A Professional Development Workshop: Introducing and Using Design Thinking

Alison Myers

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Dr. Kisha McPherson
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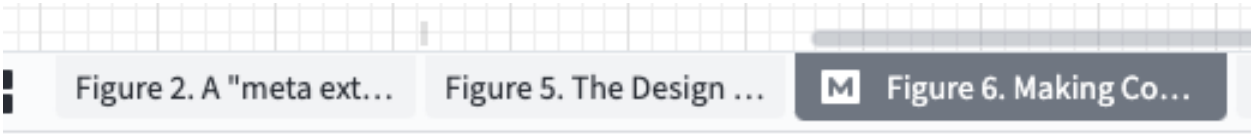
Additional Materials

All of the diagrams created for this workshop can be found:
https://lucid.app/lucidchart/b162c5b4-7097-4d38-8dae-19bc8fa88935/view

1. Select “Present” to view in full screen.

2. Or use the “tabs” at the bottom to view each Figure (where the name matches the Figures found)



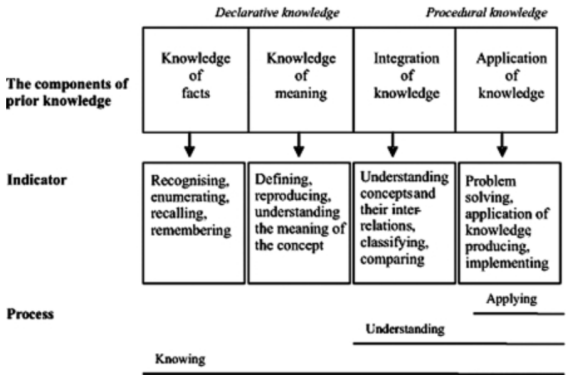
Part A

What is knowledge?

Pritchard (2018*)* identifies different kinds of knowledge including: propositional knowledge - *knowledge that* and ability knowledge - *knowledge how*. In discussion about the epistemic goals of education it is acknowledged that knowing is not necessarily the overarching goal of education, but that understanding is. This view is in line with Pritchard's objective, "common-sense" view of knowledge as some form of justified true belief, or as being representative of an external world. von Glaserfeld (2005) on the other hand does not agree, taking an anti-realist position knowledge is not some truth about the real world, rather knowledge comes from a person's actions and reflections upon those actions. It is from this philosophical standpoint that constructivism has come from – knowledge is constructed (or created), it is not discovered.

Hailikari et al., (2008) provides a useful diagram where knowledge and understanding are not different constructs, and distinguish between declarative knowledge and procedural knowledge. In a study of adult learners, the researchers found that while eliciting prior procedural knowledge was not a predictor of student success, but that deeper knowledge (knowledge of meaning, and procedural knowledge) was. In curriculum seen today the **#procedural knowledge** described is aligned with the idea of "21st Century skills" (discussed further below).

Figure 1



The model of prior knowledge. (Copyright 2007. Hailikari, Nevgi & Lindblom-Ylänne.)

Figure 1. "Model of prior knowledge". #understand #recognize #meaning #apply

A learner is a cognizing individual who exists in sociocultural environment.

A learner is a **#unique** individual…

Piaget's cognitive model of learning is described as the process of "spiraling equilibration" that is based upon dissipative structures, where new forms of order can arise spontaneously when a complex system is far from equilibrium (Fosnot & Perry, 2005, p. 14). Learning is integrating old and new constructs **(#integrate)**; it is a process of assimilation, or the organization of experience and accommodation which is the result of behaviour (or interaction with the environment). Importantly, this process is non-linear (a spiral), dynamic, and occurs within the individual. Mistakes are important and should not be avoided because they allow for the disequilibrium upon which learning occurs (Fosnot & Perry, 2005, p. 34). Mistakes can allow for **#cognitive dissonance** and may result in **#productive failure** which is essential for learning (Baskivar et al., 2009; Kumar, 2006). Treating the learner as a cognizing individual indicates the teacher should also acknowledge differences in starting points, and cultural differences of the learner.

… who exists within a **sociocultural** environment

Vygotsky is credited for the sociocultural (or sociohistorical) view of constructivism that has developed. This view focuses on students as members of a community, where engagement with others and communication is critical for learning. Vygotsky suggested that knowledge ("constructs") could come in two forms: "spontaneous" and "scientific" (Fosnot & Perry, 2005, p. 22). Scientific knowledge is more logically defined and originate from structured activity. This kind of knowledge required development based upon the ability of the child, or the "zone of proximal development" which requires a more knowledgeable other to help develop understanding and is the basis for scaffolding. Spontaneous concepts, on the other hand, are those that emerge from **#reflection** on experience without requiring any particular ability level. Vygotsky studied dialogue and explored the role of speech (both inner and with others) as a method of negotiating meaning **(#communication)**.

The "Wicked Problem" of Constructivism

We should care about wicked problems

Design Thinking is an approach to problem solving that deals with "wicked problems". Wicked problems are those without right or wrong answers, which are not bound to a particular problem space, are open to interpretation, and are unlikely to ever be solved (Koh et al., 2015). Wicked problems are appropriate for constructivist activities because it aligns with the idea that there may be no ultimate truth: the goal of education is not to move learners toward an ultimate truth, because such thing may not exist.

Challenges of constructivism in **theory**

Critics of constructivism cite issues with constructivism as a philosophy, psychology, and pedagogy (for example see (Phillips, 1995; Taber, 2019)) with a particular emphasis on issues with constructivism in science education (Kirschner et al., 2006; Matthews, 2012). Some discuss the challenge of constructivism is that the theory "does too much"; Taber, (2019) illustrates this problem with the following diagram:

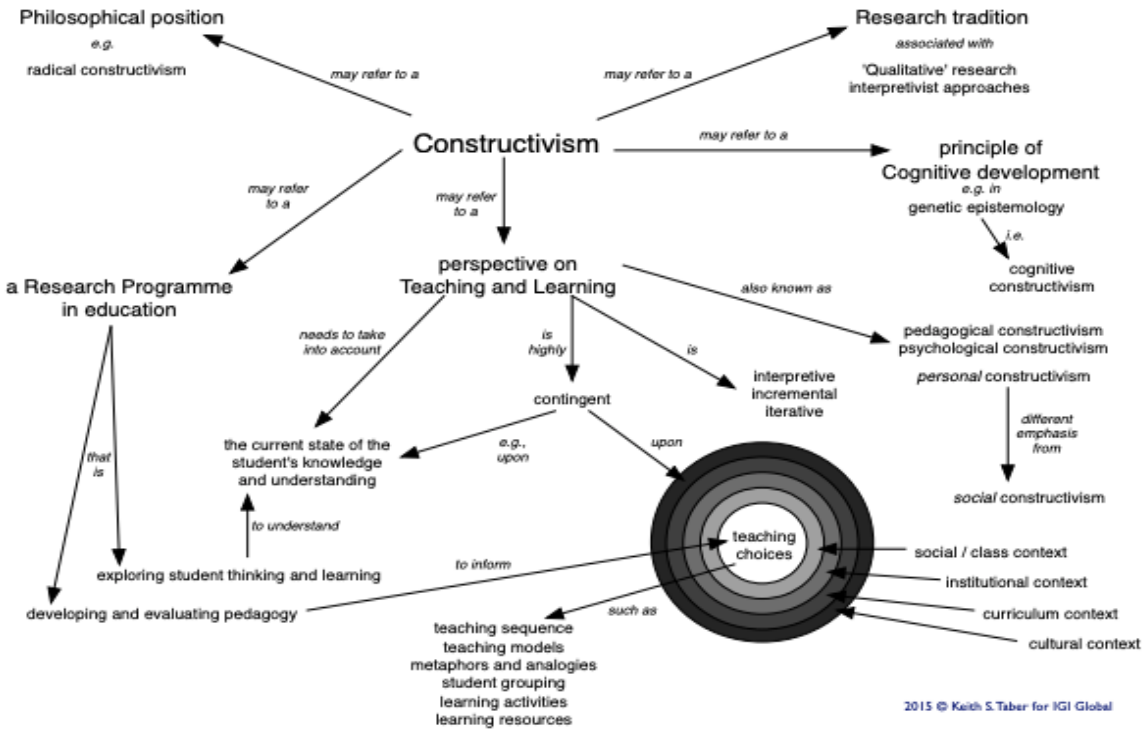


Figure 2. "Constructivism in Education" (Taber, 2019 p. 3)

Some argue against constructivism practices by pointing to evidence that specific constructivist instructional practices are ineffective, for example Kirschner et al., (2006) argue that minimal guidance is not effective for learning and that there is no empirical evidence that "unguided" instructional practices like discovery learning. They argue that these methods fail to account for the ways we learn, in particular regarding cognitive load. Kintsch (2009) responds directly to Kirschner et al., (2006) by emphasizing their disagreement that these models are all "constructivist" and points for example to appropriate levels of guidance for the learner.

Challenges to constructivism in **practice**

It is important to recognize that some find the epistemology of cognitive and sociocultural constructivism to be incompatible theories (Olssen, 1995; Phillips 1995). Keengwe et al., (2014) consider the most important principle of constructivist learning is the social: "above all, constructivist learning must occur within a social context" (p. 88). While there can be disagreement about the most important aspect of constructivism (social or individual), it is possible to reconcile the ideas by considering that regardless of where knowledge is created, the social is still an environment that an individual interacts with to construct their own understanding. Cobb (2005) suggests that the sociocultural perspective can support theories "of the conditions for the possibility" of learning, whereas the cognitive perspective can support theories of the process of, and what is learned. The adoption of a pragmatic perspective should be justified in terms of how it might contribute to improvement in education (p. 52)

A solution to the challenges - principles

The idea that constructivist principles can be extracted is shared by many, and these principles are often similar across domains. For example, "constructivist lesson is one that is designed and implemented in a way that creates the greatest opportunities for students to learn, regardless of the techniques used" (Baviskar et al., 2009, p. 542). Baviskar et al. (2009) argue that seemingly constructivist activities that do not satisfy certain conditions are not constructivist, giving the example of group activities that are claimed to be constructivist purely because there is a social aspect. Alternatively, a method of teaching that is considered "traditional" like lecturing, is not inherently *not* constructivist, but may not follow the principles of constructivism.

Just as (Cobb, 2005) took a pragmatic approach to consolidating the constructivist ideas of Piaget and Vygotsky, instructional design viewed as a practical application of constructivism can bridge the gap between theory and practice. Jonassen (1994) argues that constructivism cannot be a prescriptive theory of instruction, but guidelines on how to design learning environments that foster constructivism is possible (p. 35). More recently Karagiorgi (2005) suggest a pragmatic approach that focuses on "moderate" (rather than extreme) constructivism which makes use of emergent technologies as tools. The design task is to provide "a rich context within which meaning can be negotiated" (p. 19). A summary of some principles from various perspectives is included in the Figure below.

Table 1. Summary of principles

Fosnot & Perry, 2005	Baskivar et al. (2009)	Jonassen (1994)	Karagiorgi (2005)
Learning is development –	Elicit prior knowledge	support the construction of knowledge	The environment should for be active and authentic learning #environment #authentic #active
Disequilibrium facilitates learning #accommodate #assimilate	Create cognitive dissonance	Provide meaningful, authentic context for learning #authentic #environment	Offer multiple perspectives to learners #perspective #accommodate #assimilate
Reflection is necessary for meaning making #reflection #understanding	There must be an application of knowledge with feedback #feedback	Provide opportunities for collaboration (others and teacher) #collaborate #environment #dialogue	Opportunities for collaborative learning #collaborate #environment
Dialogue creates further thinking within communities #dialogue #community	There must be opportunity to reflect on knowledge #reflection		

Design Thinking

Scheer et al. (2012) and others propose that Design Thinking could be a missing link to connect constructivist theories and practical implementation. Proponents for Design Thinking also argue

that it encompasses "21st Century Skills" or competencies including communication, social and creative meta-competencies, and cognitive skills (Scheer et al, 2012; Watson, 2015; Elwood et al.,n.d). These "skills" are about **#understanding** and **#applying**. Gross & Gross (2016) recognize the need for an approach to problem-solving that is multi-disciplinary. Many constructivist models in practice are discipline-dependent, with a particular body of work that focuses on Science and Mathematics. For example, inquiry, discovery, project-based learning etc. are often associated with teaching in the sciences. Similarly, Akkerman & Bakker (2011) identify boundaries between disciplines in learning to be an important but overlooked aspect of institutional and professional education. Design is a discipline and not a science (Cross, 2001; Elwood et al., n.d). As a discipline the goal is to develop approaches that are domain-independent. Panke (2019) defines design thinking as a "variety of **#creative** strategies for stewarding projects with multiple stakeholders for stewarding projects or fostering organizational innovation" (p. 281). As a multi-disciplinary approach for fostering innovation, the **#collaboration** necessary for Design Thinking can involve participants that are also multi-disciplinary which can bring a diverse level of feedback and information sharing between participants.

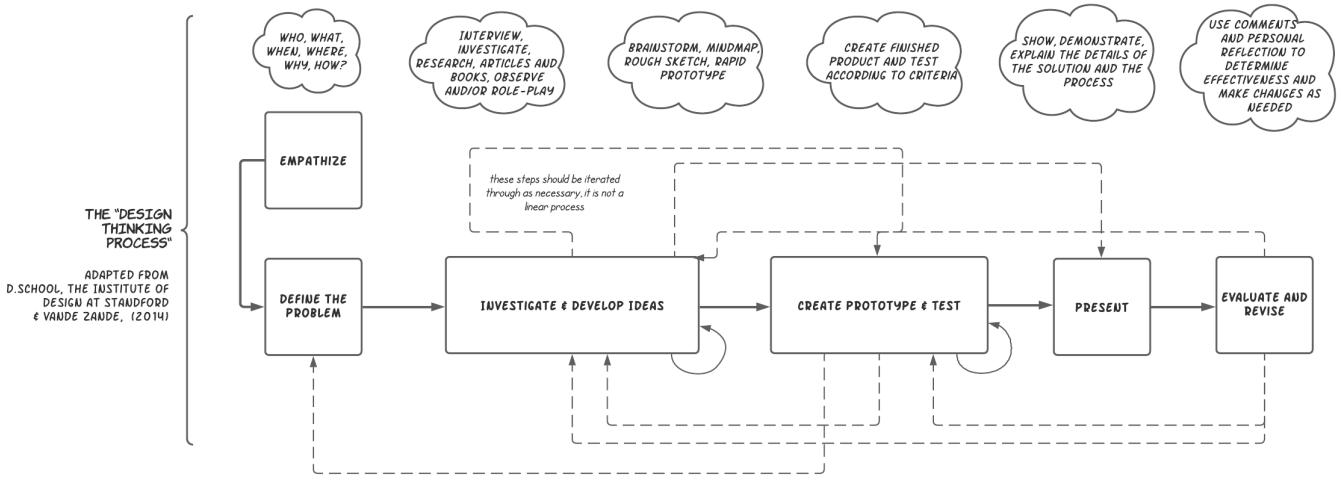


Figure 3. The Design Thinking Process (Adapted)

Assessment and Feedback

It is difficult to separate learning and assessment, even in 21st Century (Western) curriculums. From a constructivist perspective assessment should be an opportunity for the student to demonstrate both procedural and declarative knowledge, and to be given feedback. Assessment can also be an opportunity for students to reflect on their prior knowledge and become more aware of their own knowledge (Hailikari et al., 2008). It should also be seen as an opportunity for the teacher to evaluate their own practice – is the assessment/lesson designed and working as expected?

The Design Thinking process creates ample opportunity for assessment. The Reggio Emilia schools show children using "innovative media" to construct and share knowledge (Swann, 2008) just as prototyping in the Design thinking process could take advantage of multiple types of media (Gross & Gross, 2016). Prototyping is an opportunity to test one's ideas and develop new knowledge based on the outcomes of the prototype. This can occur if the prototype succeeds, or even when it fails **(#productivefailure**, **#cognitivedissonance**). A prototype can act as to **#visualize** or **#represent** knowledge, and opportunity for active learning and #collaboration. In Emilia Reggio schools children use photos and other materials to recognize prior knowledge, reorganize information, and **#integrate** new understanding. Koh et al. (2015) recognize drawing, sketching, model-making and other forms of prototypes as tools that can act as external representation of thinking which can reduce cognitive load. As external representations of knowledge, the artifacts can also be used as opportunities to provide formative feedback on procedural and declarative knowledge.

Feedback is often discussed in constructivism relative to assessment, where formative assessment is seen as an opportunity to provide feedback on procedural knowledge. Feedback can be provided by any agent (teacher, peer, experience). Hattie & Timperley (2007) suggest there are four levels of feedback: feedback about the task (referring to correctness or incorrectness), feedback aimed at the process, feedback focusing on self-regulation, or personal feedback related to the self. The Design Thinking process allows opportunity for feedback from the self, the group, the facilitator, and other groups. Through the process of rapid prototyping and

iterate, the feedback could be immediate. Collaborative technology and web-based tools also allow opportunity for delayed feedback, as artifacts can be made available without time or space restrictions once the workshop is complete.

Part B – The Workshop

Introduction

This workshop introduces the Design Thinking Process as a tool for teachers to create learning environments that follow constructivist principles while participating in an online workshop. In the workshop the teachers could be asked to design a lesson or an assignment using Design Thinking. The workshop will take place in Zoom (a video conference software). As the workshop is only 60-80 minutes, the facilitator may suggest certain technologies for the teachers to use, but it should be emphasized that these are only suggestions, and given more time it would be expected the teacher (or user of the Design Thinking Process) should not be limited to certain tools as this might inhibit the creative potential.

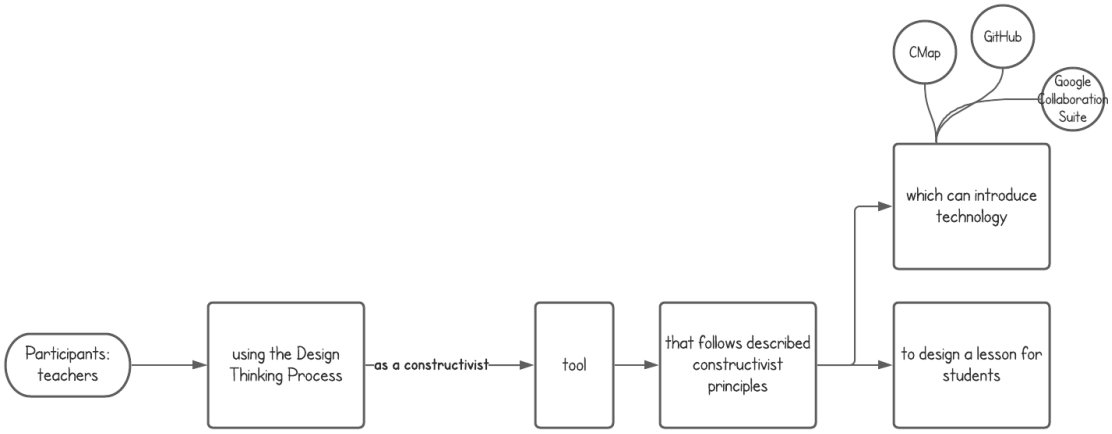


Figure 4. Workshop Overview

It is possible to add a "meta" layer which would not only integrate foundational knowledge about constructivism, but also provide a tool/framework that can be used by both the teacher and students if the problem to be solved is to then develop a lesson using Design Thinking that also uses Design Thinking.

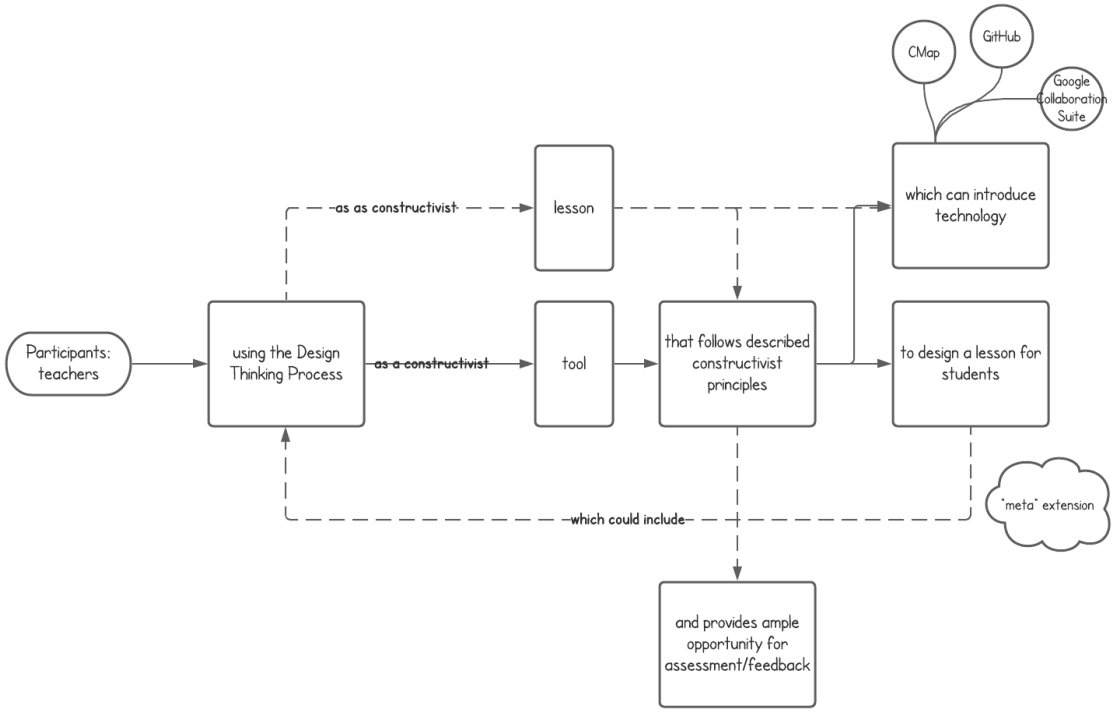


Figure 5. A "meta" extension to the workshop

While Design Thinking may seem like a systematic and linear process, in practice designers act recursively when needed or move between steps as they decide is necessary (Elwood et al., n.d). This puts the learner in control of their experience as they gather new information or make new connections during the process. The possibility for iteration and moving between steps can support a diverse group of learners by not putting time restrictions or other limitations on how the individual (or group) uses the process.

Participants

We can consider the participants to be “experts” in their own contexts, and as such be able to use as many or few pieces of this workshop as they see fit. Those interested could pursue whichever avenues the workshop most inspires them to. The content of the workshop is aimed to provide some reasons *why* Design Thinking can be considered a constructivist activity as the participants move through the Design Thinking process.

Ping et al., (2018) conducted a literature review to determine “how, what, and why teacher educators learn” (p. 93). Teachers come from different backgrounds and have different prior knowledge (#unique #priorknowledge). Learning through reflection and through collaborative activities are popular.

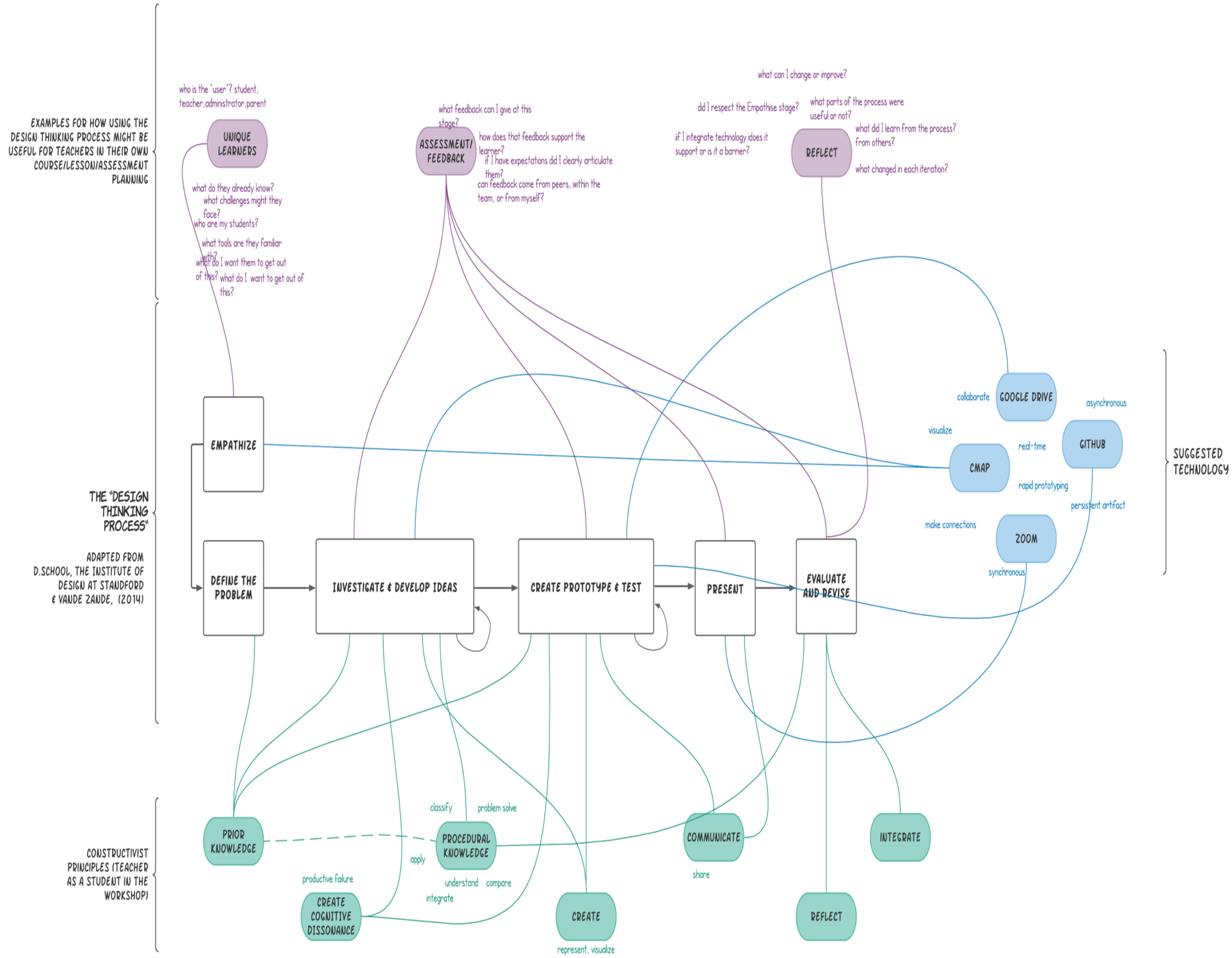


Figure 6. *Making Connections*

Introduce the Problem

The problem in this scenario will be provided to the teacher – creating lessons that follow constructivist principles. This lesson should include a topic, a plan for enacting it, and initial thoughts about how the lesson will be assessed.

Empathize

Teachers will work in groups to empathize with the users, in this scenario due to time we suggest they consider the users be the students and themselves.

The Design Thinking process first requires starts with *Empathizing* by asking and answering questions about the learner for example: who the learners are, what they already know, where they are from etc. An understanding of who the learner is provides a much richer opportunity to define the problem. The initial investigation can allow the teacher to design a lesson with the variety of learners in mind.

Investigate and Develop Ideas

The participants should examine their current understanding (#elicitpriorknowledge), share this understanding amongst themselves (#communicate), and find new sources of information related to the problem. As they do so they can #integrate the knowledge and develop ideas to solve their assigned problem. Working as a group would allow integration of knowledge from different experiences.

Create and Test Prototypes

The prototype should be in the form of text, a sketch or something else digital that can describe the prototype. Time limitations would prevent building a working prototype in this scenario.

Share and Get Feedback

Teams will partner with another team, present their ideas and get initial feedback. They can request any number of present and iteration cycles. Their last cycle should also include the workshop facilitator. This workshop will be a synchronous session that takes place in Zoom.

Zoom allows “Breakout room” features where each team can have breakout rooms, the facilitator can have a breakout room, and teams can move between the “rooms” as necessary during the sharing and feedback stages.

The technologies suggested for each stage also allow the materials to be revisited, so additional modifications and feedback could be sought after completion of the workshop.

Post Workshop

The participants will be given the opportunity in weeks following the workshop to write a personal reflection and polish any of the artifacts they created. This can then be shared with the facilitator for feedback as well as any other teams interested in providing feedback.

Possible Technologies to Suggest

> *“Using technology by itself does not support professional development; however, using technology in ways that are consistent with constructivist learning, and recognizing that online professional communities of practice can contribute to professional growth is something worthwhile to explore”*
>
> - Vrasidas & Zembylas, 2004, p. 326

Concept Mapping Tools

Concept maps provide opportunity to investigate what a learner knows, they can be created collaboratively or individually), and as an artifact provide an opportunity for formative assessment and feedback. Further, the concept map can be used at multiple points in the Design Thinking process and so provide said opportunities at multiple points in time, or to examine how a learner’s thinking process changes as they iterate. Novak & Canas (2008) differentiate meaningful learning from rote learning in their argument that concept maps are effective and constructivist tools for learning. Meaningful learning takes place when the content is clear and

presented in ways related to the **#prior knowledge** of the learner, the learner possesses relevant prior knowledge, and the learner chooses to learn meaningfully (paragraph 10).

GitHub

GitHub is a software typically used for software development. However, there are many aspects of GitHub that work well for rapid iteration and development. In particular, GitHub allows collaboration and multiple people to work on the same project at once without causing conflicts. In addition, GitHub (and Git) allow the user to track changes at a very detailed level. Using GitHub or a similar tool provides a history of development that can offer opportunities for deeper reflection.

Google Collaboration Suite

Google software like Google Docs allow authoring by multiple people at once, offers tools for commenting, chat, and other forms of feedback. Participants can rapidly share and document ideas in the same space.

Zoom

Zoom is a video conferencing and presentation software that offers many features that support a live workshop. Zoom has "breakout rooms" that would allow teams to work together, communicate in a way as close to in person as possible, and share their prototypes with the facilitator and other groups through screen sharing. Zoom also allows recording. A recorded session is another tool that participants can "take with them" which can allow further investigation, reflection, or refinement to their ideas. This is particularly important in a short, rapid, workshop.

Aims of a Professional Development Workshop (Assessment of the Workshop)

Vrasidas & Zembylas, (2004) share lessons from their development of online professional development workshops, which includes a table of lessons learned that can act as a guide for others. A review of some literature leads to thinking that a workshop can be considered similarly to any constructivist lesson, so many of the ideas in the provided content is appropriate for

considering how well a professional development activity proceeded if the "student" is considered as a professional.

Table 2. Professional Development Workshop Aims (adapted from Table 1, Vrasidas & Zembylas, (2004), p. 330

Lesson
Ownership and a shared vision is promoted among participants.
Interaction is promoted by structuring collaboration.
Choose the right technology
Designed for cognitive apprenticeship
Choose authentic tasks and activities
Provide regular feedback to participant's work
Promote reflection
Use a variety of assessment

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