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"Behind the curtain": exploring how instructional design teams function to complete design and development

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Abstract

Behind the curtain is where what makes things happen, happens. How do design teams really design? Five doctoral students from Learning Design and Technology programs across the US had a unique opportunity to pay attention to graduate instructional design teams behind the curtain designing open educational resources for a non-profit that provides learning resources for adult learners with literacy-related knowledge skill gaps. The observers provided an interesting lens to witness the unfolding of a design. We were interested in exploring what the five observers witnessed that may have helped instructional design teams complete the design and development and conducted an exploratory case study to answer our research question—How did design teams function to complete the open educational resources design and development? We discuss how preparing instructional designers to design continues to evolve so that design teams can move a design to completion. We then present the steps we took in exploring what was going on in each team outside of the purview of the instructors. Results indicate six themes of design team activities to complete the design and development phases. We conclude with implications for preparing instructional designers.

Keywords Preparing instructional designers · Authentic design · Design teams · Instructional design

Introduction

> Pay no attention to that man behind the curtain.
> The Great and Powerful Oz from The Wizard of OZ.

Behind the curtain is where what makes things happen, happens. Five doctoral students (observers) from Learning Design and Technology programs across the US had a unique opportunity to pay attention to graduate instructional design teams behind the curtain designing open educational resources (OER) for a non-profit that provides learning resources for adult learners with literacy-related knowledge skill gaps. Using ADDIE

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(analyze, design, develop, implement, and evaluate) as five phases in instructional design, the observers participated in the design and develop phases. The graduate instructional design teams designed and developed lessons that had been developed prior but had been evaluated as needing revisions. Therefore, the design teams did not spend much time in the analyze phase, nor the implement and evaluate phase as the final team requirement was to upload the final lesson to OER Commons. Each observer observed a design team collaborating and making decisions while considering project milestones, deliverables, and due dates. Directed to simply observe the design teams in action, the observers provided an interesting lens to witness the unfolding of a design. We were interested in further exploring what the five observers documented that may have helped complete the design and development phases. Our research question was—How do design teams function to complete the OER design and development?

In this study, we begin by discussing how preparing instructional designers continues to evolve so that design teams can complete a design. We provide context around the design project and share the initial observations of the five observers. We then present how we took the next step in exploring what was going on in each team outside of our purview in an effort to improve how we prepare instructional design students. We present the six themes that emerged, and then conclude with implications for preparing instructional designers.

Literature review

Preparing instructional designers

Instructional design has been defined as a process, where designers follow step by step procedures to create instruction to solve a performance problem. Preparing instructional design students to work as instructional designers traditionally includes teaching models based on theories from other educational fields (Tracey & Boling, 2013). Textbooks and most educational programs present curriculum around this systematic process and model orientation, teaching students the application of theories from fields such as communication, psychology, and education. Although the use of models to teach instructional design was intended to simplify a complicated activity, novice instructional designers embrace these models literally as step-by-step instruction rather than as conceptual frameworks (Gibbons & Yanchar, 2010). As such, this tradition of preparation has created a gap between the formal preparation of instructional designers, usually in an academic setting, and the actual practice they carry out in the field. When immersed in practice, instructional designers quickly realize that the reality of solving complex problems cannot be done solely with the tools and techniques they were presented within traditional instructional design programs.

Enriched design preparation activities

To mitigate this gap, academics in traditional instructional design programs have implemented strategies to prepare designers including collaborative teamwork to develop needed interpersonal communication skills (Julian et al., 2000), authentic instructional design projects involving clients to provide team instructional design opportunities (Tracey, et al. 2008; Knowles & Suh, 2005), design cases to provide practice (Boling, 2010) and case

studies to provide a variety of examples (Ertmer & Quinn, 2003). With the proliferation of online education, efforts to redesign instructional design courses to include authentic learning experiences have been documented (Lowell & Moore, 2020). The intent is to promote designer reflection, interaction with complex problems, and apprenticeship-like experiences (Tracey & Boling, 2013). Additionally, over the past decade we began to explore how designers in other fields are prepared for practice to better train those in our field.

Design activities in other design fields

Because Instructional Designers are designers whose role is to specifically design instruction, researchers and scholars in the field of instructional design have begun to incorporate philosophies and concepts from other fields such as *design thinking* (Cross, 2007; Lawson & Dorst, 2009), *reflective thinking* (Lowgren & Stolterman, 2004) and *empathic design* (Kouprie & Visser, 2009), altering the view of the role of the instructional designer. In discussing design thinking, Cross posits the following, (1). it is a process for creative problem solving, (2). it has a human-centered core, and (3) it empathically focuses on the people the designer is designing for in an effort to produce a better product or service (Cross, 2011). Reflective thinking in design is the act of being thoughtful; about caring for the designer's own design ability, the designs they create, and how the world will change by their design ideas and decisions. The designer uses critical thought to observe their role, the purpose and outcomes of designing in different ways and of using different methods and theories (Lowgren & Stolterman, 2004). Empathy is central to current approaches to problem-solving and a fundamental ability for designers to acquire an in-depth understanding of people to ensure designs meet human needs (Bohorquez & Andres, 2018). As such, empathy in instructional design can be viewed as a means to an end. Employing an empathic design approach also allows designers to embrace a localized context of use which emphasizes scaling context to what is needed in one specific situation (Baaki & Tracey, 2019). This means the designer will be designing for this one moment in time, for this audience, for this specific problem.

When studying design in other fields it is apparent that designers are at the center of the design process, solving design problems (Talischi et al., 2012; Boling & Smith, 2012; Feland et al., 2004). In Industrial Design for example, the designer is considered a thinker, translating those thoughts into acts. The designer has broad knowledge in numerous different areas whose diverse skills including leadership, problem solving, and research allowing them to solve complex problems (Rubio, 2020). In engineering, a Comprehensive Design Engineering program (Feland et al., 2004) was established to help engineers transition technology and products across what was defined as an *Innovation Fence* into the hands of customers. The goal of the designer in this broad sense is to meet the customer needs, test results, and deliver solutions (Friedman, 2000). This designer is an expert in design, not in specific content knowledge, who collaborates, iteratively analyzes and synthesizes problems, explains solutions through prototyping, and works in design teams complete the design. This designer understands people in order to create meaningful products, services and experiences. If instructional designers are to emulate other design fields, those who teach instructional design may choose to continue to expand the tools they use to prepare instructional design practitioners. Teaching theories and processes are foundational to practice and additional activities like those taught in other design fields will not replace the foundation but rather add to it. Instructors might consider teaching instructional designers to embrace a holistic perspective to design including the content, context, and the

collaborative nature of design practice. Today, instructors are more aware of the critical role that designers play in the design process and are conscious of the need to prepare them to succeed in this role.

Towards design completion

Designers do not design for design's sake (Cross, 2011). Simon (1969) explained that design has a purpose, "Everyone designs who devises courses of action aimed at changing existing situations into preferred ones," (p. 55). The instructional design teams who designed OER for adults with literacy-related knowledge skill gaps designed for action and change as each team was required to submit a final product by the end of the semester. Instructional designers design learning interventions to change existing situations into preferred situations by closing gaps in results (Kaufman et al., 2003). Emphasizing the design in instructional design, purpose, interaction and negotiation, and reflective practice are key elements that help instructional designers complete ADDIE's design and development phases.

A purpose drives a design toward completion

Every design situation is twofold: (a) what is required and (b) how to satisfy it. Cross (2011) notes that the reasoning processes of designers is abductive in that designers, "… shift and transfer thought between the required purpose of function of some activity and appropriate forms for an object to satisfy that purpose," (p. 10). When designers think abductively, designers start with an observation and then look for the most likely explanation. First discussed by Newell and Simon (1972) and then further explored by Maher and Tang (2003) and Dorst and Cross (2001), a problem space and a solution space co-evolve together as information moves back and forth between the spaces. Guided by an identified gap in results, an instructional designer takes information and begins to form an intervention. The initial intervention may change as the instructional designer reflects on what is required which may result in the designer redefining the problem and checking whether the redefined problem fits with the initial intervention idea. The intervention is then modified as the instructional designer remains focused on purpose—what is required of the learning and/or the performance gap and how to satisfy that gap ultimately results with an intervention.

Interaction and negotiation drive a design toward completion

Instructional designers interact empathically with their audience of focus, other designers, and a localized context of use which emphasizes scaling context to what is needed in a situation (Baaki & Tracey, 2019). Interaction can happen between members of a team and with the design project itself. Much research exists on how design teams interact. Researchers have examined how the social context moderates the culture-creativity relationship by making consensual cultural values more accessible in design teams than when designers work alone (Nouri et al., 2015), how frequent social exchanges result in positive emotions that solidify group identity and a reduction in design uncertainty (Lawler et al., 2000), how collective exploration of problems and identity- and experience-oriented design preferences assist with forming team coalitions (Ke & Im, 2014), and how clear boundaries between groups, or strong identity held separately from the full collaboration is not helpful

in complex collaborative design projects (Jacobs, 2017). Chou and Wong (2015) examined graduate students working in interdisciplinary collaborative groups. Through a process of investigation, pilot study, problem definition and project implementation students developed community art projects. Students' home discipline informed how they conceptualized the design problem, and how the group ultimately approached solutions. Schwier et al. (2004) interviewed five instructional designers regarding their participation in instructional design communities of practice and concluded that communities of practice play a mediated role in construction of instructional designer identity, and that resistance to collaborations may be partially explained by threats to identity. A common thread within these studies is that the specific design project affects how the design team functions. What is required of the gap in results and how to satisfy the gap in results matters in how the team interacts.

Design teams interact with the design project itself always taking stock in the design constraints. Baaki & Luo (2019) and Baaki, et al. (2017) showed how engineers, graphic designers, and instructional design practitioners and graduate student teams interacted with external representations (sketches, models, flowcharts, spreadsheets, etc.) to explore the co-evolution of what is required and how to satisfy what is required. An essential element to participating in the co-evolution of the problem and solution spaces and ultimately completing a design is interacting with constraints. Design constraints include time, budget, technology, and human capital. Cross (2011) contends that designers accept constraints as necessary to help determine what is required and how to satisfy it.

In the Layers of Necessity Model, Tessmer and Wedman (1990) concluded that instructional designers interact with constraints and delete or minimize design components. Amidst constraints, instructional designers select actions, "which get the job done while not necessarily in an optimal manner," (Tessmer & Wedman, 1990, p. 79). Simon (1969) introduced the terms satisficing to describe the situation. Designing with constraints is not a search for an optimum intervention given a specific gap in results. What can be done not what ought to be done determines effective instructional design (Tessmer & Wedman, 1990). Interacting with constraints can drive how instructional design teams think about design, and ultimately how they design.

Designers negotiate what is required and how to satisfy it. Learners, other designers on the design team, and a designer herself reflect on a design and react to a design (Cross, 2011). For example, when a designer provides an external representation, the design team and audience of focus negotiate differences and construct meaning of the design through reflection and collaboration (Tracey & Hutchinson, 2016). A design can move toward development when a design team and/or audience of focus come to a consensus on what can be done and what ought to be done to ensure an effective learning and performance intervention.

Design teams drive a design toward completion

Design is an inherently social, collaborative process requiring social interactions with those the design is intended for and the numerous entities who contribute to the final design (Dorst, 2003; Tracey, 2015). Design teams are critical in design activity to ensure meaningful collaboration among many different professionals. In studying design teams, Cross (2011) determined moving a design toward completion required a team who works productively, reaches a relatively successful conclusion to the set task within the prescribed time with minimal frustration or dissatisfaction within individual team members. Design

team members embrace roles and responsibilities within the team, relative to each other and have an inherent need to communicate with other members of the team. Team collaboration is successful when you have a well-balanced group with all contributing through conversation and drawings/sketches. Team members can ask questions of each other and build on each other's ideas. They generate a greater number and variety of concepts and ideas than individual designers, but different understandings may cause conflicts to arise. Cross (2011) indicates the need to identify, manage, and resolve conflicts to achieve a constructive outcome.

Reflective practice drives a design toward completion

Schön (1983) explained that reflection-in-action is the idea that while a designer is designing, they are reflecting on the design, such that through making changes around the what is required/how to satisfy it approach, they better understand the design situation, and by better understanding the design situation they progress with changes. A designer shapes a situation and allows the situation to talk back to the designer and the designer responds to the back talk (Schön, 1983). Baaki & Luo (2019), Baaki, et al. (2017) and Williams et al. (2011) showed how instructional designers and instructional design teams reflect-in-action while interacting with external representations and evaluating the progress of a design. In completing design and development, instructional designers reflect-in-action, moving from what if and design exploration to design decision and commitment.

Research context

Designing for a client

Two of the authors are professors of instructional design and technology from two universities in the United States. Both teach an Advanced Instructional Design course in a digital learning setting where class meetings are a combination of synchronous classes via WebEx or Zoom and asynchronous classes via Blackboard or Canvas. Both instructors contend that course outcomes for an advanced class must go beyond comprehension of instructional design theories and practices and anchor a design project with a client to help students develop practitioner skills.

To meet course learning goals, the instructors partnered with a non-profit client to provide students with a design project throughout the semester. They aligned their syllabi, including class activities, readings, materials, and project deliverables. The non-profit client, serving adult learners preparing to take a high school equivalency exam, asked the instructional design student teams to redesign open educational resources to assist learners with basic literacy-related knowledge skills gaps. As practitioners with a wealth of design team experience, the instructors formed five student design teams to work with the client, appointing one person on each team as the team leader.

Project team composition and roles

Each project team was comprised of four-member groups: the student design team, the client, the observer, and the instructor.

Role of the student design teams

A total of 20 graduate students from the two courses were grouped into five design teams and introduced to the client. Design teams consisted of PhD and master's instructional design students. All but one of the graduate students work in some aspect of instructional design. Each student design team was tasked to collaborate virtually to determine learner outcomes, context, content, and design an intervention applying instructional strategies and assessments, learner experience features (e.g., directions and help, aesthetics of displays, lesson sequencing, and overall ease of use), affective considerations (e.g., arousing learner curiosity and attention, relevance, level of challenge), and display features (e.g., images, graphics, audio, animation, video, or print materials).

Role of the instructors

The instructors in this learning case served multiple roles including the (1) course facilitator, (2) initial reviewer, and (3) project mentor. First, as course facilitators, the instructors worked to ensure students were supported with learning resources and examples of practice activities and assessments. The instructors created the relationship with the client and together they agreed on the scope of the project ensuring it was achievable within the semester timeline. As each project was unique, so were the deliverables and timelines, so the instructors provided a list of deliverables to each team who worked with the client to determine project milestones and an agreed upon timeline for the client, the team and to meet the requirements of the course (Table 1).

Embracing reflection-in-action (Schon, 1983), the instructors served as the initial reviewers for all deliverables. The design teams met with the instructor to discuss each

Table 1 Project milestones and deliverables

Project milestones	Deliverables
1. Problem framing	Design problem description/opportunity Description and calendar of milestone delivery dates
2. End learner description and course outcomes and assessments	Personas Empathy maps Outcomes and assessments
3. Content selection and sequencing	Content outline
4. Design plan	Design plan with outcomes and assessments, content and instructional strategies/activities aligned
5. Evaluation	Evaluation plan with formative and summative data collection activities, instruments and person or people involved in the activity
6. Prototype	Prototypes of final deliverables
7. Final design product	Final designed and developed product

deliverable before it was presented to the client. The instructor conducted design review sessions requiring the team to provide rationale for design decisions, asking reflective questions for the team to discuss regarding their design. The team revised their deliverable, sent it to the instructor for final review then sent it to the client. Finally, the instructor served as the project mentor, guiding each team in continuous actions to move the design forward to ensure that each team submitted a completed product to the client by the end of the semester.

Role of the client

The client requested that the design teams build open educational resources for adult learners with literacy-related knowledge skills gaps. Each student design team was assigned to build a learning intervention for a given topic due at the end of the semester (Table 2). In the beginning of the semester, the client met with each design team to brief them on the needs, topic coverage, and the end learner. As students worked on designing the intervention, the client committed to be available to answer questions, provide feedback, and help clarify ambiguity.

Role of the observers

Five doctoral students from Learning Design and Technology programs across the U.S. were recruited to volunteer as "shadow observers" for this case study. Students were members of an instructional design graduate student association. The graduate student association had invited one instructor to a quarterly meeting where the instructor explained the study. The graduate student association president followed with an email to the membership requesting shadow observers. Each student observed one student design team "in-action," particularly how the team functioned, collaborated, and made decisions while considering project milestones, deliverables, and due dates. Each observer had an extensive academic and/or work experience in instructional design. They were asked to commit to 30 h for the period of one semester (Spring, 2019) which included time spent on project coordination, attending design team sessions, debrief meetings, and reporting of quarterly updates of their completed volunteer hours. All these tasks were conducted remotely. Observers who successfully completed their responsibilities received a $100 stipend and a digital badge acknowledging their service on this project.

The instructors provided a loosely structured observation protocol for observers, granting each shadow observer autonomy on their observation process. Similar to setting up a site visit to observe design teams at a physical workplace or developing observation

Table 2 Client projects

Student design team	Topic	Audience of focus
Design team 1 (4 members)	Interview skills	Adult learners
Design team 2 (4 members)	Money management for adults	Adult learners
Design team 3 (4 members)	Main ideas and details (reading comprehension)	Adult learners
Design team 4 (4 members)	Understanding ratios	Adult learners
Design team 5 (4 members)	Internet search results with a career focus	Adult learners

protocols for a research project, each shadow observer was asked to be self-directed in coordinating with their assigned student design team to (silently) attend online meetings.

In the last two months of the semester, the team of five shadow observers came together for two 90-min recorded debrief sessions on Zoom to share their reflections, experiences, and insights from their observation process, spending anywhere from 5 to 15 min per person. Each observer had either attended or viewed a recording of at least one or more online meeting of their respective design teams. All observers gained access to project files, documents, or backchannel chats of their design teams.

Observer reflections

While the instructors worked with each team, the observers were noting actions that were happening "behind the curtain." They discussed and reflected on their observations and ultimately grouped these team actions into three categories, (1) conflict resolution, (2) communication and coordination, and (3) accommodation and negotiation.

Conflict resolution

Design teams were faced with unknowns and uncertainties at the beginning of the project. It was observed that the design teams began their project with undefined goals and were unfamiliar with the end learners. This led to internal conflict and disagreement on learning outcomes, activities, and assessments among the team. To work through this conflict, one strategy was to consult with the client and the instructor in separate meetings to understand the design situation, gather information about the end learner, ask questions, and clarify project expectations. One team utilized learner personas as a strategy to represent the end learner and empathize with their learner's needs. Other teams navigated internal conflict using humor and jokes in their meetings.

Communication and coordination

For the design and development phases to move forward and meet the project deadline, design teams maintained frequent communication and coordinated timelines throughout the project. Design team leaders scheduled regular team meetings and kept meeting recordings for future reference. The team selected specific online productivity tools available to the all members of the team (e.g., Google Drive, Google Docs, Google Calendar, Slack, WebEx, Email, and Zoom) for file/document organization and versioning, conducting online meetings, chats, and project scheduling. Online meetings were helpful for brainstorming, discussion, planning, decision-making, and conflict resolution. Some design teams found coordinating schedules challenging with team members geographically dispersed in varying time zones. Recordings were helpful for members who could not attend meetings. Project teams also found that working asynchronously between synchronous meetings was productive for individual work, exchanging project drafts, exchanging emails with the client and faculty, and reminding each other of upcoming deadlines.

Accommodation and negotiation

Assigned team leaders were helpful in keeping teams on task according to timelines, however, they could not fully perform this role as they would in a real workplace because this

project was one of many. It is important to note that all team members were registered for two to three graduate courses, which meant each team member was juggling multiple assignments and deadlines from other coursework. As projects approached the end and deadlines came closer, team leaders negotiated work assignments depending on who on the team was available or who was capable to do the work. One leader allowed for turn-taking, allowing each team member to work on a piece of the project at a time, relieving the other members to work on other coursework for the moment. With this strategy, project ownership was not in question but rather, project ownership was shared. It was also observed that team members take a backward approach to negotiate the amount of time, amount of work, and quality of work based on the deadline given (whether by the client or the faculty). A challenge the design teams faced completing the design project was the dissonance of managing client expectations and faculty expectations (which were associated to a class grade).

Next steps

The observers presented these reflections at an international conference where the instructors were present. These observations piqued the curiosity of the instructors. The observers were given a blank canvas, simply directed to "observe" the design teams in action. Their viewpoint was an interesting lens to witness the unfolding of a design. As researchers, the instructors believed there was something in their observations that went deeper. What was going on in each team outside of the purview of the instructors? As researchers, the instructors were interested to find out what the observers witnessed that may have helped move the design forward to completion.

Methods

Research design

In this exploratory case study approach, we followed an interpretive method to answer the question; How do design teams function to complete the OER design and development? Case studies are suitable when looking at phenomena complex in nature and when embracing a real-life context (Yin, 2003). Although this case study was context specific and results cannot be generalized, it provides a lens to view design team activities, designer communication and design decisions used to move a design forward.

Data collection

We conducted a protocol analysis methodology (Eckersley, 1988) to document the verbal exchanges of the five observers during collaborative project reflection meetings. The observers recorded two project reflection meetings. One author transcribed 13,129 words from the two project reflection meetings.

Data analysis

Once observers' recordings were transcribed, we participated in three rounds of transcript analysis. We based our intercoder agreement approach (Tinsley & Weiss, 2000) on the extent to which three independent coders evaluated team functioning characteristics

and reached the same conclusions. Our intercoder agreement approach measured the extent to which three reviewers identified the same team functioning characteristics in two recorded observer reflection meetings (Tinsley & Weiss, 2000). In round 1, separately, the instructors reviewed the transcripts and identified instances where the observers discussed teams functioning to complete the design and development phases. In round 2, the instructors met to discuss the instances and resolve any discrepancies. In round 1, there was 85% agreement on the identified instances where observers discussed teams functioning to complete the design and development phases. In round 3, the fourth author reviewed the transcript along with the instances separately identified by the instructors and provided agreement/disagreement on what the instructors had identified and provided insight on what the instructors may have missed. The fourth author agreed with the instructors' analysis. The fourth author added one additional instance and included further insight to comments made by the instructor.

The second author reviewed instances where observers discussed teams functioning to complete the design and development phases and summarized six emerging themes. For each theme, the second author included instances from the transcripts to support the theme. First the fourth author reviewed each theme individually along with the instances supporting each theme. The fourth author then reviewed all six themes looking at how the themes interrelated. The fourth author deleted two instances that did not support themes. Finally, the first author reviewed each theme individually and then all six themes together. After agreeing with the themes and their supporting instances, the first author assisted in naming the themes.

Results

The observers brought a unique perspective to this research study with their objective observations of design teams functioning "behind the curtain." Without a research goal or research questions to guide their observations, they were purely observers of real time design team activities. When reviewing the debrief meeting observer transcriptions, the researchers determined the emergence of six themes that presented how design teams functioned to complete the design and development phases. The six themes that emerged are as follows.

Design teams designed through challenges and constraints drawing on team resources

Design is all about challenges and constraints with some experienced designers maintaining that constraints result in a better design (Cross, 2012). The design teams in this study faced constraints including physical access to the end learners and their needs, a lack of similar backgrounds with their learners, and limited real-life design experience outside of coursework design. Interestingly, a clear understanding and verbalization of their constraints helped them draw on their resources to move the design toward completion. Observers noted that some team members talked with family and friends who had literacy-related knowledge skill gaps and had completed the high school equivalency exam to better understand the end learner experience. Team members transferred design

activities completed in their introductory design course to the design project including personas and empathy maps. They reflected on and discussed their own personal skill sets to see what design skills were missing in the team and how that impacted moving the design toward design and development completion as one observer noted:

> Design teams didn't feel they had the skills to be able to do that [the type of activity they wanted to create] at the time the project ended, but if they want[ed] to expand it, maybe they need[ed] some expertise.

Course deliverable requirements effectively helped the design teams organize their workflow giving them a focused goal and plan to meet milestones. One team created a method (*Slack channel*) to upload documents, for members to review and provide feedback, make decisions and use the channel as a quality control mechanism. Teams also reviewed videos and written resources from the client and followed the project development cycle outlined in class with the assignments and the timeline of deliverable due dates. As one observer noted, "they understood their marching orders, what they needed to turn in and then how to get to that point."

Design teams reflected-in-action moving "what ifs" to design decisions

Design moves through different phases. In the beginning, the design teams were not on the same page in their agreement of course goals and objectives, who the end learner was, and what skill sets the team members could bring to the team. An observer who shadowed a team focused on designing a lesson that taught financial literacy explained:

> They (design team) have had k-12 experience or, some of them I think, higher-ed, but they couldn't understand the challenges adult learners had experiencing financial literacy. So, it took them sometime to come to consensus on what should be the scope for the lesson plan, the training program because they could not visualize that learner.

Ongoing team meetings provided the venue to move the design toward completion as team members reflected-in-action while developing personas, discussing key design decisions, and assigning tasks for each team member. One observer noted that it took:

> Several steps for them (design team) to actually communicate and to make decisions for one initial design idea or questions… two of them were giving feedback and opinions and then sometimes they were adding on ideas.

Some team members worked on a task individually, then met with the team so they could work together altering and refining the same task. Team members used their team meetings to reflect on existing design elements, provide feedback and collaborate in a meaningful way to complete the design. All five teams illustrated reflective practice to complete the design and development phases.

Design teams used multiple channels to communicate

Design teams must interact and negotiate in order to function. The virtual teams in this study used multiple channels to communicate with each other and with the design. The

observers noted that the teams used a mix of productive asynchronous and synchronous methods to communicate throughout the entire design experience.

One team used *Slack* as a method to share work and communicate with each other in between team meetings. *Google Docs* were a popular method for most teams as members could communicate asynchronously in docs, while *Google Drive* was a primary storage spot for all documents, and *Google Calendar* was used to set deadlines and meeting days and times. *Email* was a means for a quick and formal way of communicating with team members, the client, and the instructors.

The teams indicated they were comfortable working online and with the technology using WebEx or Zoom for their synchronous meetings, both methods used by the instructors for all other semester course activities. The teams recorded meetings and video conferencing easily on both platforms. The observers noted that the teams coalesced around whatever communication channel they decided to use. Although the specific tools will change, virtual teams are an ongoing phenonium and having a comfort level with technology in general is important when working in a virtual design team.

Design teams produced external representations to react to

As design teams interact with complex problems, creating external representations for team members to react to provides a means to better understand the problem and possible intervention. Using the communication channels, they created, the teams shared resources, and posted drafts for team members to review and react to from the beginning of the design through the final submission. When the team was uncertain on where to begin, they shared personas created from their introductory instructional design course as an initial design discussion point, as one observer noted: "they would try to make up personas early and even reuse personas they have made in like a previous class…they brought that in to start the ball rolling on who is this learner we're talking about."

The collaborative nature of *Google Docs* provided the space to post external representations, react to and revise these representations, and have a place to store files. These external representations were the tool used to visualize the design, to collaborate and offer feedback, moving from a design idea to a final product.

Design teams formed an energized design community

When moving from learning the concepts of design to the actual practice of design, designers need a design community to produce the best possible intervention. Observers noted that some team members did not know each other when they began the project, while others knew each other from previous classes. These new relationships resulted in tension as one observer noted: "you know there's a little bit of a tension in the beginning where you were just getting to know new members of the team but also you are familiar with prior members."

The teams quickly determined team member responsibilities, meeting times, and deliverable submission team deadlines. As these were virtual teams, members had to accommodate different time zones, work schedules and other member commitments illustrated with one team determining the best times to meet was at 10:00PM or 11:00PM depending on the week. Another team divided their meeting time into two parts, one where they designed and the other where they discussed team administrative issues.

Team dynamics were noted by the observers, with one team creating a positive atmosphere using humor as the observer described: "very positive atmosphere was between them and they were using always the sense of humor to improve that and it was very motivating for them and they were really positively working together." Another team created a serious working atmosphere with the observer stating: "this group was more of a serious note… less personal, very task oriented, and very systematic quite structured I would say, highly structured…in the approach." This atmosphere proved to be energizing as the observer stated: "nobody was weird that this was a very serious there was a serious tone to it." Team members displayed respect to one another, accommodating members who joined design meetings late, expressing open and willing attitudes with ideas and coordinating and cooperating with each other. Overall, observers noted that team members expressed empathy for each other, the challenges they faced and a desire to work together to achieve their goal.

Design team's reflection-in-action caused the emergence of team roles

A purpose drives a design; what is required and how will it be satisfied. As design teams reflected-in-action defining the purpose of their design, they inadvertently defined their individual member roles. The instructors assigned team leaders in the beginning of the semester, all of whom took this assignment seriously as one observer described: "she was actually monitoring everything and also she was taking care of everything to make sure that everything and everybody was on task, if they were meeting deadlines…. She was sending them more email reminders and saying that what we are going to do, and she was also very considerate." Leadership styles varied including organized, with one leader starting every meeting with an agenda and discussion points that needed to be covered for each meeting, collaborative, with a leader stating that she would only do something if everyone agreed to do their part, and systematic, with the leader organizing all of the workflow.

In an effort to continue to complete the design, other team roles and working styles emerged including members who focused on one task at a time and shared it with the team for feedback and ultimately contribution to final submission, another team member who documented conversations and discussions creating external representations of design ideas, and a team organizer who kept track of the work and also kept everyone on track to avoid deviation from the task at hand. One team created a system of rotating roles for every deliverable where the first part would be done by one person, then the second part would be done by another, so every team member took a turn to design, review and revise a part of the design.

One design team's assigned leader relinquished her role to another leader who emerged during the design process. He took on the role as it became apparent that the complex nature of the design problem was beyond the current leader's experience. The new leader emerged with such grace that the observer noted: "there was a clear leader… I was under the impression he was assigned leadership, so I don't know if I misunderstood but he was who sent out the emails and seem to really be organizing the workflow…was a very good leader which really was a pillar for the team." Team roles emerged and shifted as the design teams reflected-in-action moving the design toward completion.

Discussion

This case study examined design teams in a graduate course working with a client designing in real time. The goal was to work within the given time and resource constraints to create an effective instructional intervention. Observing design teams during actual design practice allowed doctoral instructional design student observers to peak "behind the curtain" studying teams as they interacted with each other solving complex problems to apply empathic design for a localized context of use. The observers discussed and reflected on their findings ultimately grouping team actions into three categories, (1) conflict resolution, (2) communication and coordination, and (3) accommodation and negotiation. The researchers then conducted an in-depth analysis of these observer transcripts identifying six themes to answer the question: How did design teams function to complete the OER design and development? These six themes expand the initial identified three team activities providing a comprehensive look at design team actions as they moved the design toward OER design and development. Reflecting on these three initial design team activities and the six themes to move the design forward we see interconnections, influences and associations that can ultimately help us prepare instructional designers for practice.

Design activities that move the design toward completion

Conflict resolution was the first activity identified by the doctoral student observers. This activity included identifying and resolving internal team conflict through communication, information gathering and clarification of the project. We see that by resolving conflicts, the design teams could face the challenges and constraints inherent in the design project they were tasked with. While the instructors were unaware of team conflict, the observers witnessed the initial conflict and how it was resolved so that the teams could work together creating an effective design product. The teams designed through challenges and constraints drawing on team resources in part due because of the ability to unify and work together toward a common goal. This would not have been possible without conflict resolution early in the design team process.

Communication and coordination were the second activity identified by the doctoral student observers. The researchers also identified the use of multiple channels to communicate as a critical component in moving a design toward completion. While the observers identified specific online productivity tools (e.g., Google Drive, Google Docs, Google Calendar, Slack, WebEx, Email, and Zoom), the researchers noted that there were numerous methods of communication including presenting external representations for team members to react to and reflection-in-action to move design ideas to decisions and as the foundation for the emergence of team roles. An energized design community was formed in large part because of ongoing communication and coordination with all team members. This ultimately helped the design teams successfully complete their instructional interventions within the required timeframe.

Accommodation and negotiation were the third and final activity identified by the doctoral students. Although there were identified team leaders, the observers noted that project ownership was shared, with team leaders keeping teams on track and accommodated team members by negotiating work assignments depending on who on the team was available or who was capable to do the work. These activities created trust within the team, resulting in an energized design community where team roles emerged, and team resources were effectively used to complete the design project.

Although the course instructors did not teach conflict resolution, communication and negotiation skills or how to coordinate and accommodate a team, these skills proved critical to

each team's successful design effort. These findings have important implications on preparing instructional designers for practice.

Implications for preparing instructional designers

In an ongoing effort to better prepare instructional design students for practice, instructors are faced with the challenge of what to teach within the constraint of a limited credit hour graduate degree. Foundational instructional design must include education and instructional design theories and tools such as principles and models necessary to perform instructional design activities. Expanding this to include apprenticeship opportunities such as the one described in this case study increases the burden on university faculty and programs. To add communication, conflict resolution and team dynamic instruction in additional courses is unrealistic in graduate programs even though this research indicates the importance of these skills in producing effective instructional design products. How do we resolve this issue in preparing instructional designers for practice?

As instructors of graduate design students and design practitioners, we have long advocated for students to participate in design projects with clients during advance instructional design courses. We realize the additional burden this creates, including the additional responsibilities of creating functioning student teams who must work with a client to produce a finalized product within the semester timeframe. As course facilitators, we believe this is the best way to bridge theory to practice and to ensure our students are developing practitioner skills while engaging in iterative design work. The results from this case study indicate we need to provide additional support to our students to prepare them for practice including:

- Educate students on the basics of conflict resolution then provide activities in all graduate courses that include opportunities for students to practice conflict resolution actions.
- Demonstrate communication methods and provide opportunities for students to engage in multiple communication channels solving simple to complex problems including how to communicate with fellow team members, a client and a stakeholder.
- Create opportunities in all courses for students to practice coordination skills including team building, project scheduling and management.
- Explain the tenets of negotiation then provide opportunities for students to participate in activities where negotiations are needed for success.
- Instill in design students the critical nature of designing in teams, providing instruction on team roles, functions and dynamics.

Creating multiple opportunities for practice of the above skills could include single class activities, short term or semester long team activities. These opportunities are best if implemented to some degree in every course from the beginning to the end of a design student's graduate studies. Instructors modeling these skills as well as guiding students while they develop these essential design abilities provides design students the opportunity to observe as well as practice each skill. We believe instructors must look at the instructional designer as the arbiter of design and prepare them to be empathic creative problem solvers successfully working with others in a collaborative environment.

References

Baaki, J., Tracey. M. W. & Hutchinson, A. (2017). Give us something to react to and make it rich: designers reflecting-in-action with external representations. *International Journal of Technology and Design Education, 27*(4), 667–682. https://doi.org/10.1007/s10798-016-9371-2

Baaki, J. & Luo, T. (2019). Instructional designers guided by external representations in a design process. *International Journal of Technology and Design Education, 29*(3), 513–541. https://doi.org/10.1007/s10798-018-09493-2

Baaki, J. & Tracey, M. W. (2019). Weaving a localized context of use: What is means for instructional design. *Journal of Applied Instructional Design, 8*(1).

Bohorquez, T., & Andres, F. (2018). Developing empathy in the academic design studio: Conclusions from an empirical study in graduate and undergraduate programs in instructional design. In *Proceedings of the international image festival: New expeditions*.

Boling, E. (2010). The need for design cases: Disseminating design knowledge. *International Journal of Designs for Learning, 1*(1).

Boling, E., & Smith, K. M. (2012). The changing nature of design. In R. Reiser & J. Dempsey (Eds.), *Trends & issues in design & technology* (3rd ed.). Merrill Prentice Hall.

Chou, W. H., & Wong, J. (2015). From a disciplinary to an interdisciplinary design research: Developing an integrative approach to design. *International Journal of Art and Design Education, 34*(2), 206–223. https://doi.org/10.1111/jade.12017

Cross, N. (2007). *Designerly ways of knowing*. Springer-Verlag.

Cross, N. (2011). *Design thinking: Understanding how designers think and work*. Berg Publishing.

Dorst, K. (2003). *Understanding design: 150 reflections on being a designer*. BIS Publishers.

Dorst, K., & Cross, N. (2001). Creativity in the design process: Co-evolution of problem-solution. *Design Studies, 22*, 425–437.

Eckersley, M. (1988). The form of design processes: A protocol analysis study. *Design Studies, 9*(2), 86–94.

Ertmer, P. A., & Quinn, J. (2003). *The ID casebook: Case studies in instructional design* (2nd ed.). Merrill Prentice Hall.

Feland, J. M., Leifer, L. J., & Cockayne, W. R. (2004). Comprehensive design engineering: Designers take responsibility. *International Journal of Engineering Education, 20*(3), 416–423.

Friedman, K. (2000). Design knowledge: Context, content and continuity. In D. Durling & K. Friedman (Eds.), *Doctoral education in design: Foundations for the future.* Staffordshire University Press.

Gibbons, A., & Yanchar, S. (2010). An alternative view of the instructional design process: A response to smith and boling. *Educational Technology, 50*(4), 16–26.

Jacobs, G. (2017). 'A guided walk in the woods': Boundary crossing in a collaborative action research project. *Educational Action Research, 25*(4), 575–593. https://doi.org/10.1080/09650792.2016.1203344

Julian, M. F., Kinzie, M. B., & Larsen, V. A. (2000). Compelling case experiences: Performance, practice, and application for emerging instructional designers. *Performance Improvement Quarterly, 13*(3), 164–201.

Kaufman, R., Oakley-Brown, H., Watkins, R., & Leigh, D. (2003). *Strategic planning for success: Aligning people, performance, and payoffs*. Jossey-Bass/Pfeiffer.

Ke, F., & Im, T. (2014). A case study on collective cognition and operation in team-based computer game design by middle-school children. *International Journal of Technology and Design Education, 24*(2), 187–201. https://doi.org/10.1007/s10798-013-9248-6

Knowles, M. P., & Suh, S. (2005). Performance systems analysis: Learning by doing. *Performance Improvement Quarterly, 33*(4), 35–42.

Kouprie, M., & Visser, F. S. (2009). A framework for empathy in design: Stepping into and out of the user's life. *Journal of Engineering Design, 20*(5), 437–448.

Lawler, E., Thye, S., & Yoon, J. (2000). Emotion and group cohesion in productive exchange. *American Journal of Sociology, 106*(3), 616–657. https://doi.org/10.1086/318965

Lawson, B., & Dorst, K. (2009). *Design expertise*. Elsevier.

Lowell, V. L., & Moore, R. L. (2020). Developing practical knowledge and skills of online instructional design students through authentic learning and real-world activities. *TechTrends, 64*, 581–590.

Lowgren, J., & Stolterman, E. (2004). *Thoughtful interaction design: A design perspective on information technology*. MIT Press.

Maher, M. L., & Tang, H. H. (2003). Co-evolution as a computational and cognitive model of design. *Research in Engineering Design, 14*(1), 47–63. https://doi.org/10.1007/s00163-002-0016-y

Newell, A., & Simon, H. A. (1972). *Human problem solving* (Vol. 104, No. 9). Prentice-Hall.

Nouri, R., Erez, M., Lee, C., Liang, J., Bannister, B. D., & Chiu, W. (2015). Social context: Key to understanding culture's effects on creativity. *Journal of Organizational Behavior, 36*(7), 899–918. https://doi.org/10.1002/job.1923

Rubio, B. C. (2020). *Easier travelling with babies in cities in collaboration with Thule Sweden AB*. Master Thesis, Industrial Design, School of Engineering, Jonkoping University.

Schön, D. A. (1983). *The reflective practitioner: How professionals think in action*. Basics Books Inc.

Schwier, R. A., Campbell, K., & Kenny, R. (2004). Instructional designers' observations about identity, communities of practice and change agency. *Australasian Journal of Educational Technology, 20*(1), 69–100.

Simon, H. A. (1969). *The sciences of the artificial*. The MIT Press.

Talischi, G., Izadi, A., & Einifar, A. (2012). Nurturing design ability of novice architecture designers: Designing, implementation and testing a constructivist learning environment. *Honar-Ha-Ye-Ziba: Memary Va Shahrsazi, 17*(4), 1–18. https://doi.org/10.22059/jfaup.2012.36362

Tessmer, M., & Wedman, J. F. (1990). A layers-of-necessity instructional development model. *Educational Technology Research and Development, 38*(2), 77–85.

Tinsley, H. E. A., & Weiss, D. J. (2000). Interrater reliability and agreement. In H. E. A. Tinsley & S. D. Brown (Eds.), *Handbook of applied multivariate statistics and mathematical modeling* (pp. 95–124). Academic Press.

Tracey, M.W. (2015). Design Team Collaboration with A Complex Design Problem. In Hokanson, B., Clinton, G. & Tracey, M. (Eds.) *The design of learning experience: Creating the future of educational technology* (pp.93–108). Educational Communications and Technology Series, Springer: NY.

Tracey, M. W. & Hutchinson, A. (2016). Uncertainty, reflection, and designer identity development. *Design Studies, 42*, 86–109.

Tracey, M. W., & Boling, E. (2013). Preparing instructional designers and educational technologists. Traditional and emerging perspectives. In M. Spector, D. Merrill, J. Elen, & M. J. Bishop (Eds.), *Handbook of Research on Educational Communications and Technology* (4th ed.). (pp.653–660). New York: Springer.

Tracey, M. W., Chateauvert, C., Lake, K., & Wilson, R. (2008). Real world projects in an advanced instructional design course. *Tech Trends, 52*(4), 24–29.

Williams, D. D., South, J. B., Yanchar, S. C., Wilson, B. G., & Allen, S. (2011). How do instructional designers evaluate? A qualitative study of evaluation in practice. *Educational Technology Research and Development, 59*(6), 885–907.

Yin, R. K. (2003). Designing case studies. *Qualitative Research Methods, 5*, 359–386.

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