Making It Meaningful:

The Reciprocal Relationship Between Technology and Psychology

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Abstract

This article describes the design and implementation of the year 2 curriculum and student learning experiences in the Michigan State University Master of Arts in Educational Technology program. We discuss the ways that this second set of courses builds on the first year of the program that students encounter, and also describe the theoretical impetus and design-based implications for learning how to teach with technology in effective and creative ways. Students in this group usually come in with some prior knowledge of educational theory, as well as some experience of working with classroom technologies. We intentionally build upon this prior knowledge, to take it to the next level of a more sophisticated TPACK-oriented understanding of learning in technology-driven contexts. Our year 2 courses move classical educational psychology theories of learning, along with educational research issues, squarely into the modern context of educational technology and teacher leadership. Our curriculum design focuses centrally on making meaningful experiences for teachers around technology, and helping them develop the knowledge and skills to create such experiences for their students. Our goal is to develop teachers who see themselves as flexible designers of learning experiences through the creative re-purposing of existing technologies.

***Keywords*:** Technology, Design, Learning Theories, Development, Repurposing

What do teachers need to know? This essential question permeates all aspects of teacher education. In an educational technology Master's program, the answer appears obvious—they need to know how to use technology. However, research on teacher knowledge and technology integration has consistently shown that this may be too simplistic an answer (Mishra and Koehler, 2006; 2008). Technology integration is about much more than learning to use the newest and coolest software, tools and applications. It is about using technology to achieve a range of goals: improving student motivation; understanding the prior knowledge (including misconceptions) of subject matter they bring to the learning context; constructing engaging activities that advance their cognitive development and knowledge; developing and implementing assessments that measure this change and growth. Salomon and Almog (1998) described, what they called the "reciprocal relations" between technology and educational psychology:

> Technologies and prevailing psychological conceptions of learning, thinking, and instruction have always served and inspired each other in reciprocal ways. On the one hand, technologies in education have served to facilitate and realize the kinds of pedagogies that emanated from the changing zeitgeists and from prevailing psychological conceptions. On the other

> hand, and possibly only recently, technologies have been imported into education, challenging it and requiring novel psychological explanations and pedagogical justifications (p. 222).

In other words, Salomon and Almog argue for a transactional, dialogic relationship between the psychology of learning and the affordances and constraints of technologies, where each helps define the other. Thus the pedagogical meaning of a technology emerges not just from the tool (and its properties) but rather its deep integration into the matrix of subject matter, learners, and classroom environments. As Bruce (1997) says, "A technology is a system of people, texts, artifacts, activities, ideology, and cultural meanings."

This understanding of technology; its reciprocal relationship with psychology and its being embedded in a broader context of use; undergirds the second set of courses in the Master's program in Educational Technology. These courses build on the previous year's courses (see Hagerman et. al. in this spotlight issue for details) to move students (who are for the most part practicing teachers) to learn and apply technology for successful student learning. It is imperative that teachers are able to critically examine how technology interacts with content and learning goals in order to further develop and enrich their TPACK (Mishra & Koehler, 2006). We attempt to enact a deliberately designed learning experience that combines educational theory and research with creative and generative technology assignments, within the pragmatic demands faced by today's teachers.

The fact that our students have already gone through the foundational courses means that we have a basic structure that we can build on. Thus, these students, as experienced teachers, have already received grounding in different digital technologies and the role it can play in the classroom (i.e. the TPACK framework). In this next set of courses, the focus is on *meaning making*, through immersing them in readings, activities and assignments that emphasize the transformational aspects of technology use. This is done not by emphasizing the tools but rather by emphasizing how technology can inform and change how we think about learning, development, and research. Technology in these courses is rarely the central focus of what we do—though, at another level, it is integral to everything that we do. Our goal is to have teachers become flexible thinkers, wherein they see themselves as designers of student learning-experiences, through the creative re-purposing of digital technologies to meet specific classroom needs.

Inspiration for our approach comes from two theoretical sources. The first is Dewey's (1934) idea of a transformative experience (Wong, Pugh, & The Deweyan Ideas Group, 2001), i.e. an experience that emphasizes a unity and a forward movement of ideas, through anticipation and drama (Dewey, 1934). Though our program is made up of individual courses we seek to develop a sense of interwoven coherence and unity of vision. This occurs at multiple levels, through multiple instructors (both faculty and graduate students) and over multiple modes of delivery (face-to-face, online, and hybrid) and occurs through providing student-participants multiple opportunities for experimentation and play (Koehler, Mishra, Bouck, DeSchryver, Kereluik, Shin, & Wolf, 2011).

The second key idea that inspires these courses has to do with Donald Schon's (1983) idea of reflective practice coupled with Perkin's (1986) conceptualization of knowledge as design. The idea that knowledge is design implies that all knowledge is intimately connected to action and contexts of work and practice. Thus, we seek to guide teachers to become creative designers of technology and curriculum in their professional lives.

The Context

The second year curriculum of the Masters of Arts in Educational Technology consists of three independent yet interconnected courses that emphasize the core concepts of educational psychology (such as theories of learning, motivation and development) and ground them within the context of educational technology. This year 2 curriculum is taught in a variety of formats: face-to-face, online, hybrid, and overseas. These choices allow students to construct the Master's experience that is most meaningful and relevant to their educational needs and goals. The three main ways these courses are delivered are as follows:

a) The longest running version of these courses takes place on the campus of Michigan State University in East Lansing, MI. This hybrid summer program has students and instructors meet on campus all-day (9 AM to 4 PM) everyday for two weeks in summer (10 consecutive days, excluding weekends). Most students in this cohort come from within Michigan though there have been students from other parts of the country and internationally. This two-week face-to-face session is

followed by four weeks online with a mandatory meeting on the last day of the term where students present their work.

b) A second version of these courses is offered overseas (Rouen, France; Dublin, Ireland are recent locations). This group meets in summer for 4 consecutive weeks on a daily basis, Monday through Thursday from 8AM to 4 PM and a half-day on Friday from 9 AM to 12PM. Students here are often teachers in international schools across the globe..

c) Finally, students also can complete all these courses online. In this format the courses are taken independent of each other over regular semesters (fall and spring, though some courses may be offered in summer). This is in contrast to the other two versions where students complete all three courses in an integrated manner.

Program faculty and staff have put a significant level of effort into standardizing the key assignments, readings, and experiences between the online, hybrid, and overseas cohorts. Thus, the students receive the same core content, with some contextual variation depending upon the mode of delivery. For instance, being overseas affords us opportunities to connect with organizations and individuals we could not have ever gotten a chance to meet and interact with. For instance, students in the overseas cohort organize site visits to local schools and work with local teachers—something that would be difficult to achieve even with today's networking technologies. The online courses on the other hand allow students the flexibility of learning at their own pace, even while working full time in their classrooms.

Constructing Meaningful Learning Experiences

Our view of meaningful learning has multiple components that work together towards achieving our overarching goals. These include:

a) *Integrating educational psychology with technology*: We seek to develop a deeper understanding of educational psychology ideas through instantiating them in creative technology-design activities. Technology tools also become contexts to test and understand theories of learning, and aspects of educational research.

b) *Emphasizing playing and repurposing*: We seek to provide contexts for participants to explore, play and repurpose a wide range of digital and non-digital technologies for pedagogical purposes

c) *Developing a community*: We seek to facilitate a professional community among our students that extends beyond their being in the program. We do this in the face-to-face versions through formal and informal means and in the hybrid/online versions through the use of social media.

d) *Emphasis on authentic activity*: We seek to provide students authentic contexts for applying their learning and to develop professionally

What is innovative in our approach is that we do not seek to do achieve these goals through activities that are the independent of each other—instead we seek activities and learning scenarios that tackle more than one of these goals at a time. At one level, these assignments are about developing students' technical skills by having them play with and explore different kinds of technology. Another level of each experience ties in to the psychological underpinnings of learning theory and knowledge of cognitive and social development. Students are pushed to think beyond the operation of technology, utilizing learning theory and educational research to consider how technology can facilitate and support learning. The final level is a synthesis of the previous levels, which supports and develops educators' practical and pragmatic knowledge of technology integration (Mishra, Koehler, Zellner, & Kereluik, 2012). We provide specific examples of how these ideas occur in practice as follows.

Integrating Educational Psychology with Technology

While many of our students have some basic prior knowledge of educational theories such as behaviorism, cognitivism, and so forth, most have not considered their theoretical and pragmatic implications for educational technology. Our goal is for students to better understand how the educational psychology underpinnings that guide these learning theories are relevant across varied technology-driven contexts. We provide a couple of examples below.

Games and the Learning Theorist

To bring behaviorist theory into the realm of educational technology, students have to prepare a media presentation on how the ideas of behaviorism are embedded in educational games. Students select and study different educational games and focus on identifying specific behaviorist ideas such as classical and operant conditioning, positive and negative reinforcement and punishment, shaping or extinguishing behaviors and so on. Learning these principles, in conjunction with their experience within the game develops into an engaging, creative, and technology-rich media presentation that investigates how behaviorism illustrated in the game, and it's effectiveness for learning the given subject matter. In this way, students take theory, connect it with technological tools, and incorporate the learning context relevant to their practice.

Understanding Understanding, the Video Project

The "Understanding understanding" project requires students to create a two-minute video about misconceptions (in learning of any subject matter). The video must be dynamic and tell a story about learning and misconceptions in understanding an idea. Essentially, this is a mini-quali-

tative research project, which requires students to identify a problem, develop an interview protocol, collect and analyze the data (by interviewing members of the public) and then presenting it as a video. Technically, they grapple with issues of storyboarding, framing, shooting and editing of digital video. More important is the subtle manner in which educational psychology concepts (such as misconceptions in learning, schema theory, Piaget's ideas of assimilation and accommodation, and cognitive change) are woven into the activity itself.

Emphasizing playing and repurposing

We believe that for teachers to deeply understand the concepts and skills that underpin successful technology integration they must be able to think critically about their use of technology as a process that is dynamic, fluid and continually evolving. Most technology is not designed solely or specifically for educational purposes, so it's important that teachers be able to engage in technological exploration, understand the possibilities, and also see themselves as creative designers and re-purposers of technology (Kereluik, Mishra & Koehler, 2010; Mishra & Koehler, 2009). Thereby, we often have them engage in assignments intended to further these goals. A few examples are provided below.

Mapping Cognitive Concepts

For this assignment, students work in groups to develop a concept map that illustrates aspects of cognitive psychology. The trick here is that each group uses different concept map software. Students work collaboratively to explore the software, learn how to use it for their context/content, and then teach the tool to the other groups in a formal presentation, which includes an organized concept map of cognitive psychology ideologies. Students must organize their understanding of cognitive psychology and apply it to concept mapping. For example, students might choose to explain how concept mapping relates to organization of information in cognitive psychology, and the connection between building schemas and building a concept map. So they learn about how to use specific software, but also share in experiences about other concept mapping tools available.

The Repurposing 2.0 Assignment

The Repurposing 2.0 project requires student groups to choose a specific genre from a large online archive of Web 2.0 tools. These could include video editing tools, organization tools, and so on. Each group in the class selects a genre and each student in the group selects on Web 2.0 tool from within the genre, to focus on. Students explore and play with the software and then have to write a review, on a class wiki, about the tool and the ways it can be repurposed for classroom use. This way the entire class learns about five or six genres of tools (depending on the number of groups in the class) AND in each genre they learn about at least 4-6 specific tools. Thus by the end of the assignment, each student in the course has access to a web resource they have developed that discusses approximately 25 (or more) different tools and ways they can be used in specific contexts.

Developing a Community

Once they have finished our program, and are in their own individual classrooms and contexts, most teachers do not have an immediate network of resources and support to draw on for working with technology. However, the supportive community of learners built over the course of our Master's program, is something they can always draw on. This community provides an ongoing resource centered on learning and technology for our students.

We do our best to have our students connect to each other via twitter (using the hashtag #MAETY2), along with a dedicated and popular Facebook group. We encourage connections with the East Lansing and Online cohorts with the use of the #MAET hashtag. This engagement was especially fruitful for the summer of 2012 as we made many connections to the ICT/EdTech community in Dublin via the #edchatie hashtag. Students were able to discuss differences in our educational systems, compare challenges and successes and build their global learning networks in an authentic context. Finally, we have anecdotally observed a high level of continued engagement and discussion on Facebook, around "problems of practice", long after the students have completed the course (see the last example below).

Emphasis on Authentic Activity

Beyond the lessons and projects students engage with in their coursework, and the learning community that follows them after the program ends, we aim to craft experiences that are valuable for students in their professional lives. We provide a few examples here.

Running a Professional Conference

One project unique to the overseas cohort is the planning and implementation of a half-day educational technology professional development conference. In addition to balancing other assignments, the students must both plan and implement a learning experience for other educational professionals on topics of leadership, technology, and education. The conference is free and open to the public, and is often attended by educators from the local area. This past summer, we had over 40 educators from around Ireland participate in the conference. In end-of-semester evaluations, overseas students say that this is one of their most meaningful and "real world" experiences that they take back to their schools to utilize as future leaders. The students plan every detail from the conference website, to marketing and promotion, facilities management, in addition to the actual conference sessions. While the process can be demanding and

challenging, students have described it as being an extremely rewarding learning experience.

The DreamIT in the Real World Proposal

The DreamIT project is a culmination of the three-course experience, which asks students to identify a pervasive and authentic problem of practice, and propose a solution that leverages technology to address the problem. Additionally, students share this project through their personal websites and write a formal proposal for the problem/solution. They must reflect on the entirety of the courses to identify an educational problem and develop an informed plan of action. It is a fitting final activity for the greater course experience, as students must fully integrate their newly robust knowledge of pedagogy, content and technology into their specific context, to solve real-issues and effect change in their own students.

Does all this Work?

The relative success of these courses can be seen in different ways. For instance, end-of-semester evaluations indicate that students enjoy the classes and the various design activities. More importantly, students in our programs have often contacted us (via our Facebook groups or other social media) about how they have implemented their DreamIT projects in their classrooms and how these classes have changed their approach towards technology and teaching. Apart from these anecdotal examples we have also, over the past few years, attempted to systematically study whether engagement in these courses actually helps them develop TPACK. Specifically we have used the survey of teachers' knowledge of teaching and technology (Koehler, Shin, & Mishra, 2011; Schmidt, Baran, Thompson, Koehler, Mishra, & Shin 2009). The survey contains 47 self-report items that measured students' self-assessments regarding teaching and technology. Participants rate the extent to which they agreed or disagreed with statements about their perception of the relationships between technology and teaching on a five-point Likert scale. We have collected data from the on-campus cohort for the past four years, having students complete the survey twice, once before the courses shart and the other after the courses are done. Analysis shows that students reported significant gains in their TPACK through participation in the seminar. They perceived that they had become more knowledgeable about technology, the use of technology for subject matter learning, technology implementation in their teaching, and multi-faceted interactions of content, pedagogy, and technology knowledge compared to when they first started the course. (Details of the study are in Shin, et. al., in press.)

Conclusion

In conclusion, we would like to include an example of how these three tenets of meaningful learning exist in our second year courses. As our session ends, we assign a reading by Terry Paulson (2007)—"Feeling the Tug? Managing the Tensions that Pull Leaders in Different Directions"—which discusses the multiple approaches and ideologies that administrators need to address and balance in their schools. Throughout the course we discuss the theory of leadership, but in this activity, we also instantiate that idea in an activity that repurposes a digital camera and photograph editing software (such as Photoshop). The activity asks the class to discuss possible tensions which leaders in schools face. Each group considers the foundational pieces we have discussed, along with issues of technology integration and leadership. We develop a whole class list of these issues/tensions, which inevitably contains items such as, top-down management versus bottom up, static versus change, and traditional versus innovative. Each group chooses one of the tensions they feel is most problematic, and represents that tension visually using photographs. These are not just any photographs, but rather are digital pastiches, which include multiple images of the same person. For instance to show individual vs. social, one student created an image of themselves sitting in a corner, while four more of themselves sat talking to each other in the foreground. Not only is this an engaging and meaningful activity for the students to experience, this culminating activity incorporates our three principles of meaningful learning.

Recently, one of our graduates sent us a message on Facebook to let us know that they had repurposed this very assignment for their high-school geometry course. In a unit on isometry, she asked her students to develop photographic representations of the ideas of translation, rotation and reflection. Her students created digital images, which included multiple versions of their own selves rotated, reflected or otherwise transformed. This is an excellent example of the kind of flexibility and creativity we want to inculcate in our graduates, a way of thinking and looking at the world, they carry with them even after they have graduated from the program.

It is these types of powerful connections to the ideas in the course that allow teachers to think deeply about the foundations of educational psychology and the technological tools available. As they begin to understand how these issues intersect, they can also see them not as static, but rather as flexible mechanisms to be leveraged for creating experiences that promote meaningful learning. Back in 1998, Salomon and Almog suggested that, "Educational psychology and technology are now engaged in an intensive duet that, if seriously studied, explored, and evaluated, may offer novel and improved instruction" (p. 222). Our hope is that through engagement with this set of courses our teacher-participants view themselves as being part of this creative emergent landscape of teaching and learning (Mishra, Koehler, & Kereluik, 2009).

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