The Maker Community Guild Option for Professional Development:

A Makerspace Pilot

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Abstract

This Capstone paper considers current educational, professional development in United States public schools and proposes a disruptive innovation for improvement. This paper addresses how an educational, professional development experience can help characterize and document the learning that takes place in a Makerspace. This paper proposes that a Makerspace innovation would leverage best practices of Autonomy, Resources, Time, and Expert guidance that are necessary for effective educational, professional development. This paper coalesces the community resources of Private University, Community College, local hobby club, and school district administration in a mid-size city to produce the Maker Community Guild Option for educational, professional development. This innovation is supported by learning theories of experiential learning, constructivism, and constructionism. It is further supported by the instructional frameworks of Design Thinking and Technological Pedagogy and Content Knowledge (TPACK). A supportive peer network will include More Knowledgeable Others and System Conveners. The Maker Community Guild Option for professional development will follow a research-based approach producing a 4-phase initiative with a summer MakeCamp pilot for educators. Qualitative and quantitative research tools will assess the experiences of the participants. Together, these features comprise an integrative matrix to promote and support the learning that occurs in the Maker Community Guild Option for educational, professional development.

Key Words: Makerspaces, Educational Professional Development, Experiential Learning, Constructivism, Constructionism, Tinkering, System Conveners, Sustaining Innovations

Introduction

It is often said that education and training are the keys to the future. They are, but a key can be turned in two directions. Turn it one way and you lock resources away, even from those they belong to. Turn it the other way and you release resources and give people back to themselves.
~Ken Robinson, Out of Our Minds, Learning to Be Creative

Effective professional development leads to improved teacher practice and promotes improved student performance (Darling-Hammond, 2010; Darling-Hammond, et al. 2009). Over 90 percent of teachers attend training sessions every school year (Darling-Hammond et al., 2009). In addition to their current post-secondary degrees and certifications, K-12 educators in all 50 states must complete extra training hours each school year. In Texas specifically, teachers must complete between 12-60 extra hours during each school year, which includes the summer months. Educators refer to these hours as "rollouts" (Ritchhart, 2015), "seat-time," "staff development hours," "inservice," "recertification credits," or "continuing education credits" (Youngs, 2002). Though the topics for teacher professional development are seemingly endless, finding one with value is a feat in itself.

However well-intentioned the effort by the district administration, a majority of educators rated educational, professional development offerings as "useless" (Gulamhussein, 2013) and "contrived" (Wilson & Berne, 2012). Educational, professional development efforts also frequently fail because of "one-size-fits-all" approach (Klassen and Chiu, 2010).

Specifically, one-size-fits-all professional development is reflected in:

1.) Educational, professional development that is too big in scope (Guskey, 2000).
2.) New initiatives presented as a mandate instead of an invitation (Slepkov, 2008).
3.) Single-event, "sit and git" programs organized around topics that are not interesting to all participants (Fogarty, 2009).
4.) Educators are not given a choice as to their educational, professional development. (Klassen and Chiu, 2010)

The Idea: Situating Educational Professional Development in a Makerspace

To improve staff development the essential question to ask is, *"How can educational, professional development re-emerge into something meaningful for educators?"*

An answer emerges by combining attributes drawn from research in effective professional development. Educators advance their understanding and implement proactive and positive change when given Autonomy, Resources, Collaboration Time, and Expert Guidance (Darling-Hammond, 2013; Darling-Hammond & Bransford, 2005; Darling-Hammond, et al. 2005; Yoon et al, 2007). However, a retro-fit of effective attributes to traditional models of professional development will not achieve the goal.

Instead, situating professional development within a Makerspace offers an innovative method to combine Autonomy, Resources, Time, and Expert guidance. Makerspaces are a hive of connections and networking. With Makerspaces, "You sense a child-like curiosity and wonder that never seems to age" (Doughtery in Corcoran, 2015). Makers are active constructors instead of passive consumers.

This paper addresses considerations necessary to implement a Maker Community Guild Option for Professional Development to offer a different type of educational, professional development in the Newlen, Texas School District. Makerspaces as an educational, professional development option combine **Autonomy, Resources, Time, and Expert guidance**. Learning within Makerspaces is intergenerational between different age groups of people and pedagogically intergenerational between novice, mid-career, and veteran educators. Learning within Makerspaces is also immersive, experiential, collaborative, and interdependent. This is relevant to professional development because educators take the initiative to chart their learning and construct something meaningful to them. They have a fundamental creative drive "to figure

out how to make or do stuff on their own, rather than purchasing pre-packaged goods or services" (Dougherty, 2013). They trade their teacher identity for a transformative learner-designer role. Professional staff development situated in a Makerspace would leverage for educators the popularity and participatory learning that occurs for kids while "hanging out, messing around, geeking out" (Ito et al., 2009).

The Maker Movement and Makerspaces

Makerspaces are not new. Their roots in the Maker Movement extend to craftsman, guilds, apprenticeships, and the basic desire to create. Today, Makerspaces are more accessible because of a lower cost of parts, sharing of expertise via social media and group hubs, and OpenSource information sites. Making is growing: more than half of U.S. households engage in at least one Maker-type activity each year (Arora, 2013). Making is not confined to the quilting bee domain of older adults. Generation Y has been renamed "Generation DIY" (Fromm, 2013). More than half of the 29 billion DIY enthusiasts in the United States are under 35 years, and they spend more than $1,000 a year on projects (Arora, 2013). For people over the age of 35 years, DIY project spending is approximately $500 per year.

Central to the Maker Movement are Makerspaces. A Makerspace is a fun, productive, and active place where people visualize new things, play around with ideas, think about possibilities, collaborate, create, and construct customizable items (Hatch, 2014). The Institute of Museum and Library Services (2012) defines Makerspaces as "hands-on, mentor-led learning environments to make and remake the physical and digital worlds. They foster experimentation, invention, creation, (and) exploration" (p. 1). Sometimes in a Makerspace, it is unclear who is "in charge" and, in answer to the question, fingers point in all directions. Makerspaces also foster a collective community in a shared space with a set of collective tools that attracts fellow makers

and would-be makers (Kemp, 2013). Bruns' (2009) co-mingled term of "produser" to describe the "producer" and "user" combination of skills also applies to Makerspaces. What first appears to readers as a misspelled word is a new term mashup.

Disrupting the current status quo of professional development through the infusion of the popular Makerspace experience has potential as an innovative improvement for educational, professional development. This paper describes the design of a community guild Makerspace to address educator professional development by creating a professional development option set in a Makerspace.

Makerspaces provide opportunities for legitimate peripheral participation (Lave and Wenger, 1991), interdisciplinary, authentic Constructionist learning, and a supportive peer culture (Pfister, 2014). Makerspaces feature people turning their abstract ideas into concrete representations while working in areas equipped with resources and materials. Learning occurs in the Makerspace, which matches the description of the social context in a socially situated space (Brown, Collins, and Duguid, 1989). Although Stager claims that the "best Makerspace is between your ears" (1995), they can have both a physical and virtual location (Ito, et al. 2009).

Makerspaces exist in a variety of locations:

- K-12 schools (Hlubinka, M., et al. 2013; Blikstein, 2013; Kalil, 2013)
- Universities (Kemp, 2013)
- Libraries (Abram, 2013; Barniskis, 2014, Kroski, 2013)
- Garages (Kemp, 2013)
- Museums (Bevan, et al. 2015)
- Mobile, touring (Barniskis, 2014)
- Community centers (Maker Education Initiative, 2012; Kafai et al., 2009).
- Online (Ravelry, Code Academy)

A hybrid of both a physical and online space will serve as the situated learning context of this proposal's Maker Community Guild Option for professional development. The physical

location would be an existing MakerSpace, onsite at a private university in Newlen, Texas. A University campus was chosen for the following reasons:

1. It has the only Makerspace that is conveniently located to all district schools.
2. The Makerspace is available and underutilized during the summer months when most educational, professional development occurs.
3. The Makerspace is large enough to accommodate many people at a time.

The city of Newlen, Texas has strategic, pre-existing community partnerships. Within the area, there is a Region Education Service Center that connects seven institutions for higher learning, including three universities, three colleges, and one technical college. Within the Newlen Independent School District, there is a Career and Technology Advisory Committee, which includes 44 career cluster partnerships between educators and local businesses.

The Maker Community Guild Option for professional development will also have an online, virtual space. The virtual portal will provide introductions, extend conversations from the Makerspace, and collect reflective comments, design drawings, and photos of finished projects. Both the physical and virtual locations would encourage educators to pursue personally driven interests with a community of support around them.

Imagine walking through Frye's electronics store, the Apple Genius Bar, or Michael's Craft store. Associates circulate to answer questions. Micro-demonstrations of processes and tools occur. Areas designated for electronics, Apps, and crafts on are display. There are ad hoc areas available for impromptu practice. Now imagine that all price tags and commercial signs are gone, and there is time to investigate, play, and create something new.

The previous description is an accurate description of Makerspaces. The Maker Community Guild Option is an effective, research-based idea because it combines the four elements of effective professional development -- Autonomy, Resources, Time, and Expert Guidance with the popularity and dynamic learning that occurs in Makerspaces. It is

transformative, socio-cultural process because within the Makerspace, participants add to the experience and identity of Educator with the identity of Designer, Learner, and Maker. As Dale Dougherty said in a recent interview, "What makes a makerspace awesome are the people who know how to do things and love what they do. The more of them the merrier" (Corcoran, 2015).

Makerspaces and Design Thinking

Makerspace problem-solving coalesces with Design Thinking through iteration, repeated testing, and cyclical processing (Buechley & Qui, 2013; Martinez & Stager, 2013; Barr, Harrison, & Conery, 2011; Resnick, 2007). The goal is "to make constant forward progress through a series of gradually improving prototypes" (Martinez & Stager, 2013). Synonymous with "rapid prototyping" (Brown, 2014), "spiral design" (Bruner, 1990), or "agile development" (Martinez & Stager, 2013), Design Thinking is effective for professional development.

Imagination is paramount to design thinking. Resnick (2007) gave double emphasis to Imagination in his 6-step design process of Imagine, Create, Play, Share, Reflect, and Imagine. Martinez & Stager (2013) view the design cycle in seven steps: Initial Planning, Requirements, Analysis & Design, Implementation, Deployment, Testing, and Evaluation. Barr, Harrison, & Conery, (2011) quantify design thinking in five parts: product prototype construction, prototype beta-test, beta-test results analysis, debugging of problems, and design refinement. Buechley & Qui, (2013) condense the design process to four words – Collect, Design, Build, and Troubleshoot. Interestingly, empathy is also a listed component of design thinking (Michlewski, 2008). Empathy is an essential skill because it teaches "how to solve another person's problems by providing creative and innovative solutions that relate to his or her needs" (Alrubail, 2015). Teacher-learners' Makerspace experience translates to empathy for how their students view the experience of learning something new.

Professional development in Makerspaces combines best practices of **Autonomy, Resources, Time, and Expert guidance** The Makerspace Community Guild Option is an appealing alternative to traditional educational, professional development because it combines these effective qualities too. It offers a chance for educators to connect the popularity of Making with the opportunity of exploring autonomous project options in an operational Makerspace.

Professional Development and Makerspaces: Autonomy

Initial orienting activities will reconnect educators to fun and play. Then, educators will be invited to begin autonomous projects in their individual medium of interest. Some educators may choose to work together with Makerspace mentors on an introductory project. Others may match a project to the variety of the Makerspace, including sewing, painting, tabletop board games, mixed media, film-making, photography, woodworking, e-textiles, robotics, coding, video-making, Arduinos, circuitry, 3D printing, anime, animation in Scratch, digital storytelling, web design, hypertext writing, coding, App making, simulations, music composition, and wearable computing (Doorley & Witthoft. Dunn & Larson, 2013; Foote, 2013; Honey, 2013; Hlubinka, et al, 2013; Kroski, 2013; Martinez & Stager, 2013).

By immersing themselves in the design and construction of their products, educators become learners again. Their experience choosing among so many Makerspace resources can translate into curricular applications of the classroom-based practice, such as offering Product Extension Menus to students. Product Extension Menus are opportunities to extend knowledge acquisition with product and process choices listed in a grid (Kingore, 2004). For example, after learning basic facts of Texas forts, educators may offer their students the opportunity to represent their knowledge the architectural design of forts through items on the Product Grid. Educators'

tolerance for student autonomy grows as a result of their autonomy of product choices in the Maker Guild Community Option for professional development.

Resources: Theories of Experiential Learning and Constructivism

Learning in Makerspaces is more advantageous because of the saturation of materials, schematics, expertise, and support (Dunn and Larson, 1990). The learning resources of the Maker Community Guild Option for professional development are grounded in theories of knowledge development, socio-cultural learning, and instructional frameworks.

Education depends on the knowledge development and ideas emerging from experiences that have meaning for learners (Dewey, 1938). Dewey argued that thinking is practical problem solving, and it proceeds hypothesis testing. An emphasis on transmission, recitation, and punitive consequences produced negative or "mis-educative" experiences. Dewey argued for connecting learning involvement and transferring learning experiences because "every experience both takes up something from those which have gone before and modifies in some way the quality of those which come after" (1938, p. 27). Dewey deduced that educational experiences "must lead out into an expanding world of subject-matter…facts or information and of ideas" (1938, p.111).

Piaget also advocated for the power of experiences. In the theory of knowledge development, individuals in new experiences use the mechanism of assimilation and accommodation in order to integrate new experiences (Kafai, 2006). Learning applications in Makerspaces combine Dewey and Piaget's lens of connected experiences, play, assimilation, and accommodation with constructionist affordances of interactions with people and artifacts (Kafai, 2006; Ackermann, 2010). In the open-ended context of the Makerspace, everything they learn serves the purpose of furthering their knowledge transfer and product composition. For example,

a teacher who creates an automatic plant-watering device expands their repertoire of problem definition, timing, sequencing, gardening, and troubleshooting.

Educators become learners again because they are doing something meaningful and new to them. Educators are “minds-on” and engaged with their ideas (Duckworth, 2009, 1972), yet, they are not alone because alongside them are collegial helpers. This experience is different from a passive, professional development session in an auditorium listening to a speaker. The medium of construction is divergent. Contrast this from a professional development session in the computer lab where each educator is making a personal web page, because the message is divergent and expressed in a variety of products. A web page might show what is meaningful, but it is still bounded and contained within hypertext language. Variety in the Makerspace combines educators’ choice of both the medium and the message (McLuhan, 1964).

Resources: Theory of Constructionism

Martinez and Stager (2013) credit Seymour Papert as "the father of the Maker movement" (p. 17). They acknowledge that constructionism is the learning theory that undergirds the Maker Movement's focus on problem-solving and digital and physical fabrication. Makerspaces model all the components of constructionism. First, teacher-learners are central to the learning process. Next, learning occurs in a natural, shared Makerspace context surrounded by authentic tools. Next, a supportive culture provides help in a “Fail-fast” environment. Each navigated obstacle is an invitation to reflective metacognition.

Learning is more effectively imprinted in a socio-cultural constructionist (Papert, 1980) cycle of participants making, sharing, tinkering, refining, and sharing again. The distinguishing feature of constructionism is "learning by constructing knowledge through the act of making something shareable" (Martinez & Stager, 2013, p. 21). Pfister (2014) would add that what is

made should produce something of benefit to the community, such as embroidered, monogrammed fleece blankets for a local shelter or 3D greeting cards etched from a laser cutter for residents at an assisted living center.

Time to Collaborate and Tinker

Along with "just-in-time" knowledge transfer, educators receive peer feedback, suggestions, for improvement and one important element often overlooked in professional development sessions. Educators receive time to embody the role of the student while they construct something that is tangible and shareable (Papert, 1980). Standards and objectives in the current educational landscape often overlook time to investigate, and discover. Play is often not on the lesson plan.

Through tinkering, individuals acquire new knowledge exactly as it is needed ((Dunn & Larson, 1990; Papert (1980) and this applies to learning that occurs in Makerspaces. The Makerspace Community Guild Option Summer MakeCamp will offer "Show and Tell," in a "Show and Tinker" landscape. Tinkering time is essential because on average, implementation requires 20 separate instances of practice with the number of repetitions increasing with the complexity of the skill being taught (Joyce and Showers, 2002). These practice repetitions are accurate for both novice and experienced educators (Ermeling, 2010).

Learning in Makerspaces also occurs with resources of talking (Ito, J. 2012), computational thinking's trial-and-error (Barr, Harrison & Conery, 2011), and reflective practice (Schon, 1983). As educators create, tinker, design, and revise their ideas into products, they acquire knowledge and increase their skill level. The learning trajectory directly relates to knowledge and information distribution (Benkler, 2006), the goals of practice, peer-to-peer production, and authentic learning.

Tinkering in Makerspaces does not occur solely around the existence of a physical object,

tool, or fast microchip. It is *not* the Arduino that provides the learning; the Arduino is the physical object. Learning occurs when discussing how to accomplish a task-whether to solder connecting wires to the Arduino or to use connecting thread, and then tinkering with the circuitry connecting to the Arduino to see how it can (or can't) further the construction. Makerspace conversations evolve in a non-linear stream of possibilities (Brown and Mbati, 2015; Dunn and Larson, 1990; Ching & Kafai, 2008). Technology and conversations are tools used to influence creativity and ignite individual learning trajectories.

Educators who build and make in the summer MakeCamp would not be passive receivers of one-size-fits-all content. They will be active learners creating something personally meaningful to them, and they will adjust and readjust their designs through trial-and-error (Papert, 1980). Often, solutions depend on interaction with other makers.

Learning is not solely an individual endeavor. Learning is shared with others in a social and physical circumstances where knowledge was acquired (Donaldson, 2014; Greeno, P1998; Billett, 1996; Lave & Wenger, 1991; Brown, Collins, & Duguid, 1989).This circumstantial linkage is why most people can remember where they were when President Kennedy was shot or where they were when the Twin Towers fell.

Extroverted makers work together and alongside. Introverted makers work at the perimeter. Makers meander between their project and observe the projects of others. All remain situated in the site of practice. In the Maker Community Guild Option MakeCamp, problem-solving moves from abstract thinking (*"What if we could")* to the concrete ("*How can we*"). Participants will assist cooperatively with dispositions of confidence, patience, persistence, collaboration, and tolerance for ambiguity (Barr, Harrison, Conery, 2011; Huang, Rauch, & Liaw, 2010). They work together on projects and join in manipulating "objects to think with"

and "objects to think about something" (Papert, 1980, p. 6). For example, creating a lighted bookmark requires knowledge acquisition of the math of measurement, the precision of stitching, and the basics of LED circuitry, and that is if it works the first time! Problem-solving, concept review of measurement and circuitry, reverse engineering, tolerance for errors, and beta-testing are integrated during the inevitable "Fail-fast" scenario.

Objects and tools in Makerspace projects are not confined to pre-existing shapes and previous uses but have a "protean" or adjustable usability (Papert, 1980). Makers' learning trajectory moves beyond the cognitive application of following directional schematics to the "bricoleur-style" of improvising, recombining, and using what tools are at hand (Papert, 1980, p. 80). Foote (2013) attaches the label of "stealth programming" for the experience of setting out tools and materials and leaving the result to participants. Objects are representational. For instance, the electronic thread object becomes a way to connect components but also to think about electronics, engineering, iterative design, and trial-and-error. If we eavesdrop on a typical conversation, we may hear the following conversation:

> *"What products are best? Where can we get one of those gizmos? What can we substitute, so we don't have to wait on shipping? What can we adapt? What else can we try?"*

This MacGyver-esque style mirrors Papert's appropriation process that includes personalizing how learners "make knowledge their own and begin to identify with it" (Kafai, 2006, p. 39). Conceptually, one way this relates to professional development is the way it mirrors the quick thinking, assembling, and scaffolding that educators must do daily to individualize instruction for all learners. Another way is that teacher-learners embody Papert's conclusion of "the fundamental fact about learning: anything is easy if you can assimilate it to your collection of models. If you can't, anything can be painfully difficult" (1980, p.19).

What instructional strategies apply the theoretical concepts of Constructionism in Makerspaces? Makerspaces embrace solving problems and creating new and meaningful products. Problem-based learning is often confined to a single subject with shorter durations (Hmelo-Silver, 2004, Schwartz, Mennin, & Webb, 2001). Project-based learning is multi-disciplinary and more detailed in scope, (Schneider, Krajcik, Marx, & Soloway, 2002).

Expert Guidance from the Guild

The Makerspace is a place where everyone shares a desire to construct meaningful artifacts together and alongside each other in a replication of a creatively and purposefully playful classroom. Although *Do-It-Yourself (DIY)* is a culturally popular term, the activity in the Maker Community Guild Option for professional development would reflect a spirit of *Do-With-Each-Other* (Dyer, et al. 2009). Social learning precedes development (Vygotsky, 1978). Educators' experience their version of the Zone of Proximal Development which is the space between what can be done alone and what can be done with help from a More Knowledgeable Other (Vygotsky, 1978). Intentional and experiential learning, and an atmosphere encouraging trial-and-error is alternatively affirming and confusing. Confusion is part of the iterative cycle, and it is a building block of learning (D'Mello, et al. 2014). Each experience of confusion in the Makerspace becomes an opportunity for educators to think metacognitively. In many places, but especially in a Makerspace, there is a socially mediated acceptance of, and even encouragement for a "Fail Fast, Fail Often" approach (Ormerod, 2005). Mistakes are part of life, part of tinkering, and part of learning. It is interesting to note that Google distributes all of its Apps in "beta" format, meaning that mistakes and tweaks are expected (Martinez & Stager, 2013). Attempting to solve complex problems without the provision of support linkages can be an unproductive exercise in failure. More Knowledgeable Others in the Guild will provide

successful navigation through the Zone of Proximal Development when educators begin projects, inevitably encounter problems, interact with the Guild, share experiences, and gain more problem-solving information. They may also decide to abandon initial projects and proceed with new projects or closely related versions of their original projects.

It is possible for a lone individual to play and pursue an interest, acquire materials, pass a safety course, and watch experts enact significant steps. However, for educators, isolation is not the most rewarding professional development learning environment (Darling-Hammond & Bransford, 2005). Learning alone is bereft of "thought and stream of language" (Bruner, 1990, p. 143) and this matters because talking things over helps to "sort out that order and its meaning" (Dunn and Larson, 1990). Educators take the role of the student and inhabit a "teachers as learners" role (Christiansen, 2013). Martinez and Stager (2013) describe the importance of the "blur of the lines of teacher and student." The Maker Community Guild Option Summer MakeCamp would endorse these blurred lines.

A language is a social tool, crucial to social interaction (Vygotsky, 1980). Learning and solution-finding is integrally tied to communicative interactions with More Knowledgeable Others who navigate the Zone of Proximal Development of what is unknown and what can be learned (Vygotsky, 1978). People serve as tools for learning (Cook, 2010), and this is true for the Guild of the summer MakeCamp. Helpers provide "the power of pull" (Ito, J. 2012) through readily available resources, expertise, and supportive, collegial dialog. Conversational solution finding is "disambiguation" that "catches life in action" (Bruner, 1990, p. 48, 64). While in the Makerspace, educators ask questions. They don't get it on the first explanation or the first try. Just like in the classroom, plans do not immediately evolve successfully. They ask more questions to extend their thinking.

McLoughlin and Luca (2000) differentiate the peer activities that foster learning and these activities. These activities include engaging in collaborative tasks, offering and receiving assistance, giving feedback, challenging others' contributions, and exchanging information. These peer activities will also be present in collegial in the Maker Community Guild Option for professional development. In collegial conversations, each person brings a set of skills, knowledge, and an approach to problem-solving and solution-finding that benefits others. As they fail, revise, and continue to learn, educators increase their ability to become More Knowledgeable Others for colleagues. Their growing peer-to-peer relationship structure increases agility, innovation (Ito, J. 2012), and can demolish silos of isolation. Peer-to-peer relationships guide in knowledge co-creation, cooperative support (Pfister, 2014) and pedagogical concept knowledge (Shulman, 1987). Peers are co-intentional subjects, "not only in the task of unveiling reality and thereby coming to know it critically, but (also) in the task of recreating that knowledge" (Freire, 1993, p. 51). Peer-to-peer collegial conversation experiences transfer to the Newlen, ISD classrooms because educators who have a "sense of vocation and organizational belonging" (Day, 2013, p. 59) bring evocative learning experiences to students (Day & Leithwood, 2007; Guskey & Passaro, 1994).

The Library as Incubator Project (2013) emphasized the importance of a community component and distinguished Makerspaces as not a "specific set of materials or spaces, but rather a mindset of community partnership, collaboration, and creation." Although the onsite university Makerspace has personnel and University professors assigned to work in it, additional people must serve as helpers for collegial conversations and scaffolding with teacher-learners (Martinez & Stager, 2013; Pea, 2004). These additional helpers will come from the community through the

involvement of Community College students and city maker enthusiasts. Some helpers will also serve on the Guiding Coalition, explained more fully in the Implementation section.

Implementing the Maker Community Guild Option

Implementation of the Maker Community Guild Option for professional development will reflect Kotter's Eight Step Process for Leading Change (1996). Kotter's approach (Appendix A) includes leveraging momentum, aligning all processes, structure, centers of influence, technology, and funding to ensure that innovation reaches the target audience. Kotter's steps are not achieved in a linear fashion, but in "multiple phases at once …in a wheels within wheels" trajectory (Kotter, 1996, p. 23, 24).

Implementation of the Strategic Vision and Initiative would involve a 4-phase approach. This paper will proceed with a discussion of the implementation of Phase 1 – Phase 3.

Phase 1-Build Urgency and Awareness through Interest Coalitions to include the Maker Community Guild Option in the Newlen ISD professional development catalog.

Phase 2-Recruit Guiding Coalition members and Pilot Helper/Moderators. Recruit educators as pilot participants.

Phase 3- Pilot the Maker Community Guild Option with Newlen ISD educators with team building during the spring and hands-on experience during the summer MakeCamp.

Phase 4- Operationalize the Maker Community Guild Option with educators from the pilot incorporated as mentors for the next group of educators.

After creating a sense of urgency to include the Maker Community Guild Option MakeCamp in the professional development catalog, each phase of implementation will proceed with a guiding coalition to develop and communicate the vision. In Kotter's model, empowerment of change agents will increase the strength of alliances, remove barriers, and generate short-term wins of recruited educators, and a successful summer MakeCamp. The short-term victory of the summer MakeCamp will communicate that the Maker Community Guild

Option for professional development is a sustainable option for subsequent years. Then the policy can permeate into the school district professional development culture.

Implementation will also reflect Rogers' Adopter Classification System (2003) which specifies stages of innovation infiltration. These stages are Knowledge, Persuasion, Decision, Implementation, and Confirmation. Participants in the summer MakeCamp will be comprised of members from Rogers' five classifications of adopters known as Innovators, Early Adopters, Early Majority, Late Majority, and Laggards (2003).

Implementation Plan Phase 1 – Staff Development Catalog Inclusion

Success in Phase 1 will require implementation of Kotter's Change principles, "Creating a Sense of Urgency" and implementing a "Strategic Vision and Initiatives." A strategic vision is central because without it, "a transformation effort can easily dissolve and "go in the wrong direction or nowhere at all" (Kotter, 1996, p. 7). The innovative vision of professional development in Makerspaces will be communicated first to the decision-makers for the catalog approval, and next to a "Guiding Coalition," and to educators in the pilot. Awareness-raising is similar to fund-raising because often individuals make their participation decisions based on emotion rather than logic (Teague, 1965). It is, therefore, incumbent upon awareness raisers to mix emotional appeal and academic need (Teague, 1965). Success for the Maker Community Guild Option depends on including it in the district catalog for professional development and recruiting educators for the pilot.

The Guiding Coalition believes in the vision and communicates its message (Kotter, 1996). Guiding Coalitions are energetic people who have interconnected relationships in the organization, willingness to lead in awareness building, and most importantly, support the innovative change effort. Guiding Coalition members will grow and interchange at various

stages of Implementation, but in the embryonic stage of getting the Maker Community Guild Option in the district catalog the following groups of people are vital:

1. District and Regional associate superintendents of elementary and secondary curriculum and instruction
2. At least two innovative educators who embrace the Maker Concept
3. University Director of Technology
4. University Director of the Makerspace
5. Community College Director of Technology
6. At least two community maker enthusiasts
7. The Author who will serve as the Makerspace Project Conceptualizer

Organizing the Guiding Coalition will be accomplished informally through meetings initiated by the Author. These initial touchstone contacts will include a short, introductory, "elevator-speech" video, produced by and set in the University Makerspace.

Inclusion in the Newlen ISD Staff Development Catalog is achieved by making a presentation to the Assistant Superintendents of Curriculum and Instruction, the Professional Development Manager, and the Directors Curriculum and Instruction at the local Regional Service Center. Traditionally, this group has been concerned with the cost of innovations and the impact on teachers missed time from the regular school calendar. The Maker Community Guild Option for Professional Development location will be a pre-existing University Makerspace, where labor is covered by University personnel and student helpers. Educators will visit the Makerspace during the summer and after-school hours. Because of these reasons, district funding is not needed and this will appeal to decision-makers. Also, the culture in Newlen ISD favors innovative entrants *("If you build it, let's see if they come")*, so acceptance in the Staff Development Catalog is forecasted to succeed.

Implementation Plan Phase 2- Communicating the Vision and Recruit Educators

Once a catalog inclusion is secured, the vital step of recruiting educators for the Phase 2 Pilot MakeCamp begins. Phase 2 success requires a "Volunteer Army" to build awareness and

communicate the vision on the Maker Community Guild Option (Kotter, 1996). The Volunteer Army for this project has System Convener characteristics (Wenger-Trayner, et al. 2014).

Systems conveners are passionate communicators, with a persisting, entrepreneurial spirit who establish new insertions of input (interventions) among people from different groups (Wenger-Trayner, et al. 2014). System conveners respect existing boundaries in organizations but invite participants to extend beyond them and reach for innovations. They survey different locations in the landscape of groups where an intervention could increase the learning capability of the whole system. System conveners "honor the existing accountability of stakeholders to their contexts, including regimes of competence, the agendas and expectations of organizations involved," (Wenger-Trayner, et al. 2014, p. 102).

Newlen ISD policy requires that educators make summer staff development choices by May. Successful awareness building of information channels must begin early. These initiative roll-outs echo Kotter's principal of "Communication for Buy-in." This phase found that interconnected and agile communication channels are vital to success.

Beginning in the previous summer, the Author/Makerspace Conceptualizer will post announcements of the Maker Community Guild Option on the Newlen ISD website. The Author and Volunteer Army of System Conveners will communicate the message to the twenty K-12 schools in Newlen ISD and recruit educators for the pilot group and students for the Helper/Moderator group during weekly team meetings at schools. The reason a single school was not chosen as a sole recruiting site is because Innovators and Early Adopters are not confined to one school but scattered across Newlen ISD.

Recruiting meetings will not be "sit and git" sessions for faculty, but rather, quick, announcement bursts. For example, a Systems Convener would attend a middle school science

team meeting and use a few minutes to introduce the University Makerspace video, and display enticing products created in the University Makerspace, such as prosthetics created by Occupational Therapy students, mini robots, or talking pop-up book. Conversations would trend toward options for project construction, autonomy, resources, expert guidance and plenty of helpers. The Author and System Conveners will continue Kotter's Communication Buy-in with announcement sessions during the Fall West Texas Fair and Rodeo school release day, "Teacher Appreciation Week, and community "Art Walk." Invitation to tour the Makerspace during the University-sponsored Makerspace contest will be offered. People are essential to the Volunteer Army, but technology itself is a ubiquitous team member and it is available continuously through Public Service Announcements, social media, the community Maker Club Facebook page, and University Makerspace Facebook page.

Implementation Phase 3- Virtual Information Network and Summer MakeCamp

In the timeline of events, the majority of the face-to-face implementation of the Maker Community Guild Option for professional development would occur in the summer MCGO-MakeCamp. However, a virtual space for online resources will enhance autonomy and team-building (Benkler, 2006) and provide necessary initial support and contact (Rushkoff, 2010). Immediately following recruitment, a welcome email will invite interested summer MakeCamp pilot participants, members of the Guiding Coalition and Volunteer Army to an online, virtual learning platform. The virtual space platform will consider the technology skill level of community members and offer a short-term learning curve that will not inhibit Early Adopters. It will feature open-innovation and iterative collaborative (Benkler, 2006) and asynchronous discussions. Such a platform would collect feedback "through a continuous process of networked, asynchronous conversations among user-innovators" (Benkler, 2006, p.356). The

Author will monitor usage statistics, seed, and moderate conversations, and supply a weekly Landscape Post. Landscape Posts encourage all teacher-learners to dig deeper into the weekly content topic and continue the discussion. Landscape posts include teacher-learners' responses to forward the online dialog (Appendix B). Landscape posts are summaries that "clarify and give a sense of direction and place learners at the center of a dialog" (Collison, et al. p. 186).

Online discussions tend to be self-reflective (Means, et al. 2010) and these observations are essential to the pilot's iterative evaluation (Rallis & Rossman, 2012). The virtual learning space will allow archiving of discussions, ideas, and a posting of the gallery of culminating products/projects from the summer MakeCamp Pilot. It will include a Resource Hotlist of Maker links, introductory content, team member bios, and design content, which will expand during the summer MakeCamp Pilot.

The virtual learning platform needs to interface with existing technology firewalls and the acceptable use policies (AUP) of the school district, university, and community college. Current firewalls at the school district block Facebook, Instagram, and Tumbler. Online Learning Management Systems at the higher education campus require accounts linked to log-ins that would exclude school district educators. Other Learning Management Systems options, (Moodle, OpenClass, Blackboard, Adobe Connect) have paywall features that limit adoption. At this time, a private blog on the Edublog educational blogging platform with Google Doc templates for data collection has the most permeability across the institutional firewalls and infrastructure of all pilot groups involved. Coursemology, which was demonstrated, in Singapore is another option.

As participants increase, the Author will train a rotating roster of site moderators to answer online questions, provide encouragement, and monitor usage statistics for participation and possible intervention. All site moderators will strengthen social presence. Social presence

has variable definitions (Lowenthal, 2009), but for this paper, it is "how participants project and perceive their own and others' presence in virtual interactions (and) the willingness to build an interpersonal relationship in order to learn cooperatively" (Song, M., & Yuan, R. 2015). Social presence is important in new endeavors and to adult learners, who prefer to see theory applied, have useful experience to share, and are intrinsically motivated toward communication (Malone, 2014; Fardouly, 1998).

Implementation Phase 3- Summer MakeCamp Pilot

The Maker Community Guild Summer MakeCamp pilot will occur over three days with an interdisciplinary mix of three groups: Educators, Helpers, and System Conveners.

All district educators will be invited and encouraged to participate in the summer MakeCamp Pilot, but realistically, it will probably appeal to Innovators and Early Adopters. The Innovator and Early Adopter educator participants would be interested in completing their educational, professional development hours as least restrictively and with as much choice as possible. This group will bring the "venturesomeness" [sic] and "tolerance for uncertainty" (Rogers, 2003, p. 282) that are needed in any new endeavor but especially in Makerspaces. The appeal of Making is pervasive, yet applying the concept to professional development and blending it in a virtual communication space will require the Innovators' "ability to understand and apply complex technical knowledge" (Rogers, 2003, p. 282). The Early Adopter's role model talent will "help trigger critical mass when they adopt an innovation" (Rogers, 2003, p. 282), and this will be important for sustainable growth in Phase 4. Interestingly, the Early Adopter group has been defined as having a higher personality attribute of empathy (Rogers, 2003) which has been previously discussed in this paper as a key component of design thinking.

Innovators and Early Adopters typically represent a combined 16% of the overall participant population (Rogers, 2003). Given Newlen ISD's educator population, a realistic summer MakeCamp Pilot attendance is estimated at 20-30 educators. They would be encouraged to include the agile and nimble minds of one or two of their public school students, who would also bring energy and willingness to share what they know.

The second participant group are Helpers or More Knowledgeable Others in the Makerspace and the online virtual portal. As the largest group, it will have the most varied schedule to be available during the Phase 2 public awareness and the Phase 3 Pilot. Group 2 Helper/Moderators will build goodwill and short-term wins (Kotter, 1996). Moderators in the online virtual portal are members of the Helper/Moderator group.

So that help is always available to educators in the Makerspace, members of Group 2 would be assign to the Makerspace at peak hours for educators: after-school and weekends. There exists a pool of students at the University and Community College, who share an affinity for Makerspace participation and a need for Practicum hours. Practicum hours at the University and Community College are obtainable if a student can make a connection between the Practicum experience and their major curriculum. Currently, the College of Engineering and the Occupational Therapy College have regular class meetings in the Makerspace. These students and people in the community's artisan and city-wide hobby clubs will be approached by the Volunteer Army/System Conveners to serve as helpers.

The System Conveners group is the smallest group and includes the Author/Makerspace Project Conceptualizer, the University Makerspace Director, her two assistants, and two educators who frequent the Makerspace. System Conveners will recruit educators, managed resources of the University Makerspace, and facilitate debriefing conversations, which are

explained on the next page. The System Convener group will grow in Phase 2 as it seeded by the Innovator/Early Adopter educators completing the summer MakeCamp Pilot.

Educators in the summer MakeCamp will attain the following Learning Outcomes:

- Earn professional development credit in the Makerspace lab
- Create something personally meaningful and tangible
- Understand the principles of Making
- Connect concept knowledge with pedagogical practices for exploring Making
- Become part of a Maker network; Develop a Maker perspective
- Consider ways to implement activities from the Makerspace in a learning environment

As a result of completing the Maker Community Guild Option Summer MakeCamp, the participants will earn a Maker badge. Badges are a summative strategy to herald achievement and provide recognition for organizational and educational achievement (Richardson & Lemoine, 2015). Educators earning Maker badges will have received training embedded in the local context of the Makerspace. They will receive invitations to serve as mentors in the Phase 4 operationalizing of the next MakeCamp.

Ron Ritchhart advised that "Curriculum is not delivered, it is enacted, and enculturation is the key to deep learning" (2015). With enculturation in mind, the curricular theme of the summer, 3-day MakeCamp will center on four actions: Collect-Design-Build-Troubleshoot (Buechley & Qiu, 2013). Each day will have a flexible agenda (Appendix C). Daily Skype conversations with Maker Innovators such as Yamin Kafai, Leah Buechley, Victoria Kim, Super Awesome Silvia, and Gary Stager will increase participants' affiliation with the Maker mindset.

Reflection is essential to mitigate revision (Benkler, 2006), to understand practice (Kreber and Cranton, 2000), and see if goals are met. An important aspect of the summer MakeCamp pilot will be reflective collegial and debriefing conversations. Collegial conversations with peers and More Knowledgeable Others will occur informally during the day, as previously described on page 17. They will also occur and at the end of the day. At the end of

the day, collegial conversations will occur through the more structured practice of Exit Cards. Also known as "Exit Tickets," these cards form the context for the next day's intervention and encouragement from More Knowledgeable Others (Appendix C).

In a slightly different application, debriefing conversations will add a daily reflective and culminating component. They will occur toward the end of the day as activities are wrapping up and will be videotaped for later transcription. Debriefing conversations match Gray's definition (2009) of a qualitative interview because they will contain open-ended questions (Appendix D) to learn about the daily MakeCamp experiences of teacher-learners. Observing, listening, and responding to the practice of participants is extremely important (Richards & Morse, 2013) and will be a feature of the debriefing conversations. The Author and System Conveners will prompt educators to connect their MakeCamp experiences to pedagogical theory (Shulman, 1987) and instructional practice (TPACK). A debriefing conversation might progress as follows:

> *System Convener: So…how did it go today?*
>
> *Teacher-Learner: There are so many things I wanted to try! I love the 3D Printer! I watched Arthur use it today. It took me a little while, but Lori helped me with the filament and I didn't have much time, but I made a lanyard clip for my reading glasses. I am thinking about making something else tomorrow. I want one for my school! But I don't know how I could ever get one! I am so interested in all the possibilities!*
>
> *System Convener: I can hear the excitement and curiosity in your voice. I saw you working too! Curiosity is a deep motivator for you and me, and students too! Would your students will work for a long time on something they are curious about?*
>
> *Teacher-Learner: Yeah, if they could get a chance to create something that they want to create. Not everything has to be related to testing, testing, and more testing!*

Debriefing conversations are the educational and pedagogical equivalent to "Management by Walking Around" reimagined as "Debriefing by Walking Around." They will call attention to the transferrable skills and observed application of pedagogy as it occurs. The Author will train System Conveners in the debriefing conversation process of connecting the

MakeCamp experiences to Technological Pedagogical Content Knowledge (Shulman & Hutchings, 2004; Koehler & Mishra, 2009; Mishra & Koehler, 2006; Shulman, 1987; Thompson & Mishra, P. 2007).

Debriefing conversations in the summer MakeCamp Pilot will be designed to include both formative and summative reflective practice. Dewey concluded that we do not learn from experience, we learn from reflecting on past experiences and allowing them to stretch backward (1938). Reflection-*in*-action (Schon, 1983) is fundamental, but it must be combined with Reflection-*on*-action. Although Schon's work addressed professional situations, it also applies to educational situations too because educators will reflect on their actions in the Makerspace and make application to their professional practice in the classroom. Both collegial conversations and debriefing conversations are valuable because they ease confusion overload and prevent "rage-quitting" (to borrow a gamer term).

Assessment Plan: Formative and Summative

Results of assessment measures will be used for improvement during the Phase 4 operationalizing of future MakeCamps. Formative and summative assessment metrics are a core component of effective learning (Kreber & Cranton, 2000; Bransford, Brown, & Cocking, 2000). Newlen ISD uses the National Board for Professional Teaching Standards propositions (1989) to measure the success of professional development programs. Specifically Proposition four and five relate to the Maker Community Guild Option for teachers:

> Proposition 4: Think systematically about practice and learn from experience
> Proposition 5: Become members of learning communities.

The Maker Community Guild Option Summer MakeCamp Pilot will rely on two formative sources and one summative source of data for assessment purposes. First, along with the Guiding Coalition, we will look at the online discussion participation and posting statistics

from the virtual platform and the Makerspace attendance sign-in rosters. Secondly, we will look at interview transcripts from videotaped debriefing conversations. Thirdly, we will modify and use a technological pedagogical and content knowledge (TPACK) survey (Koh, et al., 2014). These data sources will measure the combination of National Board for Professional Teaching Standards propositions, and will evaluate the iterative effectiveness of the Summer MakeCamp Pilot. Analyzing data, studying specific reflective statements in spoken and written form, and developing themes grounds the assessment approach in the qualitative framework of Phenomenology (Creswell, 2014; Richards & Morse, 2013).

Stager's caution, "All assessment interrupts the learning process" (2014) is a reminder to embed reflection casually in the summer MakeCamp daily agendas (Appendix C). Toward this goal, the videotaped, debriefing conversations will be short, (less than one minute). The conversational interplay of the debriefing conversations has been discussed previously on page 28. The debriefing conversation's data collection process will include line-by-line transcription (LaRossa, 2005). The Author will transcribe the interviews. Textual analysis (Kuckartz, 2014) will be applied to the debriefing conversation transcripts using HyperResearch qualitative data analysis software. Of particular interest will be the frequency report generated by the software that will deconstruct data into reoccurring indicators. This process will help to uncover "meaning units" (Creswell, 2014) in the transcripts. Adult learners are open to articulating their experience (Malone, 2014; Fardouly, 1998), so reticence, either in conversations, the online portal or in Makerspace attendance will be a "red flag" for the Author. It will be a signal for the Author and the Guiding Coalition to follow Kotter's admonition of "Don't Let Up" (1996). We will investigate further and discuss possible assistance and interventions. Possible interventions include more scaffolding through increased time with teacher-learners, pairing them with another

teacher-learner, encouragement, and listening. These actions maintain the momentum to operationalize the summer MakeCamp innovation.

Summative assessment will selected items from a survey to examine teachers' perceptions of design disposition and technological pedagogical content knowledge (TPACK) (Koh, et al. 2014). The design disposition and technological pedagogical content knowledge survey was chosen because it includes statements relating to design thinking (Appendix E). The TPACK survey measures responses on a 4-point Likert scale. Likert scales feature declarative statements and ask participants to agree or disagree with them on an incremental scale (Gray, 2009). They are primarily used to measure preferences and attitudes (Gray, 2009). The design disposition and technological pedagogical content knowledge survey originally included 18 ordinal scope questions (Appendix E). For the purposes of the summer MakeCamp, only 11 questions with applicability to Makerspace and design experience will be included (Appendix F).

One weakness of Likert scales is that participants tend to self-report at unreliable levels. Additional methods are needed for more complete assessment and balance. Data triangulation helps to "balance out any of the potential weaknesses in each data collection method" (Gray, 2009, p. 36). Including the survey with both qualitative observational data transcripts and quantitative participation and usage statistics provides data triangulation (Richards & Morse, 2013, Gray, 2009).

For purposes of school district reporting, identifying data such as names and school campuses will be removed. The survey questions will be assembled on a Google doc. For maximum effectiveness, the survey will be emailed to participants at the end of Day 3 just before the gallery walk of Maker projects. (Gray, 2009). The survey will have a QR-code for mobile access. The QR-Code will be on display in the Makerspace. The projection of fewer than 30

Innovator and Early Adopter participants (page 24) classifies this as a small sample size (Field, 2003). The small sample size will restrict generalized assumptions to a large population (Field, 2003) but this is acceptable since it will be operationalized only to the Newlen ISD. The design disposition and technological pedagogical content knowledge survey will measure only the preferences and attitudes of the summer MakeCamp pilot group, but we will analyze the data to see if there is a statistically significant association between gender and perception.

Conclusion

"...one of the lasting impacts of the maker movement is to transform our education system, replacing a standardized curriculum and testing with learn-by-doing experiential learning." ~Dale Dougherty, (Corcoran, 2015)

Nurturing kids and those who teach them is community work. Connecting the collective resources of a community can reshape educational, professional development. Innovative options are needed to combat outdated and unsatisfactory methods of educational staff development. The Maker Community Guild Option for professional development is a way to offer an innovative professional development option for educators. The summer MakeCamp pilot and online virtual space will leverage and highlight the learning processes supported by Makerspaces.

Professional development in Makerspaces is both an innovation and an invitation. Makerspaces invite human beings to create their own innovations. Makerspace permit educators to learn in the ways they prefer, both formally and informally. Makerspaces promote reflective practice and time to return to craftsmanship. It is worth the effort to enact this fusion of personal creative autonomy, resources, time and expert guidance.

There is an appeal to improve and involve ourselves in something larger and greater. (Rushkoff, 2010). The invitation to the Makerspace of sustainable innovation and deep learning beckons.

References

Abram, S. (2013). Makerspaces in Libraries, Education, and Beyond. *Internet@ Schools*, *20*(2), 18-20.

Ackermann, E. (2010). Constructivism(s): Shared roots, crossed paths, multiple legacies. *Proc. of Constructionism*.

Alrubail, R. (June 2, 2015). Teaching Empathy Through Design Thinking. *Edutopia*. Retrieved from: http://www.edutopia.org/blog/teaching-empathy-through-design-thinking-rusul-alrubail

Arora, A. (2013). The Millennial Marriage of Tech and DIY. GigoOm. Retrieved from: https://gigaom.com/2013/11/02/the-millennial-marriage-of-tech-diy/

Barniskis, S. C. (2014). Makerspaces and Teaching Artists. *Teaching Artist Journal*, *12*(1), 6-14.

Barr, D., Harrison, J., & Conery, L. (2011). Computational Thinking: A Digital Age Skill for Everyone. *Learning & Leading with Technology*, 38 (6), 20-23.

Benkler, Y. (2006). *The wealth of networks: How social production transforms markets and freedom.* Yale University Press.

Bevan, B., Gutwill, J. P., Petrich, M., & Wilkinson, K. (2015). Learning Through STEM-Rich Tinkering: Findings From a Jointly Negotiated Research Project Taken Up in Practice. *Science Education*, *99*(1), 98-120.

Billett, S. (1996). Situated learning: Bridging sociocultural and cognitive theorizing [sic]. *Learning and instruction*, 6(3), 263-280.

Blikstein, P. (2013). Digital fabrication and 'making' in education: The democratization of invention. *FabLabs: Of Machines, Makers and Inventors*, 1-21.

Bransford, J. D., Brown, A. L., & Cocking, R. R. (2000). How people learn.

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

Brown, T. (2014). *Change by design*. HarperCollins.

Brown, T. H., & Mbati, L. S. (2015). Mobile learning: Moving past the myths and embracing the opportunities. *The International Review of Research in Open and Distributed Learning*, 16(2).

Bruner, J. S. (1990). *Acts of meaning*. Harvard University Press.

Bruns, A. (2009). From prosumer to produser: Understanding user-led content creation.

Buechley, L., Qiu, K. (2013). *Sew Electric*. HLT Press.

Ching, C. C., & Kafai, Y. B. (2008). Peer pedagogy: Student collaboration and reflection in a learning-through-design project. *Teachers College Record*, 110, 2601-2632.

Christensen, C. (2013). *The innovator's dilemma: when new technologies cause great firms to fail.* Harvard Business Review Press.

Collison, G, Elbaum, B, Haavind, S, Tinker, R (2000). *Facilitating Online Learning Effective Strategies for Moderators*. Madison, WI: Atwood.

Cook, J. (2010). Longitudinal, educational design research investigation of the temporal nature of learning: Taking a Vygotskian approach. *Journal of Interactive Media in Education*, *2010*(2), Art-11.

Corcoran, B. (2015). Dale Dougherty, Father of the Maker Movement Talks About Breaking Rules, Erasers & Building a Learning Culture. *EdSurge*. Retrieved from: https://www.edsurge.com/n/2015-05-27-dale-dougherty-father-of-the-maker-movement-talks-about-breaking-rules-erasers-building-a-learning-culture

Creswell, J. W. (2014). *A concise introduction to mixed methods research*. SAGE Publications.

Darling-Hammond, L. (2013). Building a profession of teaching. In *Back to the Future* (pp. 3-27). Sense Publishers.

Darling-Hammond, L. (2010). *The flat world and education: How America's commitment to equity will determine our future*. Teachers College Press.

Darling-Hammond, L. (2009). Teaching in the change wars: the professionalism hypothesis. In Wise, C., Bradshaw, P., & Cartwright, M. (2012). Leading Professional Practice in Education. SAGE.

Darling-Hammond, L., & Bransford, J. (2005). Preparing teachers for a changing world: Report of the Committee on Teacher Education of the National Academy of Education.

Darling-Hammond, L., Hammerness, K., Grossman, P., Rust, F., & Shulman, L. (2005). The design of teacher education programs. *Preparing teachers for a changing world: What teachers should learn and be able to do*, 390-441.

Day, C. (2013). The new lives of teachers. In *Back to the Future* (pp. 57-74). Sense Publishers.

Day, C. & Leithwood, K. (Eds.). (2007). Successful principal leadership in times of change: International perspectives. Dordrecht: Springer.

D'Mello, S. K., Lehman, B. Pekrun, R., & Graesser, A. C. (2014). Confusion Can be Beneficial For Learning, *Learning & Instruction*, 29(1), 153-170.

Dewey, J. (1938). *Experience and education*. New York: Macmillan.

Donaldson, J. (2014). The Maker Movement and the Rebirth of Constructionism. *Hybrid Pedagogy.* Retrieved from http://www.hybridpedagogy.com/journal/constructionism-reborn/

Doorley, S., & Witthoft, S. (2011). *Make space: How to set the stage for creative collaboration*. John Wiley & Sons.

Dougherty, D. (2013). Build a Makerspace | *MAKE*. Retrieved from http://makezine.com/projects/build-a-makerspace/

Duckworth, E. (2009). Helping Students Get to Where Ideas Can Find Them. *The New Educator* 5(3), 185-188.

Duckworth, E. (1972). The having of wonderful ideas. *Harvard Educational Review*, *42*(2), 217-231.

Dunn, S. K., & Larson, R. (1990). *Design technology: Children's engineering*. Falmer Press.

Dyer, J., et al. (2013). The innovator's DNA: Mastering the five skills of disruptive innovators, Harvard Business Press.

Ermeling, B. A. (2010). Tracing the effects of teacher inquiry on classroom practice. *Teaching and Teacher Education*, *26*(3), 377-388.

Fardouly, N. (1998). Learner-Centered Teaching Strategies. Principles of Instructional Design and Adult Learning Series, The University of New South Wales, Australia.

Field, A. (2013). *Discovering statistics using IBM SPSS statistics*. Sage.

Fogarty, R., & Pete, B. (2009). Professional learning 101. *Phi Delta Kappan*,*91*(4), 32-34.

Foote, C. (2013). Idea Watch: Making Spaces for Makerspaces. Retrieved May 2014, from Internet@Schools: An Educators Guide to Technology and the Web: http://www.internetatschools.com/Articles/Column/Idea-Watch/IDEA-WATCH-Making-Space-for-Makerspaces-91993.aspx.

Freire, P. (1993). Pedagogy of the oppressed (translated by M. B. Ramos, new rev. 20th anniversary ed.). New York: NY, Continuum.

Fromm, J. (2013). Generation Y has become Generation DIY. *Millennial Marketing Blog*. Retrieved from http://www.millennialmarketing.com/2013/12/generation-y-has-become-generation-diy/

Gray, D. E. (2013). *Doing research in the real world*. Sage.

Greeno, J. G. (1998). The situativity [sic] of knowing, learning, and research. *American psychologist,* 53(1), 5.

Gulamhussein, A. (2013). Teaching the teachers: Effective professional development in an era of high stakes accountability. *Center for Public Education.* September.

Guskey, T.R. & Passaro, P.D. (1994). Teacher efficacy: A study of construct dimensions. *American Educational Research Journal*, 31(3), 627-643.

Hatch, M. (2014). *The maker movement manifesto: Rules for innovation in the new world of crafters, hackers, and tinkerers.* McGraw-Hill Education.

Hmelo-Silver, C. E. (2004). Problem-based learning: What and how do students learn? *Educational psychology review*, *16*(3), 235-266.

Honey, M., & Kanter, D. E. (Eds.). (2013). *Design, make, play: Growing the next generation of STEM innovators*. Routledge.

Hlubinka, M., Dougherty, D., Thomas, P., Chang, S., Hoefer, S. Alexander, I. McGuire, D., Vanderwerff, A., Scott, B. (2013). Makerspace Playbook. Retrieved from: http://makerspace.com/playbook.

Huang, H. M., Rauch, U., & Liaw, S. S. (2010). Investigating learners' attitudes toward virtual reality learning environments: Based on a constructivist approach. *Computers & Education*, *55*(3), 1171-1182.

Institute of Museum and Library Services. (2012). Talking Points: Museums, Libraries, and Makerspaces. Retrieved from http://www.imls.gov/assets/1/AssetManager/Makerspaces.pdf

Ito, J. (2012). The Culture of Innovation. EmTech. Massachusetts Institute of Technology Media Lab. Retrieved from: http://www2.technologyreview.com/emtech/12/video/#!/watch/joi-ito-innovation-culture/. https://www.youtube.com/watch?v=VsjTVGIw4z8

Ito, M., Antin, J., Finn, M., Law, A., Manion, A., Mitnick, S., Scholssberg, D.; Yardi, S. & Horst, H. A. (2009). *Hanging out, messing around, and geeking out: Kids living and learning with new media*. MIT press.

Joyce, B. R., & Showers, B. (2002). Student achievement through staff development. ASCD.

Kafai, Y. (2006). Constructionism. In Sawyer, R. K., *The Cambridge Handbook of the Learning Sciences*, Cambridge University Press.

Kafai, Y. B., Peppler, K. A., & Chapman, R. N. (2009). *The Computer Clubhouse: Constructionism and Creativity in Youth Communities. Technology, Education--Connections*. Teachers College Press. 1234 Amsterdam Avenue, New York, NY.

Kalil, T. (2013). Have fun—learn something, do something, make something. *Design, make, play: Growing the next generation of STEM innovators*, 12.

Kemp, A. (2013). *The Makerspace Workbench: Tools, Technologies, and Techniques for Making*. Maker Media, Inc.

Kingore, B. (2004). *Differentiation: Simplified, realistic, and effective*. Austin, TX: Professional Associates Publishing.

Klassen, R. M., & Chiu, M. M. (2010). Effects on teachers' self-efficacy and job satisfaction: Teacher gender, years of experience, and job stress. *Journal of Educational Psychology*, *102*(3), 741.

Koehler, M., & Mishra, P. (2009). What is technological pedagogical content knowledge (TPACK)? *Contemporary issues in technology and teacher education,* 9(1), 60-70.

Koh, J. H. L., Chai, C. S., Hong, H. Y., & Tsai, C. C. (2014). A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK). Asia-Pacific Journal of Teacher Education, (ahead-of-print), 1-14.

Kotter, J. P. (1996). *Leading change*. Harvard Business Press.

Kreber, C., & Cranton, P. (2000). Exploring the scholarship of teaching. *The Journal of Higher Education*, 71(4), 476–495. doi:10.2307/2649149

Kroski, E. (2013). A librarian's guide to Makerspaces: 16 resources. *Open Education Database*. Retrieved from http://oedb.org/ilibrarian/a-librarians-guide-to-Makerspaces/

Kuckartz, U. (2014). *Qualitative text analysis: A guide to methods, practice and using software*. Sage.

LaRossa, R. (2005). Grounded theory methods and qualitative family research. *Journal of marriage and Family*, *67*(4), 837-857.

Lave, J., & Wenger, E. (1991). *Situated Learning: Legitimate Peripheral Participation*. Cambridge: Cambridge University Press.

Lowenthal, P. R. (2009). The Evolution and Influence of Social Presence Theory on Online Learning. *Social Computing: Concepts, Methodologies, Tools, and Applications: Concepts, Methodologies, Tools, and Applications*, 113.

Maker Education Initiative. Retrieved from: http://makered.org/

Malone, S. (2014). Characteristics of adult learners. Training & Development, 41(6), 10. http://search.informit.com.au/documentSummary;dn=827295107033026;res=IELBUS ISSN: 1839-8561.

Martinez, S. L., & Stager, G. (2013). *Invent to learn: Making, tinkering, and engineering in the classroom.* Torrance, CA: Constructing Modern Knowledge Press.

McLoughlin, C. and Luca, J. (2000). Cognitive engagement and higher order thinking through computer conferencing: We know why but do we know how? In A. Herrmann and M.M. Kulski (Eds), *Flexible Futures in Tertiary Teaching.* Proceedings of the 9th Annual Teaching Learning Forum, 2-4 February 2000. Perth: Curtin University of Technology.

McLuhan, M. (1964). *The medium is the message*. Hardwired, San Francisco.

Means, B., Toyama, Y., Murphy, R., Bakia, M., & Jones, K. (2009). Evaluation of Evidence-Based Practices in Online Learning: A Meta-Analysis and Review of Online Learning Studies. US Department of Education.

Michlewski, K. (2008). Uncovering design attitude: Inside the culture of designers. *Organization Studies*, 29(3), 373-392.

Mishra, P., & Koehler, M. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. The Teachers College Record, 108(6), 1017-1054.

Ormerod, T. C. (2005). Planning and ill-defined problems. *The cognitive psychology of planning*, *1*, 53-70.

Papert, S. (1980). *Mindstorms: Children, computers, and powerful ideas*. New York: Basic Books.

Papert, S. (1991). Situating Construction. In I. Harel, & S. Papert (Eds.), *Constructionism* (pp.1-12). Norwood, NJ: Ablex Publishing.

Pea, R. D. (2004). The social and technological dimensions of scaffolding and related theoretical concepts for learning, education, and human activity. *The journal of the learning sciences*, *13*(3), 423-451.

Pfister, Rachel C. (2014). *Hats for House Elves: Connected Learning and Civic Engagement in Hogwarts at Ravelry*. Irvine, CA: Digital Media and Learning Research Hub

Rallis, S. F., & Rossman, G. B. (2012). *Research Journey: Introduction to Inquiry*. Guilford Press.

Resnick, M. (2007, June). All I really need to know (about creative thinking) I learned (by studying how children learn) in kindergarten. In Proceedings of the 6th ACM SIGCHI conference on Creativity & cognition (pp. 1-6). ACM.

Richards, L., & Morse, J. M. (2012). *Readme first for a user's guide to qualitative methods*. Sage.

Richardson, M. D., & Lemoine, P. A. (January 01, 2015). Micro-Credentials, Nano Degrees, and Digital Badges: New Credentials for Global Higher Education. International Journal of Technology and Educational Marketing (ijtem), 5, 1, 36-49.

Ritchhart, R. (2015). *Creating Cultures of Thinking: The 8 forces we must master to truly transform our schools*. John Wiley & Sons.

Rogers, E. M. (2003). *Diffusion of innovations*. New York: Free Press.

Rushkoff, D. (2010). *Program or be Programmed*. Or Books.

Schneider, R. M., Krajcik, J., Marx, R. W., & Soloway, E. (2002). Performance of students in project-based science classrooms on a national measure of science achievement. *Journal of Research in Science Teaching*, 39(5), 410-422.

Schon, D. (1983). *The reflective practitioner*. New York: Basic Books.

Schwartz, P., Webb, G., & Mennin, S. (2001). *Problem-based learning: Case studies, experience and practice*. Psychology Press.

Shulman, L. S., & Hutchings, P. (2004). *The wisdom of practice: Essays on teaching, learning, and learning to teach* (pp. 219-248). S. M. Wilson (Ed.). San Francisco: Jossey-Bass.

Shulman, L.S. (1987). Knowing and teaching: Foundations of the new reform. *Harvard Educational Review*, 57(1), 1-32.

Slepkov, H. (2008). Teacher professional growth in an authentic learning environment. *Journal of research on technology in education*, 41(1), 85-111.

Song, M., & Yuan, R. (2015). Beyond Social Presence: Increasing Cognitive Presence through Meaningful Interaction. In *Global Learn* (Vol. 2015, No. 1, pp. 731-736).

Stager, G. S. (1995). In Australia: Laptop Schools Lead the Way in Professional Development. *Educational Leadership*, *53*, 78-78.

Teague, B. J. (1965). Characteristics of donors and non-donors to higher education among members of Churches of Christ in the United States (Doctoral Dissertation) Retrieved from ProQuest Dissertations and Theses. (Ascension Order No. 6512686).

The Library as Incubator Project (2013). "American Library Association Conference 2013 Wrap-up." Retrieved from: http://www.libraryasincubatorproject.org/

Thompson, A. D., & Mishra, P. (2007). Breaking news: TPCK becomes TPACK!. Journal of Computing in Teacher Education, 24(2), 38.

Vygotsky, L. (1978*). Mind in society: the development of higher psychological processes*. Cambridge, Harvard University Press.

Vygotsky, L. S. (1986). *Thought and language* (A. Kozulin, trans.).

Wenger-Trayner, E., Fenton-O'Creevy, M., Hutchinson, S., Kubiak, C., & Wenger-Trayner, B. (Eds.). (2014). *Learning in Landscapes of Practice: Boundaries, identity, and knowledgeability in practice-based learning*. Routledge.

Wilson, S. M., & Berne, J. (1999). Teacher learning and the acquisition of professional knowledge: An examination of research on contemporary professional development. *Review of research in education*, 173-209.

Yoon, K. S., Duncan, T., Lee, S. W. Y., Scarloss, B., & Shapley, K. L. (2007). Reviewing the Evidence on How Teacher Professional Development Affects Student Achievement. Issues & Answers. REL 2007-No. 033. *Regional Educational Laboratory Southwest*

Youngs, P. (2002). National Commission on Teaching and America's Future. *New York, NY*.

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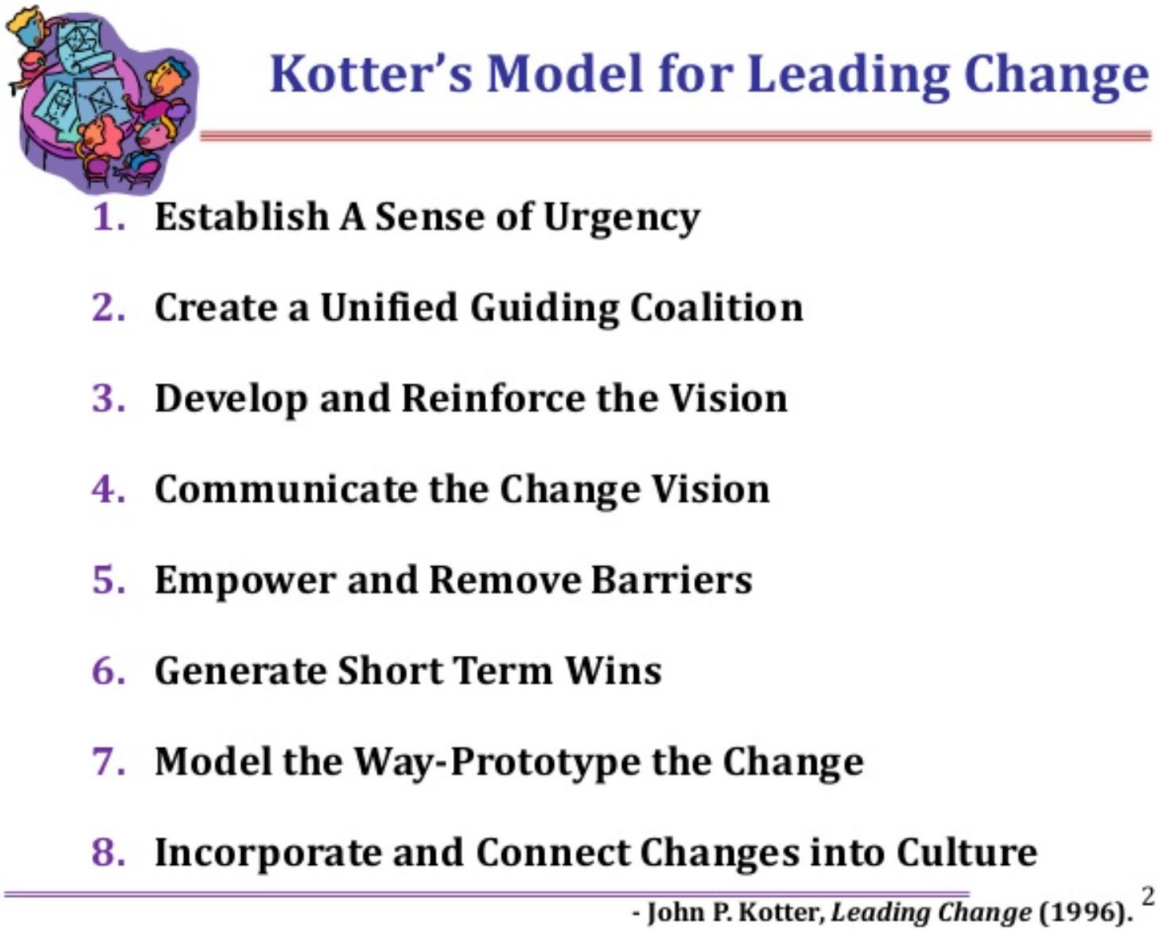
Appendix A-Kotter's Steps for Leading Change



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Appendix B- Landscape Post Example

Thinking About Connections

This week we are addressing the topic of whether the rich variety of Makerspace resources makes people think differently about constructing products. We agree unanimously that the University Makerspace is a treasure chest of resources, tools, machines, helpers, whiteboards, media, articles...well, just tons of possibilities!!

Several key concepts reappear with commonality among your posts, even though we do not all teach at the same campus. Resources matter. How we reflect on them matters too. Rebecca writes, "Reading the chapters in a textbook has its place in providing a general overview of a subject. But while creating products in the Makerspace I think I learn so much more by asking questions.

Order of operation is a key component of mathematics instruction…and, it appears to also play a role in new concept integration too. Might your reactions to the ordering of activity first, defining terms second also be reactions of your students too? Students gain from seeing connections to the content you are teaching and connections among their own collected insights. Kyle addressed this potential issue in his reply post and it is important to consider that in our classrooms, both online and face-to-face, we may have students who prefer "big picture" first and some who prefer "investigation first." And there are probably several variants in between!

Lisa offers, "When teaching students something new, I think you need to teach them to think about context – when, where, and why an event is taking place – and activate their prior knowledge as well. I know that will help me as I sew my CosPlay costume."

Prior knowledge is the superhighway to the "Ah-Ha" moment because they help us construct our own meaning. Andrea explains, "These Maker Guild activities also open up a lot of 'teachable moments' which we obviously cannot put into lesson plans."

Talking with others about learning something new necessitates a kind of active "meaning making" that practically guarantees more engagement and retention. Joyce extends on this idea, "It leads the observer to create their own conclusions and connections instead of just reading about the subject in a textbook and absorbing what someone else thinks."

Let's go a little bit deeper and reflect on Rebecca's question: "But, how do we plan a timeline for an activity that is "messy, uneven, time consuming and thrilling"?

Looking forward to learning from your responses!

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Appendix C- MCGO MakeCamp Welcome and Day 1-3 Schedule

Appendix C- Welcome and Resources

Welcome to **MCGO MakeCamp! #MCGO**

This camp will provide face-to-face, hands-on and virtually supported professional development that is immediately relevant to teachers in the:

•Integration of Making into the curriculum

•Improvement of instructional practice; and Authentic Learning experiences

•Improved student achievement in the standards-led curriculum

The primary goal of MCGO-MakeCamp is to help educators learn by making about learning by making. The MakeCamp provides resources, pedagogical theories, instructional strategies, and practices that will build skills and competencies. Ultimately, the MCGO-MakeCamp will help educators use resources in Makerspaces and other learning technologies more effectively in an effort to transform their instruction and student learning.

To enhance and support this experience educators will be using an online learning resource. This site includes session presentations, templates and online resources. We hope you enjoy this learning experience.

Here's the schedule for the next three days:

Appendix C Day 1 Schedule
Maker Community Guild Option Summer MakeCamp #MCGO

Presentation Topics	Activities/Notes	Documents/Resources
Entrance Activity	Take a Tour of the Makerspace	• Writeboard • Google Doc
Camp Opening	Meet Fellow Educators (Campers) ---------- Meet the Mentors/Moderators	• NA
Camp Format	Introduction to the MCGO format, activities, project and resources. **MakeCamp Theme:** **Collect/Design/Build/Troubleshoot**	• QR-Code to Edublog Portal
Skype Chat	What is Making? with Dr. Leah Buechley	• Skype Projection
Let's Make!	• Plan your Maker activity/project. OR • Make a mini-project together: LED Bookmark • Working with Mentors and Moderators	• Design Journal • *Sew Electric* book by Leah Buechley

Online Collaborative Models	• Review similar online Maker projects • and/or Explore resources embedded in Edublog Portal (Optional) • or Continue Making!!	• Maker Project Hotlist
Lunch	• Collegial Convos (Optional): *Describe a time when you learned something new.*	• Catered in the Maker Hall
Let's Make!	• Plan your Maker activity/project. • Finish mini-project together • Working with Mentors and Moderators	• Design Journal
Exit Card Survey Formative	• Name one thing you learned today that will be used in the future. (front of card) • Name one thing you would like to learn tomorrow. (back of card)	• Index cards

Day 2 Schedule

Maker Community Guild Option Summer MakeCamp #MCGO

Presentation Topics	Activities/Notes	Documents/Resources
Camp Housekeeping	Updates and exit card responses	
Continuing Your Maker Project	**MakeCamp Theme: Collect/Design/Build/Troubleshoot** • Continue Projects!!! • Work with Mentors and Moderators • and/or Explore resources	• Action Goals Google Doc
Skype Break	What are some trends in Maker education: Wearables ---------- Skype with Dr. Yasmin Kafai	• Skype Projection
Collegial Activity	• Continue Projects!!	• Design Journal
Lunch	Lunch-- Collegial Convos (Optional): Recommend three maker learning activities that infuse technology to a colleague.	• Student Union
Continuing Your Maker Project	• Continue Projects • Work with Mentors and Moderators • and/or Explore resources	• Activity • Explore resources embedded in Edublog Portal

Skype Break	What are some trends in Maker education: After-school Maker Club ---------- Skype with Vicki Kim, Makerspace Clubs	• Skype Projection
Collegial Activity	• Continue Projects!! • Name something you learned today and something you want to learn tomorrow	• Design Journal

Day 3 Schedule
Maker Community Guild Option-- MakeCamp #MCGO

Presentation Topics	Activities/Notes	Documents/Resources
Camp Housekeeping	Updates and exit card responses	• Whiteboard
Trending	"How can my Maker experience influence my instruction in the upcoming semester?" Conversation with educators at the Singapore American School (SAS)	
Continuing Your Maker Project	• Continue to develop your Maker activity/project. • Prototype and Test	• Action Plan Template
Skype Chat	• Next Steps in Making: Dr. Gary Stager	• Skype Projection
Sharing Your Project: Maker Gallery Walk for Your Projects	• Caption your Maker activity/project. • Share your project(s): Maker-Faire! • Leave Kudos for colleagues.	• Participant's Maker projects • Post-its • Digital Photos
Q&A/Work Evaluation	TPACK Evaluation	TPACK Evaluation
Kudos And Badge Graduation!!!		

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Appendix D- Formative Assessment Debriefing Conversation Question Bank

Formative Debriefing Conversations Question Bank

1. So…today…
2. What have you learned here? What sticks with you?
3. What's working for you in the Makerspace? What's not working?
4. Reflect on your thinking, learning, and work today. What worked and what didn't?
5. Did you encounter frustration today? How did you handle it?
6. What about your thinking, learning, or Making today brought you the most satisfaction? Why?
7. Who else might benefit most from what you've learned along the way? How can you share this with them?
8. What are your next steps or first steps tomorrow?
9. What made you curious today?
10. What can I do tomorrow to help you more?

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Appendix E: TPACK Assessment, Koh, et al. (2014). "A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK)." Asia-Pacific Journal of Teacher Education: 1-14.

Table 1. Descriptive statistics, factor loadings, and communality for the survey items.

Items	Mean	SD	Factor loading	Communality
Technological pedagogical content knowledge (TPACK, M = 4.64, SD = 1.25)				
TPACK1 – I can formulate in-depth discussion topics about the content knowledge and facilitate students' online collaboration with appropriate tools (e.g. Google Sites, CoveritLive).	4.52	1.36	0.88	0.77
TPACK2 – I can craft real-world problems about the content knowledge and represent them through computers to engage my students.	4.61	1.38	0.87	0.76
TPACK3 – I can structure activities to help students to construct different representations of the content knowledge using appropriate ICT tools (e.g. Webspiration, Mindmaps, Wiki).	4.46	1.41	0.95	0.90
TPACK4 – I can create self-directed learning activities for the content knowledge with appropriate ICT tools (e.g. Blog, Webquest).	4.57	1.36	0.92	0.85
TPACK5 – I can design inquiry activities to guide students to make sense of the content knowledge with appropriate ICT tools (e.g. simulations, web-based materials).	4.42	1.43	0.90	0.81
TPACK6 – I can design lessons that appropriately integrate content, technology and pedagogy for student-centred learning.	Removed from analysis			
Lesson design practices (LDP, M = 5.08, SD = 1.08)				
LDP1 – When designing an ICT lesson, I start by playing with a few lesson ideas.	5.05	1.23	0.89	0.79
LDP2 – When designing an ICT lesson, I consider several lesson ideas to see if they adequately address students' learning problems before choosing one idea.	5.11	1.24	0.91	0.83
LDP3 – When designing an ICT lesson, I allow conflicting lesson ideas to coexist until I feel that I have adequately understood the learning problems.	4.79	1.26	0.87	0.76
LDP4 – When designing an ICT lesson, I continually refine my lesson ideas as I develop new understandings throughout the design process.	5.12	1.26	0.94	0.88
LDP5 – When designing an ICT lesson, I consider the consequences of adopting particular lesson ideas before working out its details.	5.09	1.20	0.93	0.86
LDP6 – When designing an ICT lesson, I am prepared to completely change my lesson ideas if needed.	5.00	1.36	0.75	0.56
Design dispositions (DD, M = 5.29, SD = 0.94)				
DD1 – I am comfortable with the presence of uncertainty.	Removed from analysis			
DD2 – I am open to new experiences.	Removed from analysis			
DD3 – I am comfortable to explore conflicting ideas.	5.38	0.98	0.90	0.81
DD4 – I am comfortable to deviate from established practices.	5.35	1.06	0.85	0.72
DD5 – I am comfortable with occasional failures from trying out new approaches for ICT lessons.	5.16	1.09	0.80	0.64
DD6 – I am constantly seeking to turn constraints into opportunities.	5.26	1.12	0.85	0.73

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Appendix F- Modified MakeCamp Summative Assessment

Summative MCGO-MakeCamp Survey- Google Doc to be emailed to educators

Here we are, at the end of our **MCGO-MakeCamp!!** We have learned a lot about the joys of making and reconnecting with our Inner Maker!
Please take a few minutes to reflect on your experience by rating your answers on a scale of 1-4 with a "4" corresponding to "Strongly Agree" through "1" corresponding to "Strongly Disagree." Your comments will help in the planning for next year's educators.

Technological Pedagogical Content Knowledge and Design Decisions Survey

1. TPACK1- I can formulate in-depth discussion topics about the content knowledge and facilitate students' online collaboration with appropriate tools
2. TPACK2-I can craft real-world problems about the content knowledge and represent them through computer to engage my students
3. TPACK3- I can structure activities to help students to construct different representations of the content knowledge using appropriate tools
4. TPACK4- I can create self-directed learning activities for the content knowledge
5. TPACK5- I can design inquire activities to guide student to make sense of the content knowledge with appropriate tools
6. TPACK6- I can design lessons that appropriately integrate content technology and pedagogy for student-centered learning
7. DD1- I am comfortable with the presence of uncertainty
8. DD2- I am comfortable to explore conflicting ideas
9. DD3 -I am comfortable to deviate from established practices
10. DD5- I am comfortable with occasional failures from trying out new lesson approaches
11. DD6-I am constantly seeking to turn constraints into opportunities

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Modified from Koh, et al. (2014). "A survey to examine teachers' perceptions of design dispositions, lesson design practices, and their relationships with technological pedagogical content knowledge (TPACK)." Asia-Pacific Journal of Teacher Education: 1-14.

Appendix G -Pepperdine EDLT Cadre 19 List of Courses

Fall 2013

EDLT 724	Personal Leadership, Ethics, and Social Justice	Farzin Madjidi, Ed.D
EDLT 725	New Media Literacy	Paul Sparks, Ph.D.
EDLT 750	Introduction to Social Science Research	Kay Davis, Ed.D.

Spring 2014

EDLT 770A	Cognition, Learning, and Technology	Judith Kledzik, Ph.D.
EDLT 751	Quantitative Research Methods	Kay Davis, Ed.D.
EDLT 721	Policy Development	Paul Sparks, Ph.D.

Summer 2014

EDLT 728	Games, Simulations, and Virtual Worlds of Learning	Mark Chen, Ph.D.
EDLT 770B	Social Learning Theory and Technology	Judith Kledzik, Ph.D.

Fall 2014

EDLT 735	Inferential Statistics	Larry Oslund, Ed.D.
EDLT 740	Applied Seminar in Learning Technologies	Linda Newlen, Ph.D.
EDLT 762	Innovation and Change	Sarah Haavind, Ph.D.

Spring 2015

EDLT 721	Knowledge Creation and Collaboration	Sarah Haavind, Ph.D.
EDLT 752	Qualitative Methods and Analysis	Kay Davis, Ed.D.
EDLT 760	Global Perspectives on Learning and Technology	Paul Sparks, Ph.D.

Summer 2015

EDLT 726	Emerging Technologies	John McManus, Ph.D.
EDLT 780	Imagining Futures (Capstone)	Linda Polin, Ph.D.

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