The Effect of Design-based Activities on the Selection of Educational Technology in Lesson Planning

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Abstract

This paper explores the impact that design-based activities have on the selection of technology during the lesson planning process. In a course covering the topic of Universal Design for Learning (UDL) participants were asked to redesign and transform a lesson by applying UDL principles. Since UDL principles can be applied through the effective use of technology, participants were also required to learn about how technology might be applied to their lessons. The structure of the course was modeled after a Learning Technology through Design course offered by Michigan State University and used the Technological Pedagogical Content Knowledge approach (TPACK) as an analytic framework. Without being taught specific technology, participants in the course were expected to learn about how technology and education interact and how technology can be applied to effectively enhance a lesson. Most participants were practicing K-12 teachers, but there were also a doctoral student and a Department of Education training coordinator attending. The resulting lesson plans were evaluated for effective technology integration and the effective application of UDL principles. Based on analysis of participant’s final lesson plans, it was evident that most had thoughtfully applied the model of technology integration and effectively incorporated technology into their lessons, even those participants who self identified as being relatively technically illiterate.

Keywords: Learning Technology through Design, Universal Design for Learning, TPACK
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The availability of digital technology in many different forms has dramatically shifted the field of education. There is now significant focus on the area of instructional planning and design surrounding the use of technology in education. Mishra and Koehler (2003) argue that when technology is used in the classroom, there is a tendency to put too much focus on the technology itself. They suggest that this problem can be addressed by thinking about the application of technology through the lens of a concept called Technological Pedagogical Content Knowledge (TPACK). TPACK is described as “the complex roles of, and interplay among, three main components of learning environments: content, pedagogy, and technology” (Mishra & Koehler, 2006, p 1017)

To test, analyze and measure the effectiveness of applying the TPACK framework to educator’s professional development, a course covering Universal Design for Learning, or UDL, was designed and implemented. The topic of UDL is a natural fit for the TPACK framework since it is so technology centric. UDL is often referred to, perhaps simplistically, as curb cuts for education. Based on brain research, UDL recognizes three identifiable brain networks (the recognition, the strategic and the affective networks) that are actively involved in the learning process (Rose & Strangman, 2007). UDL principles seek to actively engage the three networks to facilitate more effective learning. The act of engaging all three brain networks can frequently be accomplished by the appropriate use of technology, particularly as it relates to the recognition network (i.e.: technology as a tool to provide multiple means of representation).

UDL involves the use of three basic principles during curriculum design (Rose & Meyer, 2002). UDL principles include:
• Multiple means of representation, to give learners various ways of acquiring information and knowledge,
• Multiple means of action and expression, to provide learners alternatives for demonstrating what they know,
• Multiple means of engagement, to tap into learners' interests, offer appropriate challenges, and increase motivation.

Briefly, CAST (a nonprofit research and development organization that works to expand learning opportunities for all individuals, especially those with disabilities, through UDL) advocates that lessons be designed from the outset with these principles in mind. The theory behind UDL posits that if lessons are designed with these principles in mind, the number of barriers present in the curriculum will be reduced or eliminated and that all students will benefit from the resulting enhanced lessons. Often curricula are fixed and inflexible, which can present a number of learning barriers to students with different learning styles or students with disabilities.

Methods

The University of Delaware catalog described the UDL course as follows: “This course will help you apply the principles of Universal Design for Learning (UDL) to your lessons in order to effectively reach the broadest range of students possible. UDL principles, which emphasize the use of multiple means of representation, expression and engagement, will help you transform your lessons and will help all your students become more effective and more engaged learners. By employing UDL principles you will help minimize the need to "retrofit" lessons to accommodate different learning styles and abilities. Participants will learn to transform assessments and instruction using tools and strategies that make curricular access for all students a reality. In a supportive environment you will have the opportunity to explore many tools and techniques that can help you create dynamic and engaging learning environments for all of your students.”
Each class participant was challenged to redesign and transform a lesson they had previously taught by applying UDL principles during the design phase of lesson planning. Each participant was expected to analyze and redesign their selected lesson from scratch and employ UDL principles. Many different types of technology were used during the UDL course delivery, but technology instruction was not part of classroom instruction unless specifically requested by participants in support of their use of a particular technology in their lesson plan implementation. This presented several challenges since some of the participants were not very well informed on the wide array of technology available.

Modeled UDL principles in course design, development and delivery

During the design phase of the UDL course, UDL principles were applied in order to model the methodology. Examples of how the course was designed were used, as appropriate, during classroom discussions. To engage the recognition network and offer optional means of accessing the course content, the primary textbook used was available in a number of formats. The textbook, *Teaching Every Student in the Digital Age*, (Rose & Meyer, 2002), could be purchased as a soft cover text through the university bookstore, was available in audio form through the class space on Sakai and was also available in its entirety on the web with built-in scaffolding and supports. To engage the strategic network, participants were able to select the curricular design methodology that best supported their individual goals. In support of the affective network, participants were encouraged to self select the ways and means to incorporate technology into their lessons. In an effort to keep the engagement level high, there was a concerted effort to make the classes student centric. The content for several class sessions was directed by the participants’ instructional needs. That is to say, they requested instruction on areas of technology which supported their lesson plan development.
**Sakai as a support and delivery mechanism**

In order to encourage participants to share knowledge and provide a collaborative learning environment during this course, Sakai was used as the learning management tool to augment lesson delivery. It provided support for the delivery of this course and encouraged the development of a community of learners, where participants shared their knowledge to enhance the learning experience. Ironically, this was particularly useful for participants who did not feel comfortable with technology. Participants were provided the opportunity to seek additional information and support outside of the regular class meetings. There were also opportunities for participants to go beyond what was covered in class. Due to the vast array of technology currently available, it is virtually impossible to cover all the technology that can potentially be used for educational purposes. The online Sakai forum provided an environment for participants to share knowledge and tools that they have found useful in their own teaching practice.

The class was a hybrid form comprised of face-to-face class sessions and an online component provided through Sakai. Lock (2006) points out a number of advantages to online professional development. Among them are the claims that online environments facilitate modeling and visualization, increase the access to information, allow for a more flexible delivery model, allow teachers to escape from the insular work environment of the traditional classroom, and can potentially reach a greater number of teachers. Lieberman and Mace (2008) also observe that teachers tend to work in very isolated work environments that preclude them from drawing on the strengths and experience of other teachers. The community aspect of Sakai helped to connect the participants in ways that were not possible in a traditional instructor led course.

Lieberman and Mace also observe that traditional workshops ignore “the needs of the students, the experience of the teacher, and the myriad possibilities for engaging students in
learning” (Lieberman & Mace, 2008, p 227). The online materials and sharing environment provided by Sakai gave each participant the ability to share their knowledge and learn from others who participated in the online forum. Students did share their knowledge and helped each other out through the forum, wiki and blog portions of Sakai.

Results

Participants selected technology which supported their specific instructional goals

The wide range of technology used to support each participant’s redesigned lesson provided evidence that the TPACK framework worked when applied. When the participant’s final projects were evaluated, it was clear that each incorporated a wide range of technology to support the learning objectives of their lesson. Even those participants who self identified as “techno-phobic” found and incorporated a variety of technology that supported UDL and resulted in more effective lessons. Some examples of technology used include cell phone GPS tracking software used for data collection in a college level Civil Engineering lesson, to custom stick figure animation tools used to graphically illustrate vocabulary words for an elementary school lesson. Several participants created a range of multimedia into their lessons, including video, pictures and graphics. One created a wiki to support his health education classes.

Since there was such a diverse range of technology used, it presented a number of challenges from an instructional perspective. In past UDL courses, some of the instructional focus was related to specific technology and involved technology centric instructional methods. Because each participant used technology that supported their particular content area and pedagogical style, we spent very little time in class on technology specific instruction. This presented challenges since unfamiliar technology was selected by some participants. In these cases, the participants were encouraged and challenged to individually find resources to help
master the technology without formal classroom instruction. As Mishra and Koehler indicate, participants learned about managing their learning in situations that were complex and sometimes frustrating (Mishra & Koehler, 2003).

Any technology specific classroom instruction was provided only after a poll of the class was taken to identify topics which interested participants the most. The participants were free to select from a menu of possible choices but were also free to request something À la carte. The results were surprising. Most participants were anxious to learn more about Microsoft Word, and the educational supports that are present in the software, but also were interested in free tools which provide text-to-speech output as a writing support tool. Several indicated that they would be interested in learning about web design tools (including Adobe Dreamweaver). Several were interested in learning about Microsoft OneNote (a software program) running on a tablet computer.

At the end of the course, even those participants who self described as uncomfortable with technology indicated that they felt as though they had learned to become comfortable incorporating technology into their lessons. After the second class meeting, one participant expressed her discomfort with the expectation that she would need to find, learn and incorporate technology into her lesson plan. She considered dropping the class because she felt as though she was not skilled enough to adopt tools that would be useful for lesson design and development. In the end, she was one of the participants who found several tools not even mentioned in class, found tutorials on how to create content that supported the learning objectives of her lessons on her own and used the technology in the lesson. While she needed some encouragement and support, she did most of the heavy lifting of learning outside of class meetings, and, at course end, was thrilled with her efforts and her resulting lesson.
Engagement level high

In spite of the condensed class schedule, participant engagement, as evidenced by the amount of time that participants stayed past official class time, and how much time they spent sharing information, was very high. Participants were active on the Sakai forum and some used the chat feature to communicate their questions and share knowledge. Once each participant started working on their own lesson plan transformation, many questions were posed that required additional time to cover. Participants were supportive of each other, whether it was related to their own class work or Sakai. Several participants made appointments to ask for specific technology related help, and traveled on their own personal time to meet.

In addition to the high level of commitment during the course, three of the participants continued to work and seek help after the last day of class. One participant sought help with video editing software which she used to create supportive multimedia for a training seminar she developed. Another sought assistance with a wiki resource he developed (and was using in the classroom) to supplant the instructional materials available in his school, which he described as hopelessly out of date. The third sought help with a number of challenges she had with a variety of software used in her lesson, including presentation and word processing software. She was the participant who considered dropping the class and needed more support than most during the class.

Challenges

Classroom teachers in Delaware do not often participate in lesson development at an early stage. Some teachers are provided very detailed, comprehensive lesson plan packages and do not have any experience with lesson design. As experienced in an earlier UDL course, this presented a number of challenges. In a previous iteration of the UDL course, we spent an entire
class session covering Understanding by Design (UBD) principles in order to give participants some background knowledge of the instructional design process. Due to the complexities of UBD and the minimal instructional time spent on the concepts, this led to significant confusion. It was important to adapt the approach in order to reduce the level of confusion. For this course, participants were encouraged to use the design methodology employed by their school or workplace. They were also given the option of using a template inspired by CAST (CAST UDL Toolkits, 2009), and modified to include terminology familiar to Delaware teachers. Several participants were working in schools that are using the Learning Focused model and were anxious to learn more about the approach and how UDL might fit into that model. This revised approach significantly reduced the confusion caused by spending insufficient instructional time covering UBD. The template also provided the scaffolding and support that was needed by several inexperienced participants.

As is common in professional development activities developed for educators, there was a wide range of technical ability and skills among the participants. One participant had previous experience in designing courses with Sakai, and several had never used a learning management system of any kind. This presented challenges and required additional instructional support for those who were using a learning management system for the first time. All of the participants who were familiar with Sakai were more than willing to help those who had no experience, which contributed to an atmosphere of cooperation and collaboration.

Discussion

As reported by Mishra and Koehler (2003), most of the participants in this course learned that technologies have affordances and constraints. Each individual explored technologies that
best suited their particular instructional needs. One participant who had identified instructional materials as being the area that required the most focus in his lesson transformation decided to create a wiki to supplant the current textbook. He reached his decision after exploring a number of different options, none of which were covered in class meetings. Another student created a substantial number of training videos and needed to learn the tools and skills necessary to record video clips, transfer the video files to a computer and edit the video content into a form that met her instructional goals. Another used a wide variety of technology to enhance her lesson, including GPS cell phone tracking software for data collection, arranging for online collaboration with a university in Melbourne, Australia, graphic organizers to present complex information and clickers for classroom sessions in order to increase the engagement level. None of the technology mentioned above was covered in the class meetings. Students were encouraged to analyze their own technological needs in terms of how to meet their own instructional goals. Most of the participants needed some level of support in selecting the appropriate technology, primarily due to lack of exposure to the many options available. Once they became familiar with a form of technology that might suit their goals, they explored numerous resources which provided information which helped them evaluate the choices. Once a decision was made they learned the skills necessary to incorporate the technology into their lesson, either on their own or with minimal support. All the participants mentioned above selected technology after carefully considering all three key sources of knowledge (technology, pedagogy and content knowledge).

Out of the five participants, one did not appear to understand the idea that the consideration of technology should not be made separate from the other two components in the TPACK model and that it should support learning objectives. This participant attempted to incorporate every example of technology used in the delivery of the UDL course into their
lesson, regardless of whether it supported the pedagogy or content involved in the lesson. This may have been due to the way that they had previously learned about educational technology (i.e.: learning about the technology, not how it can be effectively applied in pedagogically sound ways). There may have also been some extraneous personal issues which also caused distress and affected their ability to fully participate.

The format of this course certainly presented several challenges. One of the biggest was the time constraint. It was condensed into a five week session which didn’t provide adequate time between classes for some necessary learning to take place. Participants would probably have benefited if allowed more time between class meetings, which would have given them more time to establish and participate in a Sakai based learning community. The format also required that the instructors be more flexible and able to produce and/or change content on the fly. The experience would probably have been more effective if offered in a traditional semester.

Conclusion

The ways that the participants in this class approached the lesson design process was complex. But the analysis they performed as part of redesigning their lessons really helped them understand how educational technology could be applied to make the lesson more effective. It was clear that each of them brought their own technological, content and pedagogical knowledge into class. Each was able to use that knowledge to change their approach to lesson planning and was able to find, select and use educational technology successfully.

One additional observation: several participants identified themselves as being uncomfortable using technology. However, when provided with adequate support, they were able
to learn to use technology on their own. This seems to be a fairly universal experience and further study into what technical support systems might benefit teachers today may prove useful.
References


