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Open Educational Resources (OERs) for TPACK Development

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Abstract: We have developed customizable, modularized, TPACK-based online short courses that are designed to help elementary and secondary preservice teachers learn to plan technologically enhanced, curriculum-based lessons, projects, and units. We offer these multimedia materials to teacher educators internationally as open educational resources (OERs) via an attribution/share-alike Creative Commons license (<http://creativecommons.org/licenses/by-sa/4.0/>) at <http://activitytypes.wm.edu/shortcourse/>. In our SITE 2016 presentation and in this paper, we introduce, explain, demonstrate, and discuss these TPACK-based OERs, and our aims in developing, using, and making them available to others. We hope that our efforts will catalyze more widespread sharing and adaptation of TPACK learning materials among teacher educators.

Preparing novice teachers to use digital technologies effectively in teaching is no small undertaking. The publication of the TPCK and TPACK frameworks (Angeli & Valanides, 2005; Mishra & Koehler, 2006; Niess, 2005) focused and increased efforts to assist novice teachers in building their knowledge for *curriculum-based* approaches to technology integration. In the decade-or-so since the frameworks appeared, educational technology researchers have contributed an impressive amount—more than 600 refereed publications—of TPCK/TPACK-based theoretical and empirical scholarship that provides guidance to teacher educators who are working with novice teachers (<http://www.matt-koehler.com/tpack/tpack-newsletters/>).

Over time, researchers have explored a range of approaches that assist preservice teachers' TPACK development. Many teacher education programs require a separate educational technology course (e.g., Bai, 2007; Leeman, 2013), while others have worked to integrate technology integration concepts and skills throughout curriculum-oriented and methods-based coursework, including fieldwork (e.g., Brupbacher & Wilson, 2009; Dexter, Doering & Riedel, 2006). Many approaches focus upon instructors modeling and explaining effective technology integration practices (e.g., Mrazek & Meadows, 2006; Niess, 2005). Novice teachers also engage in collaborative design work with more experienced teachers (e.g., Adams, 2005; Brown & Warschauer, 2006), participate in online courses (e.g., Bannister, Ross & Schellhas, 2009), and typically approach their professional learning with active, sustained reflection and inquiry about their teaching (e.g., Cavin, 2008; Pierson, 2008). The nature and efficacy of these approaches (and more) have been documented in research about preservice teachers' TPACK development.

Materials for TPACK Development

While there is voluminous literature describing ways in which teacher educators have helped to build and evaluate preservice teachers' TPCK/TPACK, we have seen dramatically less published work regarding the development and vetting of specific *materials* that assist preservice teachers' TPACK development. Several examples have appeared, however. Figg designed and tested a 10-week gamified online learning module (<http://www.handy4class.com/h4c2011/tpack-teacher-quest-2015/>). Zeitz and his students created and shared a "wikibook" that addressed TPACK enacted in multiple curriculum areas (https://en.wikibooks.org/wiki/TPACKing_for_a_Wonderful_Educational_Trip). Doering and colleagues built TPACK development into Geothentic (<https://lt.umn.edu/geothentic/>), an immersive online learning environment for students and teachers that is focused on educational use of geospatial technologies. Angeli and colleagues created and tested e-TPCK, which is a self-paced, adaptive series of curriculum- and

classroom-based design scenarios that are presented to teacher-learners within a virtual environment. Users' responses to a sequence of personalized prompts about specific, contextualized possibilities for classroom-based instructional designs guide the program's selection of scaffolding for preservice teachers' learning within the system (Angeli, Valanides, Mavroudi, Christodoulou, & Georgiou, 2014). We worked with colleagues at six other universities to build taxonomies of curriculum-keyed learning activity types for teachers to use in instructional planning (Harris, et al., 2010), which are described below. Most other TPACK-related learning materials for preservice teachers, however, seem to have been developed and used within closed learning management systems such as Blackboard, based upon their descriptions in published TPACK literature. Offering more of these materials (e.g., assignment parameters, self-instructional modules, sample lesson plans) as open educational resources could assist teacher educators' efforts internationally in important ways.

Using Learning Activity Types in Teacher Preparation

We have used OER curriculum-keyed taxonomies of learning activity types (Harris & Hofer, 2009; Harris, et al., 2010) for seven years in our teacher preparation program to help students develop their TPACK through the process of instructional planning (Hofer & Harris, 2010). We help preservice teachers to use the taxonomies (<http://activitytypes.wm.edu>) in a heavily scaffolded lesson planning process that begins with the selection, analysis, and modification of existing lesson plans that demonstrate different educational uses of digital tools and resources. Building on this experience, the students then plan their own lessons by identifying curriculum-based learning goals and considering multiple instructional and social contexts within which learning takes place. They then select and sequence content-specific types of learning activities (including assessments). The process concludes with the students choosing technologies and resources to incorporate that are appropriate to the specific curriculum-based learning activity types selected.

During the last three years, we have gradually shifted from this primarily synchronous, in-class-with-homework learning experience to a more blended method of learning to plan technologically enriched instruction. The experience is now fully online and asynchronous. The increased flexibility of an asynchronous approach has permitted us to include many more "hard scaffolds" or "static supports" that assist students' thinking and exploration during their online learning (Brush & Saye, 2002, p. 2). These supports are necessary because preservice teachers typically have not had in-depth experience with instructional planning and teaching, especially incorporating technologies in pedagogically sound and curriculum-focused ways (Hofer & Harris, 2010). Using the asynchronous planning modules also affords students increased opportunities for consultation with peers and mentors, and extended time to grapple with multiple and complex aspects of the planning process. This longer, more in-depth learning experience has increased the quality of student work, as measured by the TPACK-based Technology Integration Assessment Instrument (Harris, Grandgenett & Hofer, 2010; Hofer & Grandgenett, 2010). Additionally, as we shift away from reliance upon the required educational technology course in our programs to help preservice teachers develop their TPACK to a more programmatically integrated approach, we predict that a series of online modules will be embedded more easily into content-based teaching methods courses. We suspect that this could be true for other teacher education programs as well.

Short Course Structure and Content

The asynchronous, online "short courses" for preservice teachers that we have created are divided into eight brief, sequential modules that mirror, but expand upon, our original in-class approach to helping preservice teachers to build their TPACK while learning to design technologically enriched instruction (Hofer & Harris, 2010). Each module begins with an overview and learning goal for the segment, and is presented as video-based content that includes narrated slides, interviews with practicing teachers, imagery, and additional online resources. Each of the videos ranges from 2-8 minutes in length, and includes verbatim closed captioning. In addition to the video segments, the modules also offer editable student learning guides that scaffold each step of the learning, and regular prompts for in-class or online discussion

with colleagues and mentors. The modules can be used as a supplement to face-to-face courses or as a completely online learning experience that might span two-three weeks. We have created different versions of the short course for elementary and secondary preservice teachers so that we could customize the examples included to maximize relevance for the learners.

In both versions of the short course, students are asked first to think about examples of digital tools and resources that they have seen used in curriculum-based teaching and learning, reflecting upon what seemed to work well, what didn't, and why. They then select three lessons of interest from a curated collection of lesson plans in multiple curriculum areas written by other preservice teachers. They analyze these three sample lessons, noting the stated or implied learning goals/objectives and curriculum standards addressed, the types of learning activities incorporated, how students' learning is assessed (formally and/or informally), and the digital and nondigital technologies incorporated. Putting those three analyzed lessons aside temporarily, the teachers then practice substituting different learning activities for ones within a single demonstration lesson plan that don't match stated learning goals well. The learners then consider substituting technologies for the ones named within the demo lesson plan, discussing their reasoning for these changes with their classmates and instructor. They also review portions of interviews with an experienced teacher who explains the reasoning behind similar types of instructional decisions in her professional work.

The students then choose a learning activity types (LATs) taxonomy in the curriculum area in which the three sample lessons they selected earlier in the course are situated. They explore the taxonomy and its subcategories. Then the novice teachers consider substitution options for the learning activities and technologies systematically within each of the lesson plans, making decisions based upon the stated learning goals/objectives/standards for the lessons and the contextual realities of the schools and classrooms in which their fieldwork occurs. The students are encouraged to discuss their ideas for substitutions with their classmates and instructor via online discussion areas and with their mentors in their fieldwork placements, if possible.

Finally, the learners begin to create their own lesson plan, first by selecting learning goals/objectives/standards that are relevant to the curriculums in their fieldwork placements, then by considering multiple contextual considerations within the classroom, school, neighborhood, and region within which they are doing fieldwork. They choose multiple possible learning activities to comprise the lesson, then systematically eliminate LATs until those that "fit" the learning goals and contextual characteristics best remain. They sequence the remaining LATs to form the new lesson's structure and sequence, then choose appropriate digital and nondigital technologies to incorporate within it, drawing upon the suggested technologies noted in the LAT taxonomy for each of the learning activities selected.

The students then subject their resulting lesson plan to two self-tests that we call "Is It Worth It?" One of these tests helps the novice teacher to ascertain whether the particular uses of digital and nondigital technologies included in the lesson plan that they created are the best choices. The second of these self-tests asks the learner to step back and consider whether the lesson is feasible, matched well to students' needs, and includes the best possible combination and sequence of learning activities, given the learning goals identified. At each step of this scaffolded lesson design and self-assessment process, specific lesson plan examples are provided and explained with embedded questions and prompts for reflection. The intent is for preservice teachers to build experiential understanding about how instructional decisions should be made: that is, with students' learning needs and preferences as the focus, and with curriculum standards, contextual realities, and technological possibilities in lesson designers' near peripheries.

Share-Alike: Customizing these OERs

As we designed and developed these fully online short courses to introduce our students to the LAT approach to lesson design with appropriate use of educational technologies, we did so intending to offer the video-based modules and supporting materials to the larger teacher education community as Open Educational Resources (OERs). In so doing, we worked to anticipate the needs of a wide range of

preservice teachers with varied experience in teaching, working in differing contexts and cultures, as much as possible. (This proved to be considerably more time-consuming, but also even more interesting, than the depth and breadth of the work that we were expecting.) We consciously erred on the side of the materials being perhaps too prescriptive and detailed for more experienced and/or advanced learners, since we suspected that it would be easier for other users to remove some of the content than to have to create additional supports.

We acknowledge, however, that despite our efforts to create content and structure in the short courses that could be used productively in many different teacher education programs, providing options for other teacher educators to customize, amend, and append the modules and supporting materials offers the most flexibility for using these materials with preservice teachers. This is why we have released the courses in a modularized (easier-to-modify) format, along with an invitation to mix, remix, and otherwise customize the materials according to the needs of different groups of teacher-learners and the instructional preferences of their professors. The Creative Commons BY-SA license under which these short courses were released stipulates only that the original authors (and later contributors) are attributed in all succeeding derivatives of the work, and that those derivatives are released under the same BY-SA license (<http://creativecommons.org/licenses/by-sa/4.0/>).

We hope to encourage customization of the short courses also by offering the materials in multiple versions. For teacher educators who would like to try the course “as is,” we have developed the content as a series of modules within the BlackBoard learning management system and have exported it as a content package file which can be imported into a variety of other systems. With either no changes or minor edits, the short courses in their current forms can be used within existing educational technology and teaching methods courses.

For educators who would prefer to modify the content, format, sequencing, and/or some of the assignments in the short courses, all of the materials are also available on the LATs Web site for download and customization (<http://activitytypes.wm.edu/shortcourse/>). The video segments are provided in .mp4 format to permit easy cross-platform use. They can be edited and/or remixed using virtually any video editing software. Additionally, word-processed transcripts of the audio portions for each video are provided to assist with re-recording segments, if desired. All of the student documents, the uses of which are prompted and scaffolded within the videos, are provided as .doc files for easy modification.

Invitation to Contribute

We hope that our teacher educator colleagues from around the world will be inspired to use and/or customize the materials that comprise these TPACK-based short courses to meet the unique needs of their preservice teacher students. To provide further benefit to all who would like to use these OERs, we encourage faculty who customize these materials to send the revised modules to us (using the email addresses displayed above) so that we can share multiple versions of the short courses via the LATs Web site (<http://activitytypes.wm.edu/shortcourse/>). It is in this spirit of open access, remixing and distributed collaboration that we can work together to expand and refine our approaches to helping novice teachers build their TPACK.

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