TPCK : A Revision of the Technology Course for Teachers

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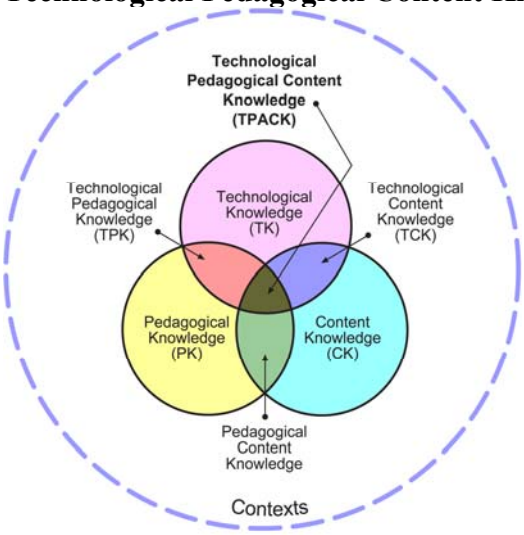
The University of Indianapolis is a private Methodist-affiliated liberal arts university located on the south side of Indianapolis. Its teacher education program has had a course originally titled "Microcomputer Applications in Education" renamed several years ago as "Technology in Education I." The course number is EDUC 220. It has served as the foundation course in educational technology for nearly 20 years. Freshman and sophomore teacher candidates in elementary and secondary education take this course, and it may be the only technology class they take prior to licensing. It has been carefully aligned with all ISTE and NCATE technology standards. It has also satisfied the liberal arts core requirement for these candidates.

During the spring of 2008 the chair of the Department of Teacher Education began discussions regarding redesigning the technology curriculum. Publication in 2008 of the Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators edited by the AACTE Committee on Innovation and Technology began to have an impact on the way universities and others viewed preparation of teaching candidates to apply technology in their teaching. The pioneering work of researchers Matthew J. Koehler and Punya Mishra, describing the power of TPCK, was being disseminated through the profession through publications and conference presentations. It was time, thought our chair, to study this body of research and apply it to our curriculum.
For the fall semester of 2008 Professor George Weimer, one of the instructors of this course, was granted three credit hours of released time to examine current trends and future needs for the courses offered for educational technology integration. He proposed to present several options to the Department of Teacher Education as it considered staffing needs for the future.

Summary of content from AACTE Committee on Innovation and Technology, (2008). Technological Pedagogical Content Knowledge for Educators. New York, NY: Routledge:



(Source: http://tpack.org/)

The diagram above shows intersections of content knowledge, pedagogical knowledge, and technological knowledge. It is helpful to understand the intersections of Pedagogical Content Knowledge, Technological Pedagogical Knowledge, and Technological Content Knowledge. But, the central issue is where all three basic areas intersect: Technological Pedagogical Content Knowledge. For teacher education institutions, it is assumed that content area methods instructors possess content knowledge. In order to be qualified to teach the content methods course within the teacher education curriculum, it must also be assumed that the instructor possesses pedagogical content knowledge (the intersection labeled Pedagogical Content Knowledge) or the ability to teach the content to candidates. The additional ability to apply technology properly to the teaching of the content area results in the combination of the three areas (TPCK) and may require that the institution rethink how content area instructors are prepared and how they prepare to teach.

Authors describe Technological Pedagogical Content Knowledge (TPCK) as representing a "wicked problem" (p. 10). They write, "Solutions to wicked problems are often difficult to realize (and maybe even recognize) because of complex interdependencies among a large number of contextually bound variables." (p. 10). The book goes into detail describing the nature of the problem.

"Implicit in the acknowledgment of the wickedness of the technology integration problem is the suggestion that teacher education programs have tended to over-simplify how technology integration is addressed…. The classic example of this over-simplification was the separation of educational technology as a field of study for preservice and in-service teachers. Examples of these phenomena include single courses on technology applications for preservice teachers…." (p. 292)

The authors caution that "Ignoring the complexity inherent in each knowledge component, or the complexity of the relationships among these components, can lead to oversimplified solutions or

failure." (p. 18) And they warn "Viewing any of these components in isolation from the others represents a real disservice to good teaching. (p. 18)

Our present university computer lab (18 student stations with iMac computers and Windows XP virtualization software) and other nearby resources allowed for the following experiences through software exploration and integration: Macintosh and Windows operating systems, Microsoft Office, Inspiration, iMovie, iDVD, PhotoShop, Audacity, Garage Band, most Web-based experiences, Tux Paint, KidPix, Photo Booth, and an interactive SmartBoard. The course historically has integrated use of blogs, wikis, and podcasts and introduced the concept of Project-Based Learning through use of Edutopia movies (http://www.edutopia.org) and project-based assignments.

We believed that what we offered in the EDUC 220 course met the NETS-Teacher and NCATE standards for technology use and that it introduced the NETS-Student standards adequately. But, we believe revision of the course, and the overall plan for integrating technology into the teacher education curriculum is necessary.

Note the following paragraph from the NCATE book: "*it seems obvious that the skills and knowledge teachers require will not be realized anymore by just taking the one 'technology course' offered by many institutions. In such a course candidates typically learn how to use technologies, but the pedagogical knowledge and content knowledge required for subject area application are often ignored. Currently, there seems to be agreement that the content taught in most technology courses should be strengthened and extended throughout the teacher preparation program by other faculty who model technology for instructional and administrative tasks…. In practice this is extremely difficult to accomplish unless the appropriate support structures for teacher education faculty are in place."* (p. 78)

The book discusses the problematic nature of effective engagement in TPCK and suggests developing a disposition to remain open and engage in experimentation when using technology tools. (p. 153)

One author of the NCATE book in the chapter on teaching science cautions, "Knowledge of technologies for teaching a particular topic, such as that described for weather, could be taught in teacher education programs or professional development, but two problems with trying to teach such specific content are (a) it may prove to be useless to some or all of the candidates when they become teachers and find that they do not have access to the technologies required or that the class they are teaching does not include the topic they learned about; and (b) it is impossible to 'cover' the terrain of science to teach either TPCK or PCK across the domain. Even with a PCK class to accompany every science class a prospective teacher takes in college (an impractical if not absurd idea) it would not be possible to anticipate the contexts in which students would teach." (p. 203)

The author continues, "What can be done then to help teachers develop TPCK? In teacher education programs, the content courses must themselves include uses of technology integral to the subject matter." (p. 204)

Another of the authors suggests "Researchers have explored various models for integrating technology into teacher preparation programs and have concluded the importance of inclusion in all courses and experiences in the programs." (p. 226)

Still another writer makes a distinction between teachers who use truly transformative software tools and those teachers who choose to use tools like presentation software, student-friendly Internet, and management tools. (p. 252) The author writes, "curricular transformation happens only in those few content areas (e.g. music, literacy, and art) that are largely defined by the media they use." (p. 253)

The final chapter of the book gives considerable insight to the challenge faced by teacher educators who are serious about TPCK: "Even though some technologies may indeed facilitate student learning, content and pedagogy are crucial ingredients in this success. And if the pedagogical content knowledge required for each discipline differs, it follows that the ways in which technology might best be used for each discipline may also differ." (p. 273)

So it was generally agreed by those involved in discussions of the future of technology integration in the teacher education curriculum that technology issues would be discussed and applied in some or all of the content area methods classes. But how do we do that?

Constraints:

While the unit has achieved quality in pedagogical content knowledge (all of our instructors are experts in their content areas and in pedagogical practice) the technological competencies of existing faculty are developing. The may be motivated to teach technology in their courses, but they may require support and instruction from someone who is more advanced in use, and educational application, of the technologies in that content area. We wondered whether there could be sufficient time available in the teaching day/week/year for content area instructors to integrate forward-looking technologies in an appropriate manner into their content area classes.

We have presently no mechanism for checking the extent or completeness of technology integration in field placements, prior to or during student teaching.

Recommendations:

Three broad suggestions seemed obvious:

1. Keep the present plan with some refinement (probably not desirable).

2. Teach a basic though smaller technology application course to first year candidates and integrate full TPCK into a selected number of content area methods courses during the remaining three years, including the student teaching semester (more desirable, but will content area methods instructors have the necessary skills to integrate technology adequately?).

3. Modify option two to have a technology person teach the smaller technology application course for first year candidates and collaborate with other content area instructors to develop and carry out technology-rich learning activities that are project-based. This is my recommendation (perhaps the best solution).

The essential modeling of TPCK in recommendation three seems the most likely to succeed. One difficulty of EDUC220 has been the fact that candidates taking the class in their first year will not actually be certified teachers until four years later! Recommendation three addresses this concern.

Suggested syllabus for a newer, leaner EDUC220 (2 credit hr?):

- Logging in to use campus network resources
- Blackboard basics
- TK 20 basics (TK20 is a data collection and portfolio building tool adopted by the Teacher Education Department in 2008)
- Blogging and wiki basics (and other Web 2.0 applications)
- Introduction to ISTE NETS (National Educational Technology Standards) standards for teachers and students (could be integrated into MS Word or PowerPoint assignments)
- MS Word project (possibly a newsletter on a topic related to technology in schools)
- MS Word and Excel mail merge tutorial
- MS PowerPoint short tutorial and interactive project-based learning project
- MS Excel tutorial and project (grade book and short project-based database)
- Inspiration tutorial and short project-based learning assignment
- Kid Pix and Tux Paint tutorials
- WebQuest tutorial resulting in a short project-based lesson
- Introduction to scanning, image adjusting, and video editing

The intent is to provide a common background of experiences that every content area methods instructor would assume students would have coming into their class.

What would be eliminated from the present EDUC220 syllabus (3 credit hr)?
Current emphasis on Project-Based Learning
Two PowerPoint assignments (Family Tree and PowerPoint quiz)
Longer WebQuest lesson assignment
Current integration of blog and wiki into assignments/projects
Close examination of content-area specific Web resources for teachers and students

These and other technology integration issues would be moved or integrated into content area courses. We suggested that content area methods courses explore the following possible technologies for learning:

- Digital photography with or without PowerPoint
- Digital movies using iMovie or MovieMaker
- Blogs, wikis, and social bookmarking integrated into learning activities
- Student produced podcasts using Garage Band or Audacity
- Project-based WebQuests for any content area or level
- Projects using Kid Pix or Tux Paint graphics (could be integrated into PowerPoint or Word)
- Inspiration concept mapping and brainstorming for project-based learning
- Spreadsheets to create and use databases, budgets, and gradebooks within projects
- Spreadsheets for teaching math concepts
- Project-Based Learning assignments where groups of students work to solve an authentic problem in the content area
- Content area-specific Web resources for teachers/student

- Assistive-adaptive devices for special learners as appropriate for the content
- Special technologies such as those used in science or kinesiology to bring data about the physical world into computers for further study

Next steps:

Following submission of the released time report, the Teacher Education Department Chair charged a committee, chaired by the Director of Graduate Programs in Teacher Education, with the responsibility of working out details for an action plan for the future. The chair invited three technology support staff from a local K-12 school district to serve as ad hoc members of the committee to provide a wider perspective. That was a brilliant decision!

Among the charges to the committee from the chair were:

1. Identify the essential technological knowledge, skills, and dispositions that graduates need to positively influence student learning.

2. Design a plan that provides graduates with identified essential knowledge, skills, and dispositions. Included in the plan (should be) a timeline for implementation, list of "essentials" (personnel, hardware/software), and course/module/performance descriptors.

Factors to consider:

1. Technology plan may or may not conform to the traditional 16-week semester with a single instructor.

2. Candidates come to the program with various skill levels. How do we honor these differences?

3. Content areas require specialized technology skills. How do we provide these? What partnerships (e.g. K-12) might help us provide specialization?

4. If we believe that all teachers are teachers of technology, what are the professional development implications for faculty?

5. Think of current roadblocks to greater use of technology. Are there ways to use existing resources in new ways?

6. How do we get started? Include a timeline for implementation?

7. Technology is constantly changing. How is this addressed in the program?

At the time of this writing, the technology committee has been actively engaged for approximately five months addressing these issues. Discussions will continue, and during the month of May 2009 the committee will present a report to the teacher education faculty with their recommendations. It appears likely that content area methods course descriptions will be rewritten during the 2009-2010 school year and be gradually implemented thereafter. The ASCUE presentation will have more information about discussions and discussions occurring after this writing.

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