Learning Science and Design-Based Research in a Corporate Training Program

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Abstract: This paper describes the use of the Social Infrastructure Framework, proposed by Bielaczyc, in an instructional design project for professional development of the direct support staff members at an organization serving individuals with autism. The Social Infrastructure Framework proved useful for both designing and evaluating the design of the learning environment. However, two areas that could be further refined in this framework are (1) consideration of existing/available technological tools and systems and (2) its application in formalized adult learning.

Background

As the discipline of the learning sciences and design-based research methods have matured, there have been increasing calls for some convergence of terminology, frameworks, and approaches. An advantage of being part of an emerging discipline is the opportunity to be part of this process of refinement. This can also be a disadvantage, as there is an array of opinions and viewpoints on what "counts" and what does not as part of the community. There are a dizzying array of frameworks and methodologies to choose from without clear indications of which are, for lack of a different word, "better." This paper is about an instructional design project for workplace training as a case study of the Social Infrastructure Framework (SIF) advanced by Bielaczyc (2006). I describe the project, how it relates to the SIF, and possible ways to refine this design framework to make it more effective on educational contexts other than K-12 settings.

The X School was founded in 2002 as an alternative educational and therapeutic program for students in preK-12. The school offered onsite opportunities for individuals with severe autism, as well as providing consultation and in-school centers for students in public school settings. The school worked with the state to obtain the certification necessary to operate as an educationally-integrated behavioral support (EIBS) program. The organization expanded in 2014 to include adult services, such as employment support and adult residential homes. In 2017, the school announced its early intervention program for preschool children. The organization currently employs about 400 employees across all programs.

Recognizing the need to address its rapid growth—the number of employees increased by almost 50% in two years—X Autism Services reorganized to include a quality, training, and research department (QTR) to evaluate and implement professional development and staff training programs across the organization. The reorganization resulted in addition of staff, including an instructional designer position, which I filled in the fall of 2018.

As part of a new self-guided learning initiative, a group of 12 behavior technicians viewed a video—a keynote from a national autism education conference by a popular and respected behavior analyst who works with adolescents and adults with autism. This training took place during a scheduled in-service day, in one of the training rooms, using laptops provided by the IT department and under the supervision of two QTR trainers.

Based on this trial, one of my initial projects was to create a library of self-guided courses. The initial requirements were rather vague. The target audience was identified as direct support professionals (DSPs) in the school program—e.g., behavior technicians. These DSPs were primarily, but not exclusively, those in their first year of employment. The stated goals for the courses were two-fold: (1) occupy the DSPs time on in-service days and (2) allow them to initiate their own professional development (PD).

Viewing this as a design-based research problem, I turned to one of the tools I have used in the past: the Social Infrastructure Framework put forward by Bielaczyc (2006). In using this framework, I recognized that it was in many ways beneficial for this project; however, there were some limitations in regards to using this model for adult training/PD that required modification. I also developed a new understanding of the nature of the relationship between the cultural beliefs component and the other dimensions of the model.

In the sections that follow, I will first describe the design actions I took and the resultant first version of the design, before highlighting some key connections between the Social Infrastructure Framework and this design project at X.

The instructional design

One thing that the Social Infrastructure Framework does not explicitly address is the constraints that occur in a specific context due to (a) existing systems that have to be accommodated, (b) resource availability, and (c) time

constraints. In this case, an additional requirement was that the learners be able to enroll themselves in the class and then mark their completion, using the company's human resources (HR) software—a small SaaS product from a regional company that has a rudimentary, but incomplete, course management system built into it. The system allows for adding of limited materials (file attachments) that open using native applications rather than in the system itself, and the inclusion of exactly one active hyperlink per class (you can add hyperlinks in the course description text, but users would have to copy/paste them).

I developed several prototypes, which did not work due to various constraints around tools, infrastructure, or other resources. These included a self-contained video with a reflection prompt hosted on asynchronous response systems (e.g. Yammer and FlipGrid) and a course satisfaction survey. However, the HR system only allowed for the inclusion of one link per course. Another approach was to create a very simple website that allowed navigation through the various items (the activating question, link to the video, and so on). However, after developing it I discovered that we did not have an internal web server nor the resources to create one.

Ultimately, we arrived at the following design: in an existing file system on the company's network, we added a folder for independent study courses where we housed PDF documents for each course. The link to the PDF was included with the class in the HR system—the one live link that could be added. Learners would receive instructions for signing up for the class and using the link to access the PDF, after which they would use the PDF to guide them through the activities, culminating in the final step of linking them back to the HR system to mark their completion of the course.

After developing this system for one course and demonstrating it to appropriate stakeholders (along with the discussion of the other designs/possible tools), we ultimately added five such courses. These would be piloted at the next in-service day with a small group of around 20 DSPs as the first iteration of this design—with feedback from that experience being used to inform redesign as we move forward with the project.

The Social Infrastructure Framework

The Social Infrastructure Framework includes four dimensions: cultural beliefs, practices, socio-techno-spatial relations, and interaction with the "outside world" (Bielaczyc, 2006; Bielaczyc, 2013). These dimensions include 14 broad design considerations, such as "How learning and knowledge are conceptualized," "The planned learning activities," "Student-teacher-machine-physical space configurations," "Bringing in knowledge from the outside," and so on. It was envisioned as a tool for both the design of learning with technology and analysis of such environments. In this section, I focus on how those elements impacted the design in this project.

Cultural beliefs

The school adheres to the principles of applied behavioral analysis in its educational and therapeutic settings. This leads to a strong behavioral component to any discussion of learning. At the same time, certain initiatives acknowledge other learning theories or paradigms, especially as they relate to employee training (or "talent development"). Another issue with the approach to teaching/learning in the internal training is that some classes are mandated by state regulations and so require certain materials/approaches to be used. Regardless, most training for staff at the school is instructor-led, uses a largely lecture-driven approach with some interactive individual and small-group activities built-in, and is then assessed by a checkout procedure (for skills such as handwashing and so on) or by means of a written assessment that is usually multiple choice or short answer with clear "right" and "wrong" answers. It should also be noted that the cultural beliefs around how learning and knowledge are conceptualized were not, in this case, monolithic—which is probably not unique to this organization. This can add an additional challenge to design, because these beliefs are not always easy to discover, and people may verbally agree with an idea in theory but espouse other ideas—either unconsciously or consciously—in practice.

Another factor in the culture is the company's rapid growth and ongoing reorganization. This may explain the hesitancy to make additional changes (such as adding an LMS, which I felt should be addressed immediately) without some additional preparation and planning. Many of the current QTR initiatives are either completely new or significantly changed, so there is some concern about overwhelming staff with changes and the resultant effects on morale and performance. The QTR group was asked to create this learning program to facilitate the training process using technology. This did not require the creation of a customized tool, but rather the design of a learning experience that used available resources while still addressing the needs of the learners, their supervisors, and the administration.

Practices

Many discussions about adult learning include the following items: adults are self-motivated to learn, adults want a clear and practical connection between learning and their activities, they are self-directed, and they need engagingly relevant content (see, for example, Clark, Nguyen, & Sweller, 2011; Knowles, 2012; and National

Research Council, 2000). Some of these beliefs exist in the culture of X. Through discussion, we determined that it would be beneficial to the learners to add an opportunity for reflection via virtual discussion groups to the learning practices. This addressed key components of learning: expression and communication of understanding (Bruce & Levin, 1997; Rose & Meyer, 2006), self-regulation (Deans for Impact, 2015), and building a learning community (Barab & Plucker, 2002). At the same time, it solved the organizational requirement of accountability for completion, but also gave the additional option for supervisors to engage with their employees around ideas that might not otherwise come up in day-to-day activities.

Another interesting feature of this design is that there is not an explicit teacher, but there is definitely an implied "teacher" who is directing the learners to complete activities in a certain order, curating videos for the learners to watch, posing questions for the learner to answer, and so on. In addition, the learner has some choice—which class to select, for example—but also not completely free choice. They could not select a video on effective cooking to watch, for example, even if they could convincingly develop a case for that being relevant to their job.

The coordination of activities is also pertinent, because each step requires the use of some tool, but there is no overarching tool aside from the actual design of the learning experience—which both requires the use of these tools and is also affected by which tools are selected. For example, when settling on which tool to use for virtual discussion, we decided on Yammer rather than FlipGrid because some folks expressed discomfort with having to video record themselves. FlipGrid also required installation of an additional app on mobile devices, while Yammer could be accessed via the built-in web browser (although there is a mobile app for those who prefer to use it). But Yammer involved some trade-offs as well—for example, while each course has a separate group to keep posts off of the main feed, the groups are still public because creating a private group would require somebody to monitor the group for requests to join and/or manually add learners to the group when they signed up for the course.

Socio-techno-spatial relations

Again, without an actual human teacher, this component becomes focused solely on the learner. In addition, there are no physical world activities, so all of the instructional and learning activities occur in cyberspace. One issue that was discussed, however, was whether learners who are completing this course at an in-service would need (or want) to be in the same room while they are independently watching (possibly different) videos. If so, how should seating be arranged? Should there be tables? Would learners know to bring their devices and headphones? Or, should they just do these things in their own workspaces—also problematic, because many of the staff members do not have an assigned office as they work with clients across multiple classrooms and settings. Another challenge is that the HR system does not have a functional mobile app for the training module, and so learners would need a tablet, laptop, or PC to complete everything from start to finish—the HR portion cannot be completed on a phone due to the screen constraints. The original decision for the first round was that a room would be made available with tables arranged in a U shape. Participating learners would be told to bring headphones, and laptops would be made available for anyone who did not have or bring their own appropriate device. However, this shifted to a reserved conference room where all participants watched the video together, theater style. We then had an in-person discussion, with posting responses to the Yammer group left as an optional activity.

Interaction with the “outside world.”

In this case, knowledge is brought in from the outside world via the curated videos from recognized experts in the field of autism research and treatment. At the same time, this interaction is one-way only; there is no easy way for the learners to have a dialogue with these people. The use of Yammer groups was intended to extend the audience for the learners as well as offer some virtual collaboration opportunities across space and time between participants and even others within the company.

Implications

The Social Infrastructure Framework was envisioned as a tool for both design and analysis of technologically-enhanced learning environments. In this case it was particularly useful for me in understanding the social aspects of designing this system. What I mean by this is, there are many tools available to use for this sort of self-study content, as well as numerous examples. The mitigating factor was the underlying cultural belief system, which constrained the use of these tools and required navigation of alternative solutions. Without those constraints, though, I may not have viewed this as a particularly remarkable design project, and therefore would not have had the opportunity to deepen my own understanding of design-based research or the applicability of this framework.

One area that is missing from the Social Infrastructure Framework, based on my understanding, is the constraining nature of existing tools and systems. It is possible that these are included or implied in the dimensions

such as cultural beliefs or socio-techno-spatial relations, but to me those considerations were in some ways separate or distinct enough to warrant their own dimension. I also had to repurpose or reimagine some of the design considerations, especially as they got narrower (such as the example questions posed by Bielaczyc [2013]), to be applicable to an educational setting that was not a K-12 or university environment.

A final realization was the reciprocal nature of cultural beliefs and design. This may have just been a refinement of my understanding, rather than any deficiency in the framework. Regardless, earlier on when I read Bielaczyc's (2013) description of cultural beliefs as the "substrate" of the model, I pictured a foundational building material. While this is certainly true, as I worked through this initial design I realized that cultural beliefs are not frozen in place; they both affect what design will be effective while simultaneously being affected by the design that is put into place. In this way, there is a symbiotic relationship between the two—so the next iteration of the design will be built on cultural beliefs that have shifted in some way due to the design. It also reminded me that adapting to change is difficult, and so a design may be adopted and adapted into the culture—but it may also be rejected by the culture if it moves too far beyond what the culture is willing to accept. In this way, and perhaps more to Bielaczyc's original intention, the culture is more of a substrate in the biological sense of the term (a surface on which an organism lives and grows) than the construction sense.

Conclusion

The learning sciences as a discipline, and design-based research as a methodology, are still emerging, having only started to coalesce in the last 30 years or so. Since then, tremendous strides have been made toward creating a shared set of standards, values, and definitions. Beginning in the 2000s and continuing through the present, learning scientists and design-based researchers have been calling for more precision in both areas (Anderson & Shattuck, 2012; McKenney, 2018), along with evidence that this is happening (Sommerhoff et. al., 2018). One advantage of being in such a young area is that there are still many opportunities to participate in this refinement; likewise, a disadvantage is that there are not always clear guidelines for "what counts" or what approaches are best to take. While it may be necessary to create new design-based research frameworks, there is also a need to thoughtfully and systematically address the many frameworks that have already been created, in order to both validate and improve those methods. The Social Infrastructure Framework addresses many relevant aspects of design-based research for learning. As such, it is worth applying for both design and analysis, with the goal of refining it for improved generalizability across many contexts and types of learning design projects.

References

Anderson, T., & Shattuck, J. (2012). Design-based research: A decade of progress in education research?. *Educational researcher*, *41*(1), 16-25.

Barab, S., & Plucker, J. (2002). Smart people or smart contexts? Cognition, ability, and talent development in an age of situated approaches to knowing and learning. *Educational Psychologist, 37*(3), 165-182.

Bielaczyc, K. (2006). Designing social infrastructure: Critical issues in creating learning environments with technology. *The Journal of the Learning Sciences, 15*(3), 301-329.

Bielaczyc, K. (2013). Informing design research: Learning from teachers' design of social infrastructure. *Journal of the Learning Sciences, 22*(2), 258-311. doi:10.1080/10508406.2012.691925

Bruce, B. C., & Levin, J. A. (1997). Educational Technology: Media for Inquiry, Communication, Construction, and Expression. *Journal of Educational Computing Research, 17*(1), 79-102.

Clark, R. C., Nguyen, F., & Sweller, J. (2011). *Efficiency in learning: Evidence-based guidelines to manage cognitive load*. John Wiley & Sons.

Deans for Impact (2015). *The Science of Learning*. Austin, TX: Deans for Impact.

Knowles, M. S., Holton III, E. F., & Swanson, R. A. (2012). *The adult learner*. Routledge.

McKenney, S. (2018). How Can the Learning Sciences (Better) Impact Policy and Practice? *Journal of the Learning Sciences, 27*(1), 1-7. doi:10.1080/10508406.2017.1404404

National Research Council. (2000). *How people learn: Brain, mind, experience, and school: Expanded edition*. National Academies Press.

Rose, D. H., & Meyer, A. (2006). *A practical reader in universal design for learning*. Harvard Education Press. 8 Story Street First Floor, Cambridge, MA 02138.

Sommerhoff, D., Szameitat, A., Vogel, F., Chernikova, O., Loderer, K., & Fischer, F. (2018). What do we teach when we teach the learning sciences? A document analysis of 75 graduate programs. *Journal of the Learning Sciences*, *27*(2), 319-351.