, 191) = 67.7$, $p < .001$.

Table 1: Multiple regression with SI and SUPR-Q as predictors for PLE, with CRIES as a control variable.

	Perceived Engagement	
Predictors	β	*SE*
SI	.589***	.078
SUPR-Q	.342***	.086
CRIES	-.108***	-.141
(Constant)	.056	.292
R^2	.515	
N	195	
Note: *** $p < .001$; ** $p < .01$; * $p < .05$ (Two-tailed test).		

There were two main themes identified that were related to the effectiveness of our ID and course usability. The first theme was "instructional design enhanced students' engagement," and the second theme was "the usability of the online course influenced students' learning experience."

Theme 1: Instructional design enhanced students' engagement

Students' engagement was defined as the amount of active participation, motivation, effort, interest, and attention while interacting with the online course. Through our analysis, we noticed emerging patterns specifically related to the implementation of the SCT instructional design model. This model used pre-recorded video to situate students in a real-life classroom context to support students' online engagement. For example, many students expressed that the design of the video lesson made them more motivated and willing to spend more time and effort learning online.

> *Student A:* "…I like the interactive ways that I'm able to learn on this [online course] activity as "…it [online course] makes me feel like the real classroom…"
>
> *Student B:* "I liked how this [online course] activity had videos and felt like you were really learning in class. It was easy and useful. This [online course] activity was also very easy to understand and helped me to understand there are many ways to solve a problem."
>
> *Student C:* "…it [online course] made me want to learn even more… also I like how they [online course] use videos to explain the lesson and that help me a lot."

Theme 2: The usability of the online course influenced students' learning experience

Students' online course evaluations provided evidence on how our course's usability supported students' UX within the online learning environment. These excerpts provide evidence on how our conscious efforts to a more human-centered design affected students' learning experience. Self-paced learning was defined as references to autonomy, on your own time, and time frames with regards to pacing while participating in the online course. For example, they could easily navigate using the back button within the course interface. Additionally, students were able to re-watch, pause, and play a video if they did not grasp the concepts or explanations the first time.

Student D: "What I liked about this learning activity [online course] is that its a video and if I don't understand something I can go back to the point I don't understand"

Student E: "I liked that I could go back and see what I either did wrong or right."

Student F: **"**I like how I can go on my own pace and replay the lesson if I need to."

Conclusion and implications

This study operationalized LXD through the combination of e-learning ID as a lever for promoting students' SI, emphasis on human-centered design to support students' UX, and the combination of SI and UX to foster student engagement. Interestingly, our analyses indicate that students' SI and UX while interacting with the online learning interface were significant predictors of students' online engagement, even after controlling for students' heightened anxieties due to the global pandemic. Snippets of student responses reveal that the use of video situated in the real classroom context may be motivating students. We deduce that students' SIs are increased as a direct result of implementing the SCT instructional design framework. When participating in the online course, students felt like they were in a real classroom and mentioned how watching real students and teachers increased their motivation to learn even more. By preserving the ecological validity of the classroom environment, students were able to follow along with the teacher and immediately practice the math concepts. Gleaning student commentaries also revealed that careful attention to the course usability promoted quality UX design by facilitating ease of use, findability, and navigability (Simunich et al., 2015). These UX design decisions afforded students the opportunity to recognize their initial understandings of the math concepts and allow students to review and practice by navigating backwards or replaying a video. As such, students were able to take control of their learning pace and adapt their learning behaviors to stay engaged in the course content. Thus, the simultaneous integration of ID and UX design may be consequential in supporting students' engagement in an online learning environment. While more research is certainly warranted, we also conjecture that the underlying mechanism linking LXD and engagement is likely to be the resulting effect of increasing student's self-efficacy, task-value, and self-regulation. In conclusion, this study supports the literature on student online engagement and students' learning experiences through empathy, informing LX designers and practitioners on how we might effectively co-design and iteratively improve teaching and learning for future instances of traditional, online and even hybrid models of instruction.

References

Agarwal, S., & Kaushik, J. S. (2020). Student's perception of online learning during COVID pandemic. *Indian Journal of Pediatrics*, 1.

Ahn, J. (2019). Drawing Inspiration for Learning Experience Design (LX) from Diverse Perspectives. *The Emerging Learning Design Journal*, *6*(1), 1.

Begolli, K.N. & Richland, L.E. (2018). Bridging Cognitive Science and Real Classrooms: A Video Methodology for Experimental Research. *The Journal of Experimental Education*, *86*(4), 671-689.

Brown, J. S., Collins, A., & Duguid, P. (1989). Situated cognition and the culture of learning. *Educational researcher*, *18*(1), 32-42.

Chen, A., Darst, P. W., & Pangrazi, R. P. (2001). An examination of situational interest and its sources. *British Journal of Educational Psychology*, *71*(3), 383-400.

Correia, A. P. "ID 2 LXD" From Instructional Design to Learning Experience Design: The Rise of Design Thinking. *Driving Educational Change: Innovations in Action*.

Floor, N. (2018b). What is Experience Design? http://www.learningexperiencedesign.com/learn-1.html

Hu, S., & Kuh, G. D. (2002). Being (dis) engaged in educationally purposeful activities: The influences of student and institutional characteristics. *Research in Higher Education*, *43*(5), 555-575.

Pappas, C. (2015). Instructional design models and theories: The situated cognition theory and the cognitive apprenticeship model.

Schraw, G., & Lehman, S. (2001). Situational interest: A review of the literature and directions for future research. *Educational psychology review*, *13*(1), 23-52.

Simunich, B., Robins, D. B., & Kelly, V. (2015). The impact of findability on student motivation, self-efficacy, and perceptions of online course quality. *American Journal of Distance Education*, *29*(3), 174-185.

Sorensen, C., & Donovan, J. (2017). An examination of factors that impact the retention of online students at a for-profit university. *Online Learning*, *21*(3), 206-221.

Sun, J. C. Y., & Rueda, R. (2012). Situational interest, computer self-efficacy and self-regulation: impact on student engagement in distance education. *British Journal of Educational Technology*, *43*(2), 191-204.

Thompson, L. F., & Lynch, B. J. (2003). Web-based instruction: Who is inclined to resist it and why?. *Journal of Educational Computing Research*, *29*(3), 375-385.