Planning for Deep Learning Using TPACK-based Learning Activity Types

Judi Harris & Mark Hofer
School of Education, College of William & Mary
Williamsburg, Virginia USA
judi.harris@wm.edu mark.hofer@wm.edu

Abstract: Teaching for students' deep learning, while rooted in venerable 20th-century educational research and theory contributed by Vygotsky, Dewey, and others, is taking on a new urgency as heretofore theoretical depictions of 21st-century learning are being operationalized in K-12 classrooms. What is the nature of deep learning? What are the pedagogical roles and practices that encourage it? How can we help teachers to plan learning experiences for and with their students that encourage and support deep learning, incorporating the use of digital tools and resources in maximally effective ways? This chapter uses extant literature on deep learning, teaching for deep learning, and recent calls for teachers' enhanced "pedagogical capacities" (Fullan & Langworthy, 2014) to argue for a reconceptualized use of TPACK-based learning activity types in educational planning for students' deep learning.

Recent conceptualizations of effective 21st-century learning point to the importance of encouraging students to engage in *deep learning* experiences. Edutopia's Teacher Leadership blog (http://www.edutopia.org/blogs/tag/teacher-leadership), for example, describes the nature of the learning environment in which key 21st-century skills are developed in no uncertain terms:

> Only a decade and a few years in, how can we fully describe the twenty-first century learner? So far, this we do know: She is a problem solver, critical thinker, and an effective collaborator and communicator. We also know that a deeper learning environment is required in order to nurture and grow such a learner. (Alber, 2013, para. 1)

Increasingly, educational researchers are linking particular pedagogical aims and practices to deep learning, which requires students' and teachers' active, intrinsic engagement and creativity, applied to authentic and often collaborative problem-solving. Fullan and Longworthy (2014) describe these *new pedagogies* that encourage deep learning in ways that parallel most depictions of 21st-century skills and attitudes in action:

> "Deep learning," in the way we will describe it, develops the learning, creating and 'doing' dispositions that young people need to thrive now and in their futures. Premised on the unique powers of human inquiry, creativity, and purpose, new pedagogies are unleashing students' and teachers' energy and excitement in new learning partnerships that find, activate and cultivate the deep learning potential in all of us….In the best examples, teachers and students are teaming up to make learning irresistibly engaging, and steeped in real-life problem-solving. (p. i)

According to these authors, strategic use of digital tools and resources in service of deep learning can greatly enhance and accelerate what their research has found to be a natural diffusion of new pedagogies among teachers that is happening in K-12 schools now. How can teacher educators assist and potentially accelerate this organic process? In this chapter, we will argue for the systematic use of TPACK-based learning activity types (Harris & Hofer, 2009; Harris et al., 2010) to support instructional planning in ways that help teachers to operationalize the deep learning environments described above.

Deep Learning

Contrary to some popular assumptions, there are no characteristically deep learners or strategies that inherently promote deep learning. Rather, deep learning is an *approach* to learning, chosen by students (not teachers), that may or may not be used for different types of learning tasks, based upon students' perceptions of and motivations to engage in each activity. These student inclinations can and do change over time and among differing learning conditions and contexts (Entwistle, 2000; Entwistle & McCune, 2004). Deep learning approaches are contrasted with *surface* and *achieving* or *strategic* approaches (Figure 1). Learners using a surface approach to a learning task are motivated by fear of failure, avoiding negative repercussions, and expending as little effort as possible to complete the task. Students using an achieving or strategic approach to a particular learning task are motivated primarily by grades or similar indicators of success. They seek to maximize efficiency in terms of space and time spent upon educational tasks while ensuring positive external assessments of their learning. Students using deep approaches are motivated by intrinsic interest in, engagement with, and meaning-seeking for the particular learning tasks in which they are participating (Biggs, 2001). Entwistle (2000) summarizes the essential processes comprising students' deeper learning as follows, contrasting them with surface learning:

> In the deep approach, the intention to extract meaning produces active learning processes that involve relating ideas and looking for patterns and principles on the one hand (a holist strategy…), and using evidence and examining the logic of the argument on the other ([a] serialist [strategy]). The approach also involves monitoring the development of one's own understanding….In the surface approach, in contrast, the intention is just to cope with the task, which sees the course as unrelated bits of information which leads to much more restricted learning processes, in particular to routine memorization. (p. 3)

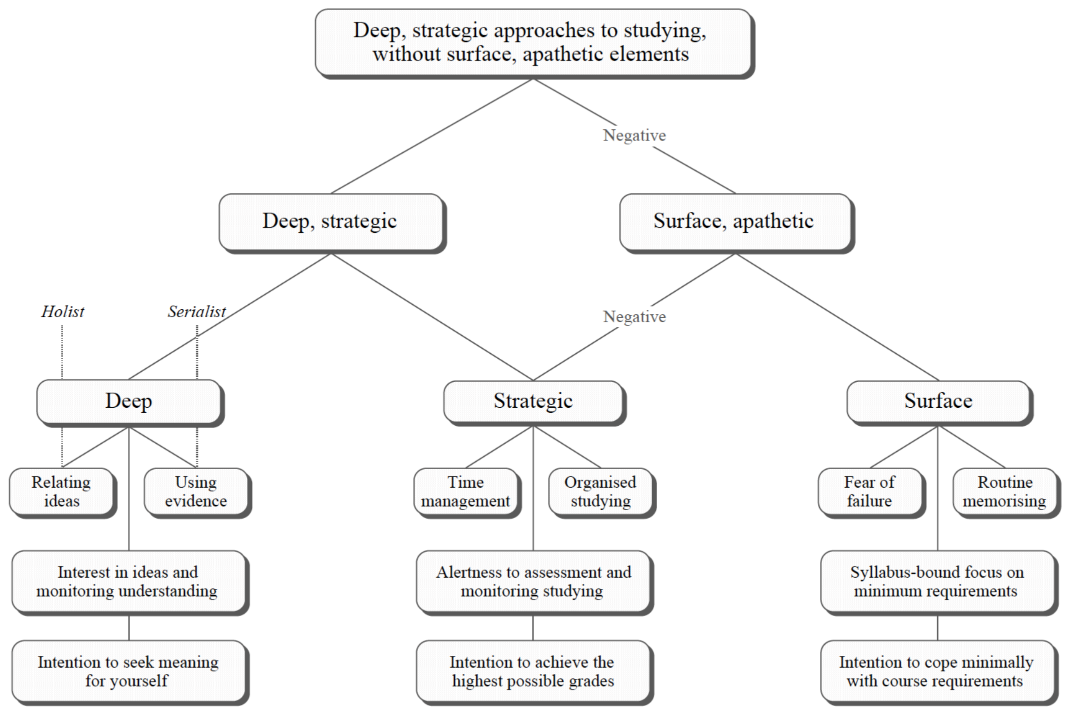

Figure 1. Deep, Strategic, and Surface Approaches to Learning (Entwistle, 2000, p. 4)

Students' perceptions of the nature and requirements of a learning task determine whether they might engage in deeper learning. Studies of university students show that their self-confidence as learners, self-efficacy related to the perceived requirements of the learning task, and perceptions of the task as motivating, stimulating, student-centered, autonomous, authentic, and assessed in appropriate ways increase the probability that they will use a deep approach. Students' preferences for interactive, understanding-based, and facilitative (as opposed to directive) teaching approaches can also predict their choices of deeper ways of learning (Baeten, Kyndt, Struyven & Dochy, 2010). College students using deeper approaches employ multiple strategies and resources; attempt to view what they are learning from multiple perspectives; integrate and synthesize new information with what they have learned previously, updating their understanding of phenomena as necessary; and demonstrate personal commitment to understanding what they are learning. They tend to earn higher grades and retain, synthesize, and transfer learning better than students who are not using deeper approaches for the same learning task. Overall, deeper learning is associated with more process-focused reflection and greater enjoyment, reading more widely, discussing ideas with other learners, and seeking to apply learning in real-world situations (Laird, Seifert, Pascarella, Mayhew, & Blaich, 2014).

Entwistle (2000) warns us, however, that since research findings describing students' deeper approaches to learning tasks are rather generic, they cannot describe accurately the complexity of highly contextually influenced, individual learning approaches. In addition, "the processes needed to develop deep learning necessarily vary between subject areas" (p. 4). We will return to this important point later in this chapter.

Teaching for Deeper Learning

If deep learning refers to approaches chosen by students, comprising multiple learning strategies and dispositions as described above, how do teachers wishing to encourage their students' deeper learning approaches do so effectively? Student-centered and project-based teaching approaches are typically associated with deeper learning and understanding. Unfortunately, studies of these types of learning environments have yielded mixed results with reference to successful deep learning—due, at least in part, to the wide variety of definitions and implementations of student-centered and project-based teaching (Baeten, et al., 2010).

Instead, studies have identified *teacher behaviors* that are more directly associated with deeper student learning. Teachers who plan for students' active, interactive learning; who encourage and provide more opportunities for autonomous investigations; who build upon students' intrinsic motivations to learn; who consciously try to change students' conceptions and understanding; who encourage students to apply their learning in new contexts and to new problems; who use authentic forms of assessment; who interact more with their students in differing contexts (Entwistle, 2000); and who generally "explain, enthuse, and empathize" (p. 8) have been found to encourage and support their students in using deeper learning strategies.

These and similar behaviors are often associated with an inductive "guide on the side" (facilitative), rather than a "sage on the stage" (directive) approach to teaching (King, 1993). Interestingly, however, Hattie's (2009) meta-synthesis of more than 800 meta-analyses of the efficacy of different teaching strategies shows that teacher behaviors that characterize a role of *activator,* rather than *facilitator,* lead to a .53 (more than three times) larger effect size in terms of measurable student learning. Fullan and Langworthy (2014) demonstrate how Hattie's "teacher as activator" role describes many teacher behaviors that past research has associated with deeper student learning. They characterize teacher-activators' roles and strategies as follows:

> Teachers who play dynamic, interactive roles with students—pushing students to clearly define their own learning goals, helping them gain the learning muscle to effectively pursue those goals, and supporting them in monitoring how they are doing in achieving those goals—have extremely strong impacts on their students' learning. Such teachers...help [students] master...the difficult and demanding process of learning. (p. 20)

Activator teachers use what Fullan and Langworthy (2014) call *new pedagogies,* "a new model of learning partnerships between and among students and teachers, aiming towards deep learning goals and enabled by pervasive digital access." (p. 2) Whereas the aim of "old pedagogies" was successful delivery of content via a limited number of primarily teacher-centered teaching strategies, teacher quality within the new pedagogies model is indicated by *pedagogical capacity,* or teachers' larger "repertoire of teaching strategies and their ability to form partnerships with students in mastering the process of learning." (p. 3) Pedagogical capacity, as Fullan and Langworthy (2014) define it, is key to the recommendations that appear later in this chapter.

According to these authors, new pedagogies focus upon deep learning, during which students and teachers discover and master content together, in service of creating and using new knowledge purposefully in the world outside of the classroom. Frequent use of digital tools and resources, both within and outside of school, "enables and accelerates" (p. 8) this deep learning process. Fullan and Langworthy (2014) emphasize that unlike an older model of technology integration, within which "technology has been layered on top of content delivery and used primarily to support students' mastery of required curricular content" (p. 3), in the new pedagogies, the *quality* of the *use* of technology to support learning and teaching is what is most important. In other words, as research has indicated consistently, "it is…the pedagogy of the application of technology in the classroom which is important: the *how* rather than the *what*" (p. 30, emphasis added).

Planning for Deeper Learning

How can teachers build their pedagogical capacities so that they can better utilize these new pedagogies? Fullan and Langworthy (2014) recommend that educational leaders partner with teachers and students to collaborate in locally contextualized, well-delineated professional learning that is focused upon specific, clearly stated student learning outcomes and success criteria. They further advocate for the careful, collaborative analysis of student work and progress that leads to well-reasoned changes in teaching approaches.

Despite the research-based nature of these recommendations, however, local professional communities of teachers may well be limited in their collective knowledge and use of multiple educational technologies and pedagogical strategies, the range and appropriateness of which Fullan and Langworthy have identified as key to developing teachers' pedagogical capacities for supporting deep learning. Some of our previous work (e.g., Harris & Hofer, 2009; Harris et al., 2010) could assist with expanding teachers' knowledge of teaching strategies and corresponding digital technology uses that can encourage students' choices of deeper learning approaches, thereby enlarging teachers' pedagogical capacities as Fullan and Langworthy suggest.

The work draws upon research about teachers' planning practices to suggest a learning activities selection-and-sequencing approach to planning lessons, projects, and units that focuses first upon student-focused, curriculum-based learning goals and last upon the digital technologies to incorporate. In this workplace-embedded approach to teachers' TPACK development, educational technologies are chosen according to the instructional content and processes that serve as learning goals for the activity-structured learning experience being planned. The key to this approach to educational planning is the use of *comprehensive,* freely available taxonomies of learning activity types (LATs) and corresponding recommended technologies in nine different curriculum areas: K-6 literacy, mathematics, music, physical education, science, secondary English/language arts, social studies, visual arts, and world languages (Harris et al., 2010). Given Enwistle's (2000) proviso that the processes needed to assist students' deep learning vary necessarily by content area, the curriculum-focused nature of these taxonomies should serve teachers well who are seeking to develop their pedagogical capacities and strategic educational technology use.

Using these open educational resources (http://activitytypes.wm.edu/) as planning aids, teachers select, combine, and sequence multiple learning activity types to comprise plans for lessons, learning projects, and units based upon knowledge of their students' learning needs and preferences, curriculum standards, and contextual conditions. Teachers' TPACK—the professional knowledge needed to use digital tools and resources effectively in teaching (Mishra & Koehler, 2006)—is therefore built, over time, in the process of using the LAT taxonomies individually and collaboratively with other teachers and/or students to plan learning experiences that incorporate educational technologies in curriculum-based and pedagogically focused ways (Harris & Hofer, 2011). More information about these materials and the research associated with them is available online (http://activitytypes.wm.edu/).

Deeper Learning Designs

Yet given that the taxonomies in all of the nine curriculum areas are comprehensive collections of all learning activity types, how can we assist teachers in selecting and sequencing those particular activities that promote deeper learning? Using the research-based definitions of deep learning explained above, discerning learning activity types that encourage students' deeper learning is a straightforward process. Entwistle (2000), for example, reminds us that deeper approaches to learning focus upon extracting meaning, looking for patterns and principles that help the learning to relate seemingly disparate ideas to each other, using evidence, critiquing arguments, and monitoring/reflecting upon the development of the learner's own understanding. We can see examples of learning activities that emphasize these actions and skills in particular in (for example) the Knowledge Building section of the social studies learning activity types taxonomy, highlighted in Table 1, below.

Activity Type	Brief Description	Possible Technologies
Read Text	Students extract information from textbooks, historical documents, census data, etc.; both print-based and digital formats	Digital archives, Web sites, electronic books, audiobooks
Read Maps, Charts and Tables	Students extract and/or synthesize information from maps, charts and/or tables	Textbook supplements, Web-based datasets (e.g., CIA World Factbook)
View Presentation	Students gain information from teachers, guest speakers, and peers; synchronous/asynchronous, oral or multimedia	Presentation software, videoconferencing, video creation software (e.g. Movie Maker, iMovie), concept mapping software
View Images	Students examine both still and moving (video, animations) images; print-based or digital format	Presentation software, word processor, video creation software (e.g. Movie Maker, iMovie), image sharing sites (e.g. Flickr.com)
Listen to Audio	Students listen to audiorecordings of speeches, music, radio broadcasts, oral histories, and lectures; digital or non-digital	Digital audio archives, podcasts (e.g., "Great Speeches in History," etc.), audiobooks
Take Notes	Students record information from lecture, presentation, and/or group work	Word processor, wiki, concept mapping software
Discuss	In small to large groups, students engage in dialogue with their peers; synchronous/asynchronous, structured or unstructured	Discussion fora, discussion in wikis and blogs
Debate	Students discuss opposing viewpoints; formal/informal; structured/unstructured; synchronous/asynchronous	Discussion fora, discussion or commenting in blogs and wikis
Experience a Field Trip	Students travel to physical or virtual sites; synchronous/asynchronous	Virtual fieldtrips, presentation, video creation software and/or Google Earth to develop their own virtual tours
Sequence Information	Students sequence information, data and/or documents in chronological order	Timeline creation software, video creation software (e.g. Movie Maker, iMovie)
Consider Evidence	Students explore a variety of types of evidence (e.g., historical documents, photographs, data) related to a topic or question	Digital archives, extant data sets (e.g., U.S. Census data), Historical Scene Investigation (HSI)
Compare/Contrast	Students interrogate information to understand multiple characteristics, evidence, and/or perspectives on a topic	Concept mapping software, word processor, spreadsheet, digital archives
Engage in a Simulation	Students engage in paper-based or digital experiences focused on a content topic which mirror the complexity of the real world	Content-specific simulation (e.g. Fantasy Congress, Stock Market Game)
Conduct an Interview	Face to face, via audio/videoconference, or via email students question someone on a chosen topic; may be digitally recorded and shared	Video creation software (e.g. Movie Maker, iMovie), audiorecorder, digital camera
Research	Students gather, analyze, and synthesize information using print-based and/or digital sources	Digital archives, word processor, concept mapping software to structure
Engage in Artifact-Based Inquiry	Students explore a topic using physical or virtual artifacts, including data, text, images, etc.	Digital archives

Engage in Data-Based Inquiry	Using student-generated data or print-based and digital data available online, students pursue original lines of inquiry	Digital archives, extant data sets (e.g., C.I.A. World Factbook, U.S. Census data, Thomas), student-collected data, spreadsheet

Table 1: Sample Knowledge Building Deeper Learning Activity Types (Social Studies)

Learning activity types that encourage students' deeper learning are similarly represented in the social studies LATs taxonomy within the Knowledge Expression category (http://activitytypes.wm.edu/SocialStudies.html, Table 2), in each and all of its six subcategories of types of learning activities, as well as in the taxonomies of learning activity types in other curriculum areas.

Although types of learning activities that encourage deeper learning can be found throughout the seven categories of LATs in the mathematics taxonomy (http://activitytypes.wm.edu/Math.html), *all* of the activities within the Evaluate and Create categories (http://activitytypes.wm.edu/Math.html, Tables 6 and 7) help students to focus upon the use of critical and generative learning processes to deepen and extend their mathematical learning. This is illustrated in Tables 2 and 3, below.

Activity Type	Brief Description	Possible Technologies
Compare and Contrast	The student compares and contrasts different mathematical strategies or concepts, to see which is more appropriate for a particular situation.	Concept-mapping software (e.g., Inspiration), Web searches, Mathematica, MathCad
Test a Solution	The student systematically tests a solution, and examines whether it makes sense based upon systematic feedback, which might be assisted by technology.	Scientific calculator, graphing calculator, spreadsheet, Mathematica, Geometry Expressions
Test a Conjecture	The student poses a specific conjecture and then examines the feedback of any interactive results to potentially refine the conjecture.	Geometer Sketchpad, content-specific interactive tool (e.g., ExploreMath), statistical packages (e.g., SPSS, Fathom), online calculators, robotics
Evaluate Mathematical Work	The student evaluates a body of mathematical work, through the use of peer or technology-aided feedback.	Online discussion groups, blogs, Mathematica, MathCad, Inspire Data

Table 2: Sample Evaluating Deeper Learning Activity Types (Mathematics)

Activity Type	Brief Description	Example Technologies
Teach a Lesson	The student develops and delivers a lesson on a particular mathematics concept, strategy, or problem.	Document camera, presentation software, videoconferencing, video creation software, podcasts
Create a Plan	The student develops a systematic plan to address some mathematical problem or task.	Concept mapping software, collaborative word processing software, MathCad, Mathematica
Create a Product	The student imaginatively engages in the development of a student project, invention, or artifact, such as a new fractal, a tessellation, or another creative product.	Word processing software, videocamera, animation tools, MathCad, Mathematica, Geometer Sketchpad
Create a Process	The student creates a mathematical process that others might use, test or replicate, essentially engaging in mathematical creativity.	Computer programming, robotics, Mathematica, MathCad, Inspire Data, video creation software

Table 3: Sample Creating Deeper Learning Activity Types (Mathematics)

As was explained above, using the taxonomies, teachers select and sequence multiple learning activity types (LATs) to form a curriculum-based lesson, project, or unit. As we experimented with using sample taxonomies to create learning experiences that could encourage students' use of deeper learning approaches, however, we realized that the individual activities that describe what are typically deeper learning experiences for students are not limited to those that *in and of themselves* reflect deeper learning processes. Rather, it is the *preponderance of* and particular *ways* in which learning activities are *enacted* within a complete plan for a learning experience that determines whether the learning approach overall will be deeper, more strategic, or more superficial. Most deeper learning will, of necessity, incorporate some learning activities that are not necessarily associated with deeper learning, such as taking notes, viewing presentations, and reading maps, charts, and tables in social studies (Table 2). Yet when these are combined with, for example, new pedagogies such as engaging in artifact- and/or data-based inquiry LATs, with support from teachers engaging in the kinds of behaviors associated with encouraging deeper learning as described above, a student's approach to the learning experience can become quite rich and deep.

Keys to Pedagogical Capacity

Fullan and Langworthy (2014) remind us that three core components of 21st-century learning—combined—enable and encourage students' deep learning approaches: learning partnerships; learning tasks that focus upon knowledge creation and purposeful knowledge use; and digital tools and resources that can facilitate and accelerate deep learning processes. These essential elements of the new pedagogies require teachers to develop and use what are new pedagogical capacities for many; in particular, to expand the number and types of pedagogical strategies that they use, which "may range from project-based learning through direct instruction to an inquiry-based model" (p. 20). This is what undergirds our recommendation to use the comprehensive learning activity types taxonomies described and referenced earlier in this chapter as one way to help teachers to develop both their TPACK and their pedagogical capacities.

The selection, combining, and sequencing of learning activities that encourage deeper learning must place the teacher in an *activating role*, personalizing authentic learning experiences as much as possible according to students' learning needs and preferences. As Fullan and Langworthy (2014) remind us,

> The key is that the teacher takes a highly proactive role in driving the learning process forward, using whichever [learning/teaching] strategy works for a specific student or task, and analyzing which strategy works best. In the new pedagogies, this means interacting with students to make the students' thinking and questions about learning more visible. (p. 20)

Given this strong recommendation for teachers' proactive roles as activators of students' learning processes, we are hopeful that our Learning Activity Types taxonomies can serve a pragmatic and beneficial function in helping to encourage and advance the use of new pedagogies with strategically selected educational technologies in service of students' deeper learning.

References

Alber, R. (2013, January 21). Deeper learning: Defining twenty-first century literacy [Blog post]. Retrieved from http://www.edutopia.org/blog/twenty-first-century-literacy-deeper-learning-rebecca-alber

Baeten, M., Kyndt, E., Struyven, K., & Dochy, F. (2010). Using student-centered learning environments to stimulate deep approaches to learning: Factors encouraging or discouraging their effectiveness. *Educational Research Review, 5*(2010), 243-260.

Biggs, J. B. (2001). Enhancing learning: A matter of style or approach? In R. J. Sternberg & L. Zhang (Eds.), *Perspectives on thinking, learning, and cognitive styles* (pp. 73-102). Mahwah, NJ: Lawrence Erlbaum.

Entwistle, N. (2000, November). *Promoting deep learning through teaching and assessment: Conceptual frameworks and educational contexts.* Paper presented at the meeting of the Teaching and Learning Research Programme, Leicester, UK. Retrieved from http://www.ed.ac.uk/etl/docs/entwistle2000.pdf

Entwistle, N. J., & McCune, V. (2004). The conceptual bases of study strategy inventories. *Educational Psychology Review, 16*(4), 315-345.

Fullan, M. & Langworthy, M. (2014). *A rich seam: How new pedagogies find deep learning.* London: Pearson. Retrieved from https://research.pearson.com/articles/a-rich-seam-how-newpedagogiesfinddeeplearning.html

Harris, J., & Hofer, M. (2009). Instructional planning activity types as vehicles for curriculum-based TPACK development. In C. D. Maddux (Ed.). *Research highlights in technology and teacher education 2009* (pp. 99-108). Chesapeake, VA: Society for Information Technology & Teacher Education (SITE).

Harris, J. B., & Hofer, M. J. (2011). Technological Pedagogical Content Knowledge (TPACK) in action: A descriptive study of secondary teachers' curriculum-based, technology-related instructional planning. *Journal of Research on Technology and Education, 43*(3), 211-229.

Harris, J. B., Hofer, M. J., Blanchard, M. R., Grandgenett, N. F., Schmidt, D. A., van Olphen, M., & Young, C. A. (2010). "Grounded" technology integration: Instructional planning using curriculum-based activity type taxonomies. *Journal of Technology and Teacher Education, 18*(4), 573-605.

Hattie, J. (2009). *Visible learning: A synthesis of over 800 meta-analyses relating to achievement.* London: Routledge.

King, A. (1993). From sage on the stage to guide on the side. *College Teaching, 41*(1), 30-35.

Laird, T. F. N., Seifert, T. A., Pascarella, E. T., Mayhew, M. J., & Blaich, C. F. (2014). Deeply affecting first-year students' thinking: Deep approaches to learning and three dimensions of cognitive development. *The Journal of Higher Education, 85*(3), 402-432.

Mishra, P., & Koehler, M. J. (2006). Technological pedagogical content knowledge: A framework for teacher knowledge. *Teachers College Record, 108*(6), 1017-1054.