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PREPARING TEACHERS TO USE TECHNOLOGY EFFECTIVELY USING THE TECHNOLOGICAL, PEDAGOGICAL, CONTENT KNOWLEDGE (TPACK) FRAMEWORK

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ABSTRACT

Although technology is on the rise in society and schools, many teachers are not effectively incorporating technology into their teaching and learning. The lack of use can be attributed to teachers' negative beliefs and feelings about technology. Effective teaching requires not only mastery of the subject content, pedagogical techniques, and technological affordances, but also how to achieve a successful dynamic interaction between those three factors. In this paper, the author has elucidated how these teacher beliefs and feelings are generate and the Technological, Pedagogical, Content knowledge framework (TPACK) framework is presented as a method of ameliorating these negative teacher impressions to work towards the effective use of technology in teaching and learning.

Keywords: TPACK, technology, pedagogy, teachers, pre-service teachers.

INTRODUCTION

In today's society there are a plethora of digital technologies to simplify or enhance our everyday lives. Educators and governments have called for educational reforms to utilize those technologies in the educational environment (Greenhow & Robelia, 2009; Jonassen, Howland, Marra, & Crismond, 2008; Common Core State Standards Initiative, 2010). Many educators are taking advantage of the affordances offered by hardware and software tools. Unfortunately, recent studies indicate that while technology use is on the rise, many teachers are not effectively incorporating technology into their teaching and learning (Groff & Mouza, 2008; Levin & Wadmany, 2008; Russell, O'Dwyer, Bebell, & Tao, 2007).

In this paper, some of the main reasons contributing to this lack of use are delineated and the technological, pedagogical, (and) content knowledge (TPACK) framework is presented as a framework to promote the effective use of techn.

THE NEED FOR TRAINING

To ensure teachers use technology effectively, it is essential that training is provided.

One appropriate place to begin that training is within pre-service teacher (PST) training programs. PSTs training can considerably influence the way teachers will teach once they complete the PST program (Gao, Choy, Wong, & Wu, 2009; Hammond et al., 2009; Lim, Chai, & Churchill, 2010). Therefore, designers of PST education programs have a duty to positively direct and prepare the future teacher workforce and training should include many opportunities to facilitate the development of knowledge and skills to effectively integrate technology. E*ffective technology integration* is defined as teaching subject content in combination with appropriate technologies and pedagogies (Mishra & Koehler, 2006).

Neiss (2005) and Syh-Jong and Kuan-Chung (2010) lamented that while many PST training programs offer technology classes, often teachers are not taught to make any connection between the technology and the subject matter. Technology in this digital age is highly dynamic, requiring PST programs to be re-evaluated and redesigned to ensure effective technology integration (Goktas, Yildirim, & Yildirim, 2009).

PSTs should complete their programs with technological knowledge, and also the ability to integrate this technological knowledge with the subject content and pedagogical practice to form a cohesive, effective practice. Only in consideration of the content, technology, and pedagogy can technology be effectively incorporated into classroom practice. Initially, educators need to start by considering the content to be taught, and then focus on technology and pedagogy jointly to ensure effective technology usage.

Many avid technology enthusiasts use technology ineffectively—they have pre-maturely decided upon the technology they want to use, and then tried to make the specific technology work with the content when it is not a good fit. As well as considering all the elements, effective PST training can also foster positive attitudes towards technology through a deeper understanding of its affordances and an increase in personal knowledge and confidence toward its use. This article will describe the TPACK framework, one such solution for specifically addressing a method of PST training to provide a model for embodying content, technology, and pedagogy for effective technology integration.

This model can also ameliorate the negative attitudes towards technology that PSTs may hold as they develop a better understanding of effective technology use.

TPACK Framework

In order to effectively incorporate technology into the classroom, many variables need to be considered. Koehler and Mishra (2008) described how teaching and learning with technology presents a "wicked problem," as the many independent variables need to be working together collectively in order to be effective. TPACK can be used as one such framework to identify and address the many contextual variables. Derived from Shulman's (1986) model, which incorporated the dynamic connection between pedagogy and content, Mishra and Koehler (2006) developed the TPACK framework to include the technological component.

Since the initial publication of TPACK in 2006, the framework has been used in a number of published research articles (e.g. Ozgun-Koca, Meagher, & Edwards, 2010; Syh-Jong & Kuan-Chung, 2010) studying teacher technology integration skills, as well as the impact of the TPACK framework in teacher training programs.

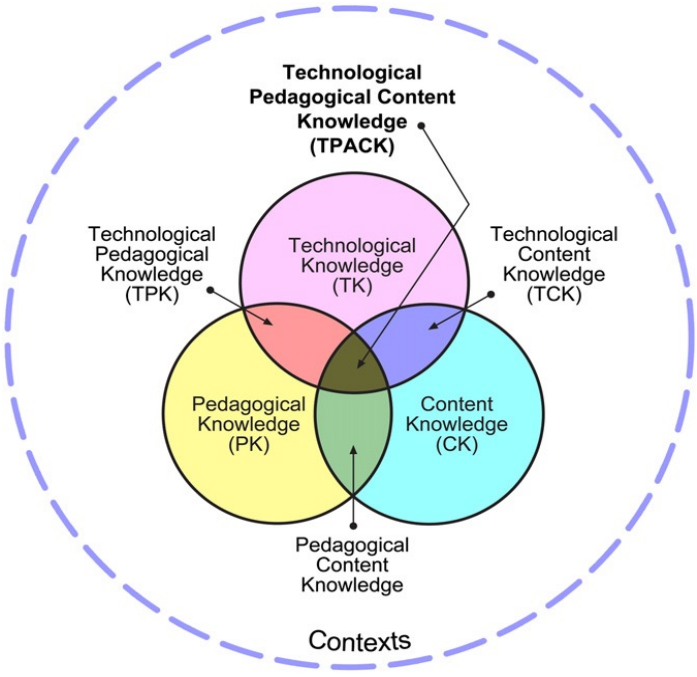

Figure. 1.
Mishra and Koehler's (2006) TPACK Framework

The framework identifies three areas of knowledge: pedagogical, technological, and content. Mishra and Koehler (2006) define content knowledge as the subject matter that is to be learned or taught, technological knowledge includes both digital and non-digital standard technologies, and pedagogy knowledge refers to the methods used in teaching and learning.

As it is shown in Figure 1, the three knowledge areas (technological, pedagogy, and content) are each identified, but by using a Venn diagram approach, the framework also points out the intersections connecting the knowledge areas: technological with content (TCK), pedagogical with content (PCK), and technological with pedagogical (TPK). The significant convergence of all three knowledge areas, defined as TPACK, refers to Technological, Pedagogical, and Content Knowledge as a cohesive whole, working together. Training can be broken up into parts where necessary, but the intent of the framework remains for the variables to be collectively considered in order for technology to be utilized effectively.

This framework seems straightforward, but PSTs may often be resistant to using technologies due to particular beliefs. These issues need to also be address for the PST to choose to use technology in their own teaching practice.

TEACHER RESISTANCE

As PSTs enter into the training program, he/she will undoubtedly hold beliefs about technology; these beliefs have been developed through their own prior use of technology and in many cases the lack of use in regard to educational purposes. Through the use of the TPACK framework in teacher training programs, many negatives beliefs towards technology can be overcome.

Details of how beliefs may be altered will be addressed a little later in this article, but first understanding how these negative beliefs are developed will assist in the understanding of how they can be quashed.

APPRENTICESHIP OF OBSERVATION

Lortie's (1975) apprenticeship of observation can be the reason why some teachers do not choose to use technology. Picture a young child playing the role of teacher in a game with friends. The child will use the teachers they have come into contact with as role models to help them act out that part in the game. They can often seem quite confident as they play the role of the teacher and often repeat particular phrases and actions.

This confidence comes from the days, weeks, and even years they have spent watching and interacting with teachers.

Now consider the PSTs, who have often come directly from school to the teacher training program; they will have had approximately 14 years of built-up knowledge of the role of the teacher. Lortie (1975) described this acculturating effect of schooling as *apprenticeship of observation*; PSTs have observed and internalized teacher behaviors and have well developed ideas of what it looks like to be a good teacher. Apprenticeship of observation can be a concern for PST educators (Bullock, 2010; Darling-Hammond, 2006) because these beliefs are often tacit and for years have gone unexamined and unchallenged.

Apprenticeship of observation causes a significant stumbling block for teachers integration of technology; PSTs may have observed minimal use of technology, as technologies integration in education has only become commonplace in the last decade. The method in which new technologies are being used in education today will be a completely novel experience to many of the PSTs. This may also be exacerbated by the PSTs having little experience with the use of technology in general, including for their own personal use.

LACKING TECHNICAL KNOWLEDGE

It is to be expected that novice technology users will experience some apprehension as they are required to use technologies in their teaching. This apprehension may in turn cause a negative feeling toward the use of technology (Gros, 2003; Rosas, 2003). PSTs may hold the view that the teacher should be perceived as the "one in control" and should certainly know how to manage everything in the classroom. This notion can cause PSTs to fear using technologies in the educational setting. Many people hold the believe that students are whiz kids with technological devices and applications, and they have even been titled "Digital Natives" (Prensky, 2001) due to having technological abilities that far surpass the "older generation" (i.e., those who were born before the technology boom of the latter 1980s). Therefore, PSTs may fear that their own lack of technological knowledge could undermine their authority and reputation with the students in the class; it will make them appear less knowledgeable and often less in control (Baylor & Ritchie, 2002).

PUTTING CONTROL IN THE HANDS OF THE STUDENTS

A teachers' concern for control can be aggravated beyond the lack of technological knowledge as technologies place knowledge within reach of the student. Students are not as reliant on teachers for access to knowledge and information (Crompton, Goodhand, & Wells, 2011); rather than waiting for the teacher to impart his or her knowledge and wisdom to the eagerly awaiting students, the students themselves can access internet search engines on their computers, laptops, and even phones to produce a whole array of answers to the questions they seek.

Technology also can provide the students with more choices as to how they learn, allowing students to select their learning type and even time they choose to learn. If a teacher prefers a linear approach to learning in which the students move step-by-step with the teacher, this is often disrupted as the technologies allow students to move laterally and even backwards to prior topics if they choose to do so.

Little to nothing can be done to avoid PSTs coming to the teacher training programs with negative feelings about technology and it is somewhat understandable how these beliefs have developed and the discomfort and even fear that comes with them.

There are no guarantees that these beliefs can be entirely eradicated, but the TPACK framework could lead to the PSTs developing a better understanding of the affordances of technology that will ameliorate some of these issues.

TPACK

As described earlier in this paper, the TPACK framework provides a clear, visual framework for use in PST training programs. The training program should include lessons focused on building PSTs' technological knowledge; this could be in the form of "how-to" tutorials where the PSTs get a chance to learn how to use various technologies. The PSTs will be able to see on the framework where the development of technological knowledge is important (referring to the pink shaded area in Figure 1), independent of any connections with other knowledge, just as they will be able to see the need to study content knowledge (blue shaded area) and pedagogical knowledge (yellow area) as stand-alone lessons.

It is unfair to expect teachers with little to no experience using technologies to not only use them in their teaching, but to do so effectively (Barton & Haydn, 2006; Teo, Lee, & Chai, 2008). By giving the PSTs opportunities to better understand the technologies, many fears will subside and may even be replaced with enthusiasm as the PSTs have the opportunity to better understand what technologies are available and how to operate them.They will also understand that there are many ways to use a technology, and even multiple ways to produce the same outcome, leading to the understanding that students may know how to do something differently while using a technology, but this is not something that teachers need to fear.

As the PSTs gain experience in the individual knowledge areas, the TPACK framework then has the portions of the Venn diagram where connections are made between two knowledge areas (e.g., content knowledge and technological knowledge). PST training would then provide guidance and time to make those connections (Sutton, 2010).

A great example of this would be when PSTs make the connection between teaching languages and how podcasts can be used to support teaching and learning. As these connections are being made, the teacher training programs will focus on the interactive connectivity between the three knowledge bases—TPACK. With the cumulative effect of the framework, PSTs will better understand the different choices of pedagogy that technology offers. Technology offers students the choice of when, where, and how to teach (Beckmann, 2010).

But this also can greatly benefit teachers and students as it

- **allows further opportunities for students to work independently from the teacher, which can still be easily monitored and evaluated (Hannafin & Foshay, 2006);**
- **enables teachers to offer different learning styles (Sun, Lin, & Yu, 2008) and perhaps even different languages to the students in the class, which they would not otherwise be able to offer;**
- **provides the opportunity for students to become active participants in their learning process, rather than passive consumers (Looi et al., 2010).**

Through the descriptions of how the TPACK framework can better support PSTs as they make decisions of what it looks like to be a "good teacher" (who can effectively incorporate technology into their practice), it is also evident that many beliefs developed during the apprenticeship of observation can be lessened to a great extent (Ozgun-Koca, Meagher, & Todd, 2010).

It is useful to point out to the PSTs that teaching will look different than what they have personally experienced, reminding them that digital technologies are ubiquitous in today's society which is probably very different that the society they grew up in.

CONCLUSION

Teaching now is more than just mastery of skills, but it involves the dynamic interaction between the technology tools, subject content, and teaching practice. Although technology is on the rise in society and schools, many teachers are not effectively incorporating technology into their teaching and learning (Groff & Mouza, 2008; Levin & Wadmany, 2008; Russell, O'Dwyer, Bebell, & Tao, 2007). This lack of use can be due to factors such as teachers' negative beliefs and feelings towards technology.

Effectively interconnecting content, pedagogies, and technologies can be a difficult problem with many of the distinct variables involved. The TPACK framework can be used in PST training programs to facilitate a better understanding of how to go about effectively creating a cohesive lesson while also ameliorating negative teacher beliefs and feelings.

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