Differentiating TPACK Development: Using Learning Activity Types with Inservice and Preservice Teachers

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Abstract: As teacher educators have begun to recognize and acknowledge the complexity of teacher knowledge for technology integration, currently conceptualized as technological pedagogical content knowledge (TPACK), researchers are exploring multiple ways to help inservice and preservice teachers develop this highly situated, interdependent professional knowledge. In this article we overview the Learning Activity Types (LAT) approach to TPACK-building that we have developed and are testing, documenting how we utilize the approach in differentiated ways for preservice and inservice teachers.

Introduction

Integrating technology into classroom teaching and learning is complex—perhaps more so than many educational technology proponents have realized. When Koehler & Mishra (2005) introduced the Technological Pedagogical Content Knowledge (TPACK) framework, this complexity was both revealed and explained. According to the TPACK framework, for teachers to effectively integrate technology in their teaching, they must synthesize their knowledge of curriculum content, teaching strategies and the affordances and constraints of technological tools and resources. Layered behind and underneath these three intersecting domains of knowledge is the context of the classroom, including social, political, and cultural factors, plus student learning styles and preferences, among many other considerations. When the requisite knowledge for technology integration is conceptualized in this way, it is no wonder that educational technologies have not always delivered the revolution that many advocates predicted.

The introduction and dissemination of the TPACK framework has spawned a flurry of research and development work related to teacher knowledge for technology integration, resulting in more than seventy presentations and publications in 2008 and 2009 alone (Koehler & Mishra, 2009), including the publication of the *Handbook of Technological Pedagogical Content Knowledge for Educators* (2008). While multiple studies attempt to understand how teachers develop their TPACK, some researchers are documenting approaches that help teacher educators to scaffold the development of TPACK for both inservice and preservice teachers. Some approach TPACK development in a learning-by-design approach (e.g., Figg & Jaipal, 2009; Koehler & Mishra, 2005; Koehler, Mishra & Yahya, 2007). Others focus on content-based instructional modeling and application (Niess, 2005). A project-based approach to developing TPACK within the context of the educational technology course is implemented in a variety of ways (e.g., Brupbacher & Wilson, 2009; Wetzel, Foulger & Williams, 2009). Other approaches utilize microteaching, inquiry and self-reflection (e.g., Cavin, 2008; Pierson, 2008). These approaches focus primarily on helping preservice teachers develop their TPACK through specific course-based experiences and assignments.

In this paper, we offer an overview of the Learning Activity Types approach to helping teachers develop and operationalize their TPACK. Rather than focusing primarily on course assignments and experiences, this approach attempts to scaffold the instructional planning process so that it supports technology integration. We first discuss the basics of the approach, then explain in some detail how this approach may be differentiated for inservice and preservice teachers for use in professional development and university course settings.

Developing TPACK via Learning Activity Types

Many professional development efforts related to technology integration—including educational technology courses in many teacher education programs—focus primarily on the affordances and constraints of particular technological tools and resources. While these learning opportunities often challenge preservice and inservice teachers to consider how particular tools and resources may best be leveraged in particular content areas and learning environments, the primary focus remains on the technology, rather than on students' curriculum-based learning needs. Though this approach is incomplete when considering the interdependent domains of knowledge in the TPACK framework, it is understandable that it is used, given the heterogeneous nature (e.g. grade level and content area focus, years of teaching experience, pedagogical approach, comfort with using digital technologies) of participants in most courses and professional development experiences. How, then, can we assist teachers in developing their TPACK in diverse settings beyond considering the affordances and constraints of particular technologies? What is needed, in our opinion, is a way to help teachers plan for technology integration based primarily upon their students' curriculum-based learning needs that is grounded in the TPACK framework, our emerging understanding of how teachers plan for instruction, and the contextual constraints teachers face daily in their classrooms.

We have designed the Learning Activity Types (LAT) approach to assist teachers in connecting curriculum-based learning goals with content area-specific learning activities and complementary technology tools. As first suggested by Shulman (1987) and reaffirmed by Mishra & Koehler (2006), pedagogical content knowledge varies by curriculum area. Learning activity types used in different content areas vary similarly. In collaboration with technology-savvy content area experts, we have developed comprehensive taxonomies of learning activities in six curriculum areas: K-6 literacy, secondary English language arts, mathematics, science, social studies, and world languages (see Harris & Hofer, 2009 for links to the taxonomies and related resources). Similar taxonomy development in the arts, physical education, and English as a second language has been planned. Learning activity types function as conceptual planning tools for teachers; they comprise a methodological shorthand that can be used to both build and describe plans for standards-based learning experiences. Each activity type captures what is most essential about the structure of a particular kind of learning action as it relates to *what students do* when engaged in that particular learning-related activity (e.g., "view a presentation;" "collect data;" "make predictions"). Selected learning activity types are combined to create lesson plans, projects and units.

To assist teachers in matching the affordances of educational technologies with selected learning activity types, we have identified suggested digital tools and resources that may help to support or enhance student learning with each. In this way, teachers select technologies based on learning activities, rather than on tools' characteristics. After teachers are familiar with the complete set of technologically supported learning activity types in a particular curriculum area, they can effectively choose among, combine, and use them in standards-based instruction.

While we do not suggest that the LAT approach is a planning model per se, we do suggest that teachers follow a general planning sequence:

1. Identify student learning goals.
2. Consider the classroom context and student learning styles and preferences.
3. Select and sequence appropriate learning activity types to combine to form the learning experience.
4. Select formative and summative assessment strategies.
5. Select tools and resources that will help best students benefit from the learning experience.

We recognize that planning is a more recursive than linear process, and that teachers may move through these steps in different ways. What we see as important about this sequence of decisions is that the process begins with the identification of student learning goals, and ends with the selection of appropriate educational technology tools and resources. By selecting the technologies that best serve learning goals and activities *last,* both students' learning and maximally appropriate educational technology uses are assured, with the emphasis remaining upon the former. By focusing first and primarily upon the content and nature of students' curriculum-based learning activities, teachers' TPACK is developed authentically, rather than "technocentrically" (Papert 1987), as an integral aspect of instructional planning and implementation.

Because TPACK is a function of teacher knowledge and classroom experience, it stands to reason that preservice and inservice teachers have different entry points to planning for technology-enhanced learning experiences. Experienced teachers have much more pedagogical knowledge (PK), content knowledge (CK) and pedagogical content knowledge (PCK) to draw upon than preservice teachers. They also have practical knowledge of classroom contexts and experience with responding to students' diverse learning styles and preferences. For these reasons, we have developed differentiated approaches to using the LAT approach with inservice and preservice teachers. While there are undoubtedly many ways to use this approach in courses and professional development experiences, we hope that outlining below how we work with our students and colleagues will help you to consider how you might leverage the LAT approach in your teaching.

Learning Activity Types and Inservice Teachers

Inservice teachers have extensive experience not only with selecting and combining learning activities to help students master curriculum goals, but also with understanding how classroom contexts and the diversity of students' learning styles and preferences both constrain and offer opportunities to plan for effective learning experiences. We can safely assume that most inservice teachers have more fully developed PCK than most preservice teachers. Rather than teaching inservice teachers how to plan lessons that use technology, we see the LAT approach as a way to connect with how teachers (already) plan for instruction. Research on teachers' instructional planning suggests that it is situated (Clark & Dunn 1991) and contextually sensitive (Brown 1990). It is also routinized and activity-based (Yinger 1979). More recent studies of teachers' planning that encompasses use of digital tools and resources (e.g., McCutcheon & Milner 2002; Tubin & Edri 2004) have reached similar conclusions. Since research on teachers' planning has established it to be activity-based and content-keyed (Wilson, Shulman & Richert, 1987), the LAT approach seems a natural fit for the kinds of planning in which experienced teachers routinely engage. Rather than suggest that teachers change the way they plan to accommodate the technology, the LAT approach simply assists teachers in considering the full range of learning activity type possibilities, then matching appropriate technologies to those learning activities.

Practice with Combining Content, Pedagogy and Technology

With inservice teachers, prior to introducing the LAT approach, we typically begin with an exercise that helps them to focus on the process of selecting different learning activities based upon a content goal. This can be accomplished in many ways. We usually ask the teachers to identify 3-5 curriculum-based topics (e.g. steps of the water cycle, solving quadratic equations, applying persuasive techniques in writing) and to write them down on white index cards. We then either provide the participants with a set of general learning activities on yellow cards (e.g. group discussion, read text, answer questions, research) or ask them to create cards with their own preferred types of learning activities. We then provide the participants with a third set of green cards with common technological tools/resources, such as "wiki," "blog," or "student response system." In varying ways, we ask small groups of teachers to form combinations of content topics, pedagogies and technologies that they think would work well or not work well together, then discuss their reasoning and reactions. We might begin with drawing one of each of the cards at random to determine how well the three "fit" together. We might also suggest that they pick two cards of each color and create the best combination of content, pedagogy and technology. The important element of this exercise, which is based upon "The TPACK Game" first introduced by Koehler, Harris, and Mishra at the 2007 National Educational Technology Leadership Summit, is to help teachers become aware of the deliberate process of selecting learning activities to support a particular curriculum topic.

Exploring Relevant Learning Activity Types Taxonomies

The next step is to introduce the teachers to the LAT taxonomies appropriate to their area of teaching. We encourage elementary teachers who teach multiple subjects to select a taxonomy from among these content areas with which to work. We ask them to note how the taxonomies are organized. For example, the Mathematics taxonomy is structured according to the National Council of Teachers of Mathematics Process Standards (Grandgenett, Harris & Hofer, 2009), while the K-6 Literacy taxonomy is structured according to the reading and writing processes (Schmidt, Harris & Hofer, 2009). We then ask teachers to read through the names and

descriptions of the learning activity types, making notes with questions or realizations. At the same time, we ask them to circle any of the technologies with which they are unfamiliar, and add technologies as needed to relevant learning activity types. We then as them to discuss their questions about and reactions to the various taxonomies, emphasizing their subject-specific nature.

Applying the Learning Activity Types Taxonomies in Instructional Planning

Once teachers are familiar with their chosen taxonomy of learning activities, we discuss how they typically plan for lessons/projects, noting the common progression from learning goals through assessments. We then suggest that the appropriate place to consider possible technology options is *after* they have already selected and sequenced learning activities and assessments. The teachers typically express satisfaction that technological choices follow learning activity selection, rather than determining the nature of instruction, in this approach. They can then begin to plan several days of instruction, using shorthand versions of the LAT names. Alternatively, they can review unit plans they have already created, identify the learning activities already present, and consider alternate learning activity types. Once the teachers have determined a sequence of learning activity types for a project or unit of study, they are able to consider the suggested technologies associated with each learning activity type to determine which, if any, technological tools or resources would add value to the learning experience.

Inservice Teachers' Feedback on the AT Approach

As you may have noted while reading through the steps described above, using the LAT approach is quite natural for inservice teachers, requiring relatively little scaffolding along the way. Experienced teachers in both our graduate courses and professional development workshops have recognized two primary benefits to the LAT approach. First, while teachers report that only a few of the learning activities in a given taxonomy are entirely new to them, they express the utility of a comprehensive taxonomy to re-familiarize them with the full range of learning activity types, which helps them to make their lesson, project, and unit plans more varied (Harris & Hofer, 2010), thereby better accommodating the different learning styles and preferences of their students. The second advantage inservice teachers report is in providing guidance for selecting appropriate technologies. In the LAT approach, the range of technology choices is narrowed considerably as they select the learning activities they will employ in the instructional plan, since each learning activity has only several corresponding suggested technologies. For experienced teachers who are less experienced with digital technologies, this narrowing of the possibilities seems to make technology integration less overwhelming. For more experienced technology-using teachers, we suspect that this narrowing of technological possibilities will help them focus on learning goals and activities, rather than on ways to use technologies.

Learning Activity Types and Preservice Teachers

Although the LAT approach was designed primarily to assist experienced teachers in integrating technology into their teaching, we have had success using the approach with preservice teachers as well. They do, however, require significantly more scaffolding than inservice teachers. The increased scaffolding required is primarily a function of their relative lack of experience with designing instruction. In our teacher education program, students are co-enrolled in the educational technology course and their curriculum-specific teaching methods courses. Since much of the introduction to and practice with lesson planning is addressed in methods courses, preservice teachers' knowledge of learning activity types is often limited to what is directly taught to or modeled for them by their methods professors. The comprehensive taxonomies of learning activity types in the LAT approach help to augment and extend, rather than compete with, this learnin.

There are many ways a teacher educator might use the LAT approach in both educational technology and teaching methods courses. Here we share one approach that seems to work well for preservice students in both our undergraduate and graduate preservice educational technology courses. The educational technology course in our program is worth two credit hours, meeting for one hour and forty minutes per week. The lesson development sequence described below typically spans three of the fifteen class sessions. The sections of the course consist of approximately twenty students each and are divided into elementary (PK-6) and secondary (middle and high school) levels. Students in our undergraduate courses are primarily full-time students in their early 20's. Student populations within our 11-month Master's program are typically more heterogeneous, with participants ranging

from 22-50 years of age.

Identifying the Building Blocks of Lesson Plans

The first challenge we often encounter when working with preservice students planning for technology integration is to help them understand the building blocks of lesson plans: learning activities. By the midpoint of the semester, students have been introduced to one or more planning models for creating lesson and unit plans (e.g. the Learning Cycle or Understanding by Design (UbD)) in their methods courses, and have begun to plan lessons accordingly. At this point in their learning, students typically have given little thought to selecting learning activities. For example, after identifying the student learning goals and essential questions in the UbD model, students typically identify assessments and learning activities based upon some combination of their prior educational experience, the modeling of their methods professors and their observations in school practica experiences, rather than through any deliberate selection process.

To help students to think about different options for learning activities in a given lesson plan, we often review two or more high quality lesson plans focused on the same learning goals and curriculum topics. Students discuss which version of the lesson they think might be most effective. We discuss the merits and challenges that are associated with particular choices. We then challenge students to identify several curriculum standards that they may have the opportunity to teach during their student teaching semester and collect several existing lesson plans that focus on these topics. They then attempt to identify the specific learning activity types utilized in the different lessons and reflect on the degree to which the particular learning activities selected support the stated learning goals. The key concept here is that learning activities should be purposefully selected to match particular learning goals, and that there are multiple ways to address a single curriculum goal effectively.

Scaffolding the Selection and Combination of Learning Activity Types

After understanding how other teachers have chosen to combine learning activities in a lesson, the next step in the process focuses on helping preservice teachers to learn how *they* might select and combine learning activities in their own instructional planning. This is perhaps the most heavily scaffolded stage in the process in our teaching. After reviewing the existing lesson plans, the most common question from our preservice students is, "OK, I get that there are lots of different kinds of learning activities, but how do I choose the ones that are most appropriate?"

Building on their exploration of existing lesson designs, we will typically select three very different types of lesson plans, in terms of both content and structure (i.e. some that are very didactic and teacher-focused, and others that are more constructivist and student-centered). For each lesson, as a group, students identify the learning activity types that comprise the lesson. At this stage, it is not important whether or not the names of the learning activity types match those on the LAT taxonomies. Instead, we focus upon helping the preservice teachers to clearly conceptualize and explain the activities. We then brainstorm alternate learning activities that would be as (or more) appropriate, given the learning goals specified. We repeat this process with the remaining lessons, discussing the merits of particular combinations of learning activities we create.

At this point, typically one of the preservice teachers asks *how* they decide which combination of learning activities to use in their plans. This often leads to an interesting discussion, where opinions of the students are often grounded in unacknowledged assumptions. For example, some students may place a high value on inquiry-based learning and suggest that the more student-centered and inquiry-oriented the activities are "better." Others will suggest that certain topics lend themselves better to certain types of learning activities. Still others argue that teachers should choose learning activities based upon the needs and preferences of their students. We then discuss how all of these approaches may be appropriate and that, in reality, multiple selection criteria are used in combination. The key understanding we hope that students develop in this stage of the process is that learning activities should be purposefully selected and varied according to established criteria.

Introducing and Planning with the Learning Activity Types Taxonomies

Once perservice teachers are comfortable with the notion that lessons, projects, and units are comprised of combinations of learning activities, and that multiple combinations of learning activities can be designed to help students meet learning goals, we then introduce the relevant LAT taxonomies. Similar to the process for inservice teachers, secondary preservice teachers select the taxonomy for their content area, while elementary teachers who teach multiple subjects select taxonomies from one of their primary areas of teaching. Students review the taxonomy prior to coming to class, noting questions they have and also reflecting on connections they see between the learning activities in the taxonomy and what they are observing in their methods courses and practica work. During class, we discuss how teachers and/or methods professors may gravitate towards a subset of the learning activities in the taxonomy based on their past experience and/or philosophy of teaching and learning. We then discuss how particular technologies are suggested for each of the learning activities in the taxonomies, and that the use of these technologies may add value to student learning when used as part of planned learning.

Once students are familiar with an LAT taxonomy, we ask them to select three curriculum standards that they will be addressing during their student teaching semester that may lend themselves to some form of technology integration. We challenge students to complete an LAT Planning Guide for each standard. The Planning Guide is comprised of multiple prompts to help preservice teachers to structure a lesson. For example, the first part of the lesson might focus on "hooking" the students or activating their prior knowledge relative to the learning goal. A second block may provide students with an opportunity to build their knowledge or explore a problem. For each part of the planning guide, students are challenged to identify three alternate learning activity types from the taxonomy that would support the learning goal(s) of that particular portion of the lesson. Once they have identified multiple activity types for each part of the lesson, students form small groups to discuss the different options and how one learning activity from one lesson segment might connect with a learning activity in a later segment. In this way, they begin to build an effective combination of learning activities for a particular lesson.

Determining Technologies' Situational Advantages

Once the preservice teachers have selected and combined learning activity types to form their lessons, they can then shift their focus to possible educational technologies to incorporate,referring back to the LAT taxonomy for suggestions. For each learning activity, they think about the degree to which particular tools and resources would support student learning, and how accessible the requisite tools are in their practicum classrooms. In some cases, the value of using a particular technology is easily determined. In the case of the writing process, for example, the value-added dimension of using concept mapping and/or word processing software for planning, editing and revising is fairly clear. In other cases, however, potential benefits are not as obvious. For example, while Google Earth certainly reflects many geographical concepts and topics, it may or may not be the optimal choice for a lesson focusing on human migration patterns over time. To help students to assess the value of using a particular educational technology in a lesson plan, we encourage them to apply the "Is It Worth It?" self-test (Harris, 2005). This three-part test asks teachers to consider the following questions (p. 36).

- The Feasibility Test: *Will this* learning activity/project/unit idea *work*, given the technological, interpersonal, logistical, and contextual factors currently operating in this particular learning environment?
- The Appropriateness Test: *Is this* learning activity *appropriate* both for this student/these students, given what we know about their learning needs and preferences, and for teaching the particular curriculum content and processes targeted?
- The Relative Advantage Test: *Can* the *same learning outcomes be accomplished* just as well or better *using more readily available and easy-to-use tools and resources*?

Though this test is helpful, and challenges preservice students to be judicious in their use of technologies, we emphasize that while they should make deliberate and critical choices about which technologies to use, often a teacher has to try something in practice and reflect on its effectiveness before being able to determine accurate answers to the "Is It Worth It?" questions. The key element in this decision-making phase is linking the affordances of particular tools to specific and pedagogically congruent learning activities.

Assessing the Quality of Technology Integration

Once students finish designing their technology-integrated lesson plans during the course, the instructor assesses the quality of the integration represented in the plan. We have recently developed and tested a TPACK-based assessment rubric to help meet this need (Harris, Grandgenett, & Hofer, 2010). The rubric consists of four dimensions, each focusing on a different element of the TPACK framework:

- Curriculum Goals and Technologies (TCK)
- Instructional Strategies and Technologies (TPK)
- Technology Selections (TPACK)
- "Fit" (TPACK)

Scorers assess the quality of technology integration in each of these dimensions on a scale of one to four. The total score provides the professor with a TPACK-based measure of the quality of technology integration proposed in the plan.

Conclusion

Helping both inservice and preservice teachers develop their TPACK is a significant challenge. The complex and interdependent nature of this knowledge is unique to each teacher, necessitating varied professional development approaches. We have designed the LAT approach to be grounded in classroom practice. By suggesting content-keyed learning activities paired with suggested technological tools and resources, the approach attempts to scaffold the process in ways that will help teachers become more discerning about and confident with their technologically integrated planning. We hope that the approach to developing teachers' technology integration knowledge presented here, differentiated for experienced and novice teachers, will be adopted and adapted by our colleagues so that it can be used in a wide variety of teacher education contexts.

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