Conceptual Shift through Constructionist Learning

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Abstract: Conceptualizations of learning impact our practices as learners. The dominant conceptualization of learning is grounded in the transfer/acquisition metaphor of learning, and leads to practices such as those involving lectures, textbooks, and exams. Another conceptualization of learning is grounded in the construction metaphor of learning, and leads to practices such as collaborative learning, project-based learning, situated learning, and critical reflection. This paper describes a framework and design case of a learning environment to facilitate conceptual shift regarding the nature of learning through constructionist learning with an emphasis on bricolage, embodied cognition, and reflective practices.

Introduction and Theoretical Framework

As a constructionist educator and learning scientist my conceptualization of learning is grounded in the construction metaphor. My students, however, often remain deeply enculturated in the popular conceptualization of learning which is grounded in the transfer/acquisition metaphor. In order to facilitate powerful learning, I have been designing learning interventions to facilitate conceptual shifts in the way students conceptualize learning. The first section describes a conceptual framework for the design of learning environments which facilitate conceptual shift through constructionist learning with an emphasis on conceptualizations of learning, bricolage, embodied learning, and reflective practices. Then a design case is presented in which this framework is operationalized, followed by results, challenges, opportunities, and discussion.

Conceptualizations of Learning

At the core of constructionism are questions regarding the nature of learning (Martinez & Stager, 2013). We often focus the processes and contexts of learning, but sometimes overlook the importance of conceptualizations of learning. Views regarding the nature of knowledge and the nature of learning impact learners' practices (Lakoff & Johnson, 1980; Sandoval, 2009). The most common conceptualization of learning is grounded in a transfer/acquisition metaphor of learning which sees learning as a process by which knowledge is transferred from external authoritative sources into the minds of learners. This conceptualization has been described by Freire (1970/2005) as the banking approach and by Papert and Harel (1991) as instructionism. It can be traced back to the ancient *tabula rasa* (blank slate) metaphor and has been linked to practices in learning and teaching such the use of lectures, textbooks, tests, and prescribed learning objectives (Kincheloe, 2006).

A conceptualization of learning common in the learning sciences uses the metaphor of construction to describe learning as meaning construction individually and collaboratively through

situated socio-historical processes. This conceptualization is at the heart of Piaget's, Vygotsky's, and Bruner's constructivisms (Bruner, 1996), as well as Papert's constructionism (Papert & Harel, 1991). Kincheloe, Steinberg, and Tippins (1999) argued that this conceptualization leads to very different practices than the transfer/acquisition metaphor, and emphasizes collaborative learning, situated learning, critical reflection, and transformational learning.

Constructionist Learning

In constructionist learning environments, all learning activities are structured around the construction of artifacts as well as the facilitation of tinkering, learner agency, situating learners as designers, and designing for authentic audiences (Kafai, 2006; Papert & Harel, 1991).

Conceptual Shift

There are various methods described in the literature which attempt to facilitate conceptual change (Sinatra & Chinn, 2012). In recent work I have found it useful to focus on the problematization process which happens before conceptual change can take place – a process of conceptual shift. A mix of individual and group reflective activities specifically engaging learners in critical investigation of their own and society's assumptions regarding the nature of learning is a good starting point (Kincheloe, 2006).

Bricolage: It Takes Time

Any attempt to rush the process of conceptual shift can be counterproductive. Even in courses designed according to the principles of constructionist learning learners spend a great deal of time engaged in practices grounded in the construction metaphor of learning. However, the majority of learners in these environments remain firmly entrenched in the transfer/acquisition conceptualization of learning. Reductionist academic traditions which categorize, isolate, and delineate knowledge into disciplines, subjects, and domains are grounded in—and perpetuate—the transfer/acquisition metaphor of learning. Facilitating conceptual shifts towards the construction metaphor of learning requires helping learners embrace extreme complexity, interdependencies, and multiple perspectives. The constructionist learning environments both model and facilitate this through the tools of bricolage, such as interdisciplinary investigations, methodological experimentations, epistemological explorations, ontological deconstruction, and tinkering (Kincheloe, 2006; Resnick & Rosenbaum, 2013). Becoming a bricoleur is a long-term process, but designing learning environments where learners use the tenets of bricolage—"Use what you've got, improvise, make do" (Papert, 1993, p. 144)—initiates learners into a transformational modality of learning and sets them on the path toward becoming bricoleurs. The longer learners engage with the tools and tenets of bricolage, the more open they become to the construction metaphor of learning, and the more they see the absurdity of the transfer/acquisition metaphor of learning.

Embodied Learning

The collaborative creation of artifacts in constructionist learning environments serves a particularly important function in providing structure for embodied cognition (Abrahamson & Lindgren, 2014), embedded cognition (Abrahamson et al., 2006), and extended cognition (Clark & Chalmers, 1998) in contexts of situated cognition (Nathan & Sawyer., 2014). Collaborative construction of artifacts in constructionist learning environments facilitate identity exploration and construction (Bers, 2001), and the constructionist principle of situating learners as designers (Resnick & Rusk, 1996) can interact with such identity exploration. The design thinking processes involved in collaborative construction of artifacts, the identity exploration, construction of meaning, and embodied cognition work together to facilitate conceptual shift. The embodied cognition aspect of constructing artifacts can facilitate reflection upon the nature of learning. By making things, the constructedness of meaning is brought into conscious awareness and made tangible.

Reflective Practices

Reflective practices are powerful when they are used frequently and routinely over an extended period of time. These practices include metacognitive strategies of reflective explanation and reflective discussion (Bransford et al., 2005), memoing as adapted from practices in design-based research (Anderson & Shattuck, 2012), and development of reflection-in-action through reflection *upon* reflection-in-action (Schön, 1983). These reflective practices can be designed into the learning environment such that they become routine and core practices which are seen by learners as being of co-equal importance with construction practices. At regular intervals, learners can be prompted to reflect upon the real-world relevance of their constructions through various lenses such as empathetic perspective-taking in design thinking (Kelley & Kelley, 2014) and constructionist dialogue between constructions, constructed meaning, and intended audience (Kafai, 2006). These relevance reflection practices encourage learners to develop meaningful relationships with their constructed artifacts, the end users of their artifacts, and the meanings they have constructed.

The frequency, deep level of embeddedness, and diversity of reflective practices in these constructionist leaning environments facilitate gradual shifts in conceptualizations of learning. Students who have experienced years of enculturation into the dominant transfer/acquisition conceptualization of learning not only engage in reflection which opens their eyes to the relationship between the constructed nature of their constructed artifacts and the constructed nature of the meanings they have constructed, but also engage in critical reflection which opens their eyes to the constructed nature of knowledge in society (Kincheloe et al., 1999).

Theoretical Framework Synthesized

Figure 1 describes the synthesized framework for design of learning environments which facilitate conceptual shift through the use of the principles of constructionist learning with an emphasis on bricolage over time, reflective practices, and embodied cognition.
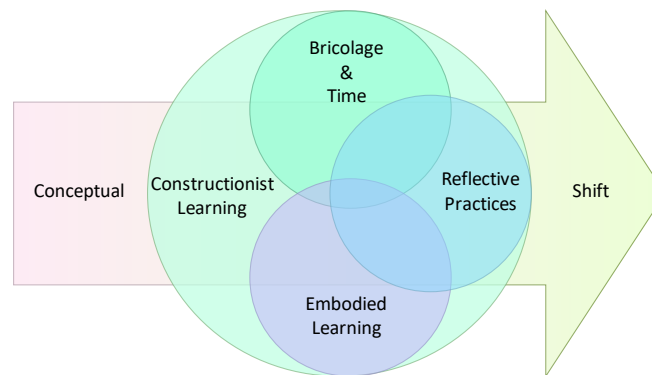
Figure 1: Conceptual Shift through Constructionist Learning

Intervention

I have implemented the intervention described here in a variety of contexts, but this discussion will focus on the design and facilitation of an undergraduate/graduate course at a private non-profit research university. The purpose of this design was to meet the course learning outcomes while also facilitating conceptual shift regarding conceptualizations of learning. The principles described above were used to re-design a 10-week summer course I teach every summer in multimedia development for instruction. The course learning outcomes include multimedia development skills, use of multimedia tools, and instructional design. The course usually has around 12 students who are in teacher training programs. The current design is the third iteration.

Using the conceptual framework described above, I structured the course around construction of artifacts. Because construction of artifacts is a design process, I used the Design Thinking for Engaged Learning framework (Donaldson & Smith, 2017) to provide purpose and structure to all learning activities. This DTEL framework includes a design thinking process model through which learners engage in five phases: Name and Frame, Diverge and Converge, Prepare and Share, Analyze and Revise, and Deploy. During the ten weeks of the course, students engage in two design thinking projects in small groups.

In order to operationalize the constructionist learning principles of learner agency and designing for authentic audiences, groups asked to identify real-world problems that were immediately relevant in their own contexts, design artifacts to address those problems, and implement/deploy their designs in real-world contexts. Students engaged in bricolage throughout all aspects of the course. Although they were given structure through the design process, they were not given instructions regarding what tools to use, nor explicit criteria for the design of their artifacts. However, they were frequently pushed to explore and tinker across disciplines, repurpose tools, and celebrate what we called "epic fails."

Embodied learning was facilitated not only through the construction of artifacts, but also through frequent discussion and prompts to think of the tools and strategies they were using as extensions of their own thought processes.

Reflective activities were built into the course design such that no more than an hour of activity would pass without some form of reflective practice. Each of the five phases of the design thinking process was broken down into smaller stages, and reflective activities were embedded at each transition. These activities asked the students to reflect (either individually or in discussions) on their experiences in the previous stage, how those experiences relate to their own identities, and how those experiences impact the subsequent stages. Furthermore, reflection-in-action was fostered by encouraging a form of think-aloud protocol in small group work.

A variety of design features helped students engage in conceptual shift regarding conceptualizations of learning. During the first week, students were asked to record 5-minute audio clips of themselves answering the question "what is learning?" They did this again during the fifth week, and in the final week they wrote reflective short essays regarding how their experiences in the course contributed to their understandings of the nature of learning. Additionally, during many stages of the design thinking process the students were asked to identify and question assumptions, including those of society, academia, and their own. Because students often find it difficult to identify assumptions, many of these assumption-questioning activities had students identify, characterize, and question metaphors in which many assumptions are grounded. For instance, they were asked to investigate metaphors of mind to reveal what assumptions arise from, for example, the mind as computer metaphor (information input, processing, storage, short/long-term memory, retrieval, etc.) and what would happen if we were to reject those assumptions.

Intervention Results and Implications

During the first five weeks of the course the students indicated in reflections and discussions that they were confused—and at times even upset—at the lack of information delivery by the teacher, as well as lack of clear-cut instructions and assignment criteria. They wanted to be told what they "needed" to know and how to craft their assignment products to match my "expectations." In other words, they seemed to be primarily concerned about how to get an A grade in the course. By the sixth or seventh week there were indications that they understood that my expectation was that they take on the responsibility of setting their own individual and group expectations. Also, their concerns may have been alleviated due to my practice of frequently stopping the class to celebrate and analyze epic fails.

In their final reflective essays, all of the students indicated some form of the sentiment: "I never thought learning could be so engaging, meaningful, and deep." By engaging in constructionist

learning, they developed an appreciation for it and many expressed determination as future teachers to design their own classrooms according to constructionist principles.

The audio recordings in the first week about the nature of learning revealed that all of the participants were using the transfer/acquisition conceptualization of learning. The fifth week recordings also indicated a dominance of the transfer/acquisition conceptualization. Although none of the final reflective essays suggested radical conceptual change regarding conceptualizations of learning, all of them indicated conceptual shift in the form of problematization of their previous conceptualizations of learning.

Challenges and opportunities

The biggest challenge in designing learning environments to facilitate conceptual shift regarding the nature of learning is the dominance of the transfer/acquisition conceptualization in society along with a positivist worldview. Ten weeks is not enough time for students to question their own conceptualizations and assumptions built up over a lifetime of schooling grounded in the transfer/acquisition conceptualization. Due to this socialization into the norms of schooling, students not accustomed to constructionist learning, and since this form of learning does not facilitate "acquisition" of prescribed sets of knowledge they may believe that it is a waste of time. Another challenge is that it is difficult to assess learning in constructionist learning environments because there is a great deal of learner agency in determining their own objectives, processes, and artifacts.

Despite these challenges, this design shows great promise in facilitating change in students' conceptualizations of learning as well as their identities as learners and teachers. Students reported that this design will heavily impact their future practices as teachers.

Finally, this design suggested that it is easier to see evidence of conceptual shift (instances of problematization of conceptualizations/frames) than conceptual change. Therefore, design for conceptual shift may be more desirable in many cases than design for conceptual change.

Conclusion

The design of constructionist learning environments can be seen as design for conceptual shift, rather than design for the mastery of learning objectives. There is a large gap in the literature regarding the design of digitally-mediated learning in which a primary concern is conceptual shift regarding the nature of learning. Because conceptualizations of learning impact one's practices in learning, there may be merit in the argument that facilitating shifts in learners' conceptualizations of learning from the dominant conceptualization grounded in the transfer/acquisition metaphor toward conceptualizations grounded in the construction metaphor of learning is a prerequisite to powerful learning. Equity and access for all can only be achieved when learners are empowered as authoritative producers of knowledge. The design of learning for conceptual shift through constructionist learning shows promising results in helping students develop agentic identities as learners.

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