Developing and Modeling 21st-Century Skills with Preservice Teachers

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Today's youth face a rapidly changing world, requiring them to move beyond basic formulaic knowledge and skills. Current educational policy, such as the Common Core State Standards (CCSS), represents a shift away from rote learning and memorization of facts to the development of the 21st-century skills of creativity: critical thinking; communication; collaboration; and information, media, and technology skills (IMTS). Business and political leaders also recognize the necessity in addressing these core competencies for the 21st-century landscape (Ravitch, 2010). For students to be competent in a global society, K–12 teachers need to develop, model, and assess the 21st-century skills in their students (National Governors Association Center for Best Practices [NGA] & Council of Chief State School Officers [CCSSO], 2010; Partnership for 21st Century Skills, 2016; Rotherham & Willingham, 2009; Truesdell & Birch, 2013). As such, there is a call for teacher education programs to facilitate preservice teachers' personal development of these

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skills as well as their application to educational settings (American Association of Colleges for Teacher Education, 2010; Michaels, Truesdell, & Brown, 2015).

While research exists on each of the 21st-century skills in isolation or in pairs, a scarcity of research exists on the process of explicitly facilitating them with preservice teachers (Kagle, 2014; Kokotsaki, 2011; McDonald & Kahn, 2014; Thieman, 2008). Some international examples, such as Singapore's TE21 Model of Teacher Education and teacher education in Finland, have elements of 21st-century skill training; however, few studies detail how to explicitly facilitate this process (Schleicher, 2012). To that end, this study describes a collaboration in one university between three teacher education programs (multiple subject, single subject, and education specialist) that explores how and to what extent faculty are developing and modeling the 21st-century skills in preservice teachers. In addition, this study analyzes preservice teachers' perceptions of their competence in 21st-century skills and their ability to incorporate them into their own teaching. Relying on the theory of cognitive apprenticeship (Collins, 2006; Collins, Brown, & Newman, 1987), the researchers approached this process primarily for the purpose of promoting expertise in teaching, focusing on teaching methods including modeling, coaching, scaffolding, articulation, reflection, and exploration.

This current study fills a gap in the teacher education literature as it identifies how teacher educators across programs within one institution developed the 21st-century skills with preservice teachers, through both course work and field experiences. The current study asked, How and to what extent do our teacher education programs develop and model the 21st-century skills in preservice teachers? This study also aimed to build a model for teacher education programs by purposefully facilitating the development of these skills (see Figure 1); specifically, the initial stage is personal development of each skill, followed by the application of these skills in educational contexts, and finally their utilization professionally with K–12 students, colleagues, and parents.

21st-Century Skills

The 21st-century skills of creativity, critical thinking, communication, collaboration, and IMTS are not novel to today's educational and business settings (Rotherham & Willingham, 2009; Silva, 2009). Indeed, these skills have been integral elements throughout human history; however, *how* these skills are taught and developed in K–12 schools has evolved. The CCSS represents a shift away from basic drill and recitation of simple facts to an emphasis on the multifaceted processes of learning (NGA & CCSSO, 2010).

The recently adopted CCSS intentionally include 21st-century skills. Literacy standards contain explicit requirements for communication. The other elements of creativity, critical thinking, collaboration, and the use of technology are all subsumed in the standards for literacy, math, and science (NGA & CCSSO, 2010;

Partnership for 21st Century Skills, 2016). In fact, even the names of math standards speak to these skills, identifying creativity and critical thinking explicitly (NGA & CCSSO, 2010).

As the CCSS require K–12 students to demonstrate competency in the 21st-century skills, teachers also need to understand how to develop, model, and assess these skills. In turn, teacher education programs should be expected to start this process by facilitating preservice teachers' exploration and reflection on these

Figure 1

Model of 21st-century skill development for teacher education programs (Michaels, Roshandel, Truesdell, & Urbani, 2015). This trajectory identifies three phases: (a) personal development (preservice teachers' capacity to understand and apply these skills in multiple contexts, not limited to educational settings), (b) applied development (continued building of individual capacity as preservice teachers, while facilitating the skill development within their students during supervised teaching fieldwork), and (c) professional development (continued development of these skills with students, colleagues, parents, and administrators as in-service teachers).

competencies to apply them within their classrooms, so they continue to develop and learn throughout their careers (Darling-Hammond, 2006). While an abundance of research on developing the 21st-century skills through professional development for *in-service* teachers exists, fewer studies focus on more than one or two elements of 21st-century skills in *preservice* teachers (Dong, Chai, Sang, Koh, & Tsai, 2015; Hagevik, Aydeniz, & Rowell, 2012; Jones & Jones, 2013; Pamuk, 2011). As the existing definitions of the skills focus on K–12 students (Partnership for 21st Century Skills, 2016), and can be applied to schools and the workplace (Silva, 2009), this study recognized the need to define the 21st-century skills for preservice teacher education. Therefore the existing literature was analyzed to develop definitions (see Figure 2) to use in teacher education programs (e.g., Hora & Holden, 2013; Partnership for 21st Century Skills, 2016; Rotherham & Willingham, 2009; Ryhammar & Brolin, 1999; Sternberg & Lubart, 1999; Ward & McCotter, 2004). The foundation of the 21st-century skills elements and definitions stem from the framework presented by Partnership for 21st Skills (Dede, 2010). The following sections explore research on each identified component in teacher education.

Creativity

Research on creativity with preservice teachers is limited and identifies its restriction within classrooms in several ways: fidelity to the curriculum and standards, assessment of creativity, and a lack of training in the development of

Figure 2

Definitions of 21st-century skills for preservice teachers (Michaels et al., 2015).

Creativity	Creativity is the ability to develop, choose, and integrate novel, unconventional, and innovative approaches to teaching and learning.
Critical Thinking	Critical thinking is the ability to effectively use higher order thinking skills to plan, teach, and reflect on instructional practice while integrating and applying theories of teaching, learning, and development.
Communication	Communication is the ability to successfully use interpersonal skills and components of literacy (reading, writing, speaking, and listening) to contribute to teaching, learning, and development.
Collaboration	Collaboration is the ability to work productively and equitably while valuing others in diverse educational settings.
Information, Media, and Technology Skills (IMTS)	IMTS is the ability to access, manage, apply, analyze, and evaluate digital information and instructional technological tools. This includes leveraging technology innovatively and effectively in diverse learning environments to collaborate, communicate, think critically, and create new functions in the midst of rapidly changing technological advances.

creativity (Kampylis, Berki, & Saariluoma, 2009; Kokotsaki, 2011). Grounded in self-report data, these studies asked preservice teachers how they prefer students to respond during classroom discussions. For example, Beghetto (2007) asked secondary preservice teachers their preferences for unique versus relevant answers. Unique answers were defined as students using creative thinking skills, including novel ideas, varied perspectives, and creative connections, whereas relevant answers were defined as providing answers and demonstrating one's competence without digressing from the curricular expectations. The majority of preservice teachers preferred relevance over uniqueness. However, it is important to note that creativity requires both uniqueness and relevance (Amabile, 1996; Plucker, Beghetto, & Dow, 2004), as it is essential to teach preservice teachers how to identify, develop, and assess these elements and encourage their own students to further develop their creative skills (Beghetto, 2007).

The limited studies on creativity have also suggested that certain content areas are perceived as offering fewer opportunities for creativity than others (Beghetto, 2007; Bolden, Harries, & Newton, 2010). For example, regardless of grade level, studies have shown that preservice teachers do not believe math to be a creative subject and thus perceive creativity as a potential distraction (Beghetto, 2007). In addition, preservice teachers could not distinguish between teaching creatively and teaching *for* creativity and had difficulty in identifying ways of encouraging and assessing this skill in the math classroom (Bolden et al., 2010). However, preservice teachers indicated that all other subject areas provide more opportunities for creativity through discussions, exploration of ideas, and freedom of choice (Beghetto, 2007; Bolden et al., 2010). Although these perceptions may exist due to potential constraints in the curriculum, it is imperative for teacher education programs to develop, model, and assess what it means to be creative (Beghetto, 2007; Bolden et al., 2010; Kokotsaki, 2011).

Critical Thinking

Research on critical thinking in teacher education has typically focused on critical reflection during course work and fieldwork. The universal challenge is to encourage preservice teachers "to reflect on their practice in meaningful ways, to consider the effect their teaching has on student learning, and develop habits that will stay with them" (Ward & McCotter, 2004, p. 244). To this end, teacher educators have designed assignments that allow preservice teachers to practice and demonstrate critical reflection. Researchers measured the development and quality of critical reflection skills using a common framework: a low level is identified as a focus on themselves and teaching tasks, whereas a high level is demonstrated by a focus on pedagogy and multiple perspectives, resulting in a transformative change in teaching practice (e.g., McDonald & Kahn, 2014; Ward & McCotter, 2004).

A common method for researchers to study critical reflection is to analyze

preserve teachers' written assignments (e.g., autobiographies, self-assessments, and fieldwork essays). Results indicate that the majority of essays are written at the lower levels of critical reflective thinking, that is, preservice teachers' focus on themselves and teaching tasks (Griffin, 2003; Ward & McCotter, 2004). It may be natural for preservice teachers to have a self and teacher task emphasis rather than a higher level of critical reflection (Ward & McCotter, 2004). However, preservice teachers can move from concrete thinking about themselves to thinking through a variety of perspectives within the context of teaching and learning (Griffin, 2003). For example, McDonald and Kahn (2014) found that critical self-assessments generated a greater self-awareness, improvements in teaching practice, and progress in seeing through multiple perspectives. In addition, participation in action research or small-group discussions that incorporate peer feedback improve preservice teachers' critical reflection skills (Griffin, 2003; Hagevik et al., 2012).

Teacher educators play an important role in the development of preservice teachers' critical reflection skills through coaching and scaffolding. McDonald and Kahn (2014) found a direct relationship between preservice teachers' level of critical reflection and the level of professors' prompts, questions, and feedback. In addition, Ward and McCotter (2004) recommended that teacher educators use provocative questions and high-level prompts and feedback to assist preservice teachers in developing these skills. Once preservice teachers begin their first year of teaching, they are expected to do more than critically reflect on their practice; they are expected to be critical thinkers, model critical thinking, and demonstrate that they can teach students to develop their own critical thinking skills in a variety of academic subjects and classroom situations (California Commission on Teacher Credentialing, 2013). In addition, researchers advocate that teacher educators explicitly guide preservice teachers to the higher levels of critical reflection (Jones & Jones, 2013; Ward & McCotter, 2004); therefore teacher education programs need to be intentional in developing, modeling, and assessing these skills.

Communication and Collaboration

Reseach on communication and collaboration is often presented simultaneously, as effective communication is vital for and leads to successful collaboration (Partnership for 21st Century Skills, 2016). A common example of the integration of these two skills in education is professional learning communities (PLCs), which focus on teacher discussions and collaborations. For example, Kagle (2014) created a PLC for undergraduate preservice teachers to develop their skills in collaboration, critical reflection, and pedagogy. A protocol provided a structured format for preservice teachers to bring a dilemma with their teaching to their peers for feedback. In particular, they experienced a shared language, developed critical inquiry skills, built knowledge for practice, and learned the value of collaboration with colleagues. Teacher education programs need to explicitly provide opportuni-

ties for the development of communication and collaboration for the purposes of improved instructional practice.

PLCs also promote the practice of critical reflection and critique, both individually and with a group. Daniel, Auhl, and Hastings (2013) found that preservice teachers experience difficulty with offering and receiving critical feedback. Specifically, this study focused on how to offer critical feedback in a way that can be heard and responded to, while maintaining a collaborative environment. As the study progressed, preservice teachers recognized and valued the importance of critique to improve teaching practices. Arguably, while learning how to give and receive critical feedback can be difficult, the results on teaching and learning can be significant. The implications from research are that preservice teachers can and should begin to experience collaboration to promote critical reflection on their own teaching practices (Elster, Barendziak, Haskamp, & Kastenholz, 2014; Kagle, 2014). Therefore the limited research supports the need for teacher education programs to facilitate development of these skills in their preservice teachers.

Information Media and Technology Skills

In addition to the development of creativity, critical thinking, communication, and collaboration, emergent technologies have altered how and to what extent 21st-century skills are integrated in the classroom. Technology has become a tool with which these skills are leveraged both in and outside of the classroom (Thieman, 2008), teaching students how to effectively transfer their learning to varied contexts (Saavedra & Opfer, 2012). Research on IMTS indicates that K–12 schools are facing digital natives in the classroom; hence effective training needs to be developed for preservice teachers. This includes modeling the use of instructional technology as well as deliberately incorporating the National Educational Technology Standards for Students (NETS) in teacher education programs (Collier, Weinburgh, & Rivera, 2004; Graham, Cox, & Velasquez, 2009; Pamuk, 2011).

Thieman (2008) explored how preservice teachers use technology through the lens of NETS. The study examined work samples and reflections to discern the extent to which they integrate instructional technology into their planning and to measure how that integration relates to 21st-century citizenship. Findings indicated that 85% of preservice teachers integrate instructional technologies with their K–12 students, and approximately 50% documented the use of technology in conjunction with creativity, communication, collaboration, and IMTS to conduct research. Despite this push toward modeling effective technology use in teacher education programs, some studies have found that preexisting belief systems and practices tend to hinder teacher educators from learning new technologies and adapting their pedagogy (Dong et al., 2015; Hora & Holden, 2013; Nicholson & Galguera, 2013). Considering that IMTS are integral components of the development of 21st-century skills, research supports this study's structured approach to incorporating these tools for preservice teachers.

The Current Study

This study recognized the need to establish definitions specific to the roles and responsibilities of teacher educators and preservice teachers (see Figure 2). The researchers used these definitions as a framework to ensure consistency across the four courses under study, which shaped the model of 21st-century skill development for teacher education (see Figure 1). This trajectory identifies three phases:

1. *personal development*: preservice teachers' capacity to understand and apply these skills in multiple contexts, not limited to educational settings

2. *applied development*: continued building of individual capacity as preservice teachers while facilitating the skill development within their students during supervised teaching fieldwork

3. *professional development*: continued development of these skills with students, colleagues, parents, and administrators while in-service teachers

In summary, there is a need for teacher education programs to provide opportunities to develop and model 21st-century skills in both course work and fieldwork requirements. Scholars have noted the importance of transferring theory and course work to practice for preservice teachers (Rust & Bergey, 2014; White & Chant, 2014). Therefore the current study examined preservice teachers' perceptions of the impact of anchor assignments on their personal and applied development through course work and fieldwork experiences. This study builds a model for teacher education programs by purposefully integrating the 21st-century skills (see Figure 1). Owing to these efforts, preservice teachers may be better prepared to facilitate the learning of today's diverse student population in a rapidly changing world.

Methods

Research Design

A mixed methods approach was used to measure how and to what extent teacher education programs develop and model the 21st-century skills in preservice teachers. Researchers were faculty in one university across three teacher education programs, thus classifying this study as participatory action research (Berg, 2004; Gabel, 1995; Stringer, 1999), as it investigated the effect of researchers' practice on participants (Berg, 2004).

Sample

This study took place in a small, private university in northern California. Participants ($N = 54$) were graduate ($n = 39$) and undergraduate ($n = 15$) preservice teachers enrolled in multiple subject ($n = 19$), single subject ($n = 16$), and education specialist (n

= 19) programs. Some preservice teachers were enrolled in multiple courses involved in this study. They ranged in age from 20 to 60 years, and 10% were men. Participants were 75% White, 15% Latina, 7% Asian, and 3% African American.

Data Collection and Measures

Data were collected from four courses, taught by each of the four researchers, and chosen to represent each program, including a foundational course in which all preservice teachers across programs must enroll (see Figure 3). Each course also aligned with either the personal or applied developmental stage of the conceptual model. Surveys were created to measure the extent to which anchor assignments developed preservice teachers' competencies with the 21st-century skills as well as their ability to incorporate these skills into their own teaching. Whereas the quantitative data provided preservice teachers' perceptions of the impact of anchor assignments on their personal and professional development, the researchers were also interested in gathering more information on how that development occurred based on instruction. Therefore, at the end of the semester, nine preservice teachers participated in a focus group to elicit that information.

Survey data. The survey instrument measured two areas: (a) impact of the anchor assignments on preservice teachers' personal development of competencies in the 21st-century skills and (b) impact of the anchor assignments on preservice teachers' ability to incorporate the 21st-century skills into their teaching. A closed-ended 4-point Likert-type scale ranging from 4 (*a great deal*) to 1 (*not at all*) measured each component of the 21st-century skills. Because of the small sample size, survey responses were analyzed using basic statistics, which generated percentages of preservice teachers' responses. These methods allowed for comparison of responses between 21st-century skills and anchor assignments.

Focus group data. A focus group was conducted at the end of the semester to elucidate how the instruction and assignments in the four selected courses developed preservice teachers' skills personally and facilitated their application of these skills to classroom settings. The focus group was conducted with nine preservice teachers (17% of the original 54) across the selected classes to represent a sample of the teacher education programs. Three of the focus group participants were undergraduates, two were Latina, and one was male.

The facilitator was selected from outside the Department of Education due to a background in organizational development as well as expertise with conducting focus groups. The facilitator requested information on how the assignments, activities, and instruction engaged preservice teachers and facilitated development of 21st-century skills. In addition, the facilitator asked ways that the learning experience could be improved, referred to as the delta. The focus group was audiotaped and transcribed using the research software HyperTRANSCRIBE.

Figure 3

Description of courses and anchor assignments, aligned with developmental level of the 21st-century skill development for teacher education programs conceptual model (see Figure 1).

Course Description	*Anchor Assignment*	*Developmental Level*
Teaching for Equity: All Programs Teaching for Equity is a 3-unit course that examines principles of educational equity and diversity and their implementation in curriculum content and school practices. Candidates examine their own beliefs, attitudes, biases, and expectations about educational equity, so that they may be better prepared to create equitable classrooms. In this course, candidates also explore the historical and cultural traditions of cultural and ethnic groups in California, and ways to include cultural traditions in instructional programs. Candidates will learn how to maximize the academic achievement for ALL students.	**Diversity Statement** Preservice teachers write narrative essays describing the value of a multicultural perspective and consider the following questions: (a) What is a multicultural perspective? (b) Why is it important for educators to have a multicultural perspective? If you do not think it is important, why not? (c) What are your beliefs about teaching and learning with a diverse student population? (d) How do you teach (or see yourself teaching) in a diverse classroom? (e) Why do you think that teaching that way will address the needs of all students? (f) What norms for student behavior and interactions will you develop in your future classroom? and (g) How might 21st Century Skills enhance teaching diverse learners?	**Personal**
Teaching Mathematics: Multiple Subject & Education Specialist This course prepares preservice teachers to teach mathematics in elementary school. Candidates are prepared to deliver a balanced instructional program through active construction of pedagogical knowledge and skills. Candidates learn developmentally appropriate strategies to teach students California's Mathematics Content Standards. Candidates participate in fieldwork where appropriate mathematics instruction is modeled.	**Student Work Analysis** Preservice teachers analyze elementary student work samples (addition and subtraction of 3-digit numbers with and without regrouping), representative of a class of 25 third-grade students. Preservice teachers analyze the student work for accuracy, and procedural and conceptual knowledge. Based on this analysis, they create lesson plans to teach and reach all students.	**Personal**

Figure 3 (continued)

Course Description	*Anchor Assignment*	*Developmental Level*
Preparation for Student Teaching: Single Subject This course develops an understanding of school culture and adolescent development while preparing candidates for the demands of a teaching career. It explores the essential knowledge and skills required for effective secondary teaching and learning as defined by the California Teaching Performance Expectations (TPEs).	**Practice Lessons** Preservice teachers will design and teach two lessons in classrooms where they are observing and will student teach. Each lesson design must include differentiated instruction and/or assessment for at least one individual in two groups of students: English learners and students with special needs. This assignment includes (a) planning the lessons, (b) conferring with the supervising teacher, (c) eaching the lessons, (d) assessing their own instruction in each practice lesson, (e) securing observation notes/ feedback from university supervisors and directing teachers, (f) writing a critical reflection the lessons.	**Peresonal & Applied**
Program Design & Curriculum Development: Education Specialist Candidates learn about Individual Education Plan (IEP) development and curriculum planning and instruction for students with mild/moderate learning challenges. Candidates write a complete IEP including transition plans. Candidates learn how to make adaptations to general education curriculum in order to ensure student success. Knowledge of ethical standards related to laws and regulations that provide equity for students with learning challenges is emphasized.	**Individualized Education Program (IEP)** Preservice teachers independently develop a quality IEP, detailing the current functioning and areas of strength and struggle for a K-12 student, relating these to the goals and accommodations. The required elements include: Assessment Summary, Eligibility, Present Levels of Academic Achievement and Functional Performance, Measurable Annual Goals, Services, Setting, Statewide Assessments, and Transition Services.	**Personal**

Researchers coded the transcripts by developing a preliminary list of codes (Miles & Huberman, 1994; Miles, Huberman, & Saldana, 2013), which stemmed from the study's conceptual framework, around the variables creativity, critical thinking, communication, collaboration, and IMTS, as well as their deltas. The researchers read and coded transcripts separately for each class and then across the programs, establishing an interrater reliability of 94%. The analysis and coding were conducted using the research software HyperRESEARCH.

Results

To investigate how and to what extent our teacher education programs developed and modeled the 21st-century skills in preservice teachers, the following questions were examined: What are preservice teachers' perceptions of the impact of anchor assignments on their personal and applied development of the 21st-century skills? How did course instruction affect the development of these skills? Specifically, survey results indicated that the anchor assignments impacted preservice teachers' ability to incorporate 21st-century skills in their teaching (see Tables 2, 4, 6, and 8) more than it impacted their own personal competencies in these skills (see Tables 1, 3, 5, and 7). Results of the focus group and surveys were analyzed based on preservice teachers' competencies and their ability to incorporate the 21st-century skills into their classrooms; these results are simultaneously reported for each skill. Survey results of each course, including descriptive statistics, are reported in Tables 1–8.

Creativity

Preservice teachers cited a variety of examples of creativity in their course assignments and activities and described how their professors modeled and instilled a sense of creativity. For example, a participant from the Preparation for Student Teaching course stated that incorporating creativity into daily lesson planning is a

Table 1

Impact of Teaching for Equity Anchor Assignment on Preservice Teachers' Competencies in the 21st-Century Skills

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	71.4	21.4	7.1	–	3.64 (0.63)
Collaboration	71.4	28.6	–	–	3.71 (0.47)
Critical thinking	71.4	28.6	–	–	3.71 (0.47)
Creativity	85.7	7.1	7.1	–	3.79 (0.58)
IMTS	21.4	21.4	28.6	28.6	2.36 (1.16)
CCSS	28.6	42.9	7.1	21.4	2.79 (1.12)

Note. n = 14. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

major component of being a teacher. Lesson planning was the anchor assignment for this course; preservice teachers developed and taught two lessons in a second-

Table 2

Impact of Teaching for Equity Assignment on Preservice Teachers' Ability to Incorporate the 21st-Century Skills in Their Teaching

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	92.9	7.1	–	–	3.93 (0.27)
Collaboration	92.9	7.1	–	–	3.93 (0.27)
Critical thinking	78.6	14.3	7.1	–	3.71 (0.61)
Creativity	85.7	14.3	–	–	3.86 (0.36)
IMTS	14.3	35.7	14.3	35.7	2.29 (1.14)
CCSS	14.3	42.9	14.3	28.6	2.43 (1.09)

Note. $n = 14$. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

Table 3

Impact of Teaching Mathematics Anchor Assignment on Preservice Teachers' Competencies in the 21st-Century Skills

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	27.8	38.9	22.2	11.1	2.83 (0.99)
Collaboration	27.8	50.0	16.7	5.6	3.00 (0.84)
Critical thinking	88.9	11.1	–	–	3.89 (0.32)
Creativity	55.6	16.7	22.2	5.6	3.22 (1.00)
IMTS	–	22.2	50.0	27.8	1.94 (0.73)
CCSS	27.8	44.4	11.1	16.7	2.83 (1.04)

Note. $n = 18$. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

Table 4

Impact of Teaching Mathematics Anchor Assignment on Preservice Teachers' Ability to Incorporate the 21st-Century Skills in Their Teaching

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	38.9	33.3	16.7	11.1	3.00 (1.03)
Collaboration	16.7	50.0	27.8	5.6	2.78 (0.81)
Critical thinking	61.1	27.8	5.6	5.6	3.44 (0.86)
Creativity	55.6	27.8	16.7	–	3.39 (0.78)
IMTS	–	17.6	47.1	35.3	1.82 (0.73)
CCSS	22.2	50.0	16.7	11.1	2.83 (0.92)

Note. n = 18. CCSS = Common Core State Standards. IMTS = information, media, and technology skills

ary classroom, receiving written feedback from their university supervisors and directing teachers. The qualitative data coincide with survey data on the anchor

Table 5
*Impact of Preparation for Student Teaching Seminar Anchor Assignment
on Preservice Teachers' Competencies in the 21st-Century Skills*

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	61.5	38.5	–	–	3.62 (0.51)
Collaboration	53.8	38.5	7.7	–	3.46 (0.66)
Critical thinking	69.2	23.1	7.7	–	3.62 (0.65)
Creativity	84.6	15.4	–	–	3.85 (0.38)
IMTS	61.5	23.1	15.4	–	3.36 (0.78)
CCSS	69.2	23.1	7.7	–	3.62 (0.65)

Note. $n = 13$. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

Table 6
*Impact of Preparation for Student Teaching Seminar Anchor Assignment
on Preservice Teachers' Ability to Incorporate the 21st-Century Skills in Their Teaching*

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	69.2	23.1	7.7	–	3.62 (0.65)
Collaboration	61.5	38.5	–	–	3.62 (0.51)
Critical thinking	61.5	23.1	15.4	–	3.46 (0.78)
Creativity	69.2	23.1	7.7	–	3.62 (0.65)
IMTS	61.5	15.4	23.1	–	3.38 (0.87)
CCSS	69.2	23.1	7.7	–	3.62 (0.65)

Note. $n = 13$. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

Table 7
*Impact of Program Design Anchor Assignment on Preservice Teachers' Competencies
in the 21st-Century Skills*

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	47.4	42.1	10.5	–	3.37 (0.68)
Collaboration	36.8	47.4	15.8	–	3.21 (0.71)
Critical thinking	68.4	21.1	10.5	–	3.58 (0.69)
Creativity	31.6	47.4	21.1	–	3.11 (0.74)
IMTS	11.1	33.3	27.8	27.8	2.28 (1.02)
CCSS	26.3	21.1	31.6	21.1	2.53 (1.12)

Note. $n = 19$. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

assignment for this course, with 84.6% of preservice teachers responding that it impacted their competency in creativity "a great deal" (see Table 5).

Additionally, preservice teachers spoke about how the professor addressed teaching the CCSS in the Teaching for Equity course, stating that while the standards are set, how one imparts or teaches to the standards is when a teacher can facilitate creativity. This course also incorporated creativity in learning how to teach to a diverse student population through various classroom activities, such as cultural simulations and analysis of case studies and equity policies. Preservice teachers wrote reflective papers on their views and on how their own cultural lens can influence how they teach; one participant commented that these reflections allowed for creativity in addressing various topics around equity in education. Survey data indicate that 85.7% of preservice teachers in the Teaching for Equity course most developed their personal competencies with creativity (see Table 1).

Preservice teachers in the Teaching Mathematics course described creativity as the most developed 21st-century skill within that course, citing examples of developing math games for students that provided opportunities to use their creative problem-solving skills. Preservice teachers valued the chance to share their new games with each other during class time because the feedback highlighted how they interpreted the game in a variety of ways: "You get other differentiated ideas that you can create and modify" (Participant 4).

Areas for improvement, referred to as the delta in the focus group, appeared with preservice teachers in the Teaching for Equity course. Although they understood the importance of critical reflection, participants indicated that they would have appreciated learning creative activities to use with their students as well. Another suggestion emerged from the discussion of the course for education specialist participants. A major component of this class was learning how to develop Individual Education Programs (IEPs); preservice teachers discussed the creativity required in writing IEPs in general but cited a need to discuss a variety of classrooms and settings, not just special day classes or younger, elementary-aged students.

Table 8
*Impact of Program Design Assignment on Preservice Teachers' Ability
to Incorporate the 21st-Century Skills in Their Teaching*

21st-century skill	A great deal (%)	To some extent (%)	Minimally (%)	Not at all (%)	Mean (SD)
Communication	52.6	42.1	5.3	–	3.47 (0.61)
Collaboration	52.6	36.8	10.5	–	3.42 (0.69)
Critical thinking	68.4	10.5	15.8	5.3	3.42 (0.96)
Creativity	36.8	36.8	21.1	5.3	3.05 (0.91)
IMTS	15.8	36.8	15.8	31.6	2.37 (1.12)
CCSS	26.3	26.3	21.1	26.3	2.53 (1.17)

Note. *n* = 19. CCSS = Common Core State Standards. IMTS = information, media, and technology skills.

Critical Thinking

Preservice teachers reported that all anchor assignments greatly impacted their competence in critical thinking skills and in their ability to incorporate these skills into their teaching (see Tables 1–8). The Teaching Mathematics anchor assignment, analysis of elementary student work samples, demonstrated the strongest results, with nearly 90% of preservice teachers reporting that their competency in critical thinking was further developed "a great deal" (see Table 3). Focus group data supported these results, as preservice teachers saw the importance of critically reflecting on their own teaching practices. One participant commented that examining student work for strengths and needs prompted consideration of what future instruction should look like to ensure student success and that this was "one of the most helpful activities" within the teacher education program (Participant 5).

Nearly 70% of preservice teachers in the Preparation for Student Teaching course found that the anchor assignment of designing and teaching two lessons increased their competency in critical thinking (see Table 5). One participant commented, "It was the reflection piece afterwards that really got me thinking critically about what went well, what needs improvement, and the . . . overall scope of the lesson" (Participant 6). Others discussed the benefits of practicing their lesson plans with their peers in class and receiving critical feedback, which improved the lesson when implemented with secondary students. Preservice teachers in the Program Design and Curriculum Development course agreed that developing lesson plans for their case study students required them to think critically about the diverse needs of students and, in particular, required careful consideration of the accommodations students would need to access the curriculum. Of the preservice teachers enrolled in this course, 68.4% indicated that the anchor assignment (developing an IEP) aided their competency and ability to incorporate critical thinking skills in their practice (see Tables 7–8).

The Teaching for Equity course required preservice teachers to "question our own thinking, like the way that we have been thinking for our whole lives. It really inspired a lot of critical thought about yourself and how you do things and how you treat other people" (Participant 2). In terms of the delta, another participant from that course commented that "98% of that class involved critical thinking . . . what I found in myself is that I felt a little weary on the case studies for some reason" (Participant 1). The participant suggested readjusting a three-part assignment to be more varied and have different directives.

Communication and Collaboration

As in prior research, preservice teachers found it hard to distinguish between communication and collaboration. The survey data mirrored this, as communication and collaboration were often identified as providing the same amount of impact on the development of these skills (see Tables 1–8). For example, 71.4% of the preservice teachers enrolled in the Teaching for Equity course indicated that the

anchor assignment, a diversity statement, impacted their personal competencies "a great deal" in both communication and collaboration (see Table 1). In addition, 92.9% of these preservice teachers identified the anchor assignment as developing their abilities to impart both of these skills in their future teaching (see Table 2).

Several examples appeared throughout the focus group of how preservice teachers developed the specific 21st-century skills of communication and collaboration. For example, in the Teaching Mathematics course, preservice teachers were provided time to share their various assignments (such as math games, rubric development, and lesson plans) and offer one another feedback. One preservice teacher commented that she appreciated sharing her own thoughts and talking with peers for the sake of improved learning activities for her elementary students. Preservice teachers in the Preparation for Supervised Teaching course commented on the benefit of communicating and connecting with their classmates about their experiences in real classrooms and schools as they prepared for their student teaching. Within the Program Design and Curriculum Development course, preservice teachers described how the writing of IEPs developed communication and collaboration skills with small groups in university classes as well as with parents and school personnel in field placements. For example, one participant commented, "It was a good experience to be able to work with other people on an IEP, which is the reality of it" (Participant 7).

Finally, preservice teachers recognized the benefits of collaboration in groups with peers who were at different places in the credentialing program and identified the benefit of communication in classes where all credentialing programs were represented. For example, one participant commented, "It brought me back to what it feels like to work on a group project where everyone is kind of at different places in their learning" (Participant 7). They identified how hearing from peers focusing on different grades or ability levels provided them with ideas they had not previously considered.

The delta on development of communication and collaboration skills was identified by preservice teachers as a need for more opportunities to practice difficult conversations they might encounter with other teachers, specialists, and parents. Particularly, education specialist preservice teachers asked for guidance and practice in communicating with general education teachers to ensure coordinated, quality instruction and access to necessary accommodations across classrooms.

Information Media and Technology Skills

Focus group participants identified IMTS as a supportive tool for use in conjunction with the other 21st-century skills. For example, the Preparation for Student Teaching course used wiki pages to elicit communication and collaboration during class. The pages were projected on a screen, and preservice teachers worked in groups to contribute relevant Web sites on curriculum planning. The wikis were

then saved on the course Web site so all participants could access these resources after class.

A specific example of collaboration and technology use occurred in the Teaching for Equity course. Preservice teachers were required to present first collaboratively in a group on equity policies and then individually on a chosen topic. A focus group participant commented that she felt "rusty on the technology" (Participant 1), so it was helpful to lean on peers during the first presentation. By the individual presentation, the preservice teacher felt more confident, as she noted, "I had a better grasp of instructional technology to present on my own."

Connections between IMTS and the other 21st-century skills of critical thinking and creativity also emerged in the data. For instance, the professor in the Program Design and Curriculum Development course brought in iPads to explore applications for special education classrooms and students. The professor allotted time in class for preservice teachers to investigate various applications and to discern which they felt comfortable applying in the field. This exercise tapped into their creativity and critical thinking skills as they explored useful applications to accommodate various learning needs and abilities.

Notably, the descriptions of IMTS in the focus groups centered mainly on class activities (exploring online rubrics and Web sites, investigating applications for use with whole classes and for special needs students) and professors modeling its use (through the use of online classroom platforms and apps used for instruction). Fewer statements linked anchor assignments to technology, which is reflected in the survey data. Only one anchor assignment indicated an increase in IMTS competencies above 25%, which was the Preparation for Student Teaching Seminar, at 61.5% (see Table 5).

Focus group participants made some suggestions on the role of IMTS in their course work, which serve as a delta in this area. Some indicated a desire for more hands-on time with the technology, more specifically iPads. Overall, focus group participants cited the importance of professors modeling the use of various technologies; however, they requested more on how to integrate IMTS in the classroom before their supervised teaching experiences.

Simultaneous Integration of the 21st-Century Skills

Arguably, the most compelling emergent finding was the integration of various 21st-century skills simultaneously (see Figure 4). Participants repeatedly commented on their engaged and improved learning when it specifically involved more than one aspect of these vital skills. While previous research has identified ways in which teacher education programs have supported one or two 21st-century skills (Dong et al., 2015; Hagevik et al., 2012; Jones & Jones, 2013; Pamuk, 2011), this study was purposeful in examining how teacher education courses developed all of these skills. Indeed, the researchers anticipated that some skills may prove

more influential in the different courses, based on curriculum content, classroom activities, and assignments. However, the preservice teachers indicated that the simultaneous integration of all the 21st-century skills had the most effect on their learning. For example, preservice teachers identified the benefits of collaborating and communicating in small groups, in various courses, for varied purposes, such as developing creative lesson plans for a case study student; presenting content to their peers via technology; or communicating with parents, administrators, and other school personnel.

In the Teaching for Equity course, preservice teachers were required to collaborate on a topic, which they then presented via technology. This first collaborative presentation was designed to support and scaffold preservice teachers in their

Figure 4

Simultaneous integration of 21st-century skills. When 21st-century skills were intrinsically linked, the most effective teaching and learning occurred. This process of integration allowed preservice teachers to develop these skills both personally and professionally.

learning of both the content and IMTS. One preservice teacher commented that when presentations were disjointed, it was obvious that there had not been smooth collaboration. She further commented that as a future teacher, she would "have to recognize when a collaboration doesn't work" and determine the contributions of individuals (Participant 1).

In the Program Design and Curriculum Development class, preservice teachers were required to collaborate as a small group to develop IEPs. They commented that working as a group prior to developing an IEP independently was beneficial for sharing ideas and receiving critical feedback, which helped to expand their thinking. Within the Preparation for Student Teaching course, preservice teachers collaborated on content using an iPad application, whereby they were all able to contribute to the discussion.

Furthermore, preservice teachers in the Teaching Mathematics course identified the simultaneous integration of all of the 21st-century skills through coordinated assignments across the semester. Preservice teachers developed a math game and rubric, using online sources, and then presented it to their classmates. In particular, a preservice teacher commented on the benefits of researching the rubric, presenting it to the class, and learning from peers how they interpreted the rubrics for the assignment. Once the preservice teachers had designed the game, they then taught their classmates how to play it. Another participant identified this as "the most effective piece of creativity" (Participant 4) because they were creative with their games and learned ideas for differentiation and modification of the games from each other. As part of their fieldwork requirements, preservice teachers taught their math game to a small group of elementary school students. Afterward, the preservice teachers were asked to critically reflect on what worked and what did not, with classmates and the professor providing constructive feedback. Preservice teachers then taught the same math game to a different group of elementary students, relying on their own critical reflection and peer and professor feedback to improve upon the lesson. In addition, all the math games were posted on the class Web site as a resource.

Notably, not only was simultaneous integration of the 21st-century skills evident in the Preparation for Supervised Teaching course but they were almost evenly disbursed (see Tables 5–6). This course was linked directly to fieldwork, so preservice teachers applied those skills in weekly class discussions, utilized them in their own preservice teaching, and then reflected on them in course assignments. For example, focus group participants cited the use of technology to collaborate and communicate in class, using creativity to devise and implement their own lesson plans, and then reflecting on their lessons and observing other teachers in the field in a critical manner.

Discussion

Although this study reviewed the literature and analyzed the results for each

component of 21st-century skills separately, the emergent finding was the power of simultaneous integration (Figure 4). Overwhelmingly, preservice teachers indicated that the most powerful learning took place through integrated learning experiences. As exemplified in the findings, when 21st-century skills were intrinsically linked, the most effective teaching and learning occurred. Moreover, this process of integration allowed preservice teachers to develop these skills personally, while applying them to educational settings. Scholars have argued for establishing strong teacher education programs that develop teachers who continue to learn throughout their careers (Darling-Hammond, 2006).

Arguably, it is imperative for teacher educators to enhance their own 21st-century skills in order to transfer this skill set to their students (Rust & Bergey, 2014; White & Chant, 2014). Grounded in cognitive apprenticeship theory (Collins, 2006; Collins et al., 1987), this process starts with foundational course work upon entrance into the program, followed by applications to the field and continued development as in-service teachers. This theory focuses on teaching methods that include modeling, coaching, scaffolding, articulation, reflection, and exploration and is therefore applicable to teacher education. The current study reflects the transferability of these skills to teacher education, as the research identifies how and to what extent teacher educators influence the development of 21st-century skills in preservice teachers.

Limitations of this study should be considered when interpreting the results. The definitions of 21st-century skills that the researchers developed were not provided to participants prior to the study, and as a result, participants' preconceived understandings may have influenced their responses. Participants may have over- or underestimated their competencies in each of the measured skill areas. Anchor assignments were not grounded in the 21st-century skills framework, which limited researchers' assessment of these areas. Finally, the current study was conducted at one university. Future research that includes a larger sample of university teacher preparation programs will enhance the reliability of results.

On the basis of the results, researchers will collaborate with teacher education faculty to provide consistency around the conceptualization of 21st-century skills. First, they will embed definitions in all syllabi. Second, to assess these developing competencies, faculty will collaborate to design rubrics for anchor assignments to deliberately measure these skills. Finally, as it is imperative to assess how preservice teachers are applying and facilitating the skill development during supervised teaching fieldwork, observation forms will intentionally measure the effective application of these skills. Future research will develop into a longitudinal study to measure and assess graduates' application of 21st-century skills as they transition to in-service teaching in their own classrooms.

Results of this study indicate future directions for teacher education programs. As learning can occur not only from professors but from peers as well, there is a need to create opportunities for preservice teachers across various programs to

interact and engage together in learning. Preservice teachers need guidance in applying their knowledge to learning activities for their students as well as support in how to do so in various educational contexts (Darling-Hammond, 2006). Teacher education programs need to provide more hands-on experience with technology and guidance on how to implement IMTS into teaching. Therefore teacher educators need to consistently integrate new technologies to enhance their instruction and model these techniques for their students. It is imperative for teacher educators to remain current in the rapidly changing field of IMTS (Hora & Holden, 2013; Nicholson & Galguera, 2013).

Implications of this research are twofold. The results indicate that teacher educators need to be strong models of the simultaneous integration of 21st-century skills. It is essential to consistently develop, model, and assess these skills in preservice teachers throughout all aspects of their program to graduate teachers and leaders (Gibson, 2010). Preparing preservice teachers consistently throughout their preparation programs ensures a more seamless transition to in-service teaching, creating a cadre of confident and effective educators in our 21st-century society.

References

Amabile, T. M. (1996). *Creativity in context: Update to the social psychology of creativity*. Boulder, CO: Westview.

American Association of Colleges for Teacher Education. (2010, September). *21st-century knowledge and skills in education preparation*. Retrieved from http://www.p21.org/storage/documents/aacte_p21_whitepaper2010.pdf

Beghetto, R. A. (2007). Does creativity have a place in classroom discussions? Prospective teachers' response preferences. *Thinking Skills and Creativity, 2*, 1–9. doi:10.1016/j.tsc.2006.09.002

Berg, B. (2004). *Qualitative research methods for the social sciences* (5th ed.). Boston, MA: Pearson Education.

Bolden, D. S., Harries, T. V., & Newton, D. P. (2010). Pre-service primary teachers' conceptions of creativity in mathematics. *Educational Studies in Mathematics, 73*, 143–157. doi:10.1007/s10649-009-9207-z

California Commission on Teacher Credentialing. (2013). *California teacher performance expectations*. Retrieved from http://www.ctc.ca.gov/educator-prep/TPA-files/TPEs-Full-Version.pdf

Collier, S., Weinburgh, M. H., & Rivera, M. (2004). Infusing technology skills into a teacher education program: Change in students' knowledge about and use of technology. *Journal of Technology and Teacher Education, 12*, 447–468.

Collins, A. (2006). Cognitive apprenticeship. In R. K. Sawyer (Ed.), *The Cambridge handbook of the learning sciences* (pp. 47–60). Cambridge, UK: Cambridge University Press.

Collins, A., Brown, J. S., & Newman, S. E. (1987). (BNN Laboratories Technical Report No. 403). Cambridge, MA: Centre for the Study of Reading, University of Illinois.

Daniel, G. D., Auhl, G., & Hastings, W. (2013). Collaborative feedback and reflection for

professional growth: Preparing first-year pre-service teachers for participating in the community of practice. *Asia-Pacific Journal of Teacher Education, 41*, 159–172. doi: 10.1080/1359866X.2013.777025

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of Teacher Education, 57*, 300–314. doi:10.1177/0022487105285962

Dede, C. (2010). Comparing frameworks for 21st century skills. In J. Bellanca & R. Brandt (Eds.), *21st century skills* (pp. 51–76). Bloomington, IN: Solution Tree Press.

Dong, Y., Chai, C. S., Sang, G.-Y., Koh, H. L., & Tsai, C.-C. (2015). Exploring the profiles and interplays of pre-service and in-service teachers' technological pedagogical content knowledge (TPACK) in China. *Educational Technology & Society, 18*, 158–169.

Elster, D., Barendziak, T., Haskamp, F., & Kastenholz, L. (2014). Raising standards through INQUIRE in pre-service teacher education. *Science Education International, 25*(1), 29–39.

Gabel, D. (1995). *Presidential address*. San Francisco, CA: National Association for Research in Science Teaching.

Gibson, R. (2010). Points of departure: The "art" of creative teaching—implications for higher education. *Teaching in Higher Education, 15*, 607–613. doi:10.1080/13562 517.2010.493349

Graham, C., Cox, S., & Velasquez, A. (2009). Teaching and measuring TPACK development in two preservice teacher preparation programs. In I. Gibson, R. Weber, K. McFerrin, R. Carlsen, & D. Willis (Eds.), *Proceedings of Society for Information Technology & Teacher Education International Conference 2009* (pp. 4081–4086). Chesapeake, VA: Association for the Advancement of Computing in Education.

Griffin, M. L. (2003). Using critical incidents to promote and assess reflective thinking in preservice teachers. *Reflective Practice: International and Multidisciplinary Perspectives, 4*, 207–220. doi:10.1080/14623940308274

Hagevik, R., Aydeniz, M., & Rowell, C. G. (2012). Using action research in middle level teacher education to evaluate and deepen reflective practice. *Teaching and Teaching Education, 28*, 675–684. doi:10.1016/j.tate.2012.02.006

Hora, M., & Holden, J. (2013). Exploring the role of instructional technology in course planning and classroom teaching: Implications for pedagogical reform. *Journal of Computing in Higher Education, 25*(2), 68–92. doi:10.1007/s12528-013-9068-4

Jones, J. L., & Jones, K. A. (2013). Teaching reflective practice: Implementation in the teacher- education setting. *The Teacher Educator, 48*(1), 73–85. doi:10.1080/08878 730.2012.740153

Kagle, M. (2014). Professional learning communities for pre-service teachers. *National Teacher Education Journal, 7*(2), 21–25.

Kampylis, P., Berki, E., & Saariluoma, P. (2009). In-service and prospective teachers' conceptions of creativity. *Thinking Skills and Creativity, 4,* 15–29. doi:10.1016/j.tsc.2008.10.001

Kokotsaki, D. (2011). Student teachers' conceptions of creativity in the secondary music classroom. *Thinking Skills and Creativity, 6*, 100–113. doi:10.1016/j.tsc.2011.04.001

McDonald, D., & Kahn, M. (2014). So, you think you can teach? Reflection processes that support preservice teachers' readiness for field experiences. *International Journal of the Scholarship of Teaching and Learning, 8*(2), 1–35.

Michaels, R., Roshandel, S., Truesdell, E., & Urbani, J. M. (2015, June). Developing and assessing 21st-century skills across teacher education programs. *California Council on Teacher Education Newsletter*, pp. 36–37

Michaels, R., Truesdell, E., & Brown, B. (2015). Incorporating 21st-century skills into

teacher preparation programs: A collaborative approach. *Journal of Scholastic Inquiry: Education, 5*(1), 47–72.

Miles, M. B., & Huberman, A. M. (1994). *Qualitative data analysis* (2nd ed.). Thousand Oaks, CA: Sage.

Miles, M. B., Huberman, A. M., & Saldana, J. (2013). *Qualitative data analysis: A methods sourcebook*. Thousand Oaks, CA: Sage.

National Governors Association Center for Best Practices & Council of Chief State School Officers. (2010). *Common Core State Standards*. Washington, DC: Authors.

Nicholson, J., & Galguera, T. (2013). Integrating new literacies in higher education: A self-study of the use of Twitter in an education course. *Teacher Education Quarterly, 40*(3), 7–26.

Pamuk, S. (2011). Understanding preservice teachers' technology use through TPACK framework. *Journal of Computer Assisted Learning, 28*, 425–439. doi:10.1111/j.1365-2729.2011.00447.x

Partnership for 21st Century Skills. (2016). *Framework for 21st century learning*. Retrieved from http://www.p21.org/about-us/p21-framework

Plucker, J. A., Beghetto, R. A., & Dow, G. T. (2004). Why isn't creativity more important to educational psychologists? Potentials, pitfalls, and future directions in creativity research. *Educational Psychologist, 39*, 83–96.

Ravitch, D. (2010). *The death and life of the great American school system: How testing and choice are undermining education*. New York, NY: Basic Books.

Rotherham, A., & Willingham, D. (2009). "21st century" skills: Not new, but a worthy challenge. *Educational Leadership, 67*(1), 16–21.

Rust, F., & Bergey, N. (2014). Developing action-oriented knowledge among preservice teachers. *Teacher Education Quarterly, 41*(1), 63–83.

Ryhammar, L., & Brolin, C. (1999). Creativity research: Historical considerations and main lines of development. *Scandinavian Journal of Educational Research, 43*, 259–273.

Saavedra, A., & Opfer, V. (2012). Learning 21st century skills requires 21st century teaching. *Phi Delta Kappan, 94*(2), 8–13. doi:10.1177/003172171209400203

Schleicher, P. (2012). *Preparing teachers and developing school leaders for the 21st century: Lessons from around the world*. Paris, France: OECD.

Silva, E. (2009). Measuring skills for 21st-century learning. *Phi Delta Kappan, 90*(9), 630–634. doi:10.1177/003172170909000905

Sternberg, R. J., & Lubart, T. I. (1999). The concept of creativity: Prospects and paradigms. *Handbook of Creativity, 1*, 3–15.

Stringer, E. T. (1999). *Action research* (2nd ed.). Thousand Oaks, CA: Sage.

Thieman, G. Y. (2008). Using technology as a tool for learning and developing 21st century citizenship skills: An examination of the NETS and technology use by preservice teachers with their K–12 students. *Contemporary Issues in Technology and Teacher Education, 8*, 342–366.

Truesdell, E., & Birch, R. (2013). Integrating instructional technology into a teacher education program: A three-tiered approach. *AILACTE Journal, 10*(1), 55–77.

Ward, J. R., & McCotter, S. S. (2004). Reflection as a visible outcome for preservice teachers. *Teaching and Teacher Education, 20*, 243–257. doi:10.1016/j.tate.2004.02.004

White, J. W., & Chant, R. H. (2014). Challenging idealism: Pre-service teachers' core beliefs before, during, and after an extended field-based experience. *Teacher Education Quarterly, 41*(2), 73–92.