Handbook of Technological Pedagogical Content Knowledge (TPCK) for Education

Edited by the AACTE Committee on Innovation and Technology

Published by Routledge/Taylor & Francis Group for the American Association of Colleges for Teacher Education
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This Handbook addresses the concept and implementation of technological pedagogical content knowledge—the knowledge and skills that teachers need in order to meaningfully integrate technology into instruction in specific content areas. Recognizing, for example, that effective uses of technology in mathematics are quite different from effective uses of technology in social studies, teachers need specific preparation in using technology in each content area they will be teaching. Offering a series of chapters by scholars in different content areas who apply the technological pedagogical content knowledge framework to their individual content areas, the volume is structured around three themes:

- What is technological pedagogical content knowledge?
- Integrating technological pedagogical content knowledge into specific subject areas
- Integrating technological pedagogical content knowledge into teacher education and professional development

The Handbook of Technological Pedagogical Content Knowledge (TPCK) for Educators is simultaneously a mandate and a manifesto on the engagement of technology in classrooms based on consensus standards and rubrics for effectiveness. As the title of the concluding chapter declares, "It's about time!"
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THE AACTE COMMITTEE ON INNOVATION AND TECHNOLOGY

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The twenty-first century is under a process of advances in technology, which has significantly impacted the field of education. With the integration of technology in the classroom, educators are challenged to adapt and incorporate new tools and methods. This section of the document highlights the role of TPCK in various educational contexts, from preservice to in-service education, emphasizing the importance of integrating technology effectively.

Between the lines, the changing nature of these challenges necessitates a continuous update of educational strategies. The evolving landscape of technology poses new questions for educators, particularly in the realm of teacher education. This section aims to address these challenges by providing insights into how TPCK can be effectively integrated into teaching practices.

Like many technologies, technology in education has been a topic of discussion and implementation. The volume of this section supports the assumption that technology is an essential component of the modern educational landscape. However, the unequal presence of technology across different educational settings remains a critical consideration for educators and policymakers alike.
TPCK
An integrated framework for educating world language teachers

MARCELA VAN OLPHEN

Introduction

Over the last three decades, critical changes have occurred in the field of education. These changes, chiefly driven by rising educational theories, have had an effect on the ways that the learning and teaching of second and foreign languages (L2) are conceptualized and practiced. As educational and intellectual environments move toward more critical and socio-constructivist approaches to teacher education, we ought to consider the scope of the knowledge base of language teachers vis-à-vis current and emerging needs in the world languages education (WLE) field.

Today's teachers are confronted with a broader range of needs than teachers were a few decades ago. These changes affect the body of knowledge that teachers need to have in order to thrive in their profession as well as to promote successful learning experiences among their students. To this end, current research on teacher cognition has been consistently linked to research on pupil cognition. Pupil cognition has also been considered a critical component of research on teacher education (Alton-Lee & Nuthall, 1992; Freeman & Johnson, 2005b; Morine-Dershimer, 2001). Morine-Dershimer (2001) asserts that the strengthening of this knowledge stems from experienced teachers who became researchers and whose insightful experiences have added to the development of and discussions in the field.

The knowledge base of world languages teacher education (WLTE) has been under discussion for several decades (Bernhard & Hamadou, 1987; Schulz, 2000; Tedick & Walker, 1994). Researchers have embarked on a quest for agreement regarding what should constitute the knowledge base of WLTE (Adger, Snow, & Christian, 2002; Freeman & Johnson, 1998, 2005a; Tarone & Allwright, 2005) as well as who is in charge of teacher development (Schulz, 2000). There have been lengthy and fruitful discussions about this important topic. Yet, as Tedick (2005, p. 2) noted when addressing Tarone and Allwright's (2005) response to Freeman and Johnson's (1998) article, in some cases, researchers have "agreed to disagree" about what constitutes the knowledge base for WLTE. Professional and learned associations such as the
American Council of Teachers of Foreign Languages (ACTFL) and the Teachers of English to Speakers of Other Languages (TESOL) have undertaken the task of writing standards for students as well as standards for professional preparation. Both ACTFL and TESOL have joined efforts and worked collaboratively with the National Council for Accreditation of Teacher Education (NCATE) to develop program standards for the preparation of world languages teachers.

The ACTFL/NCATE Program Standards for the Preparation of Foreign Language Teachers document is structured around six content standards: (1) language linguistics, comparisons; (2) cultures, literatures, cross-disciplinary concepts; (3) language acquisition theories and instructional practices; (4) integration of standards into curriculum and instruction; (5) assessment of languages and cultures; and (6) professionalism. Each standard is further divided into supporting standards, accompanied by explanations and rubrics as well. The TESOL/NCATE Standards for Accreditation of Initial Programs in P-12 ESL Teacher Education document is structured around five domains: (1) language, (2) culture, (3) instruction, (4) assessment, and (5) professionalism, at the core. These domains are divided into standards (13 total), which are also broken down into performance indicators (Tables 5.1 and 5.2). These program standards provide a framework from which teacher education programs may draw while outlining what should constitute the knowledge base for world languages teacher candidates.

As teachers and teacher educators prepare to educate new generations, new needs and dimensions arise, as the dynamic nature of the evolving socio-cultural contexts of education is considered. Specifically, the study of world languages teachers’ cognition as it relates to their knowledge of educational technology has not received a great deal of attention (Lam, 2000; Rodriguez-van Olphen, 2002). Furthermore, although an opportunity for teacher candidates to experience technology is mentioned as one of the requirements for programs of world languages teacher preparation (ACTFL, 2002, p. 2), neither the ACTFL/NCATE nor the TESOL/NCATE professional preparation standards includes a specific standard that relates to a teacher’s understanding of educational technology, computer-assisted language learning (CALL), or the integration of technology into the curriculum. Instead, it is briefly mentioned but not developed as a stand-alone standard.

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This chapter attempts to advance the current understanding of the kinds of knowledge world languages teachers need to have to integrate technology in thoughtful and pedagogically sound ways into the curriculum. To accomplish this goal, I examine Koehler and Mishra’s (2005) concept of technological pedagogical content knowledge (TPCK) as a framework for a sound integration of technology into the curriculum as it relates to WLTE. The following sections look at (a) two of Shulman’s (1987) categories of the knowledge base for teachers—content knowledge (CK) and pedagogical content knowledge (PCK)—as they relate to world languages teachers’ knowledge and as predecessors of TPCK; (b) technological content knowledge (TCK) as it relates to CALL; and (c) Koehler and Mishra’s (2005) concept of TPCK as it pertains to current research about teachers’ cognition and the integration of technology into the teaching and learning of foreign and second languages. Although CK, PCK, TCK, and TPCK have been described in different sections for organizational purposes, they “exist in a state of dynamic equilibrium” (Koehler & Mishra, 2005, p. 14) and often involve overlapping or related attributes.

**Content knowledge in foreign language teacher education**

Shulman (1987) explains his definition of CK within teachers’ scholarship in their content discipline. That is, CK is referred to as the “knowledge, understanding, skill, and disposition that are to be learned by school children” (p. 9). Drawing from Shulman’s definition of CK, world languages educators have to develop the knowledge, understanding, skills, and disposition of their target language. Moreover, students seeking to learn another language need to develop a working knowledge, understanding, and disposition, as well as a set
of skills, for their target language while learning to communicate across cultures. Thus, the CK of language educators consists of, but should not be limited to, proficiency in and knowledge about the target language and its culture(s).

Richards (1998) proposes six domains of expertise, knowledge, and skill for second language teacher education as a blueprint for designing programs and advancing professional development. The components of two of those domains, (a) subject matter knowledge and (b) communication skills and language proficiency, are closely related to CK. For Richards, subject matter knowledge involves a teacher’s understanding of (a) the nature of language and language use, (b) the nature of second language learning, and (c) approaches to language teaching, curriculum development, testing and evaluation, and materials development (p. 15). The remaining four domains are discussed in the next section of this chapter, as they are more closely related to PCK.

Lafayette (1993), in his overview of the specialist education that world languages teachers need to achieve, states that CK in WLTE includes (a) language analysis, (b) language proficiency, and (c) an understanding of civilization and culture. These components are not simple pieces of the world languages teachers’ CK. Instead, each is made up of a complex web of interconnected elements that I will not address further here (for more information, see Schulz, 2000). When these components are taken into consideration, CK for teachers broadly encompasses the study of language-specific linguistics (morphology, phonetics, phonology, pragmatics, second language acquisition, semantics, socio-linguistics, and syntax) and the development of both cross-cultural awareness and near-native language proficiency. Ideally, CK for language teachers includes all the necessary elements that help language learners to communicate both verbally and non-verbally across linguistic and cultural borders. Understanding how second languages are acquired has a direct effect on how languages should be taught. The next section, which offers a brief and non-exhaustive account of current approaches to second language acquisition (SLA), aims to provide some insights into the basics of SLA.

Current approaches to SLA

Current research in SLA has shed light on the teaching and learning of languages. Understanding the theoretical underpinnings of current approaches to language learning and teaching is a crucial component of effective language teaching and, by extension, to meaningful integration of technology.

Chomsky (1959), reviewing Skinner’s work, criticized existing approaches to language learning and proposed that languages are not learned solely by memorization. Instead, human minds possess a language acquisition device (LAD) that enables children to learn the grammar rules of their language. Hymes (1961) foregrounds the importance of language use in social settings.
as it pertains to language performance. Chomsky (1965) made the distinction between competence and performance. According to Chomsky (1965), competence refers to the knowledge of how a linguistic system works, how the grammar rules and syntax work, whereas performance refers to the person's ability to produce language. In other words, competence addresses what one knows about the language, and performance, what one can do with the language. Drawing from these two concepts, linguists elaborated on the role of social interactions (Halliday, 1975), and Chomsky's definition evolved into a broader notion, communicative competence (Bers, 1990; Campbell & Wales, 1970; Canale & Swain, 1979; Hymes, 1972; Savignon, 1972). Canale and Swain (1979) state that communicative competence consists of four components: (a) grammatical competence, (b) sociolinguistic competence, (c) discourse competence, and (d) strategic competence.

Krashen (1981, 1982) proposed the monitor model as a theory of SLA. According to this model, adults acquire language structures in a predictable order provided that they are exposed to comprehensible input and within a low anxiety environment while an internal monitor acquires and makes sense of correct language functions. The Monitor Model is organized around five hypotheses. These hypotheses are (a) the acquisition-learning hypothesis, (b) the natural order hypothesis, (c) the input hypothesis, (d) the monitor hypothesis, and (e) the affective filter hypothesis. Despite the wide criticism this model has received and the controversies raised, it has provided the theoretical basis for the Natural Approach and has had a strong influence on classroom practices.

Loa (1980, 1983), when proposing his Interaction Hypothesis, contends that native speakers make modifications to interact with non-native speakers. These modifications have two dimensions: (a) the adjustments made in order to prevent glitches when communicating, and (b) the adjustments made to repair communication when glitches happen. Also, he states that input can be made comprehensible by (a) simplifying the input (i.e., using cognates and familiar vocabulary), (b) using linguistic and extralinguistic features such as gestures and background knowledge, and (c) modifying the structural interactions of conversations with non-native speakers.

Swain (1985, 1995) takes one step further than Krashen and Long and proposes the Output Hypothesis. She argues that input alone is not enough to acquire native-like language competence. Swain, while conducting a study of productive skills of French immersion students in Canada, observed that comprehensible input alone did not help students to move to higher levels of language proficiency. These observations served as a springboard to claim that language production or output that is accurate is necessary to reach higher levels of language proficiency.

Cummings' theories of bilingualism and cognition emphasize that being bilingual poses a cognitive advantage and that the first language provides the
foundation for the acquisition of the second language. Cummins' (1979, 1980, 1981) concepts of basic interpersonal communication skills (BICS), cognitive academic language proficiency (CALP), separate underlying proficiency (SUP), and common underlying proficiency (CUP) are major contributions to the understanding of bilingual education as well as to dispelling the myths about a first language hindering the acquisition of second languages.

Finally, but not least important, it is necessary to point out the role of Sociocultural Theory. Vygotsky (1978) highlighted the importance of social interactions as they pertain to language development. Within this theoretical framework, language development is socially constructed and is as much a cognitive process as a social process, as opposed to the theory of Piaget, who stressed the importance of individual cognitive development as a relatively solitary act (stages). According to Vygotsky (1978) learning occurs within a “zone of proximal development” defined as “the distance between the actual developmental level as determined by independent problem solving and the level of potential development as determined through problem solving under adult guidance or in collaboration with more capable peers” (p. 86). Therefore, a language teacher working within this framework will provide a classroom learning environment that fosters communicative pair or group work and that provides ample opportunities for students of varied proficiency levels to interact within a safe and rich environment.

Pedagogical content knowledge (PCK)

According to Shulman (1987) PCK, a special fusion between content and pedagogical knowledge, “represents the blending of content and pedagogy into an understanding of how particular topics, problems, or issues are organized, represented, and adapted to the diverse interests and abilities of learners, and represented for instruction” (p. 8). To this end, Shulman introduces the concept of pedagogical reasoning as the ability of teachers to progress from their role as learners as they make sense of, reorganize, and elucidate the subject matter in original ways so that it can be learned by students. Hence, building upon what constitutes the CK for language teachers, which is the form of knowledge that calls for all the necessary elements to help language learners to communicate both verbally and non-verbally across linguistic and cultural borders, PCK for WLTE refers to what teachers know about teaching the target language to empower students to communicate across linguistic and cultural borders.

Teacher educators researchers have long discussed the PCK for language teachers as a relevant category of the knowledge base within WLTE and have tried to promote PCK-relevant research that advances current understandings in the field. For instance, Lafayette (1993) recommends that research be performed to specify the PCK of foreign and second language teachers. Further, he questions the similarities and differences among fields (social studies,
math, science, etc.) and languages (French, German, Latin, Spanish, etc.) and how they interact when trying to outline PCK for foreign language teachers. Wing (1993) contends that it is imperative for teachers to understand the content from the student's perspective as well as to scrutinize precedent and up-to-date teaching and learning practices if they are to advance in their preparation as foreign language teachers. To this end, Wing discusses Jarvis' (1983) observations and warns the teacher education community about relegating PCK to methods courses instead of incorporating it throughout the teachers' professional education. Thus, language teacher education programs should sustain the pedagogical reasoning development of teachers as an ongoing matter.

Richards' (1998) four remaining domains draw from Shulman's (1987) concepts of PCK and pedagogical reasoning. In this regard, Richards' proposed domains are (a) theories of teaching, (b) teaching skills, (c) pedagogical reasoning, and (d) contextual knowledge. The aim of these domains is to provide second language teacher education with an agenda that promotes and strengthens the teachers' engagement in the exploration of knowledge, beliefs, attitudes, and thinking as they inform their teaching endeavors.

To the same effect, Freeman and Johnson (1998) raise awareness of the need for more articulated approaches to bridge content and pedagogical knowledge. They contend that the activity of teaching itself, the teacher who performs it, the contexts in which teaching occurs, and the pedagogy involved must be the core of the knowledge base. Then PCK becomes a crucial component of WLTE within this emerging reconceptualization.

Technological content knowledge (TCK)

TCK pertains to what teachers know about how technology and subject matter knowledge are interconnected (Koehler & Mishra, 2005). Specifically, TCK for foreign language teachers is defined as the body of knowledge that teachers have about their target language and its culture and how technology is used to represent this knowledge. In order to promote curriculum integration and technology-capable students and teachers, the International Society of Technology in Education has published the National Educational Technology Standards for Students: Connecting curriculum and technology (NETS), a comprehensive document for connecting curriculum and technology. Among the aims of this project are refining and developing sets of standards for students and for the professional preparation of teachers. Other important components of this document are the sections that specifically provide examples of connecting curriculum and technology by demonstrating the effective infusion of technology into content areas. In addition to national efforts such as this, researchers have widely studied the impact that new technologies have when foreign languages are learned, giving birth to a new field of study that is referred to as computer-assisted language learning (CALL). CALL research
looks at how technology shapes foreign language educators and assists them in representing content knowledge. Understanding the contributions that CALL can make to the field of foreign language education is essential for the development of TCK among teacher candidates. In fact, one of the key elements for integrating new technology is that teachers understand how the technology can enhance the learning process (van Olphen, 2003).

**Impact of computer-assisted language learning (CALL)**

During the last decade, a wealth of research has documented the impact of technology on language learning. The pervasive presence of technology in L2 teaching and learning and WITE triggers the need for developing pedagogy that benefits from it (Chapelle, 2005). Evidence of these efforts exists in the body of research published in specialized scholarly journals such as *CALICO, Language Learning and Technology*, and *System*, not to mention research studies that have been published in general second language education and applied linguistics journals such as *Foreign Language Annals, Modern Language Journal, TESOL Quarterly*, and *Studies in Second Language Acquisition*. Specifically, researchers have looked at CALL and its impact on both the teaching and learning processes (Bax, 2003; Bush & Terry, 1997b; Chapelle, 1998; Egbert, Paulus, & Nakamichi, 2002; Garrett, 1991; Salaberry, 2000; Warschauer, 2002). It is fundamental for teachers to understand how CALL shapes their teaching practices. The contributions of CALL to the field of foreign language education are crucial to the understanding of TCK. This section describes the growing body of research as it pertains to CALL and its impact on second and foreign language learning.

The following account, although brief, offers examples and an overview of how new technologies can shape the ways teachers represent their subject matter knowledge. Engaging language students in contextualized and meaningful conversations in the target language is always a challenge for the language teacher, not to mention providing students with a challenging environment that sustains the development of this skill. By means of synchronous (real-time) communication, researchers have found a way to allow students to “virtually” speak to one another. Findings from studies that document students’ progress when exposed to synchronous networked discussions (such as those in Internet chatrooms) are consistent across the board. The students’ writing, reading, and conversational skills seem to benefit from the use of these real-time networks (Beauvois, 1997). Asynchronous environments (such as email) can also be useful for extending conversational classroom practice (Gonglewski, 1999).

Finding authentic and up-to-date materials for practicing listening comprehension used to be an ordeal. Now the World Wide Web offers an ample spectrum of authentic materials for teachers and students. These materials are most commonly found in the format of audio files, online dictionaries with
sound, digitized short stories, etc. Gonglewski (1999) states that these materials facilitate the implementation of standards and promote students' success in reaching benchmarks.

Like opportunities for listening comprehension, vocabulary acquisition and retention are issues that teachers find troublesome. Each new chapter of a foreign language text features a myriad of words and expressions that students need to master. Ideally, students should not learn vocabulary by rote memorization. Instead, they should have opportunities to infer the meanings of these new words and expressions. Fortunately, the implementation of hypertext and hypermedia applications has proven to be of great benefit for the acquisition and retention of new vocabulary. Grace (1998) looked at vocabulary retention when presented in contexts that promote inference instead of word-to-word translation while addressing the specific design of software for CALL.

Reading is another important skill that both teachers and students work diligently to improve. Reading in the second language is not the same as achieving literacy in the first language (L1) (Martinez-Lage, 1997). In an attempt to elucidate how to help students develop their second language reading skills, researchers have looked at the effects of multimedia packages, hypermedia technologies, CALL software, and other media. For instance, Hong (1997) evaluated the effectiveness of multimedia computer-assisted reading in business Chinese. The findings suggest that learners performed more efficiently with the support of multimedia technology. Martinez-Lage (1997) examined the application of interactive hypermedia technology to the teaching of reading modern languages.

A common example of technology integration in the language classroom is the facilitation of the students' writing process. Researchers have found the use of Microsoft Word (and its editing tools) to be beneficial for both student-teacher and peer-review activities. Another example is the use of concordancing and other packages in teaching both English as a second language and modern languages (Chavez, 1997; Howells, 1998). Telecommunication networks have also been proven to enhance the students' writing process, particularly when students had to write email messages and respond to those they received (Allen & Thompson, 1995). In general, researchers have found that asynchronous networks help to advance students' writing skills while providing a low-anxiety atmosphere (Beauvois, 1997).

New technologies have expanded the horizon for second and foreign language classrooms. The Internet, chatrooms, email, video-conferencing, and digital communications have shaped the ways in which teachers introduce culture to their students. When students are learning a second language, a tight connection to an understanding of that culture is important. One of the best assets that teachers can have for teaching culture is access to authentic materials and environments that, in most cases, are physically far away. New
technologies grant both the students and teachers opportunities to build cultural bridges. Kern (1998), who studied a group of students using email, states that networked environments cultivate the development of cultural literacy. Another example is Kubota's (1999) successful implementation of four projects using the World Wide Web and word processing to address cultural topics and to raise cultural awareness in an intermediate Japanese college classroom. Sebaoui (2001) examined the use of computer technology to develop critical cross-cultural awareness. Pearson (2004) proposes a web portfolio to strengthen cultural awareness while teaching Spanish reading. Drawing from research studies, Pearson contends that this type of Internet-based project to raise cultural awareness helps students increase linguistic proficiency. All these findings suggest that a major strength of CALL is its potential for opening doors to connect people and to build communities while promoting cross-cultural communicative competence.

As newer technologies such as podcasting, blogging, text-messaging, and digital video emerge, research studies will follow that provide information about how these potential tools affect language learning as well as how they shape teaching practices. CALL has much to offer the field of foreign language education. It is imperative that this body of knowledge becomes part of the knowledge base of teacher candidates. If teachers are not fully aware of these findings and if their beliefs make them hesitant to incorporate this technology into their teaching practice, they will be unable to integrate technology in a pedagogically sound way. It is vital that we use the emerging research about how CALL affects the teaching and learning of languages to inform teachers' PCK. The combination of PCK and the impact of CALL leads one to consider the conceptual framework designed by Mishra and Koehler (2006) for educational technology as a robust structure for advancing the current understanding of teacher cognition, as the fields of second language teacher education and educational technology intersect.

**Technological pedagogical content knowledge (TPCK)**

Mishra and Koehler (2006) contend that “thoughtful, pedagogical uses of technology require the development of a complex, situated form of knowledge we call Technological Pedagogical Content Knowledge” (p. 1017). Koehler and Mishra (2005) coined the term TPCK as they attempted to provide a framework that incorporates the indispensable trait of an educator’s knowledge as he/she integrates technology into his/her teaching practice at the same time as attending to the complexities of this particular kind of knowledge. TPCK is an emergent form of knowledge as a response to the growing need for a scaffold that supports the sound integration of technology. TPCK is not an extension or appendix of content, pedagogy, and technology but rather a complex form of knowledge that blends all three components (CK, PCK, and TCK) and the dynamic relationships that exist.
among them. Furthermore, Mishra and Koehler (2006) assert that “there is no single technological solution that applies for every teacher, every course, or every view of teaching” (p. 1029). Thus, teachers’ knowledge and their ability to integrate technology into their pedagogy are intricate and multidimensional phenomena.

These phenomena are not made any less complex when analyzed within the context of second language teacher education. Following Mishra and Koehler’s (2006) explanation of how TPCK lies at the core of teaching with technology, it is possible to assert that the foundation of good language teaching with technology requires (a) an understanding of how linguistic and cultural concepts can be represented using technology; (b) educational approaches to language teaching that draw from socio-constructivist philosophies to develop students’ language and cultural competence; (c) an awareness of what facilitates or hinders the acquisition of language and the development of language competence and how technology, specifically CALL or computer-mediated communication (CMC), can revamp common problems that students ordinarily face; (d) an awareness of students’ previous knowledge, and particularly a knowledge of second language acquisition (SLA) and cognitive development theories; and (e) an understanding of how current and emerging technologies can be used to advance present knowledge and to develop new epistemologies and sustain previous ones.

Grosse (1993) analyzed 157 foreign language methods course syllabi to gain a better understanding of the knowledge base for WITE. Her analysis revealed integration of technology as one of the five areas that need further development in the world languages methods courses. These findings emphasize the need for teacher educators and teacher education programs to prepare world languages teachers to opt for, adapt, implement, and even design meaningful technology-based activities that are aligned with current approaches to language learning and teaching. That is, meaningful technology-based materials and CALL should be rooted in the theoretical underpinnings of the social construction of knowledge.

Teaching and learning languages through CALL is an ever-evolving process that is intertwined with CK, PCK, and TCK. Within Mishra and Koehler’s (2006) framework, a change in one of the components generates a change in the others. These changes happen as compensatory mechanisms to maintain the dynamic equilibrium. For example, consider a Spanish writing class where the students have to write and edit an essay about cross-cultural differences between holidays in the U.S. and in Spain. Writing the essay in Spanish (stylistics, syntax, cultural differences—i.e., content) drives the types of representations to be used (analysis of Spanish writing samples, semantic maps, visual representations of how to structure writing in Spanish, editing exercises—i.e., pedagogy), plus the necessary technologies to influence them. In this case, the Internet, web-based resources, Microsoft Word and its “track
changes” tool, wikis, or even blogs would fit the purpose for interactively creating, developing, and writing the essay. Had the teacher not had all these technologies at hand, she/he would have to implement other ways of representing content. Obviously, this change when representing knowledge would also generate an adaptation or modification at the pedagogical level. As Mishra and Koehler (2006) note, newer technologies upset the status quo and demand that teachers reconfigure their current understanding of technology as well as of the three components. Such is the case for the example above in the event that a teacher decides to use only Word and the “track changes” tool in contrast to seeking to integrate newer technologies like wikis and/or blogs.

Raven McCrory’s (see Chapter 9) example of a virtual dissection illustrates an important point. Specifically, she states that technology should be used to carry out activities that would otherwise be impossible to accomplish. In the same vein, world languages students often cannot afford studying abroad and being exposed to the magnificent art in museums such as the Louvre, the Prado, or even national art galleries. In this case, a virtual tour of a museum or culturally relevant places can afford students a better understanding of their target language. As Neal Grandgenett (see Chapter 7) points out, it is a matter of thinking imaginatively about “how” technology may support teaching and learning more than focusing too much on “what” technologies may be used. In addition to Mishra and Koheler’s (2006) theoretical framework, there have been other attempts to propose curricular models for the meaningful integration of technology (Angeli & Valanides, 2005; Otero et al., 2005; Wildner, 1999). Angeli and Valanides (2005), in their study about preservice elementary teachers as information and communication designers, propose an instructional design system (IDS) model to develop information and communication technology (ICT)-related PCK. They contend that this model was effective in developing some aspects of ICT-related PCK. Otero et al. (2005) also provide a critical framework drawing from the concept of situated practice and communities of discourse in their college of education. In their study, they present and discuss how understandings of meaningful technology use were negotiated among graduate students and faculty through their interactions. Wildner (1999) uses national technology standards and institutional features as a framework to propose a model of technology integration into foreign language preservice teacher education. This model provides graduates with a pedagogical and technological foundation that enhances their teaching practices and, in turn, their future students’ learning. These curricular models have their strengths and weaknesses, but they provide guidance to administrators and faculty who have to update teacher preparation programs.

Mishra and Koheler’s (2006) concept of TPCK provides a robust framework for professionals seeking to understand the complexities of meaningful integrative approaches for technologies as they pertain to the knowledge base of second language teacher education.
TPCK, the knowledge base of world language teacher education, and technology integration into the second language classroom: current trends and practices

Traditionally, research involving technology use in the field of world languages has focused on the learner and the learning process—particularly on how to enhance the students' learning and the teachers' practices (Beauvois, 1998; Biesenbach-Lucas, 2005; Borras & Lafayette, 1994; Bush, 1997; Bush & Terry, 1997; Chambers, 2005; Cui & Bull, 2005; Davis & Lyman-Hager, 1997; Horst, Cobb, & Nicola, 2005; Joiner, Bush, & Terry, 1997; Ware & Kranisch, 2005; Weinberg, Peters, & Sarma, 2005). Conversely, little attention has been paid to the processes that teacher candidates experience as they learn to integrate new technologies. The study of world languages teachers' cognition as they learn to integrate technology into their practices is an emerging area of research. Evidence of this is the scarcity of empirical research on how foreign language teachers learn to integrate technology into their curricula (Lam, 2000; Rodriguez-van Olphen, 2002). In fact, in September, 2000, Y. Zhao and S. Tella underscored this shortcoming when they called for papers for a Special Issue of Language Learning and Technology with a theme of Technology and (Language) Teacher Education that was to be published a year later. The editors highly recommended that potential contributors submit original research that focuses on teachers' integration of technologies into their pedagogical practices and necessary conditions that should be met to successfully integrate technology, among others.

Kassen and Higgins (1997), when addressing technology integration in the WLTE, identify three central issues in the preparation of WL teachers: (a) comfort level, (b) technology integration, and (c) critical skills to use technology. Moreover, they state that "Integration entails not only the use of the computers in the classroom but also its use to support curriculum goals" (p. 266). From their perspective, the integration of technology should be cultivated within a program's goals. Likewise, Rubio and Sedersten (2001), when presenting an account of how they integrated technology throughout their program, discuss the importance of helping students develop pedagogical knowledge. Ely (1994) points out that when making decisions regarding how to prepare second language teachers, the challenge is how to help them develop their pedagogical belief system. This belief system should serve as a springboard for teachers to develop their personal and professional guidelines, which will inform their decision-making process. As Freeman (1996) notes, teacher decision-making has provided researchers with "a cognitive map of teachers' mental world and intentions while teaching" (p. 361). Teachers' thinking is divided into two broad categories: (a) preactive decisions and (b) interactive decisions. Language teachers who are integrating technologies make decisions prior to teaching (preactive) in light of their
subject matter and their knowledge about how to make the content more readily available to students. For instance, during this decision-making process, TCK is involved as teachers use chat tools to present content. Thus, the use of chat tools modifies the way teachers present content to the students. While teaching, teachers make decisions (interactive) that shape their teaching practices.

The dynamic amalgamation of CK, TCK, and PCK inform and shape each other. To this end, Shaffer and Richardson (2004), who studied student teachers’ views of the use of information and communication technologies (ICT), report how the students came to realize that they had to change their teaching practices as a result of the use of ICT. Specifically, participating students linked the use of ICT with a transformation in the nature of classroom exchanges and the restructuring of teaching and learning.

**Reasons that hinder or promote the integration of technology by teachers**

The survey “Technology Counts ’99: Building the Digital Curriculum” showed that just 29 percent of the teachers participating stated that they had more than five hours of technology training in curriculum integration during the past year. Furthermore, this report states that a shortage of training is the chief barrier that deprives teachers from integrating technology into their subject matter. This is consistent with previous and more current findings (Akins, 1992; Lam, 2000). Preservice teachers’ methods courses are generally taught separately from those education courses that provide training in technology; this arrangement does not facilitate the meaningful and contextualized integration of technology. In some cases, uncertainty becomes an obstacle for teachers who seek to integrate new technologies. The sources of these uncertainties vary along the continuum offered by social, temporal, and spatial factors. Shaffer and Richardson (2004) found that although preservice teachers who participated in their study showed a strong desire to infuse technology into their teaching, they were uncertain as to what extent and how frequently this should happen. Lam (2000) found that teachers were reluctant to use technology for teaching because of a lack of (a) knowledge about teaching second language with computers, (b) confidence that was due to an absence of the necessary skills, (c) sustained access to computers, and (d) understanding of students’ needs. Obviously, some of these teachers felt very insecure about using technology because of social and academic factors.

Ertmer and Hruskocy (1999), in a study where teachers were provided with professional and instructional support through in-service workshops, found an increase in the teachers’ instructional and professional use of computers. Some of Lam’s (2000) participants decided to use technology because it motivates students and offers a different mode of introducing materials. Ma, Anderson, and Streith’s (2005) findings suggest that preservice teachers’ perceptions of the usefulness of technology had a significant impact on their
intentions to use it. This is consistent with Sime and Priestley's (2005) findings. The participants reflected on technology integrated in teaching and used in meaningful situations vis-à-vis technology used as an end in itself. Basically, if teachers see and understand how technology can affect the content to be represented, they are more likely to integrate it into their teaching. Similarly, the teachers' level of reflectivity can be considered another factor that promotes the meaningful integration of technology. Zhao, Pugh, and Sheldon (2002) found that when teachers are more reflective, they are more likely to integrate technology consciously and in accordance with their pedagogical beliefs. It seems that when there are no broken links among CK, PCK, and TCK, the integration of technology naturally slides into TPCK. Another way of presenting this idea is that when the integration of technology is conceived within the TPCK framework, each component falls into place. That is, all three components are assumed to be interconnected and to be dynamically balanced.

But what can be done?

Bailey et al. (1996), when examining Lottie's (1975) idea of "apprenticeship of observation" and how the 13,000 hours that students have spent throughout their K-12 school years shapes and informs the ways in which teachers teach, make a strong case for modeling the types of behavior that teacher educators would like to encourage for preservice teachers. An example of the initiatives that teacher educators have undertaken to provide both fellow teacher educators as well as language teachers with learning opportunities is the National Foreign Language Resource Center (NFLRC) at Iowa State University. This center's mission is to sustain opportunities for educators' professional development as well as to advance student learning of foreign languages across the nation. Specifically, the NFLRC provides professional development institutes that model sound integration of technology for both K-12 language teachers and faculty involved in teacher preparation courses.

Another example of projects for professional development that promote good models for pre- and in-service teachers is The Technology Collaboratives (TechCo) for Simultaneous Renewal in Teacher Education project. According to Thompson, Schmidt, and Davis (2003), TechCo is a collaborative project that draws from Goodland's (1994) theory of simultaneous renewal. This project envisions technology as a tool that facilitates renewal in both K-12 and teacher education programs. To accomplish this project's goals, the College of Education at Iowa State University (ISU) and four K-6 schools work in concert to integrate technology into both teacher education and K-6 curriculum. In addition, New Visions in Action, also hosted at the NFLRC (Iowa State University), has identified exemplary programs that prepare preservice teachers to integrate technology-based activities and assessments for the elementary and/or secondary classrooms. To this end,
Chuang and Rosenbusch (2005) stress the importance of faculty teaching education courses that model the meaningful uses of technology and learning environments.

An additional example of what universities can do to support teacher education faculty and teachers is The Florida Center for Instructional Technology (FCIT), located in the College of Education, University of South Florida (Tampa). The center is funded by the Florida Department of Education, Office of Instructional Technology, and USF, and exists in part to keep the College of Education abreast of pedagogical developments with relation to technology. FCIT staff members and graduate assistants offer training and support to USF faculty and preservice teachers via a “one-stop-shop” regardless of instructional need, topic, or content. In addition, the center maintains and coordinates a wide variety of teaching and learning resources (online and on site), and promotes workshops, training sessions, and classroom techniques that model best teaching practices to assist Florida’s schools and districts with technology integration. As the primary support center for teachers and teacher educators at USF, the FCIT offers learning opportunities in a supportive and diverse environment, not only at the university, but also throughout K-20 education in the state of Florida (for further information visit http://fcit.usf.edu/) (J. Takacs, personal communication, October 21, 2006).

The use of web-based courseware tools such as WebCT and BlackBoard in methods courses and practica has proved beneficial for world languages teacher candidates (WLTC). Kamhi-Stein (2000), who studied the use of WebCT by TESOL candidates in a practicum, states that the use of computer-mediated communication in a practicum can help teacher candidates learn more about integrating technologies and develop a reflective approach to technology integration. In the same vein, van Olphen (2007a) reported that WLTC found that the use of WebCT in a methods course was beneficial; it also promoted reflective practice when used as a medium to develop teacher candidates’ digital portfolios (van Olphen, 2007b). Participants in van Olphen’s (2007a) study also reported that the use of web-based courseware tools helped them increase their confidence in the use of technology while increasing their awareness of how technology could be integrated into the world languages classroom. Similarly, Asan (2003) focused on preservice teachers who used a self-paced multimedia tutorial that had two modes of information delivery—traditional and interactive multimedia; the interactive multimedia group, but not the traditional group, responded positively to integrating technology. Thus, teacher education programs can provide preservice teachers and in-service teachers with models and opportunities to achieve professional experience in learning how to integrate technology in pedagogically sound ways.
Conclusion

The adoption of the TPCK framework provides educators of second language teachers with a venue to enhance classrooms with technology while making them more culturally and linguistically valuable. Furthermore, TPCK offers a conceptual blueprint for language teacher education programs and language teacher educators who envision the seamless and pedagogically meaningful integration of technology in their programs. Specific examples have illustrated the interconnected nature of how language and culture, the teachers' understanding of how to translate this subject matter to their students, and the teachers' understanding of how different technologies shape and inform content and representations within second and foreign languages. Research findings indicate that when teachers have an understanding of TPCK, they have the foundation to enhance second language learning with a purpose (Rodriguez-van Olphen, 2002). Conversely, if teachers do not have a solid knowledge base, technology becomes one more object—or simply an ornament—in the lesson plan. In sum, the concept of TPCK, when used as a framework, is intended to further our understanding of foreign language teachers' cognition to achieve a sound infusion of technology into their content areas, which in turn advances students' second language competence.

Notes

1. I have used the term “world languages teacher education” to refer to English as a second language (ESL), foreign languages (FL), and English as a foreign language (EFL) teacher education to reflect some of the commonalities, shared body of knowledge, and interrelatedness among ESL, EFL, and FL teacher education. However, generalizations of research findings from one context into another one should be carefully analyzed. For instance, findings about L2 learning in the EFL context should be carefully examined before being generalized to the ESL context and vice versa. For further information on this topic see Bernhardt and Tedick (1991), Bigelow and Tedick (2003), Guntermann (1993), Hammadou (1993), and Tedick, Walker, Lange, Paige, and Jorstad (1993).
2. See Johnson (2004), Ellis (1985, 1997), for further information about SLA.
3. Although this project is no longer funded, the following site provides valuable information, http://www.nrlc.iastate.edu/nva/hompage.html.

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