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Creativity and the development of technology integration skills of preservice teachers: a mixed methods study of online course activities

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CREATIVITY AND THE DEVELOPMENT OF TECHNOLOGY INTEGRATION SKILLS OF PRESERVICE TEACHERS: A MIXED METHODS STUDY OF ONLINE COURSE ACTIVITIES

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ABSTRACT

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The purposes of this study were to explore how the four abilities of the creative process encouraged preservice teachers who studied in an online course to have better understanding about technology integration and recognize approaches to promote creativity. Related theories and models of technology integration and the creative process were used to design activities. Descriptive analysis, repeated–measures analysis of variance, and a coding technique were used to analyze the data. The results showed that the four abilities of the creative process helped the preservice teachers know how to integrate technology into classrooms. Moreover, the study gave them valuable learning experiences about the creative process because it encouraged them to recognize the ways to successfully promote creativity to their future students.

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CHAPTER I

INTRODUCTION

Technology is an important part of learning and teaching in the 21st century. The Centers for Quality Teaching and Learning (2011) defined the 21st century classroom as requiring the effective use of technology to enhance student learning skills. The Partnership for 21st Century Skills (P21) (2011) organization provided a framework that presents the skills necessary for learning and teaching in the 21st century. For learning, the organization indicates creativity as one of the four significant learning skills learners should achieve. Creativity involves three aspects: thinking creatively, working creatively with others, and implementation. In terms of teaching, the organization indicates that 21st century instructors should be able to find innovative methods in using and integrating technologies to enhance student learning skills. Giving opportunities for teachers to recognize the 21st century skills and practice integrating technologies are the approaches used in preparing teachers for 21st century classrooms. For teacher preparation programs, the organization suggests balancing direct instruction and project–oriented teaching methods to encourage preservice teachers to have a thorough understanding of subject matter and also have valuable experiences in integrating various strategies and technologies.

Statement of Problem

Technology Integration

Clearly, technology is a critical part of 21st century education. Baytak, Tarman, and Ayas (2011) indicated that technology is a powerful tool that can be used for improving teaching and learning. In terms of teaching, Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, and Sendurur (2012) showed that technology is a tool allowing teachers to experiment and find a new approach in teaching and learning. It plays an important role in promoting success in both the administrative and teaching–learning processes (Gulbahar, 2007). In terms of learning, technology can make instruction motivating, enjoyable, and more interactive for students (Baytak et al., 2011). The appropriate use of technology within classrooms may enhance student learning (Krentler & Willis-Flurry, 2005) and also may expand classrooms to the outside world (Gibson & Oberg, 2004; Venezky, 2004). Speaker (2004) conducted a study in which the results demonstrated that the learning performance of students is improved when technology is part of learning.

Although technology has the potential to improve learning, the presence of technology in classrooms does not immediately translate into better learning performance (Sivin-Kachala & Bialo, 2000). The task of teachers in managing and using technology within classrooms is an important aspect that makes it an effective tool for promoting student learning. As Keengwe and Onchwari (2009) stated, "Although technologies allow students to work productively more than in the past, the teacher's role in modern technology–rich classrooms is more demanding than ever" (p. 210).

Technology integration is vital knowledge encouraging teachers to recognize how to manage and use technology for supporting student learning within classrooms; thus, it refers to the ability to plan on using various types of technology to enhance meaningful student learning. Walters (2004) mentioned that the greatest challenge for integrating technology into instruction to bolster student achievement is incorporating an effective strategy with available technologies in an instructional program. Gulbahar (2007) indicated that technology integration is a demanding issue, and it is necessary for teachers to have a proper plan for using technology in their classrooms. Gulbahar also suggested that in developing technology plans, teachers need to focus on two significant parts: the technology itself and the levels of student learning. Teachers need to consider the needs of students, the goals of the curriculum, and the availability of technological tools when integrating these into instruction (Hsu, 2010). Al-Bataineh and Brooks (2003) stated that the use and integration of technology should be consistent with the curriculum's philosophy and theory of learning. In order to support student learning efficiently, significant information, such as learning theory, standards, and models, is essential for teachers to use in developing a plan that integrates technology with their teaching methods.

Despite the importance of technology integration, the International Society for Technology in Education (ISTE) (2000) reported that it has been lacking throughout school curricula in the past few years. A common cause of this problem is that most teachers simply do not know how to integrate technology into their classrooms. As Liu and Johnson (2003) described, most teachers only add technology rather than integrate technology into their instruction. In addition, many teachers assume that if they have

used tools, such as digital presentations or digital word documents to deliver content, then they have integrated technology into their classrooms, which is not true (Beaver & Moore, 2004). Furthermore, some teachers focus only on adding technology into their lesson plan (Beaver & Moore, 2004), but they do not consider the advantages of the technology toward student learning and its appropriateness with the content areas or objectives of the instruction. As a result, the technology they use within a lesson plan is of little value and does not enhance student learning successfully.

Another problem of technology integration is that teachers often do not have sufficient experience in learning and integrating technology into their classrooms. Hew and Brush (2007) indicated that lack of instruction in programs to prepare and encourage teacher candidates to learn and use technology in their classrooms is an important factor that reduces technology integration skills of future teachers. The National Council for Accreditation of Teacher Education (NCATE) (1997) reported that several teaching institutions were not fully meeting their responsibility for preparing tomorrow's teachers to use technology. In addition, only a few teacher preparation programs provided sufficient knowledge and opportunities to their candidates to learn and practice integrating technology into their teaching. Most teacher candidates have little technical and pedagogical knowledge, therefore, have little insight in how to integrate technology into their teaching (Recesso, Wiles, Venn, Campbell, & Padilla, 2002; Willis, 2007). Lacking a technological community is another factor preventing teachers in improving their technology integration skills (Ertmer et al., 2012). A technological community refers to a place where teachers can learn, share, discuss, and exchange information with each other about technology in education. Teachers who do not have sufficient

opportunities to share and discuss technological information seldom encounter new and improved ideas in choosing and integrating technology with their teaching. Therefore, sufficient technological knowledge and opportunities to learn, discuss, and share information about technology are essential elements that teaching preparation programs need to provide in preparing and supporting their teacher candidates with better technology integration skills.

Promoting creativity for students is another important task for teachers in the 21st century. The P21 (2011) organization indicated that creativity is an important skill needed by students. Students who have creativity, in terms of both thinking and working, have the potential to create new knowledge, methods, and understanding, which are essential for helping them be successful in working and living in the 21st century.

Creativity in Education

The advantage of creativity is that it encourages students to think differently and consequently leads them to find innovation or solutions for problems. Fluency, flexibility, originality, and elaboration are the four key abilities within the creative process essential for promoting creativity (Shively, 2011). A teacher is an important person in promoting creativity in students. As Kampylis, Berki, and Saariluoma (2009) indicated, "Teachers' roles in the development of primary school students' creativity is very important, because they act as role models and mentors and spend a considerable amount of time with students" (p. 15). However, the problem is most teachers do not know how to promote creativity within students. Loveless, Burton, and Turvey (2006) stated that many teachers lack experience and knowledge in the creative process, which makes it difficult for them to teach and encourage creativity in their students. Brinkman

(2010) stated that teaching students to be creative is a task teachers do not take because most teachers only recognize approaches for teaching for the best learning results rather than teaching for the discovery of new knowledge and creative ideas.

Therefore, it is important to prepare teachers to recognize the process of enhancing creativity to promote creativity in their students. Instruction within teacher preparation programs that integrates and supports creativity is a good solution in preparing future teachers. As Abdallah (1996) stated, most teachers teach as they were taught, but prospective teachers trained in thinking and teaching creatively will be better prepared to show the same creative characteristics in their classrooms.

Creativity is a skill that can be taught within online learning as well. At present, online learning has become an essential part of higher education studies, including teacher preparation programs. According to Allen and Seaman (2011), in the past eight years the online enrollment numbers have been growing faster than the overall higher education enrollments. The data showed that over 6.1 million students were taking at least one online course during fall 2010, and 31% of all current higher education students are taking at least one online course. The affordability and accessibility of computers and the Internet for learners are two main reasons for the growing demand for online courses (Dobbs, Waid, & Carmen, 2009). In addition, the flexibility of online courses, allowing learners to access classes anytime and anywhere, is another factor for the increasing number of learners in online courses (Leonard & Guha, 2001). For teacher preparation programs, creativity is a skill that can be promoted for those who enroll in online courses. Muirhead (2007) indicated motivation, interaction, and reflection are important factors that may increase online learner creativity. Freedom and a supportive

environment are factors for increasing motivation for online learners. Muirhead also pointed out that discussions and self-reflections encourage online learners in improving their creative thinking. Therefore, to promote creativity for those who enroll in online courses, teacher preparation programs should create a supportive online learning environment with online discussion and self-reflection to support creativity.

Technology Foundation in Education

The Technology Foundation in Education is a required online course for the students in a school of teacher education in a western university. The goals of the course are (a) to provide students with basic knowledge regarding technology within elementary education, and (b) to give students valuable experiences in using, creating, and adapting technology for supporting teaching and learning within the PreKindergarten (PreK)–12 education. Most learning activities and assignments in the course focus on learning theory, principles of technology in education, and standards of teaching and learning in PreK–12 education. Students who enroll in the course are preservice teachers from various majors, such as mathematics, science, or history.

Technology integration is a major area the course emphasizes. Preservice teachers are required to learn theory and design lesson plans that include technology instructions supporting student learning. However, according to student data, the preservice teachers in the course do not recognize the principles of technology integration, as most of them thought if they used the tools for delivering content, this meant they had already integrated technology into their instruction. Furthermore, when they designed their lesson plans, they only added tools into their plan without considering student needs, goals of instruction, and type of content. They also could not explain why

they integrated those tools into their instruction and how those tools supported student learning. Another problem is the preservice teachers had few new ideas for choosing and integrating technology into their lesson plans. The data clearly show that most of them designed lesson plans using the same technological tools, even though their lesson plans contained content in different subject areas. Therefore, most of their lesson plans were not motivating and contained technological tools that were of little value and inappropriate for enhancing student learning.

In terms of creativity, the Technology Foundation in Education online course does not contain sufficient instruction and activities encouraging preservice teachers to develop creative ideas or to recognize the process of creativity they might apply to use. Most of the assignments are direct instructions with the preservice teachers required to read text-based information and then complete the assignments. They have few opportunities to apply, discuss, and exchange information with each other, which are the ways to support creative skills.

Purpose of the Study

The Creative Technology Integration Project was designed to promote technology integration and creativity for preservice teachers. The goals of the project were not only to support preservice teachers in obtaining more knowledge about technology integration, but also to encourage them in developing creative skills and recognize the process of creativity.

According to the advantages of creativity toward learning, the researcher believes that creativity is the needed skill to expand the vision of preservice teachers in choosing and integrating a variety of technological tools for enhancing student learning. The

researcher applied the four abilities (fluency, flexibility, originality, and elaboration) of the creative process as strategies to encourage preservice teachers to obtain new and improved ideas in choosing and integrating technology instruction appropriate for enhancing learning. In addition, the learning activities provided in the project encouraged preservice teachers to recognize the creative process to promote creativity in their future students.

Therefore, this study focused on two areas: knowledge of technology integration and creativity. The objectives of this study were to explore (a) how the four abilities of the creative process encourage preservice teachers to have better understanding about technology integration, and (b) how preservice teachers transfer the four abilities of the creative process learned from participating in this project to promote creativity in their future students. Related theories, models of technology integration, and the four abilities of the creative process were used for designing learning activities appropriate for promoting technology integration skills and creativity of preservice teachers enrolled in an online classroom.

Research Questions

Q1 Does preservice teacher knowledge about technology integration change after they recognize the four abilities of the creative process?

Q2 How do the four abilities of the creative process encourage preservice teachers to have a better knowledge regarding technology integration?

Q3 Does preservice teacher knowledge about the four abilities of the creative process change after they complete the Creative Technology Integration Project?

Q4 How do preservice teachers transfer their knowledge regarding the four abilities of the creative process into their future classrooms to promote student creativity?

Significance of the Study

The results of this study provide a guide for preservice teacher preparation programs to develop instruction enhancing creativity and technology integration skills. Moreover, the results show evidence to support creativity as an important skill that provides benefits to teaching and learning. In terms of teaching, the results show that creativity expands and provides a new vision for preservice teachers to choose and integrate appropriate technology into their teaching, thus, successfully enhancing student learning. In terms of learning, the results demonstrate that the four abilities of the creative process are approaches that encourage preservice teachers to obtain more knowledge in technology integration.

Definition of Terms

Creative process. This approach enhances creativity and encourages people to think differently and innovatively (Low, 2006). The process requires people to have a sensibility to problems, transformation of thought, and reinterpretations (Guilford, 1956).

Creativity. This is the sequence of thoughts and actions that lead to innovative and adaptive productions (Lubart, 2001). It has the potential in supporting people to think of new and useful ideas and also search for new meaningful connections (Massialas & Zevin, 1983).

Technology integration. This is the combination of curriculum goals and technology (Dockstader, 1999). It refers to the use of various types of technology to support meaningful student learning and is a skill that includes teachers' motivations, perceptions, and beliefs about learning and technology (Keengwe, Onchwari, & Wachira, 2009).

CHAPTER II

REVIEW OF LITERATURE

The chapter begins with an introduction of 21st century education to demonstrate the importance of technology toward learning and teaching. The chapter contains the three main areas of the study: theories, models, and strategies of technology integration; creativity; and online education.

Technology and 21st Century Education

Al-Musawi (2011) indicated that technology is changing our ways of learning and has become a critical component of the educational experience. In the 21st century, technology has become an important part of learning and teaching. The P21 (2011) organization is providing resources and guidance for developing learning and teaching in the 21st century and indicated that technology is a critical part of learning and teaching to help learners with essential 21st century skills. The P21 organization provides a framework of holistic views toward 21st century skills in terms of learning and teaching. In terms of learning, P21 indicated four essential skills learners in the 21st century need to achieve to be successful in their lives: critical thinking, communication, collaboration, and creativity. In terms of teaching, P21 pointed out that technology is an important tool for enhancing learning in the 21st century. The organization suggested that curriculum and instruction in 21st century education should encourage teachers to integrate supportive technologies to enhance learning, use inquiry– and problem–based approaches

to strengthen thinking skills, and also include resources outside the classroom to encourage making connections between knowledge learned and the community and everyday living.

Professional development is an important aspect for preparing teachers for teaching in the 21st century. The P21 (2011) organization stated that providing opportunities for teachers to learn and practice integrating 21st century skills, tools, and teaching strategies into their instruction is a useful approach and suggested an instruction curriculum for a teacher preparation program should balance direct instruction with project– oriented teaching methods. Furthermore, the curriculum should encourage teachers and preservice teachers to gain experiences with various strategies to reach diverse learners and create a motivated learning environment. In terms of technology, P21 pointed out teacher preparation programs should help preservice teachers gain sufficient technological knowledge. As Smith and Owens (2010) stated, technology becomes an effective learning tool when teachers have sufficient knowledge and become familiar in using technology. It is important to not only help teachers and preservice teachers to use technological tools effectively, but also focus on supporting them in using technology as a tool for motivating learning (McEwen, 2008).

Technology in Education

Okojie, Olinzock, and Okojie-Boulder (2006) defined technology in education as a technical device or tool to enhance instruction and technology integration and a process of using existing tools, equipments, and electronic media for that purpose. Several types of technologies are available and widely used within learning and teaching. Means

(1994) classified technologies based on their roles in education: tutor, exploration, tool, and communication.

Tutor

Technology used as a tutor refers to the technology teachers use for providing information, demonstration, or simulations within a specific lesson or piece of material. Computer–assisted instruction is an example and is defined as the use of instructional material for presenting information, filling a tutorial role, or testing learners for comprehension ("Computer–Assisted Instruction," 2009). In the 21st century, computer–assisted instruction is widely used in elementary and secondary school computer laboratories and in college distance education programs (Kridel, 2010). Various computer–assisted instruction technologies include content tutorials, simulations, and games.

Exploration

Technology used for exploration refers to the technology teachers use for facilitating more open-ended learning. Instructors use these technologies to help learners discover a fact or demonstrate procedures within a specific content area, such as laboratory tools or a multimedia system.

Tool

Technology used as a tool refers to the technology teachers use for accomplishing a task, data storage, or data analysis, such as word processing, desktop publishing systems, video recordings, or editing. Computer managed instruction is an example of this type of technology used for branching, storing, and retrieval capabilities to save instructions and maintain tracking of student progress and records.

Communication

Technology used for communication refers to a tool teachers use for creating a sense of community within classrooms, increasing interaction and collaboration, and encouraging learners and instructors to exchange information with each other. Computer mediated communication is the technology for allowing this interaction between learners and teachers. Two types of computer mediated communication are commonly defined within education: asynchronous and synchronous technologies. Asynchronous technologies allow learners and instructors to share their thoughts at different times; therefore, they have the freedom to respond and interact with each other at a time and place they prefer. In contrast, synchronous communication technologies requires learners and instructors to collaborate and share their thoughts in the same time; thus, learners and instructors need to be available at the same time or the same place to interact and discuss with each other (Serce et al., 2010).

Technology Integration

While technology is an important tool for enhancing learning and teaching in the 21st century, technology integration is important for teachers to recognize, as well. Technology integration can be defined as the combination of goals of curriculum with technology (Dockstader, 1999); it can be described as a process of using existing tools, equipments, and electronic media for that purpose (Okojie et al., 2006). It refers to the use of various types of technology to support meaningful student learning. It is a skill that includes teacher motivation, perceptions, and beliefs about learning and technology (Keengwe et al., 2009). Technology integration is an important aspect for learning and considered part of the instructional preparation process (Okojie et al., 2006).

Technological knowledge and resource management are the key skills for technology integration (Hew & Brush, 2007). To facilitate learning, teachers need to know how to manage and coordinate the available instructional aids and resources. Also, technology integration requires teachers to use appropriate technology to present and evaluate instruction as well as relevant technology for performing a learning activity. As Hew and Brush (2007) concluded, it is important for teachers in a technology–integrated classroom to know how to organize the class effectively so students have equal opportunities to use computers and obtain assistance regarding technical problems.

Dillon-Marable and Valentine (2006) indicated four characteristics of optimal technology integration: seamlessness, appropriateness, facilitation, and empowerment. Seamlessness is technology allowing learners and teachers to feel comfortable when interacting in both group–oriented and project–based instruction. Appropriateness is technology integrating into instruction in a way that fits the backgrounds of all the learners and teachers. The authors explained that effective learning technology include tools so everyone feels comfortable and familiar. Facilitation is instruction containing technology to be used as guidance or encouragement for students to achieve class goals. Empowerment is the most important characteristic of optimal technology integration and refers to integrating technology for students to be proactive in using technology to support their learning. The authors stated that optimal technology integration should assist students in using the rich resources available and involve them in both collaborative and independent learning modalities.

The ISTE (2011) is the primary association for educators and education leaders with the goal to improve learning and teaching by advancing the effective use of

technology in PreK–12 and teacher education. The ISTE originally developed the National Educational Technology Standards for Students (NETS–S) in 1998 for evaluating students' skills and knowledge to perform in a global and digital world. In 2007, the revised standards of NETS–S were released and focused on emerging digital technologies, collaboration, and 21st century skills: creativity and innovation, communication and collaboration, research and information, critical thinking and problem solving, digital citizenship, and technology operations and concepts. Technology operations and concepts is one standard of the NETS–S that focuses on supporting learners to demonstrate a sound understanding of technology concepts, systems, and operations. The standard shows that learners should be able to understand and use technology systems, select and use applications effectively and productively, troubleshoot systems and applications, and transfer knowledge to learning new technologies.

The ISTE also developed the National Educational Technology Standards for Teachers (NETS–T), which is used for evaluating the skills and knowledge educators need to teach, work, and learn in an increasingly connected global and digital society. The ISTE (2011) clearly indicates that all teachers need to meet five major standards: facilitate and inspire student learning and creativity, design and develop digital age learning experiences and assessments, model digital age work and learning, promote and model digital citizenship and responsibility, and engage in professional growth and leadership (see Table 1).

Table 1

National Educational Technology Standards for Teachers (NETS–T)

Standard	Description
1. Facilitate and inspire student learning and creativity	Teachers use subject matter knowledge, teaching and learning, and technology to facilitate experiences to advance student learning, creativity, and innovation in both face-to-face and virtual environments by (a) promoting, supporting, and modeling creative and innovative thinking and inventiveness; (b) engaging students in exploring real world issues and solving authentic problems with digital tools and resources; (c) promoting student reflection using collaborative tools to reveal and clarify students' conceptual understanding and thinking, planning, and creative processes; and (d) modeling collaborative knowledge construction by engaging in learning with students, colleagues, and others in face-to-face and virtual environments.
2. Design and develop digital age learning experiences and assessments	Teachers design, develop, and evaluate authentic learning experiences and assessment incorporating contemporary tools and resources to maximize content learning and develop the knowledge, skills, and attitudes identified in the NETS–S by (a) designing and adapting relevant learning experiences that incorporate digital tools and resources to promote student learning and creativity; (b) developing technology enriched learning environments to enable all students to pursue their individual curiosities and become active participants in setting their own educational goals, managing their own learning, and assessing their own progress; (c) customizing and personalizing learning activities to address students' diverse learning styles, working strategies, and abilities using digital tools and resources; and (d) providing students with multiple and varied formatives and summative assessments aligned with content and technology standards and use the resulting data to inform learning and teaching.
3. Model digital age work and learning	Teachers exhibit knowledge, skills, and work processes representative of an innovative professional in a global and digital society by (a) demonstrating fluency in technology systems and the transfer of current knowledge to new technologies and situations; (b) collaborating with students, peers, parents, and community members using tools and resources to support student success and innovation; (c) communicating relevant information and ideas effectively to students, parents, and peers using a variety of digital age media and formats; and (d) modeling and facilitating the effective use of current and emerging digital tools to locate, analyze, evaluate, and use information resources to support research and learning.

Table (continues)

Table 1 (continued)

Standard	Description
4. Promote and model digital citizenship and responsibility	Teachers understand local and global societal issues and responsibilities in an evolving digital culture and exhibit legal and ethical behavior in their professional practices by (a) advocating, modeling, and teaching the safe, legal, and ethical use of digital information and technology, including respect for copyrights, intellectual property, and appropriate documentation of sources; (b) addressing the diverse needs of all learners by using learner-centered strategies and providing equitable access to appropriate digital tools and resources; (c) promoting and modeling digital etiquette and responsible social interactions related to the use of technology and information; and (d) developing and modeling cultural understanding and global awareness by engaging with colleagues and students of other cultures using digital age communication and collaboration tools.
5. Engage in professional growth and leadership	Teachers continuously improve their professional practice, model lifelong learning, and exhibit leadership in their school and professional community by promoting and demonstrating the effective use of digital tools and resources by (a) participating in local and global learning communities to explore creative applications of technology to improve student learning; (b) exhibiting leadership by demonstrating a vision of technology infusion, participating in shared decision making and community building, and developing the leadership and technology skills of others; (c) evaluating and reflecting on current research and professional practice on a regular basis to make effective use of existing and emerging digital tools and resources in support of student learning; and (d) contributing to the effectiveness, vitality, and self-renewal of the teaching profession and their school and community.

To encourage teachers to create instruction that meets the standards of NETS–S and NETS–T, it is important to emphasize related models of technology integration. The Technological Pedagogical Content Knowledge (TPACK), Analyze, State, Select, Utilize, Require, and Evaluate (ASSURE), and Technology Integration Planning (TIP) models are accepted and widely used for helping teachers recognize the principles for

integrating technology into instruction. In addition, these models provide approaches to help teachers recognize how to manage and arrange technologies that fit their learning activities and content.

Technological Pedagogical Content Knowledge

The TPACK model is widely used for helping teachers recognize the significant skills needed for integrating technology into their classroom. The model demonstrates a complexity of relationships among students, teachers, content, technologies, practices, and tools (Archambult & Barnett, 2010). Graham (2011) stated the TPACK has the potential to provide a strong foundation for future technology integration research. It provides theoretical guidance for training teachers to use technology in content specific as well as general ways. Koehler (2011) indicated that true technology integration refers to the way educators and teachers understand and negotiate the relationships between the kinds of knowledge within the TPACK model.

Mishra and Koehler (2006) stated the TPACK is the basis of teaching with technology and requires teachers to understand the concepts of using technologies with pedagogical techniques to create constructive ways to teach content. The TPACK model also focuses on encouraging teachers to recognize strategies that make concepts easy to learn theories of epistemology and knowledge in how technologies can be used and applied to build knowledge and develop new epistemologies. The six skills in the TPACK model are divided into three phrases: acceptance and technical proficiency (technology knowledge / technology pedagogical knowledge), subject-focused pedagogical modeling (technology pedagogical knowledge / technology content knowledge), and pedagogical application (TPACK) (see Table 2).

Table 2

Technological Pedagogical Content Knowledge (TPACK) Framework

Standard	Description
Content knowledge	It refers to subject matter taught or learned in the classroom. It also includes facts, concepts, theories, and procedures within a given field.
Technological knowledge	It refers to the knowledge of computer hardware and the ability to use basic software tools such as word processing, spreadsheets, browsers, and e-mail.
Pedagogical knowledge	It is the knowledge of processes and strategies of teaching and learning and encompasses issues of student learning, classroom management, and lesson plan development and implementation.
Pedagogical content knowledge	It is the combination between pedagogical and content knowledge that refers to understanding how to organize, adapt, and present particular aspects of subject matter in instruction.
Technology pedagogical knowledge	It is the combination between technological and pedagogical knowledge that refers to the understanding of technological knowledge used for enhancing teaching and learning.
Technology content knowledge	It is knowledge that combines technological and content knowledge and refers to understanding and using technology to demonstrate the concepts of subject matter.

Analyze, State, Select, Utilize, Require, and Evaluate

The ASSURE model contains six elements that demonstrate effective ways in integrating technology into instruction (Heinich, Molenda, Russell, & Smaldino, 2001).

The six essential components that should be included within a lesson plan are learner analysis, stating objectives, selecting media and materials, utilizing media and materials, requiring learner performance, and evaluating (see Table 3).

Technology Integration Planning

The TIP model was developed by Roblyer (2006) to provide effective approaches in integrating technology into teaching. Roblyer stated the TIP model demonstrates a set of planning and implementation steps for teachers to ensure the technology they use in instruction is efficient and successful to meet learners' needs. The model contains five components teachers need to realize when choosing and integrating technology into instruction (see Table 4).

Creativity

Lubart (2001) explained that creativity refers to the sequence of thoughts and actions leading to innovative and adaptive productions. It is the potentiality that prompts people to think of new and useful ideas and also search for new meaningful connections (Massialas & Zevin, 1983). In education, creativity is a skill that needs to be taught in schools. The Office for Standards in Education stated that creativity is a significant feature in the educational experience, and it is also considered a fundamental skill needed for the future (Shaheen, 2010).

Table 3

Analyze, State, Select, Utilize, Require, and Evaluate (ASSURE) Model

Element	Description
Learner analysis (A)	The first step in designing a lesson plan is to define the learner. Teachers need to know who their learners are to select the best strategies and technology to meet their objectives. For this phase, teachers need to provide a description of general characteristics such as grade level, age, prior background knowledge, learning skills, and attitudes about the topic and learning styles of the learners.
Stating objectives (S)	It is an important part of the lesson plan, and teachers need to include objectives in the lesson plan. Clear objectives help teachers easily design and choose appropriate materials and learning activities to effectively enhance learning. Objectives in a lesson plan need to indicate who the learners are and what skills they are expected to achieve after they complete the instruction.
Selecting media and materials (S)	Teachers need to select available materials, modify existing materials, or design new materials to help learners accomplish the objectives of the instruction. In the lesson plan, teachers should provide a brief description regarding why the technology is appropriate for integrating technology into instruction.
Utilize media and materials (U)	In a lesson plan, teachers need to describe how they will use technology during the instruction with the learners. This section includes information about the learning environment that contain the necessary equipments for delivering information for the lesson.
Require learner performance (R)	In a lesson plan, teachers need to describe how learners will actively use the materials they have selected. This section contains information regarding learning activities provided to learners during the instruction.
Evaluation (E)	In the lesson plan, teachers need to consider approaches in how to assess the learning levels of learners. The assessment the teacher chooses needs to examine the degree learners achieve the learning objectives, the instructional process, and the impact of using technology and media (Smaldino, Lowther, & Russell, 2012). For the lesson plan, teachers need to indicate in this section what instruments or approaches they will use to assess learners.

Table 4

Technology Integration Planning (TIP) Model

Element	Description
Determining the relative advantage of technology toward instruction	Teachers need to consider whether the technology or tools they use or integrate in their instruction are good solutions for learning problems or effective approaches for enhancing learning.
Deciding objectives and assessments	Roblyer (2006) explained that a clear objective of instruction is an important aspect and provides a way of setting expectations for what technology–based methods will accomplish. For technology integration, teachers need to realize the technology they use should be consistent with the goals and assessments of their instruction. A clear objective will help teachers design and integrate appropriate technology into instruction.
Designing strategies	Teachers need to consider how they will assist learners to use technology during the instruction effectively and what technology is appropriate for supporting teaching and learning strategies in the instruction.
Preparing the instructional environment	This refers to the decision making of teachers regarding what kinds of technology or tools are appropriate to use within a learning environment. Evaluating Integration Strategies refers to the evaluation on how well technology integration strategies work for learners

The P21 (2011) organization indicated that creativity is one of the essential skills learners in the 21st century need to achieve to be successful in their lives. The benefits of creativity are to expand human visions, discover new challenges, and help attain career success and productivity (Treffinger, Isaksen, & Dorval, 2000). In addition, it is a skill

that inspires people to find innovation and create new technologies important for developing the country (Saebo, McCammon, & O'Ferrell, 2007).

The P21 (2011) organization provided the definition of creativity for 21st century education in which it focuses on three aspects: thinking creatively, working creatively, and implementing innovations. Thinking creatively refers to the ability that learners can use a wide range of techniques to create worthwhile ideas. It also encompasses elaboration, analysis, and evaluation of ideas to improve and maximize creative efforts. Guilford (1956) noted that thinking creatively requires people to have a sensibility to problems and also includes transformations of thought, reinterpretations, and freedom from functional fixedness in driving unique solutions (Kim, 2006).

Working creatively refers to abilities that learners may develop, implement, and communicate new ideas to others effectively. The P21 (2011) organization indicated that learners who work creatively also need to be open and responsive to new and diverse perspectives, incorporate group input and feedback, demonstrate originality, and understand real world limits to adopt new ideas. In addition, they need to view failure as an opportunity to learn and understand that creativity is a cyclical process of small successes and frequent mistakes. Saebo et al. (2007) stated that respecting different ideas, allowing mistakes to occur, and encouraging active rather than passive learning are the ways to support creativity.

The last aspect of the creativity skill is an implementation innovation. The P21 (2011) organization indicated that creative learners have the ability to make their creative ideas tangible and also provide useful contributions to the field.

Componential Model of Creativity

Urban (2007) proposed a componential model of creativity that represents areas needed for enhancing creativity divided into cognitive and personality domains. The cognitive components are divergent thinking, general knowledge, and specific knowledge. The personality components are task commitment, motivation, and tolerance of ambiguity. Urban stated that these components work together as a functional system to develop creativity. Moreover, all of these components are used to determine the creative levels of individuals. All six components are divided into two groups: cognitive and personal.

Cognitive components. Cognitive components include:

Divergent thinking. Divergent thinking refers to a process of how to think creatively and involves both planning and exploring new pathways, flexibility, fluency, and problem sensibility. Runco (2009) stated that divergent thinking represents the potential for creative thinking. It is considered an essential component for the creative process, and it relates to an intellectual skill that encourages people to see problems through several perspectives (Sternberg, 2006). Craft (2006) stated the use of knowledge and intelligence are necessary for increasing creativity. Divergent thinking strategies, such as open-ended or constructive questions within a discussion, are appropriate to promote a basis of creative thinking at all educational levels. Sternberg (2006) indicated that these strategies help learners see different perspectives toward the problem, which becomes inspiration and encouragement to think differently.

General knowledge. Urban (2007) explained that all types of general knowledge are important to start a creative process. It is an important feature that needs to work

with divergent thinking to make the creative process move forward (Runco, 2009). General knowledge refers to metacognition, critical and evaluated thinking, reasoning and logical thinking, and a memory network. It also involves a deeper level of understanding within the areas learners are interested or working.

Specific knowledge base and specific skills. Specific knowledge includes memory for factual knowledge, technical proficiency, and special talent in the target work domain (Amabile, 1996). As Sternberg (2006) suggested, teachers should require learners to show an in-depth understanding of the knowledge and concepts within the topics they are working. A deeper understanding helps learners feel comfortable, which will motivate them to work and keep developing creative works.

Personal components. Personal components include:

Task commitment. Urban (2007) explained that task commitment refers to the attention and passion of learners working creatively. The author indicated that concentration and selectivity are necessary for learners to collect, analyze, evaluate, and elaborate the information needed to develop creative ideas.

Motivation. Motivation is an important factor to keep people working and thinking creatively (Vidal, 2009). Kaufman, Plucker, and Baer (2008) indicated that both intrinsic and extrinsic motivation are important factors for enhancing creativity. Intrinsic motivation, such as passion and personal interests, are key features to help learners continue to develop their creative skills (Sternberg, 2006). Freedom and a supportive environment are extrinsic motivation that engages people in developing creative work as well. In terms of teaching, Saebo et al. (2007) stated the importance of supporting creativity within classrooms is respecting ideas and providing the freedom to allow

learners to choose their own topics, rather than forcing them to follow rigid guidelines or a standard class curriculum.

Tolerance of ambiguity. This refers to a readiness to experiment and take risks. Gnezda (2011) stated that learners need opportunities to actualize their creativity and freedom to explore their ideas and instruction. Allowing mistakes to occur is an approach for supporting learners to gather new ideas and develop their creativity. However, positive thinking and reviewing mistakes are important skills that teachers need to encourage in learners. This will help their comfort and continue working and improving upon their creative works.

Creative Process

The process is important in enhancing creativity. Low (2006) explained that the creative process goes beyond classic logic because it encourages people to think differently and innovatively. It requires people to have a sensibility to problems, transformation of thought, and reinterpretations (Guilford, 1956). It involves freedom from functional fixedness in driving unique solutions as well (Kim, 2006). The creative process usually starts with a single point and then extends into many different directions (Treffinger et al., 2000). Guilford's (1956) Fluency, Flexibility, Originality, Elaboration (FFOE) model is used for supporting creativity within education (Shively, 2011) and contains the essential abilities people gather in the four stages of the creative process.

Fluency. Fluency is similar to task identification and refers to the ability learners have for generating possible ideas about creative works; it is related to divergent thinking skills. Various perspectives from brainstorming or group discussions help learners expand and generate ideas about creative projects.

Flexibility. This refers to the ability that students need to look at a question or topic from different perspectives. Students who have flexibility should easily achieve originality, an important aspect within creativity. Reflection is a strategy that increases flexibility for students because it helps students to exchange and see perspectives from other people toward the projects in which they are working. Therefore, in terms of teaching, instructors may set up discussion activities to help students reflect upon their ideas with instructors and other students. The results will open students' minds and encourage them to clearly see other sides of their problems.

Originality. Originality is another important aspect of creativity. It refers to how students generate unique, unusual, or unexpected ideas and products. Shively (2011) indicated that originality is the root of innovation and requires the greatest risk taking. Therefore, in order to support originality within the student creative thinking process, it is important for instructors to allow mistakes and problems to occur. Moreover, instructors should provide sufficient support and motivation for students to encourage them to find solutions and answers for those problems. The best solutions or answers a student discovers will ultimately be developed into innovation and unique ideas ultimately.

Elaboration. This refers to the process of completing a project by adding details and filling in the gaps so that creative projects look more real, understandable, and aesthetically pleasing. Shively (2011) stated that people do not recognize the full potential of creative projects if the creators do not include elaboration. Therefore, in the final step of completing student creative projects, instructors need to ask students to review and add necessary information to make the projects real, rational, useful, and applicable to real settings.

Creativity in Online Education

The numbers of online enrollments have been growing faster than overall higher education enrollments in the past eight years. The data showed that over 6.1 million students were taking at least one online course during fall 2010, and 31% of all current higher education students take at least one online course (Allen & Seaman, 2011). The affordability and accessibility of the computer and Internet to learners has added to the demand for online instruction (Dobbs et al., 2009). In addition, the flexible options of online courses allow learners greater access to educational opportunities (Leonard & Guha, 2001). Wilen-Daugenti (2009) also stated that most students in higher education feel the flexibility of the online classroom makes them feel more comfortable in learning more than within a traditional classroom.

Technology for Enhancing Creativity in Online Education

Communicative interaction is key for promoting learning within online education. As Bing and Ai-Ping (2008) stated, communicative interaction is a central concern to quality teaching and learning in web-based distance education. In terms of creativity, several studies show creativity can be taught in online education, and interaction is a factor for promoting creativity in online learners. Computer mediated communication is a technology used for increasing interaction between online learners and teachers. It plays an important role for enhancing learning and teaching within an online classroom. Common types of computer mediated communication within online education are electronic mail (e-mail), computer conferencing, and electronic bulletin boards. Serce at el. (2010) described that e-mail or discussion boards provide flexibility for online learners and instructors in contacting and sharing information with each other at their

own time and place. For video conference or online chatting, the authors stated these tools increase social interaction and also provide a valuable collaborative learning experience for online learners and teachers.

In order to promote creativity, computer mediated communication is a suitable technology that online teachers can use for increasing communication and motivation in learners. E-mail and discussion boards are appropriate tools for providing freedom and making learners feel comfortable to participate and share ideas within online classrooms. Video chatting, blogs, and wikis are suitable tools for increasing community and collaboration among online learners and teachers within classrooms. Carney-Strahler (2011) stated that a wiki is an innovative social technology tool that supports collaboration and offers new possibilities for learning. Wiki technology enables learners to cooperate in attaining learning goals as they construct their own knowledge and allows people to communicate and generate ideas. In addition, learners who use wikis may improve their reading, writing, and discussing skills.

Strategies for Enhancing Creativity in Online Education

Strategies used for promoting creativity are not only appropriate for using with online learners, but they are also needed for promoting the cognitive and personality components of creativity. According to Urban's (2007) componential model of creativity, divergent thinking and the use of knowledge are the cognitive components necessary for developing creativity. Techniques online teachers may use for helping learners develop divergent thinking skills include brainstorming and subject mapping.

Brainstorming is a technique involving generating a list of ideas in an unstructured manner. The goal of brainstorming is to ask learners to generate as many

ideas as possible in a short period of time. During the brainstorming process, all ideas need to be recorded and not criticized. After learners finish generating ideas, they may go back and review the ideas to critique their value or merit. Subject mapping is a technique similar to brainstorming, but it involves placing ideas in the form of a visual map to show their relationships. Learners start with a central idea or topic and then draw branches off the main topic. A visual map of ideas helps learners develop and expand their creative ideas.

Task commitment and tolerance of ambiguity are the personal components needed to increase creativity; they are also important components of learning strategies within constructivism, the primary theory for learning and teaching within an online environment. According to Driscoll (2005), the principle of constructivism focuses on learning experiences or how people learn. The theory points out that learners should generate and construct their own understanding or knowledge of the world through their experiences. The role of teachers within a constructive learning environment is to facilitate learners to gain knowledge by themselves rather than give knowledge directly to them. Therefore, most of the strategies of constructivism focus on encouraging learners to use active techniques such as experiments or real world problem solving in order to create more knowledge. The benefit learners gain is an increase in their abilities to integrate new information. Self-regulated learning and collaboration are samples of constructivist strategies used for promoting creativity in learners in online education. Moreover, both strategies may increase task commitment and a tolerance of ambiguity for learners, the personal components of creativity.

Self-regulated learning is the constructivist learning process that provides freedom to learners to learn and work on a project independently. Craft (2006) stated that self-creation and self-expression are also necessary for increasing creativity. It is a self-directive learning process that encourages learners to generate thoughts and behaviors oriented to achieve their goals. An independent project is an example of an appropriate self-regulated learning activity allowing learners to choose and conduct a study relating to their interests. Moreover, it provides opportunities for learners to set up their goals, conduct their own learning, monitor, and evaluate their own learning progress. In addition, self-regulated learning is an approach to increase tolerance of ambiguity in learners. Learners have the opportunity to experience and learn from mistakes they make during the learning process. However, the goal for self-regulated learning is that teachers need to create motivation and provide supportive thinking to learners. Muirhead (2007) stated one effective way to create motivation for online learners within self-regulated learning is to report grades weekly. Learners who monitor their performance often will have the potential to continue developing their creative works. In addition, another consideration is that teachers need to insure that learners know their limitations. Zimmerman (2002) indicated that learners who know their limitations become self-aware and proactive, which are approaches that bring learning success.

Collaboration is another constructive strategy used for increasing a sense of community and interaction within an online environment. Craft (2006) stated that creativity is located in a social and culture context. Therefore, appropriate learning activities teachers can use to promote creativity are group discussions, reflections, and

negotiations (Richey, Klein, & Tracey, 2011). Significant benefits learners will gain from collaboration include expanding their ideas and seeing problems from multiple perspectives, that is, from other people within the group. For online education, collaboration is not only a strategy for increasing interaction among online learners and teachers, but is also needed for promoting creativity. Online discussion is a technique that allows learners to collaborate and exchange information with each other. Discussion boards, blogs, or wikis are technologies that may be used to increase collaboration for online learners and teachers.

However, the main considerations for enhancing creativity through collaboration are the types of questions and motivation within online discussion. According to Muirhead (2007), the results of his study show that an important way to support creativity within online education is through creative discussion. The author indicated that online teachers should create reflective questions for learners to encourage expanding ideas and having a deeper knowledge within the content areas.

In conclusion, technology integration is an important area that impacts the development of teaching learners in the 21st century. Technology becomes an important part of education in the 21st century, and it is a powerful tool to be used for improving teaching and learning. Technology integration is important knowledge that encourages teachers to recognize how to manage and use technology for supporting student learning within classrooms. In terms of learning, creativity is one of the four significant learning skills learners in the 21st century should achieve. An advantage of creativity is to encourage students to think differently and consequently lead them to find new solutions for problems. A teacher is a significant person in promoting creativity for students; thus,

it is important to encourage teachers to recognize the process of enhancing creativity and prepare them for promoting creativity in their 21st century students.

CHAPTER III

METHODOLOGY

The purpose of this study was to find an approach to encourage preservice teachers enrolled in an online education class to gain more knowledge about technology integration and creativity. The study applied the four abilities of the creative process as an approach for enhancing technology integration skills for preservice teachers. The researcher believes that these four abilities of the creative process not only expand the vision of preservice teachers in choosing and integrating various technological tools to successfully enhance student learning, but also support preservice teachers in gaining more knowledge about technology integration. Moreover, at the same time, preservice teachers would have experiences to learn and recognize the four abilities of the creative process, which they could use to support creativity in their future students.

The study was a mixed–methods study, with an Institutional Review Board exempt status (see Appendix A). The quantitative data from surveys indicated whether the technology integration knowledge and creativity of preservice teachers changed after completing the Creative Technology Integration Project. The qualitative data from reflection papers provided detailed explanations of how the four abilities of the creative process changed the technology integration knowledge of preservice teachers and how preservice teachers transferred and applied these abilities to support creativity in their future students.

Related learning theories, models, and strategies of technology integration, creativity, and online education were used to design appropriate learning activities and assignments of this study that promoted technology integration and creativity of preservice teachers within an online classroom.

Research Questions

Q1 Does preservice teacher knowledge about technology integration change after they recognize the four abilities of the creative process?

Q2 How do the four abilities of the creative process encourage preservice teachers to have a better knowledge regarding technology integration?

Q3 Does preservice teacher knowledge about the four abilities of the creative process change after they complete the Creative Technology Integration Project?

Q4 How do preservice teachers transfer their knowledge regarding the four abilities of the creative process into their future classrooms to promote student creativity?

Participants

Participants of this study were 135 preservice teachers who enrolled in a Technology in Elementary Education online course. All participants were undergraduate students in a school of teacher education at a western university in Colorado. All were studying in elementary education from various majors, such as mathematics, literature, science, and history. In terms of technological knowledge, most participants knew how to use basic technological tools for communicating, searching information, and creating learning materials; for example, e-mails, Internet, and some educational software. Moreover, most participants had an online learning experience before enrolling in this course; therefore, they were familiar with the functions provided within the online course, such as a discussion boards, assignment links, and submission links.

Technology in Elementary Education

Technology in Elementary Education was an online course specifically designed for preservice teachers in a school of teacher education to increase technology knowledge within PreK–12 education. The course provided instruction and practice using a variety of technological tools, and students who enrolled in this course explored issues related to the application of these tools (i.e., visual literacy, information literacy skills, copyrights, and trends) within a variety of contexts.

The goal of the online course was to promote technology integration that was seamless and added significant value to student learning of core curriculum (language arts, mathematics, social studies, and science). The course encouraged students to recognize the use of technology in K–12 classrooms and address the integration of technology in all curricular areas, such as language arts, mathematics, social studies, and science. Preservice teachers, who enrolled in the course, investigated theoretical and practical issues surrounding the use of multimedia, e-mail, Internet resources, educational software, and hardware within the K–12 classrooms.

Materials

Lesson Plan Assignments

Three lesson plan assignments were designed by the researcher. The purposes of these assignments were to improve knowledge of technology integration and also encourage participants to recognize the four abilities of the creative process. In all assignments, participants needed to create their lesson plans by filling out the essential information within the templates designed by the researcher. The templates were designed by combining all elements of the TPACK, ASSURE, and TIP models, which

were the technology integration models used in this study. The descriptions of the three assignments were as follows:

1. Generate an idea plan was the first assignment of this project. Its purpose was to encourage fluency, which was the first ability of the creative process for the participants. The researcher applied brainstorming, a constructivist strategy, to design the learning activity of this assignment. Therefore, the assignment was not only effective to use for enhancing fluency ability but also appropriate for promoting learning in online classrooms.

   For the first assignment, the participants were asked to generate possible ideas about their lesson plans. First, they filled out important information within the template the researcher provided, such as a specific topic for their lesson plan, content area, content, and NETS-S standards. Next, they listed possible technological tools they would integrate into their lesson plan and wrote brief explanations of why they chose those technologies and how those technologies supported teaching and student learning in their lesson plans (see Appendix B).

2. A draft lesson plan was the second assignment of this project. The purpose of the assignment was to encourage participants to recognize the significant models of technology integration. In this assignment, the participants began designing their lesson plans by filling out detailed information related to all elements of the TPACK, ASSURE, and TIP models within the template provided by the researcher. Examples of information they needed to provide were descriptions of technological tools, explanations of how they integrated those tools with activities

for enhancing learning, and descriptions of instruments for accessing student learning (see Appendix C).

3. The final lesson plan purpose was to support the participants in recognizing the final two abilities within the creative process: originality and elaboration. First, participants finalized their lesson plans from the second assignment by editing or adding further information according to the feedback received from group discussions. They used the same template from the second assignment (see Appendix C) to revise their final lesson plans. The purpose of this activity was to encourage the participants to produce their original lesson plan and recognize originality, which was an important ability of the creative process. Next, participants wrote summaries of feedback they received from group discussion and explanations of what they changed in their lesson plan from their first draft until the final work. Writing summarizes and explanations were an approach that helped participants recognize elaboration, which was the final ability of the creative process.

Reflection Papers

Two reflection papers were assignments given to the participants after the project was completed. The qualitative data from both reflection papers demonstrated how the participants' perceptions regarding technology integration and creativity changed after completing the Creative Technology Integration Project. In addition, data from both reflection papers showed how the four abilities of the creative process improved participants' knowledge of technology integration.

The first reflection paper was given to participants before the Creative Technology Integration Project began and contained two questions used to explore general ideas of the participants toward technology integration and creativity. The questions were:

- Please provide your opinions toward technology integration skill. What is technology integration in your opinion, and why is it important toward learning and teaching?
- Please provide your opinions toward creativity. What is creativity in your opinion, and why is it important toward learning and teaching?

The final reflection paper was given to participants after they submitted the final assignments. The first purpose was to examine the development of technology integration and creative knowledge of the participants after completing the Creative Technology Integration Project. The second purpose was to explore how the four abilities of the creative process helped participants to choose and integrate technologies into their lesson plans and how participants transferred and applied the knowledge of creativity that they learned from the project to their students in the future. Therefore, the second reflection paper contained four questions in which two of them were the same questions found in the first reflection paper:

- After you completed the project, please explain what technology integration is in your opinion, and why is it important toward learning and teaching?
- After you completed the project, please explain what creativity is in your opinion, and why is it important toward learning and teaching?

- How have the four abilities of the creative process (fluency, flexibility, originality, and elaboration) helped you to choose and integrate technology into your lesson plan?
- How do you transfer the knowledge of creativity that you have learned from the project with 21st century learners to enhance their creativity?

Instruments

Technological Pedagogical Content Knowledge Survey–Revised

The original of TPACK assessment was developed by Schmidt et al. (2009) to examine technology integration knowledge of preservice teachers. The self-assessment originally contained 57 questions divided into 9 sections that focused on 6 types of knowledge within the TPACK framework: content knowledge, technological knowledge , pedagogical knowledge, pedagogical content knowledge, technology pedagogical knowledge, and technology content knowledge (see Appendix D).

For this research study, two research advisors reviewed and selected 26 questions from the original TPACK assessment to collect the data of this study. All selected questions relate to the goal of the study and all focused on the six types of knowledge within the TPACK as well. Examples of the selected questions from the TPACK assessment are:

- I have various ways and strategies of developing my understanding of the content that I am going to teach.
- I have sufficient knowledge about the content that I am going to teach.
- I can adapt my teaching based upon what students currently understand or do not understand.

- I know about technologies that I can use for supporting understanding and doing in the content that I am going to teach.

Participants were asked to take the survey before the project started, in the middle of the project period, and after the project was completed. They rated their responses toward the statements through Likert scales from 1 (*strongly disagree*), 2 (*disagree*), 3 (*neutral*), 4 (*agree*), to 5 (*strongly agree*) (see Appendix E).

Creativity Styles Questionnaire–Second Revised

The Creativity Styles Questionnaire–Revised was a self-assessment survey developed by Kumar and Holman (1997), and the purpose of the survey is to explore how people understand creativity and accomplish a creative act. The original Creativity Styles Questionnaire–Revised survey contained 78 questions that focused on personalities of creative people (see Appendix F). For this study, two research advisors reviewed and selected 20 questions from the original Creativity Styles Questionnaire–Revised survey to collect the data. All of the selected questions were related to the goal of the study and characteristics of the four abilities of the creative process. Examples of the selected questions from the self-assessment are:

- I believe that creativity comes from hard work and persistence.
- I typically create new ideas by combining existing idea.
- I am always thinking about how to do everyday things differently.
- I often look for new ideas outside of my own field and try to apply them to my own.

For this study, the participants were asked to take the survey three times: in the first, fourth, and final weeks of the Creative Technology Integration Project. The

quantitative data from the survey showed whether their belief about creativity changed after completing the Creative Technology Integration Project. Participants rated their responses through Likert scales from 1 (*strongly disagree*), 2 (*disagree*), 3 (*neutral*), 4 (*agree*), to 5 (*strongly agree*) (see Appendix G).

Technology Integration Assessment Instrument

Britten and Cassady (2006) developed the Technology Integration Assessment Instrument (TIAI) for evaluating the level of technology integration of teachers. The TIAI measures the strengths and weaknesses of integration of educational technology within a lesson plan through five dimensions and also compares levels of technology integration of lesson planning among groups of teachers. The TIAI not only provides an overview for teachers, administrators, and program evaluators on how technology is integrated but also shows how technological tools relate to pedagogical features, such as assessment, student needs, and educational standards within a lesson plan. The instrument explores levels of technology integration with four specific classifications: technology not present, non-essential technology, supportive technology, and essential technology. All five dimensions of the TIAI are reliable, easy to use, and relatively free from ambiguity (Britten & Cassady, 2006). The five dimensions of the TIAI are:

1. Planning: It refers to the use of technology within a lesson plan for evaluating and organizing learning activities. Britten and Cassady (2006) indicated that, for learning to occur, lesson plans should include technology used for content delivery or essential learning resources for learners.
2. Standard relations: A lesson plan should include two standards: content and NETS–S. The authors indicated that a lesson plan should address both standards

and demonstrate how technology or the tools used give outcomes to meet the standards. Moreover, the dimension examines how teachers identify and incorporated both content and NETS-S into a learning activity or lesson appropriately.

3. Student needs: The authors indicated that technology integrated into classrooms should not only be used for presenting content to learners but should allow learners to have the freedom to choose content that relate to their interests and skill levels.
4. Implementation: It focuses on learning and teaching. In terms of learning, implementation refers to the use of technology to increase student understanding of content. In terms of teaching, implementation refers to the level that teachers rely upon technology to deliver content during an instructional session.
5. Assessment: This refers to the use of technology within a lesson plan. As Britten and Cassady (2006) explained:

> Essential technology builds upon the expectations for supportive technology by requiring that the assessment be impossible in the absence technology. There is also the expectation that the lesson will include assessment of mastery of NETS-S (or an alternate technology standards system) by the learners. (p. 57)

For this study, the researcher used five dimensions of the TIAI as a rubric for grading participant lesson plan assignments. The scores of participants' assignments by using the TIAI instrument indicated strengths and weaknesses of their lesson plans and demonstrated the development of technology integration knowledge skill of participants after completing the Creative Technology Integration Project as well (see Appendix H).

Procedure

The Creative Technology Integration Project took seven weeks to complete. In the first week, participants were asked to complete the TPACK–Revised survey, Creativity Styles Questionnaire–Second Revised survey, and write the first reflection paper. The links of the surveys and the first reflection paper were posted in the online course in the first week of the project. Participants had one week to complete the surveys and submit the first reflection paper.

In the second week, the researcher posted all the learning materials and the first lesson plan assignment of the Creative Technology Integration Project within the assignment link of the online course. The objective of the first assignment was to encourage participants to recognize fluency, which was the first ability of the creative process. In this week, participants read all learning materials posted in the assignment folder, which reflected important information of 21st century education, technology integration, and creativity, such as learning theory, learning and teaching standards in 21st century education, technology integration models, the creative process, and benefits of creativity toward learning and teaching. All of these learning materials were important resources for helping participants recognize the principles of technology integration and the significance of creativity toward learning and teaching. Next, participants worked on the first assignment to generate possible ideas for designing their lesson plans. Participants had the freedom to choose a topic or content area they were interested in for designing their lesson plans. Giving freedom to the participants was an important approach for increasing motivation.

The researcher set up four discussion groups within the discussion board in which they focused on four separate content areas: mathematics, social studies, literacy, and science. After participants completed and submitted their first assignments, they shared their first assignments in the group that related to the content of their lesson plans. Participants had one week to submit their first assignments via the submission link and also share their first assignments in a discussion board within the online course.

In the third week, all participants were required to participate in the first online group discussion activity; the objective was to increase participant flexibility, which was the second ability of the creative process. The interaction within an online group discussion not only expanded participants' vision in integrating technology into their lesson plans but also encouraged them to exchange information and recognize various perspectives in integrating technology into lesson plans. Participants provided feedback to at least four people within a group. Participants had one week to complete the first online group discussion activity. Participants were asked to use questions provided by the researcher as guidance for writing their feedback for each lesson plan. Those questions were:

- Which are the tools or websites that are listed in a lesson plan do you like or you do not like? Why?
- Do you think those tools and websites will help students to achieve the standards and objectives of the lesson plan? How? If not, why?
- Do you think those technologies and websites are appropriate with the student grade level? For using to teach in that content area and topic of the lesson plan? How? If not, why?

- Do you think the lesson plan contains enough tools and websites for promoting student learning?
- Please provide at least one suggestion for improving a better lesson plan. You need to have one suggestion in each feedback.

In the fourth week, the researcher posted the links of the TPACK–Revised survey, Creativity Styles Questionnaire–Second Revised survey, and information of the second assignment within the online course. In this week, participants took surveys, read feedback they received from group members, and began working on the second assignment. The objective of the second assignment was to show participants how to recognize originality, which was the most important ability of the creative process. The researcher created a new thread in a discussion board that contained four groups of different content areas. Participants shared their second assignments in a group that related to the content of their lesson plans again. Participants had one week to complete the surveys, submit their second assignments via the submission links, and share their works in a discussion board within the online course.

In the fifth week, participants participated in the second online group discussion activity; the objective was to show participants how to recognize that flexibility was an important ability that improved and helped them create their original creative works. In this week, participants provided feedback to at least four people within a group by using the TIAI given by the researcher as guidance for writing feedback. Participants had one week to complete the second online group discussion activity.

In the sixth week, participants read all the feedback they received from group members and completed their final assignments. In this week, participants revised their

lesson plans by editing information in the lesson plan template according to the feedback they received from the second online group discussion activity. Its purpose was to show participants how to recognize originality and also allowed them to create their original lesson plans. Next, participants wrote summaries on the feedback they received from group members and explanations of what they changed from the first until the final lesson plans. Its purpose was to show them how to recognize elaboration, which was the last ability of the creative process. Participants submitted their final assignments, summaries of feedback, and explanations of their lesson plans via the submission link within the online course within a week.

In the seventh week, the researcher posted the links of the TPACK–Revised survey, Creativity Styles Questionnaire–Second Revised survey, and questions of the second reflection paper within the online course. Participants had one week to complete the surveys and submit their responses of the second reflection papers. All data were collected and analyzed after the Creative Technology Integration Project was completed.

Statistical Design

Q1 Does preservice teacher knowledge about technology integration change after they recognize the four abilities of the creative process?

Descriptive and repeated–measures analysis of variance (ANOVA) were appropriate statistic methods for analyzing the quantitative data from the TPACK–Revised survey. The results from descriptive analysis demonstrated the development of participants' technology integration knowledge during the time they were participating in this project. The result from repeated–measures ANOVA showed whether participants' knowledge of technology integration changed after participants recognize the four abilities of the creative process.

In addition, the qualitative data of the first question from the first and second reflection papers were compared and analyzed by using a coding technique to identify themes of participants' responses. The result provided detailed explanation of how participants' technology integration knowledge changed after completion of the Creative Technology Integation Project. The question was:

- Please explain what technology integration is in your opinion and why is it important toward learning and teaching?

  Q2 How do the four abilities of the creative process encourage preservice teachers to have a better knowledge regarding technology integration?

By using the TIAI, scores of the participants' final lesson plan assignments were analyzed to demonstrate strengths and weaknesses of technology integration knowledge of participants after they recognized the four abilities of the creative process. Moreover, a coding technique was used to analyze the qualitative data from the third question in the second reflection paper to show themes and provide detailed explanations of how the four abilities of the creative process improved participants' knowledge of technology integration. The question was:

- How have the four abilities of the creative process (fluency, flexibility, originality, and elaboration) helped you to choose and integrate technology into your lesson plan?

  Q3 Does preservice teacher knowledge about the four abilities of the creative process change after they complete the Creative Technology Integration Project?

Descriptive and repeated–measures ANOVA were appropriate statistic methods to analyze the data from the Creativity Styles Questionnaire–Second Revised survey. The results from descriptive analysis demonstrated the development of participants'

creativity knowledge during the time they were participating in this project. The result from repeated–measures ANOVA indicated whether the participants' knowledge of the four abilities of the creative process changed after completing the Creative Technology Integration Project.

The qualitative data from the second question in both reflection papers were also analyzed and compared by using a coding technique to demonstrate and provide detailed explanation of how the participants' knowledge of creativity changed after participating in this project. The question was:

- Please explain what creativity is, in your opinion, and why is it important toward learning and teaching?

    Q4 How do preservice teachers transfer their knowledge regarding the four abilities of the creative process into their future classrooms to promote student creativity?

A coding technique was used for analyzing the qualitative data from Research Question Q4 in the second reflection paper to find themes and describe how the participants recognized, transferred, and applied these abilities to promote creative learners in the 21st century. The question was:

- How do you transfer the knowledge of creativity that you have learned from the project with 21st century learners to enhance their creativity?

CHAPTER IV

RESULTS

This study focused on two major areas: (a) development of knowledge regarding technology integration, and (b) creativity of preservice teachers within an online foundation of technology in education course. The study contained four research questions that specifically explored whether the preservice teachers showed a better understanding about technology and creativity knowledge after they participated in the Creative Technology Integration Project, how the four abilities of the creative process encouraged preservice teachers to gain knowledge of technology, and how they transferred the four abilities of the creative process to promote creativity in their future students. Both quantitative and qualitative results are reported in this chapter and organized by the research questions.

Technology Integration Knowledge

Q1 Does preservice teacher knowledge about technology integration change after they recognize the four abilities of the creative process?

A repeated–measures ANOVA was conducted to test whether the knowledge of technology integration of preservice teachers in an online course, Creative Technology Integration Project, changed over the time of participation. Knowledge of technology integration was measured by self-report with the TPACK–Revised survey, which was

administered to each participant three times during the study. The alpha level was set at 0.05 for all tests of significance.

The descriptive statistics are displayed in Table 5. The data show 106 preservice teachers completed all three TPACK–Revised surveys. The internal reliability of the survey was 0.703.

Table 5

Descriptive Statistic of Technology Pedagogical Content Knowledge–Revised Survey

TPACK–Revised surveys	First Administration (N = 122)	Second Administration (N = 119)	Third Administration (N = 112)
TPACK	3.70 (0.585)	3.92 (0.441)	3.98 (0.493)
Technology knowledge	3.42 (0.729)	3.63 (0.644)	3.71 (0.709) Reliability = 0.895
Content knowledge	3.68 (0.622)	3.93 (0.579)	4.03 (0.385) Reliability = 0.657
Pedagogical knowledge	3.82 (0.504)	3.99 (0.490)	4.07 (0.617) Reliability = 0.8111
Pedagogical content knowledge	3.61 (0.755)	3.86 (0.700)	4.03 (0.616) Reliability = 0.638
Technology content knowledge	3.52 (0.853)	3.75 (0.663)	4.00 (0.690) Reliability = 0.596
Technology pedagogical knowledge	3.74 (0.524)	3.99 (0.490)	4.05 (0.570) Reliability = 0.818

Note. Valid N (listwise) N = 106

Prior to conducting the repeated–measures ANOVA, Mauchly's test of sphericity was conducted. The result was significant ($p < .0001$), indicating that sphericity could not be assumed. Therefore, the Huynh-Feldt correction factor was used to adjust the *p*-value.

The results of the repeated–measures ANOVA showed a significant change in the TPACK survey over the three administrations, $F(1.604, 105) = 21.419$, $p < 0.0001$. Follow-up tests of within–subjects contrasts were conducted to determine where the changes occurred. There was a significant increase in the TPACK–Revised survey score from the first to the second administration, $F(1,105) = 20.852$, $p = < 0.0001$. However, the increase from the second to the third administration was not significant, $F(1,105) = 1.839$, $p = 0.178$. This revealed the knowledge of technology integration of preservice teachers who enrolled in the online course significantly changed over the time of participation in the Creative Technology Integration Project. Specifically, the scores significantly increased between the first and the second times that they took the TPACK–Revised surveys (see Appendix I).

A repeated–measures ANOVA was conducted to test whether all types of knowledge within the TPACK framework of preservice teachers changed over the time of participation. Knowledge of technology integration was measured by self-report with the TPACK–Revised survey which was administered to each participant three times during the study. The alpha level was set at 0.05 for all tests of significance (see Appendix J).

Mauchly's test of sphericity of technology knowledge was not significant ($p = 0.118$), indicating that sphericity was assumed. The results showed a significant

change in technology knowledge over the three administrations of participants, $F(2, 201) = 19.08$, $p < 0.0001$. Follow-up tests of within–subjects contrasts were conducted to determine where the changes occurred. There was a significant increase in the technology knowledge score from the first to the second administration, $F(1,105) = 22.176$, $p = < 0.0001$. However, the increase from the second to the third administration was not significant, $F(1,105) = 2.934$, $p = 0.090$. For content knowledge, the result of Mauchly's test of sphericity was not significant ($p = 0.066$), indicating that sphericity was assumed. The results showed that there was a significant change of content knowledge in participants over the three administrations, $F(2, 210) = 15.769$, $p < 0.0001$, and there was a significant increase in the survey score from the first to the second administration, $F(1,105) = 14.677$, $p = < 0.0001$. The increase from the second to the third administration was not significant, $F(1,105) = 3.297$, $p = 0.072$.

The result of Mauchly's test of sphericity for pedagogical knowledge was not significant ($p = 0.067$), indicating that sphericity was assumed. The results showed that there was a significant change over the three administrations of participants as well, $F(2, 210) = 17.172$, $p < 0.0001$. Follow-up tests of within–subjects contrasts were conducted to determine where the changes occurred. There were significant increases in survey scores from the first to the second administration, $F(1,105) = 15.406$, $p = < 0.0001$, and from the second to the third administration, $F(1,105) = 4.427$, $p = 0.038$.

For pedagogical content knowledge, the result of Mauchly's test of sphericity was not significant ($p = 0.078$), indicating that sphericity was assumed. The results showed there was a significant change over the three administrations of participants,

$F(2, 210) = 14.559$, $p < 0.0001$. There were significant increases in survey scores from the first to the second administration, $F(1,105) = 9.902$, $p = 0.002$, and from the second to the third administration, $F(1,105) = 5.694$, $p = 0.019$. For technology content knowledge, the result of Mauchly's test of sphericity was significant ($p < .0001$), indicating that sphericity could not be assumed. Therefore, the Huynh-Feldt correction factor was used to adjust the *p*-value. The results showed that there was a significant change over the three administrations of participants, $F(1.757, 184.527) = 19.505$, $p < 0.0001$. There were significant increases in survey scores from the first to the second administration, $F(1,105) = 10.188$, $p = 0.002$, and from the second to the third administration, $F(1,105) = 13.143$, $p = < 0.0001$.

As same as for technology pedagogical knowledge, the result of Mauchly's test of sphericity was significant ($p < .0001$), indicating that sphericity could not be assumed. Therefore, the Huynh-Feldt correction factor was used to adjust the *p*-value. The results indicated a significant change over the three administrations of participants, $F(1.725, 181.075) = 30.869$, $p < 0.0001$. There was a significant increase in survey scores from the first to the second administration, $F(1,105) = 36.129$, $p = < 0.0001$. The increase from the second to the third administration was not significant, $F(1,105) = 2.888$, $p = 0.092$ (see Appendix K).

The results clearly indicated that, after completion of the project, most preservice teachers had more confidence about their abilities in teaching lessons that appropriately combined the content they would be teaching, using technologies, and teaching approaches after completing the Creative Technology Integration Project.

Qualitative Data of Reflection Papers

The reflective responses preservice teachers submitted before and after completing the Creative Technology Integration Project were analyzed using a coding technique to identify themes of their reflections. The data from both reflection papers were summarized, compared, and reported in two subsections: (a) summaries of preservice teacher responses that emphasized the definition of technology integration, and (b) summaries of preservice teacher responses that focused on the importance of technology toward learning and teaching.

Definition of Technology Integration

A total of 120 reflection papers were submitted to the researcher before and after the project. The results from both reflection papers clearly showed most of the preservice teachers defined technology integration into two areas: (a) enhancing student learning, and (b) supporting teaching methods.

Enhancing students learning. Before the project started, 75 (62.5%) preservice teachers stated that technology integration was defined as the use of technology in a classroom for improving student learning. It was the tool to help students comprehend the content or learning materials taught in a classroom. Examples of preservice teacher responses are as follows:

> Technology integration is integrating technology into your classroom in a way that enhances learning in a deeper, more meaningful way. (Participant 5199)

> Technology integration is an ability to take content material and through the use of technology teach students the materials with technology so that they can have a better understanding of the material. (Participant 0075)

> To me technology integration is where technology is used in the classroom as a way to help build children's understanding on the content matter. (Participant 7306)

> In my opinion, technology integration is when you not only use technology to teach a lesson but you also use it to enhance your lesson so that your students will be able to understand and comprehend what you are teaching them. (Participant 0094)

The results in the second reflection paper showed 98 (81.66%) preservice teachers could provide a detailed definition of technology integration and included additional keywords, such as experiences, learning styles, and students needs, after the Creative Technology Integration Project was completed. Of the 98 preservice teachers, 66 described technology integration as referring to the use of various types of technology in a classroom to improve experiences for students, helping students in all learning styles, and meeting the needs of all students at the same time. There were 32 preservice teachers who indicated that technology integration was the key factor to successful learning in the 21st century, and it required "creative ideas" to guide students to learn. Examples of responses from the second reflection papers are displayed below:

> Technology integration, to me, is the integration of technology as a tool to help improve and enhance the experiences and education of children, as well as coworkers, in the classroom. (Participant 7679)

> Technology integration is the ability to use various forms of technology in the classroom to create lessons, cater to students needs, enhance learning, build knowledge about technology and assess students' knowledge. (Participant 8620)

> With so many different learning styles in one classroom, technology integration is a wonderful way to fill the needs of several students at the same time. (Participant 3899)

> Technology integration requires using a variety of creativity and technology to help students learn in different ways. It is a creative way to learn information, and is a way to learn hands on and be engaged. (Participant 2737)

> I think technology integration is a key factor in students coming of age in the 21st century. Technology integration is when the teacher uses technology to supplement a lesson with engaging learning activities that make students think critically. (Participant 4227)

Supporting teaching methods. Preservice teachers also defined technology integration as the way teachers incorporate technology into teaching. In the first reflection paper, 56 (46.66%) preservice teachers described technology integration as ways teachers used for teaching students, illustrating ideas or lesson, and preparing students for living in society. Examples of preservice teachers responses are as follows.

> Technology integration is when you incorporate technology into teaching. (Participant 5101)
>
> Technology integration is when you integrate technology into your lessons to teach your students different and interesting ways of learning topics. (Participant 0104)
>
> Technology integration is the use of technology in a lesson. In other words, teaching a lesson through the use of technology, or having students use technology to determine answers to questions a teacher may pose. (Participant 1861)
>
> To me, technology integration means the use of technology to describe or illustrate an idea. More often than not in the classrooms I have been in, teachers' ideas of technology integration is a PowerPoint presentation that states almost exactly what they were planning to say in the lecture. (Participant 5704)
>
> Technology integration is something that could greatly improve the classroom and make the learning more relevant to society today as long as it is in moderation. (Participant 9656)

In the second reflection paper, several keywords, such as "creativity," " learning styles," and " interactive," were included in the definition of technology integration. There were 61 (50.83%) preservice teachers who defined technology integration as the combination of technology with teaching approaches, which refers to teachers' abilities in incorporating technology and "creative ideas" to guide "students' learning" and the use of available technology in a classroom to the "best advantage of students" and making learning more "interactive." Sample responses are shown below:

> Technology integration is the combining of technology within the means of teaching. (Participant 0590)
>
> Technology integration is putting together new and creative ideas that will support and guide a student's learning. (Participant 9489)
>
> After these weeks of study, technology integration is, as my understanding, knowing the advantages and usages of technologies in K–12 classroom and making the best use of them to help student learn creatively. (Participant 8391)
>
> Technology integration is how teachers incorporate the use of technology in their classrooms. It helps to show different ways of teaching certain lessons and usually makes learning more interactive and visual, which better helps students with that learning style. (Participant 8907)
>
> I think technology integration is a key factor in students coming of age in the 21st century. Technology integration is when the teacher uses technology to supplement a lesson with engaging learning activities that make students think critically. (Participant 4227)

Importance of Technology Integration

All of the reflective responses in both reflection papers clearly showed that preservice teachers realized the importance of technology integration toward learning and teaching before and after they participated in the Creative Technology Integration Project. The results are reported and organized into two sections: (a) summary of preservice teacher reflections regarding the importance of technology integration toward learning, and (b) summary of preservice teacher reflections regarding the importance of technology integration toward teaching.

Learning. The preservice teachers agreed that technology was an important tool for enhancing learning. Before the Creative Technology Integration Project started, 84 (70%) preservice teachers thought that integrating technology into a lesson made learning more interactive, and it also encouraged students to create a meaningful relationship with their classmates. They explained that technology not only helped students to have a

better understanding about content matter, but it also promoted "communication skills, cooperative perspectives, self-esteem, and expanded creative ideas." Sample preservice teacher opinions in the first reflection papers are as follows:

> It [technology] helps them, the students, become more motivated, have better self-esteem, they can accomplish more complex tasks by learning technology skills, and they can be more collaborative with peers. (Participant 0038)

> Technology brings new options for teaching into the classroom, for instance communicating with students through a classroom website, creating opportunities for students to work collaboratively within small groups, and allowing students to present information to the whole group in new and innovative ways. (Participant 9323)

> A positive attribute of technology is that it can connect students in one place to students and resources in other places. . . . This collaboration and interaction can help students gain a more international and cooperative perspective than they might have gained from isolated learning in their individual classrooms. (Participant 4307)

There were 99 (82.5%) preservice teachers who believed technology was an important tool for enhancing learning after they completed the Creative Technology Integration Project. They provided detailed explanations of why technology integration was important for learning in the second reflection papers and also indicated that technology was a key tool that should be used in every step of the learning process because it gave students a new resource for learning and allowed them to express themselves in new and unique ways. Samples of preservice teacher opinions in the second reflection papers are below:

> Technology integration is important to learning because it can be used in every step of the learning process from the first introduction of the content all the way to assessment. (Participant 8620)

> Technology integration is important to learning. It has the ability to reach the creative processors of learners, allowing them to express themselves in new and unique ways. (Participant 5469)

> Technology is a part of everyday life and is imperative to most jobs today. Students need to be prepared to step into this technological world with confidence which only comes from the careful guidance of the teacher. (Participant 9323)

Teaching. Only 27 (22.5%) preservice teachers stated in the first reflection papers that technology was an important tool for teaching. They explained that technology provided opportunities to teachers to make connections with students or other teachers around the world. Moreover, it helped teachers explore their own creative ideas and find further information they could use to support their teaching methods. Examples of preservice teacher responses are displayed below:

> Teaching with technology gives the teacher the chance to meet the students where they are in their world. Technology can be a teacher's best tool with proper training and an open mind. (Participant 9323)

> Technology has also given teachers across the world to communicate with one another and share ideas and brainstorm ideas that they can all take back to their own class and try different methods of teaching that they may not have had without the usage of technology. (Participant 7117)

The number of presrvice teachers who agreed that technology was important for teaching increased after completion of the Creative Technology Integration Project. The results showed 60 (50 %) preservice teachers indicated that technology integration was an "essential skill" teachers needed. They stated that technology gave teachers a choice to operate with individuals on a world-wide basis, and it offered many additional resources and materials for teachers to use for teaching in a classroom. Examples of the preservice teacher responses are shown below:

> Technology integration is essential in learning and teaching, because it offers a differentiated way of viewing the material that might be exactly what a particular learner needs or might help a learner's understanding. (Participant 0653)

> The wonderful thing about technology is its versatility. Technology gives students and teachers the choice to operate on a world-wide basis of individuals. (Participant 5704)

> Technology also provides many more options and materials to teach with. The classroom expands to the rest of the world and becomes much more real world applicable. (Participant 6391)

However, only 7 (5.83%) preservice teachers in the first reflection papers and 9 (13.33%) preservice teachers from the second reflection papers stated they were concerned about limiting the use of technology within the classrooms. They felt that, although technology was an important tool for learning and teaching, it needed to be limited in a classroom. They explained that integrating technology into a lesson was critical, but needed to be balanced between technology and traditional teaching approaches. These preservice teachers believed that a traditional teaching approach was still important, and technology was only a part of it. Sample reflections of these preservice teachers are as follows:

> Technology is not being overused in the classroom. I do not think that all of the teaching in schools needs to be done with technology. It should be about a 50% of technology teaching as well as old school teaching with hands on work. (Participant 0027)

> However, I am a strong believer that changing the classroom in order to fit the needs of technology is not always the way to go. With technology comes a lot of confusion, not only with the teacher but with the students as well. (Participant 4707)

> I think that it is important to integrate technology into the classroom but I do not think that it should be in all aspects. It is important to have a balance between technology and pen and paper. (Participant 5973)

In conclusion, the data from survey and reflection paper clearly showed that technology integration knowledge of the preservice teachers changed after the preservice teachers recognized the four abilities of the creative process. The results showed that the preservice teachers recognized more fully the main concepts of technology integration and realized the importance of technology integration toward learning and teaching.

Q2 How do the four abilities of the creative process encourage preservice teachers to have a better knowledge regarding technology integration?

Participant responses in the second reflection papers were summarized and presented in this section to describe how the four abilities of the creative process encouraged participants to have a better knowledge regarding technology integration. After the Creative Technology Integration Project was completed, 120 responses were submitted to the researcher. The results showed most preservice teachers felt the creative process was helpful and it encouraged them to be able to (a) create a better lesson plan and (b) think more critically about integrating technology into learning and teaching. However, only 19 (15.83%) preservice teachers did not clearly explain how the four abilities of the creative process helped them to have a better technology integration knowledge.

Create a better lesson plan. There were 49 (40.83%) preservice teachers who believed the creative process significantly helped them guide their students in the right direction to success. It also helped them to see a clear structure of a lesson plan, provided guidelines of how to choose and incorporate technologies into a lesson, and expanded their ideas in using technologies in a classroom. These preservice teachers indicated that elaboration, the last ability of the creative process, made them feel confident with technologies that they integrated into lesson plans as well. Sample reflections of these preserves teachers are as follows:

> Learning all four of these aspects properly will help me guide my students in the right direction to success. (Participant 2873)

> In general they helped by guiding me to find the perfect sources that were appropriate for my students and applied to what I was going to teach. It also helped me think about how I could use these as an guide for my lesson plan rather than just use these only for my lesson. (Participant 2385)

> The creative process has helped me come up with new ideas that I would not have thought of otherwise and expand the uses for those ideas in a lesson. (Participant 8620)
>
> Finally the fourth ability, elaboration, also had a direct impact on my lesson plan. It allowed me to confirm with myself that the technology I am using is following the guidelines and meeting the needs of my students. (Participant 3899)
>
> These abilities helped me to make sure that technology was effectively integrated into an engaging and academically focused lesson, not simply adding technology to a lesson. (Participant 4307)

Think critically about integrating technology. There were 52 (43.33%) preservice teachers who stated that the creative process made them think more in depth about how to adapt technology into real-life scenarios and consider new ways of using technology to enhance student learning in a classroom. They thought that the creative process encouraged them to have better ideas in using technology and provided the most benefits to both students and teachers. It encouraged them to see the importance of technology toward learning and teaching, which inspired them to want to integrate more technology into their classrooms in the future. Examples of preservice teacher responses are as follows:

> The four abilities of creativity have helped me integrate technology into my lesson by making me think more in depth about what technologies I am including and why I have decided to include those technologies. (Participant 8303)
>
> The four abilities of the creative process helped me to choose and integrate technology into my lesson plan because it helped me consider the different ways that technology can affect the students in the classroom. (Participant 2207)
>
> The creative process helped me think about different ways to teach the same lesson because not all of our students will think and will not be able to process information the same, so teachers need to be prepared and be able to accommodate as many students as you can. (Participant 3887)
>
> Overall, I think these four abilities are very helpful guidelines to help improve my lessons and I plan to carry them with me into my future teaching. (Participant 2385)

> These four abilities from our lesson plan have definitely made me want to integrate technology into my future classroom! (Participant 5179)

Four Abilities of the Creative Process versus Technology Integration Skill

After completion of the Creative Technology Integration Project, preservice teachers provided detailed explanations of how the four abilities of the creative process enhanced their technology integration knowledge. The results are summarized and reported into four subsections. Each section focuses on how one ability within the creative process enhanced technology integration knowledge of the preservice teachers after they completed the Creative Technology Integration Project.

Fluency. There were 43 (35.83%) of the preservice teachers who indicated that fluency helped them to recognize guidelines in designing their lesson plans. Thirteen (10.83) preservice teachers explained that brainstorming was the strategy that helped them develop more new ideas for their lesson plans. There were 22 (18.33%) preservice teachers who said fluency encouraged them to recognize what they needed to know for using technology, and it was an important ability to make their lesson plans flow and meet specific goals and standards. Samples of preservice teacher opinions are displayed below:

> Fluency has helped me to understand the organization behind my lesson plans. It is important for my lesson plans to flow together and meet a specific goal. It takes staying on track and focusing on ways to accomplish the goal in order to meet the needs of my future students. (Participant 6391)

> Fluency has been a great thing to learn about because it has taught me to plan ahead and get things in order so that when I start the lesson plan it can flow and be easy to get from one activity to the next. (Participant 6430)

> Fluency has helped me to be able to do the research and to know what I need to know in order to be able to use the technology. Brainstorming and creating a lesson plan from scratch was extremely helpful. (Participant 4679)

Flexibility. There were 83 (69.1%) preservice teachers who agreed that flexibility helped them have better technology integration knowledge in two ways. First, 50 (41.66%) preservice teachers said flexibility helped them see problems in lesson plans from a different point of view. They indicated that receiving feedback from others, an important strategy from flexibility, did not only help them to see problems, but it expanded their technology integration knowledge. Second, 33 (27.5%) preservice teachers stated that students were changed and "being flexible" was an important factor that made lessons more effective. They explained that students did not all study in the same way and sometimes activities or technologies given to them did not work as teachers expected. Therefore, to create meaningful learning, teachers should be able to edit and change their lessons to fit the background and meet student needs. Samples of the responses are as follows:

> The feedback was valuable to assist me in viewing my lessons from different perspectives and gave me a lens to the needs of my students. (Participant 0653)
>
> I received good feedback from my peers that I was able to think about critically and revise my plan. This allowed me to add another technology I hadn't thought of. (Participant 4244)
>
> Flexibility was another ability of the creative process that helped me while creating my lesson plan. In order to turn in a successful final project I needed to be flexible and willing to change up the details of the lesson plan to best fit all of my students' needs. (Participant 0485)

Originality. There were 49 (40.83%) preservice teachers who realized they should develop original and unique lesson plans to create meaningful learning for students. They said teachers needed to be creative to make their lesson plans unique and also retain student interest. Examples of preservice teacher opinions are displayed below:

> Originality is very important in the technology integrated lesson plan because one must be extraordinarily ordinary in order to create a meaningful and essential lesson plan! (Participant 6727)

> Originality is also very important when using technology because your lesson plans need to be more original so that it will keep the students interested every lesson. (Participant 7127)

> When it comes to originality I have learned that being creative in choosing and integrating technology into my lesson is very important. As a teacher you must be creative in order to bring exciting and new things into the classroom that will keep the students interested. (Participant 6931)

Elaboration. There were 54 (45%) preservice teachers who believed that elaboration was the most important ability for enhancing their technology integration knowledge. They explained that elaboration allowed them to see how they could expand their lesson plans into a larger area and fill in the gap that made them more realistic with students. Also, elaboration made these preservice teachers think critically about integrating the appropriate technology for learning in the 21st century. Examples of the preservice teacher opinions are as follows:

> The elaboration step allowed me to look how I could expand my lesson plan. (Participant 6187)

> Elaboration was the time we refine our work. When I worked on the same project for the second time, since I had experience peers' thoughts, and got some suggestions from other perspectives, I could see my problems and how they can be improved. (Participant 1861)

> Elaborating also helped me become more aware of integrating technology because I have to think about the lesson I wanted to present in the classroom but in a way that is 21st appropriate. (Participant 9489)

However, only 4 (3.33%) preservice teachers stated that the creative process did not really help them to have better technology integration knowledge. They felt that they repeated doing the same things, and technology was difficult to represent as creative. One preservice teacher suggested that the creative process would be effective if it was

applied to projects in an actual classroom rather than an online course. Samples of the preservice teacher responses are shown below:

> The creative process that we used just seemed like we wrote the same thing over and over again and put it onto a different template. Honestly, this would be something that would be better taught in an actual classroom if you want learning to take place. (Participant 5469)

> I know this was probably a part of what you were supposed to do, but creativity and technology can mix very rarely, and usually only when you are very talented. Nice effort, but technology is difficult to represent as creativity. (Participant 2737)

Final Lesson Plans

In the final week of the Creative Technology Integration Project, 117 preservice teachers submitted lesson plans to the researcher. Scores of the lesson plans are displayed in Table 6. Results show all lesson plans met the highest level component of each dimension in the TIAI rubrics. For planning, the results show preservice teachers included the use of technologies in their lesson plans. There were 96 (82.05%) of the lesson plans that contained essential technology and were discussed within the context of the lesson. Approximately 106 (90.59%) of the lesson plans contained technologies that directly corresponded with content standards. There were 95 (81.19%) of the lesson plans that included NETS standards appropriate for grade-level and learning goals.

Table 6

Descriptive Statistics of Preservice Teachers' Lesson Plans

Technology Integration Assessment Instrument (TIAI) components	*n*	%
Planning (material, equipment, etc.)		
Computer is essential to planning of lesson (e.g., WebQuest). Equipment and technologies are built into lesson design and objectives, and are discussed within the context of the lesson and not as an external component.	96	82.05
Uses computer to plan for lesson. Make mention of necessary equipment and technologies for replication purposes.	20	17.09
Uses technology in lesson not related to the addressed standards.	1	0.85
No mention of technology.	NA	NA
Standards (content standards per grade level and content area)		
Technology use in the lesson is directly linked to one or more standards, making acquisition of that standard possible.	106	90.59
Uses technology supports or promotes the acquisition of standards in the lesson but is not directly tied to the standards itself.	7	5.98
Uses computer to plan for lesson.	NA	NA
No mention of technology, or no mention of content standard.	4	3.41
National Educational Technology Standards for Students (NETS–S)		
NETS are present and integrated into grade-level appropriate learning goals.	95	81.19
NETS are present but not identified or embedded into the lesson as a learning goal. NETS are grade-level appropriate.	18	15.38
NETS are presented but no identified or embedded into the lesson as a learning goal. NETS addressed are not up to expected grade level.	1	0.85
No mention of technology or no mention of NETS.	3	2.56
Attention to Student Needs		
Technology is the only means by which this lesson can be adapted to meet the needs of students from diverse backgrounds; that is, the technology tool or activity is designed to be adaptive.	107	91.45
Technology can be modified by the teachers or students to meet the needs of students from diverse backgrounds.	10	8.54
Technology is not used in an adaptable fashion. All students use the same technology tools or complete the same technology tool or technology-based activity.	NA	NA
No mention of technology	NA	NA

(Table continues)

Table 6 (continued)

Technology Integration Assessment Instrument (TIAI) components	*n*	%
Implementation (use of technology in learning)		
Technology impacts learning by presentation, products, or process.	108	92.3
Learning is impacted in time, quality, or wealth of resources by the use of technology.	25	21.36
Technology is not expected to directly impact learning.	1	0.85
No mention of technology.	NA	NA
Implementation (Use of technology in teaching)		
Equipment and technologies are built into lesson design and objectives and are discussed within the context of the lesson and not as external component. Lesson requires the use of technology (process and products are dependent upon technology).	85	72.64
Lesson is facilitated with technology, but learning goals could be achieved without technology in place (process-oriented and/or product-oriented technology).	25	21.36
Lesson uses technology but does not impact implementation (product-orientated technology).	6	5.12
No mention of technology.	NA	NA
Assessment		
5.Technology products and/or processes are directly accessed, or assessment relies upon use of technology for delivery or collection. Identified assessment could not be conducted without technology. NETS are identified as part of assessment.	84	71.79
6.Technology-based product is assessed or technology application is used to deliver and/or score the assessment instrument. A similar assessment could be replicated without technology.	17	14.52
7.Technology is not used in the assessment component (neither the use of technology nor a product of technology.	12	10.25
8.No mention of assessment or technology	3	2.56
TOTAL	117	

There were 107 (91.45%) of the final lesson plans containing technology adapted to meet the needs of students from diverse backgrounds. For implementation, 108 (92.3%) of the lesson plans the preservice teachers created contained technology that

impacted student learning, and 85 (72.64%) of the lesson plans contained equipments and technologies necessary for using in teaching. However, there were 25 (21.36%) of the lesson plans that only facilitated technology, and only 6 (5.12%) of the lesson plans that did not include technology that impacted implementation. For assessment, 84 (71.79%) of the lesson plans contained assessments that relied upon the use of technology for delivery or collection, and only 12 (10.25%) of the lesson plans did not include technology as a part of assessment.

In conclusion, the results clearly showed most of the preservice teachers had positive perspectives toward the four abilities of the creative process. They believed that fluency, flexibility, originality, and elaboration of the creative process was a helpful guideline for them to design lesson plans to effectively enhance student learning. Also, they agreed that the creative process helped them develop new ideas for choosing and integrating technology into their lesson plans and classrooms in the future.

Creative Process

Q3 Does preservice teacher knowledge about the four abilities of the creative process change after they complete the Creative Technology Integration Project?

A repeated–measures ANOVA was conducted to test whether knowledge about the four abilities of the creative process of preservice teachers in an online course changed over time. Knowledge of the creative process was measured by self-report with the Creativity Styles Questionnaire–Second Revised survey which was administered to each participant three times during the study. The alpha level was set at 0.05 for all tests of significance.

The descriptive statistics are displayed in Table 7. There were 108 preservice teachers who completed all three Creativity Styles Questionnaire–Second Revised surveys. The internal reliability of the survey was 0.851. Prior to conducting the repeated–measures ANOVA, Mauchly's test of sphericity was conducted. The results indicated that the assumption of sphericity had not been violated ($p = 0.854$). The results of the repeated measures ANOVA showed a significant change in the Creativity Styles Questionnaire-Second Revised survey over the three administrations, $F(2, 214) = 38.444$, $p < 0.0001$. Follow-up tests of within–subjects contrasts were conducted to determine where the changes occurred. There was a significant increase in the Creativity Styles Questionnaire-Revised survey score from the first to the second administration, $F(1.107) = 39.871$, $p < 0.0001$, and from the second to the third, $F(1, 107) = 4.493$, $p = 0.036$ (see Appendix L).

The results of Mauchly's test of sphericity for all groups within the Creativity Styles Questionnaire–Second Revised are displayed in Appendix K. The alpha level was set at 0.05 for tests of significance. The assumption of sphericity of creativity capacity had not been violated ($p = 0.085$) and sphericity was assumed, $F(2,204) = 16.238$, $p < 0.0001$. Follow-up tests of within–subjects contrasts were conducted to determine where the changes occurred. There was a significant increase in survey score from the first to the second administration, $F(1,107) = 16.768$, $p = < 0.0001$. However, the increase from the second to the third administration was not significant, $F(1,107) = 2.052$, $p = 0.155$.

Table 7

Descriptive Statistics of Creativity Styles Questionnaire–Second Revised Surveys

Creativity Styles Questionnaire–Second Revised	First Administration (N = 124)	Second Administration (N = 120)	Third Administration (N = 124)
Creativity styles	3.51 (0.360)	3.71 (0.398)	3.78 (0.436)
Creativity capacity	3.91(0.660)	4.15 (0.581)	4.22 (0.573) Reliability = 0.75
Belief in unconscious process	3.18 (0.803)	3.54 (0.849)	3.58 (0.879) Reliability = 0.813
Use of techniques to facilitate creativity works	3.45 (0.368)	3.63 (0.414)	3.71 (0.449) Reliability = 0.826
Use of people to facilitate creativity works	3.96 (0.714)	4.01 (0.642)	4.08 (0.742) Reliability = 0.718
Note. Valid N (listwise)			N = 108

For belief in the unconscious processes, the results showed that sphericity was assumed, $F(2, 212) = 17.168$, $p < 0.0001$, which means the preservice teachers believed in the creative process as inspirational over which they had little control. There was a significant increased survey score from the first to the second administration, $F(1,106) =$

23.440, $p = < 0.0001$. However, the increased score from the second to the third administration was not significant, $F(1,106) = 0.282$, $p = 0.596$.

The results also indicated that the preservice teachers used several specific strategies or techniques within the creative process to facilitate their creative works after they finished the Creative Technology Integration Project. The assumption of sphericity of creativity capacity had not been violated ($p = 0.989$) and sphericity was assumed, $F(2,212) = 27.740$, $p < 0.0001$. There were significant increase survey scores from the first to the second administration, $F(1,106) = 26.318$, $p = < 0.0001$, and the second to the third administration, $F(1,106) = 4.549$, $p = 0.035$.

For the ability of using people to facilitate creative works of the participants, the results indicated that the assumption of sphericity had been violated ($p = 0.007$), indicating that sphericity could not be assumed. Therefore, the Huynh-Feldt correction factor was used to adjust the *p*-value. The results showed that there was no significant in participants' abilities in using other people for facilitating creative works, $F(1.866, 197.81) = 1.488$, $p = 0.229$. In addition, there was no significant increase score from the first to the second administration, $F(1,106) = 0.487$, $p = < 0.487$, and from the second to the third administration, $F(1,106) = 0.980$, $p = 0.324$, meaning the data did not change, and the preservice teachers still consulted or worked with different people in order to improve their creative works before and after they knew the four abilities of the creative process.

Qualitative Data of Reflection Papers

There were 122 preservice teachers who submitted their responses to the researcher before and after completion of the Creative Technology Integration Project.

The data from both reflection papers are analyzed, compared, and reported in this section. The results were organized into three separate topics: definition of creativity, importance of creativity toward learning and teaching, and key factors in promoting creativity within a classroom.

According to data from both reflection papers, preservice teachers defined creativity into four abilities: (a) creating unique ideas or products, (b) thinking outside one's comfort zone, (c) idea expression, and (d) problem-solving. Approximately 10 to 12 preservice teachers did not provide the definition of creativity in both reflection papers.

Creating unique ideas or products. Before the Creative Technology Integration Project started, 50 (40.98%) preservice teachers defined creativity as the ability to create new ideas or products. They described creativity as the way people created unique ideas or products totally unique from others; it refers to the ability of people going beyond traditional ideas and creating new ideas. They believed everyone had abilities to be creative, and everyone was creative in a multitude of ways. Samples of participant responses in the first reflection are as follows:

> Creativity in my opinion is the ability to be able to use your own ideas to create new ideas or to help other individuals learn new concepts. (Participant 6187)
>
> I believe creativity is the ability to go beyond traditional ideas and create new ones. I believe everyone is creative in different ways and everyone has the ability to be creative. It is something that all people are born with yet some seem to be more creative than others. It is something that helps tell who someone is and what their process of thinking is like. (Participant 0485)
>
> Creativity is when you come up with new ideas that can make life and learning fun. I believe that creativity is around, and it has made a difference in society. (Participant 6430)

> I think creativity is a vital part of life. It allows us to create something new that was formulated by our ideas. To me creativity is to have the chance to come up with something new. It can take place in any forms and anywhere but it is what drives innovation. (Participant 0411)

After completion of the Creative Technology Integration Project, 53 (43.44%) preservice teachers defined creativity as the "process" of developing new, unique, and "original" ideas, and creativity contained many stages and required a lot of effort and time for people to complete it. Sample preservice teacher opinions are shown below:

> I believe creativity is the process by which a person develops new ideas. Often, this means taking from information and making it their own. No matter how intelligent a person is, they are capable of creativity. (Participant 0485)

> Creativity is when you have an original thought that you came up with yourself. It's not copied or repeated, but something that has come from your unique mind. Since we do not all have the same brains, we all think differently. Therefore, creativity is the process of thinking up ideas based on your own knowledge, and then integrating it into your everyday life. (Participant 5101)

> I believe that creativity is the process of adapting and creating something new that will better suit the situation or outcome that you are looking for. I think that is a detailed process that is time consuming and requires a lot of effort but it is also very rewarding and worth the time and energy because it helps serve a deeper purpose. When something is creatively constructed I think that it is so well thought out and handled that it helps all people understand the concept better. (Participant 6391)

> Creativity in my opinion is taking something and making it more original, more exciting, and using your ideas. It is important to use your creativity because it also shows your passion towards something and when you show your passion about something to your students, they are able to see that you care, which can cause them to care more as well. (Participant 5474)

Thinking outside one's comfort zone. In the first reflection papers, 25 (20.49%) preservice teachers defined creativity as the way people thought and looked at ideas from different perspectives. They stated it referred to an exploration or expansion of existing ideas of people to improve it. Examples of preservice teacher opinions are as follows:

> Creativity is thinking out of the box, to look at things from different views, and benefit existing concepts. (Participant 4465)
>
> Creativity to me is exploration. I explore my own ideas and the ideas of others to come up with a new way to view something or handle a problem. (Participant 8074)
>
> For me, creativity is being able to think outside of the confines that are typically presented to us and come up with new ideas or expand on previously existing ideas. I do not believe that for creativity we need to reinvent the wheel, but I do believe that creativity should push us slightly out of our comfort zone. (Participant 8084)
>
> Creativity is the ability to think outside the box and take something quite generic and make it into something extravagant by changing minor details in the process. (Participant 9890)

After completion of the Creative Technology Integration Project, preservice teachers continued to define creativity as they reflected in the first reflection papers, but they provided more specific information into the definition. There were 25 (20.49%) preservice teachers who thought creativity was the way people "tried to think differently" to "develop and create new and exciting things." Moreover, creativity required "a lot of thoughts and careful planning." Sample responses in the second reflection papers are shown below:

> Creativity is thinking outside the box, doing something no one else has done, and coming up with it all on your own. Yes, we may gain ideas from others, but once we get our thoughts running we then start to see our ideas bounce off the walls. This is the creativity process. (Participant 7173)
>
> Creativity is thinking outside of the box in order make things better. When you use creativity it can make for more interesting and enjoyable activities. When you use the creativity, that either comes naturally or takes careful planning depending on the person and their personality, you may be able to draw in the attention of the children in the classroom. By using creativity, it allows more options for activities to be learned or taught differently; that way, each child that learns differently, like through listening, seeing, or hands-on, is able to understand the material that they are learning and enjoy it as well. (Participant 5101)

> In my opinion creativity is a way that students can think differently; it helps people think outside the box and to solve problems in different ways that are not the regular way. (Participant 3686)

Idea expression. Creativity also refers to the way ideas are expressed. In the first reflection papers, 20 (16.38%) preservice teachers believed that creativity related to self-expression; therefore, it referred to the way people expressed their ideas to others to show their identities. Samples of participant responses in the first reflection papers are as follows:

> I believe creativity has a lot to do with self-expression. Creativity shapes who a person is and helps to individualize people. Without creativity, everyone would be alike; however, with creativity there are many unique people that make the world a more colorful and better place. (Participant 4679)

> I think creativity is the allowance to be open minded and the opportunity to freely express oneself. (Participant 6727)

> In my opinion creativity is expressing oneself. There are so many different ways creativity can be expressed; therefore, there are many different ways an individual can express himself or herself. I think creativity is so important because it is showing pieces of yourself, how you learn, think, and feel. In teaching I feel creativity is important because children need to be able to express themselves to other people through something other then words. (Participant 2248)

In the second reflection papers, preservice teachers continued to define creativity as an idea expression but they realized the importance of idea expression toward learning. Only 17 (13.93%) preservice teachers indicated that creativity was an important skill that teachers needed to promote in a school because it could motivate students to learn more in a classroom. Examples of preservice teacher responses are shown below:

> Creativity is a form of expression and it needs to be taught to students by teachers in order for the students to be able to express themselves starting at a young age. (Participant 0485)

> Creativity is the way that people express themselves. Some do it through art and music, but it's a process that people use to get their ideas out. It's a lot of fun and kids in schools love to be creative because it gives them a chance to put a little bit of themselves in their work. They can do it anyway that they want and they love it. It's very important for watching and learning since being creative can make learning and teaching a whole lot more fun for everyone involved which allows for the desire to learn to grow even more. (Participant 8907)

> Creativity in my opinion is the ability to express oneself. I think that creativity is an important aspect that students and teachers should both have. It is a way in which they can convey their thoughts and ideas without them having to be defined by those thoughts and ideas. I believe that is important toward learning and teaching as it allows students to not be restricted by guidelines or grades. It gives them the opportunity to show what they are thinking, learning, and exploring through their own ideas. This permits a student to feel free in a classroom. This freedom is often an oppressed thought for a child as many worry about being judged by their classmates and getting answers wrong. However, if a student is given the opportunity to express themselves without the lingering feeling of being judged, they can often times learn more about the topic they are exploring. (Participant 0078)

Problem-solving. The last definition of creativity is as a problem-solving ability. There were 17 (13.93%) preservice teachers who had the same perspectives in defining creativity as the ability of people to solve problems before and after they completed the Creative Technology Integration Project. These preservice teachers explained that people used creative thinking as a tool to solve problems and, thus, create a better society. Therefore, they viewed creativity as the process of creating or improving something to be more effective, referring to the way of improving something that people had done previously. Sample preservice teachers' perspectives from the first and second reflection papers are displayed below:

> Sample responses in the first reflection papers:

> Creativity is something of a tool you use to solve a problem or do something new. It's important in teaching because sometimes without creativity skills you can't solve the problem your stuck on. It's a great tool especially when your put on the spot sometimes under pressure. (Participant 0894)

> I believe that creativity is when you think of different ways to solve problems. For instance if tying your shoe is not working the way you learned it then finding a new way to tie it would be considered creative. (Participant 7172)
> Creativity is a great way to problem solve for teachers on what works and does not work within a class. . . . Creativity in my world is problem solving, on how to show students information that they can actually retain, make them want to learn. This takes a lot of time and trial and error; every idea may seem awesome while writing it down but when followed through it could be a big flop. (Participant 4521)

Sample responses from the second reflection papers:

> Creativity in my opinion is creating a new or different approach to form a solution to a problem, regardless if it is a problem organizing the closet, or discovering a new way to teach students. (Participant 7574)

> Creativity can also be the process of brainstorming ideas and being able to refine them with even more ideas to come to a polished final product. There is much to be said for creative problem solving and working and bouncing ideas off of others to generate more creativity. I believe that this is very important in learning and teaching because creativity keeps everything fun and draws the learner in. A creative teacher helps teach students to think outside of the box and try things that haven't been done before. (Participant 4388)

> In my opinion creativity is a way that students can think differently, it helps people think outside the box and to solve problems in different ways that are not the regular way. (Participant 3686)

Importance of Creativity Toward Learning and Teaching

All 122 preservice teachers shared the same perspectives toward the importance of creativity before and after they completed the Creative Technology Integration Project. They agreed that creativity was an important skill for learning and teaching because it improved many aspects of education and provided the best benefits to learners. They believed that creativity would encourage people to learn. If people did not learn, they would not have inspiration to develop or create better things for society. The data from both reflection papers were summarized and compared to demonstrate the importance and benefits of creativity toward learning and teaching.

In terms of learning, 90 to 110 of preservice teacher opinions from both reflection papers indicated three main advantages of creativity toward learning development in students: (a) increasing student engagement, (b) improving student learning, and (c) enhancing student social skills.

Increasing student engagement. In the first reflection papers, 28 (22.95%) of the preservice teachers agreed that creativity was the key for increasing motivation and engagement of students within a classroom. The creativity factor made teaching and learning more fun and interesting. These preservice teachers believed that students would learn better when they felt comfortable in a classroom, and creativity was the factor that changed a classroom in a welcoming atmosphere.

These preservice teachers also suggested that teachers should create their lessons to be more exciting if they wanted to maintain student interest. Furthermore, they indicated that it was important for teachers to be creative in designing lesson plans because the level of interest and engagement of students depended on creativity that teachers applied and used within a classroom. Specifically, the more creativity teachers applied in a lesson, the more likely their students would learn from a lesson. Examples of preservice teacher perspectives from the first reflection papers are displayed below:

> I think that creativity is extremely important toward learning and teaching. As a teacher, it is important that you are creative with your lesson plans. The level of interest and engagement that your students have depends on your creativity in the classroom. Therefore, the more creativity that you have in your classroom, the more likely your students will learn. (Participant 5839)

> When teachers bring creativity to the classroom, children are more willing to learn and understand a topic, and the classroom changes from a place where one "needs to be" to learn, into a fun and welcoming atmosphere. Changing things up in a classroom can dissuade students from becoming bored and uninterested in the subject being taught. It can also broaden understanding for students who don't learn well in a traditional setting—for the student who has trouble sitting through

> a presentation, letting him or her instead write a poem or draw an picture, creatively illustrating what he or she has learned, can be a great tool for tracking children's learning without using standard methods, which some students do not perform well on. (Participant 8561)

> Creativity must be a top priority in the classroom so that students can stay engaged and interested in what they are learning. If the teacher creates a learning environment where creativity is evident, then students will also be inspired to be creative. (Participant 2873)

After they completed the Creative Technology Integration Project, 44 (36.03%) reservice teachers believed that creativity was the key for increasing student engagement; they also indicated that technology was the tool that made learning interesting and maintained students" interest in a classroom. Sample responses from the second reflection papers are as follows:

> It is important to use creativity in learning and teaching in order to keep things interesting and fresh. When students have different ways of learning they can better remember the new material and may become more interested in the subjects which you are teaching. It is important to use unique ways of teaching the students so they are not going through the same exact process that they normally would have in a day. Changing from worksheets and tests to more creative ways of evaluating the students can make them think they are not being tested at all. (Participant 8074)

> As teachers, it is important to remember to use creativity in our classrooms because our students need to still be engaged in what we are teaching. Creativity is a great way to do this because they will have more fun and exciting ways to learn the material that is being taught to them. (Participant 5825)

> School for some students can get boring; therefore, if the activities for students are very creative, the better of an education a student will receive because he or she will be interested and want to learn. Students enjoy activities that are fun/creative and will keep them from not getting bored which is why I think creativity is so important toward teaching and learning. (Participant 3601)

Improving student learning. Results showed creativity allowed students to have the freedom in expressing their ideas to others. Therefore, this became the way to help students expand their knowledge and be able to accept new and different ideas from other

people. Before the Creative Technology Integration Project started, 42 (34.42%) preservice teachers stated that creativity allowed students to open their minds, which greatly helped them to connect with topics or concepts they were studying in a classroom. Examples of preservice teacher responses are as follows:

> In my opinion, creativity is a great tool to teach students new information. Creativity is a way of expressing oneself through the use of the arts, such as writing, music, or painting. It is a way for children to experiment with originality and non-traditional ideas. . . . Allowing creativity in the classroom allows students to express themselves as individuals, so that they connect more thoroughly with the topic or concept being learned. (Participant 8651)

> I believe it is very important for learning because it can really broaden the horizon for many students and it can also show them that everything does not have to be so structured when they are working on the assignments. It is very good for students to be thinking outside the box because then they may use that creativity in real life when they actually need it. (Participant 8894)

> Creativity is important to learning and teaching because it helps expand the mind. With creativity you get to go outside the box and try new things and put different things together that you normally wouldn't . . . I think that if students learn to have creativity in their life, and have the chance to have it, then they will have a better outlook on life. This means that they will be able to put things together whether it be for a project or just in their head. (Participant 8074)

After completion of the Creative Technology Integration Project, 39 (31.96%) preservice teachers still believed that creativity improved learning and expanded the thinking processes of students. Moreover, seven of them thought that creativity encouraged students to feel ownership of their learning, which would inspire them to put more time and effort in creating better works in the future. Samples of participant opinions in the second reflection paper are displayed below:

> Creativity is being able to create new ideas or expand on existing ones to make something more successful or accessible. This is important towards learning because you might have to change the way you access information to make it more relevant to the way you learn. (Participant 0207)

> Creativity forces the individuals to not only relay on their own thinking and reasoning but also on the thinking and reasoning of others to help improve and expand on their thought process. Learning with creativity allows for new inventions and ways of thinking to occur. Creativity is a skill that is necessary in order to be successful when working with others and sharing ideas. (Participant 6391)

> I believe that creativity is important in learning because students will feel more of an ownership to their work and want to take pride in it if you give them the freedom to have options that allow for creativity. When students take ownership of their learning they are more likely to want to do better and to put more time and effort in to their work. (Participant 5489)

Enhancing student social skills. Preservice teachers thought creativity helped students to develop some essential skills needed for living. In the first reflection papers, 20 (16.39%) preservice teachers indicated communication and collaboration were the important skills that students would gain from creativity. Examples of participant responses are as follows:

> Creativity is important toward learning and teaching because [creativity] forces the teacher to figure out how to come up with original ideas, so the teacher can help students figure out how to generate topics for reading, writing, or anything else that requires the use or creativity and imagination. Creativity doesn't just help generate ideas, it also helps with solving problems, entertainment, communicating with others, designing, or even just for simple every day tasks. (Participant 7306)

> Also having creativity allows students to learn how to work with each others ideas and accept new things that they might not have thought of. Also having creativity may make one thing combined with another idea or thing become something even better and workable. It allows people to work as a team, and put forth ideas, that maybe only segments get taken of, but it allows for idea meshing. (Participant 4679)

After completion of the Creative Technology Integration Project, 27 (22.13%) preservice teachers believed that creativity improved several essential skills, such as communication, collaboration, and also rationality to students. Moreover, they clearly indicated that creativity was a skill teachers needed to promote in students to prepare

them for living in society in the future. Sample responses from the second reflection papers are as follows:

> Creativity forces the individuals to not only relay on their own thinking and reasoning but also on the thinking and reasoning of others to help improve and expand on their thought process. Learning with creativity allows for new inventions and way of thinking to occur. Creativity is a skill that is necessary in order to be successful when working with others and sharing ideas. Creativity is learning because there is never a right or a wrong way to be creative and because of this there are no limitations. (Participant 6391)

> Creativity in the classroom will also help boost students self-esteems when their original work or ideas are praised. It also helps prepare the students for real life situations by working on critical thinking and solving problems whether it be with others or on their own. As you can see, creativity is an essential part of education and can always hold a more prominent role in the classroom in the future. (Participant 4264)

> Creativity also involves collaboration. This could be between students and teachers, teachers and teachers, or students and students. It is essential to hear and share new ideas to get additional perspectives. Learning is not black and white; everyone learns differently. Collaboration ensures that everyone learns perspectives other than their own. Collaboration is integral to creativity because creativity involves taking ideas from others and improving them to create a new idea of your own. (Participant 7761)

For teaching, the results showed that creativity was an important skill for teachers, as 62 to 63 (53.27%) preservice teachers stated in both reflection papers that creativity not only improved student learning, it also inspired students to develop their creativity in the future. These preservice teachers mentioned three major benefits of creativity toward teaching: help teachers develop better lesson plans, allow teachers to discover proper strategies to enhance student learning, and encourage teachers to have a better connection with their students.

Help teachers develop better lesson plans. The preservice teachers agreed that creativity not only encouraged teachers to recognize how to teach a subject or content, but it also helped them to create lesson plans that were appropriate for teaching students

in all learning styles. In the first reflection papers, 37 (30.32%) preservice teachers believed that creativity allowed teachers more opportunity to develop and select the best ways to integrate methods into their lesson plans so they could approach the multiple learning styles of their students. They indicated that creative teaching was necessary because students learned in different ways, and teachers needed to be able to teach ideas and topics in ways to help all students understand. Examples of preservice teacher opinions in the first reflection papers are as follows:

> Creativity not only makes a lesson more interesting to understand, but when teachers use different creative manners of teaching, they cater to a wider variety of learning styles. . . . Teaching in creative ways keeps the class engaged and speeds up individual student progress. (Participant 0653)

> As a teacher you must use creativity to grasp your students' attention. Create new ways to teach a subject so that the student is more excited about it or so the student comprehends it better. We as teachers should pay close attention to our students' creativity because they might have answers to questions we have been asking for years. They may invent a better way to make your lesson more clearly to other students. Also we as teachers should consider using more than one creativity method for a specific topic because every student learns differently and it is our job to make sure they understand and to make accommodations to help them understand. (Participant 4295)

> Creativity is important in the teaching world because a method that might work with one group of students might not work with another. It is important for teachers to discover new ways to integrate methods so that they can approach multiple learning styles at once. . . . Creativity might also boost productivity in the classroom; it will enable teachers to teach in a way that will be exciting to learners. I think creativity is a very important ingredient for teachers in the classroom. It's important to help students use creativity in their own lives so that they might inspire themselves or somebody nearby. (Participant 7675)

> Creativity is also important to teaching because every student is different and every student learns differently, so as a teacher you must be able to be creative to then work around these students and be able to come up with creative and different ways to teach all your students. If teachers can be more creative with their teaching styles it would be much more beneficial for their students. By teachers being more creative with their teaching, it will help the students to start using creativity in their thinking. (Participant 3686)

After completion of the Creative Technology Integration Project, 37 (30.32%) preservice teachers still believed that creativity helped teachers to develop teaching methods and made interesting and appropriate lesson plans for students in all learning styles. These preservice teachers indicated that creative teaching would encourage students to learn more from a classroom and inspire them to want to be creative people in the future. Examples of participant opinions in the second reflection papers are shown below:

> There are several forms of creativity and all of them address the different types of learning in some way allowing students with diverse learning styles to be able to learn. This is why it is important to incorporate creativity in teaching because it opens up the opportunities for students to be able to experience each type of learning. (Participant 8516)

> Creativity is essential for teaching, especially in my field of special education. When encountering a student who is struggling to grasp a concept, trying different, creative methods of learning can make all the difference. Students are all individuals, and therefore, they learn in individual ways. A teacher who can modify an assignment in many different ways is much more effective at teaching than a teacher who can only teach the same lesson one way. By teaching in creative methods that support all learning styles, there is a better chance that most students will understand the lesson. If a lesson is only taught in one style, only students who learn from that specific style will understand the lesson, leaving many students behind. (Participant 0653)

> I believe that creativity is important to teaching because as a teacher not only do we have to use our own creativity to come up with lesson plans, activities, and games for the classroom. But, we as teachers also have to inspire and help students to develop their own creativity. (Participant 3887)

Help teachers solve student problems. The second benefit of creativity was that it gave teachers the opportunity to help students solve problems. There were 21 (17.21%) preservice teachers who provided similar opinions in both reflection papers, in which they thought that teachers needed be creative to develop new ways of teaching to

help students solve problems. Examples of participant opinions from the first reflection papers are displayed below:

> If a student does not understand something, he or she must use creativity to look at the subject from a new perspective. Sometimes teachers understand things and try to express them to students, but the students do not follow the thought process of the teacher. A good teacher will recognize this and revise his or her teaching strategy to make it more receptive for his or her students. Revising a strategy takes creativity, because a teacher must create an original idea from previous ideas. Teachers and students think creatively to solve problems that they previously could not understand. (Participant 4307)

> It [creatvitiy] is important towards learning and teaching because each child learns differently. If the a student simply doesn't understand a problem for the life of them, we [teachers] have to be creative and develop a new way (even if it's branching off of the book) to help students understand. (Participant 5986)

Additionally, 19 (15.57%) preservice teachers had similar ideas where they felt that creativity was an important problem-solving skill. Examples of participant responses from the second reflection papers are displayed below:

> Everyone has a form of creativity, and this is very important for learning and teaching because as a teacher we need to understand that all our students learn differently and we must be creative in teaching them in new ways. Also as teachers we need to find ways to help students think more creativity so when our students come across a problem our a question they cannot answer, they have the tools to solve these problems creativity. (Participant 3686)

> In my opinion, creativity is the ability to create something original. I think that it [creativity] is important towards learning and teaching because it is an important problem solving skill, and it is quickly becoming more and more helpful in the work force. People who can come up with creative solutions to problems will be more desirable in the workplace because their ideas will be more innovative and original. (Participant 8311)

Build a connection between teachers and students. The preservice teachers agreed that creativity helped teachers have better communication with their students. In the first reflection papers, 4 (3.27%) of the preservice teachers said that creativity created

better connections between students and teachers. Sample preservice teacher opinions in the first reflection papers are below:

> [Creativity] is important toward learning and teaching because it allows students to expand on ideas and to stretch their understanding of concepts. Teachers can use creativity to reach out to all types of learners. (Participant 3516)

> As future teachers, we are always striving to find new ways to connect with each student. I feel that creativity can be a channel from teacher to student and also from student to student. Not everyone thinks of things in the same way, but some of other people's ideas may lead to new and exciting ideas of one's own. I think that all children are creative and that helps us learn. (Participant 5084)

> In the classroom, with such a diverse group of people, creativity allows both students and teachers to connect with one another and reach out to those who might not grasp a certain traditional style of learning or teaching. I think creativity is great, and balanced with goals it has the power to make a difference in a classroom with 25 young children. (Participant 9184)

In the second reflection papers, 7 (5.73%) preservice teachers believed that creativity helped teachers have better communication and collaboration with their students. It was an important skill that encouraged teachers to make a good connection with their students. Sample preservice teacher opinions in the second reflection paper are below:

> Also it is important to understand that as teacher we're able to learn from our students, create a "healthy" relationship between teacher–students to gain experience and succeed in our classroom. There are different activities where students can be creative, following state parameters. As part of different projects, students can be involved in social activities. This will allow students to create a conscience about what they are doing in real life. Students have a huge responsibility because the world is in new tje generation's hands. And our responsibility is to provide our students with the tool needs to build a new and better world. (Participant 6786)

> The first reason that [creativity] is important for teaching is that it allows for teachers to help make those connections for their students, or at least model them. Encouraging creativity through teaching not only helps the student, but also helps the teacher. (Participant 8928)

> Even though I am a creative person, it is challenging to be creative in a teaching setting. I am glad and determined to be diligent and do my best to be a creative teacher. It is not about me, I need to be creative to be able to reach out and help all of my students learn from their individual needs; whether they are on an IEP [Individualized Education Program] or not. This is the importance of being creative as a teacher. To help all of your students learn in the ways that are best for them. (Participant 2737)

Factors for Promoting Creativity

Preservice teachers mentioned several key factors for promoting creativity in both reflection papers. Before the Creative Technology Integration Project started, 18 (14.75%) preservice teachers clearly indicated that "imagination, experiences, and communication" were the keys for promoting creativity. They described creativity as referring to a way of using imagination to transfer a mental image into a physical object. They believed creativity occurred through interaction between human imagination and social context. Sample preservice teacher responses are shown below:

> In my own opinion, creativity has three aspects: imaginative, effective, and ethical. Creativity requires both base knowledge and imaginations. We must be master for some kind of principles before we are able to create new approaches. Effective, this also means workable/helpful, is the feature that makes a new idea meaningful. If we come up with some new thoughts but these new thoughts are not very productive, then we should go back to rework on that. Helpful is an aspect to not only apply to the new idea, but also referring to some existing ideas. Sometimes we can use some existing ideas to work in a different situation or a new way. Ethical is very important for everyone when we are creating. We should respect others work and refuse to copy or plagiarize. (Participant 8391)

> Creativity is the use of imagination and having the ability to transfer ones mental image of the imagination into a physical object that can be used in whichever means it was meant for: teaching, learning, clothing, decorating, and so forth. (Participant 7117)

> In my opinion, I believe that creativity does'"t just happen in our heads but in the interaction between our imagination and our social context. You will gain creativity through experiences and the communication of others in a social context. Creativity indicates to who we are as a person in the world; our imagination, our thoughts, our words, our culture, our experiences, and our actions all contribute to what creativity is as a whole. I believe that personal

> creativity is not all about intelligence or how much information you have, its about the inspiration and knowing that it's the key to discovering the creativity that is waiting to express through you. (Participant 1913)

However, after the Creativity Technology Integration Project was completed, preservice teachers mentioned "strategies for increasing creativity," such as brainstorming, generating, and collaboration, in their reflection papers. They thought that creativity was a process of brainstorming ideas involving imagination, progress, and determination. There were 12 (9.83%) preservice teachers who indicated that technology integration was an important factor that teachers could use for promoting creativity within a classroom. They explained that technology was the tool that encouraged students to think outside of the box and motivated students to learn more in the classroom as well. Examples of the preservice teacher opinions are displayed below:

> Creativity can also be the process of brainstorming ideas and being able to refine them with even more ideas to come to a polished final product. (Participant 4388)

> Creativity involves imagination, progress, and determination. When creativity is expressed, often times it is done in a way that is original, whether that be having an original idea or design or modifying an existing idea with an original idea. It [creativity] involves their own experiences, own beliefs, and own personality. Teachers can do this by using original ideas to teach material. (Participant 8084)

> I also learned that creativity can be brought out by integrating new technologies into the classroom where the students are allowed to think outside the box and they are always interested if there is technology around. Another great way to enhance creativity is to put the students in groups so that they can bounce ideas off of each other in their group, and this will hopefully bring out the creativity in the students as they get to think together. (Participant 7993)

> Integrating technology into your lesson plan and teachings at school makes your instruction appealing to students and gets them interested in the topics they are required to learn. The main importance of incorporating creativity into your lesson plan makes your teaching, lesson plans, and your instruction appealing to everyone. (Participant 3992)

Negative Comments

A few preservice teachers indicated different perspectives toward definition and importance of creativity toward learning and teaching. Data from both reflection papers demonstrated 13 (10.65%) preservice teachers believed it was difficult to define what creativity was, and creativity was an important skill teachers needed to teach to students in a classroom. These preservice teachers also thought technology was not the correct tool to use to promote creativity; rather, they felt that overuse of technology would make people lose their creative ability. Examples of negative responses of preservice teachers from both reflection papers are as follows:

> I think creativity doesn't exist. How can a word like this have any original meaning? You can't define creativity, it's impossible. Nothing and no one is creative because you still have to compare it to something and the idea of comparing something else also looks at like qualities. I think you can be moderately unique, but no one is creative because that would mean that each one of us is a creator of something. We can't be creators of anything we only can procreate and even that isn't physically unique because it takes two people. Creative is a word that someone came up with because they couldn't find a synonym to intelligent at the time. (Participant 2672)

> Even though I think it is important for a teacher to emphasis how important creativity is, I don't think it is a skill a teacher can necessarily teach. I think it is the student's job to develop their own creativity. (Participant 5839)

> I actually don't really believe in the word creativity. It is so different for everyone and such an opinion. Creativity is different for art than it may be for writing or math and science. (Participant 2273)

> Although there is a place for creativity in technology, I truly believe that technology is not a way to promote being creative. I feel that much of the youth has lost creativity due to the overuse of technology. (Participant 4707)

In conclusion, the results from the Creativity Styles Questionnaire–Second Revised surveys and reflection papers clearly showed preservice teachers had a better recognition about the main concepts of creativity and the importance of creativity toward improving

teaching and learning in the future after they completed the Creative Technology Integration Project.

Q4 How do preservice teachers transfer their knowledge regarding the four abilities of the creative process into their future classrooms to promote student creativity?

There were 120 preservice teachers who provided their responses to the final question in the second reflection paper. According to their reflections, there were three major ways for transferring and promoting creativity to future students: applying the four abilities of the creative process into a lesson plan, integrating appropriate technology, and defining the role of teachers within a classroom.

Applying Four abilities of the Creative Process into a Lesson Plan

Results showed 45 (37.5%) preservice teachers would apply all the knowledge learned from the Creative Technology Integration Project into their lesson plans to create activities appropriate for promoting creativity in their future students. These preservice teachers stated that the creative process would be important knowledge for students to carry with them to further their education. They indicated the best method for transferring creativity was to incorporate the four abilities of the creative process into a lesson plan and to point out the importance to students in every step. Examples of preservice teacher perspectives are as follows:

> After doing the creative technology integration project, I have discovered many new ways to enhance learning for 21st century students. First, I have learned about utilizing all the elements of creativity in to a lesson. Using fluency, flexibility, originality, and elaboration, I can create a lesson plan with new elements that can reach out to my students and help them learn at a deeper level. (Participant 5666)

> I think this creativity process should be used to make and form the lesson plan, but I also think it should be a part of the lesson plan. I think this creativity

> process would be a great skill for students to carry on with them to further their education and for things later on in life. (Participant 4465)
>
> By planning lessons with the four abilities that require student creativity in the lesson, then 21st century learners will develop skills for creativity. Using the creative process to construct lesson plans is one great way to transfer the knowledge of creativity because it produces effective technology integrated lessons that make students think critically, creatively, and apply the knowledge they learn to new concepts. By making lessons plan include creative thinking and working, then students will have the potential for creating new knowledge, methods, and be successful in working and living in the 21st century. (Participant 4307)
>
> Transferring the information of the four steps of creativity to 21st century learners is important because it allows for a deeper level of thinking and learning to occur. The best way to share this information is incorporating it into lessons and discussing the importance of the creativity steps. (Participant 9695)

These preservice teachers also provided two suggestions on how to apply the four abilities of the creative process into lesson plans to successfully promote creativity in their future students. Two suggestions were that a lesson plan should (a) allow students to have an opportunity to think creatively, and (b) contain appropriate strategies for enhancing creativity.

Allow students to think creatively. Fourteen (11.66%) preservice teachers said that thinking differently or thinking outside of the box was one of the best approaches for supporting students to develop their creativity. Sample preservice opinions are displayed below:

> I made sure that in my lesson plans the students had the opportunity to really think creatively to develop their thoughts while still learning the material that hey needed to. (Participant 1574)
>
> By transferring the knowledge of creativity that I have learned into the 21st century learners to enhance their creativity, I believe that it is important to give the students the opportunity to use their own creativity as well. If they are able to start learning and advancing their creativity at a younger age, then they will be able to make it grow faster and better and use it long into the future. (Participant 4227)

> I can use what I learned in this class to enhance my students' creativity in subtle ways. I can encourage them in everything to be creative and not just think outside the box, but tear it up. (Participant 0078)

Appropiate strategies to enhance creativity. There were 31 (25.83%) preservice teachers who suggested that teachers needed to include appropriate strategies for enhancing creativity, such as brainstorming, peer editing, and collaboration, in their lesson plans. They pointed out that transferring creative knowledge would be successful when students were encouraged to brainstorm, collaborate, and investigate the information highway with safe boundaries and guidance. Examples of suggestions from preservice teachers are as follows:

> I have learned quite a bit about the creative process and how to encourage it in my students. Creativity is a lot about brainstorming many ideas, collaborating with others and then going back through those same ideas with a finer comb. When working with 21st century learners, this can be done using creative approaches to learning, which goes hand in hand with technology. (Participant 5666)

> Creativity can work alone, but it is always nice to brainstorm with other people too. I would pass this on by just encouraging other people to never stop trying to be creative no matter how hopeless it seems. I do not feel like a creative person myself, but when I use the resources available to me I am able to find a way to do something creative even when I thought I could not. (Participant 7635)

> Peer editing is another aspect of the project that will enhance the students' creativity because they are practicing looking at things with a critical eye while at the same time getting helpful feedback to make their paper or project that much better. With the feedback, it also almost forces the students to add the suggestions into their project in a new creative manner. (Participant 7172)

> I believe in peer–to–peer education because sometimes the teacher might say it one way that doesn't make sense, but a peer can think of it differently and explain it differently and their peer understands. The students can use their creativity to help figure out how they can explain a topic or how they approach a topic and solve it. I want my students to always be using creativity and share that creativity with the class. (Participant 0078)

Incorporating the Use of Technology in a Lesson Plan

Another way to transfer creative knowledge is to incorporate technology into lesson plans. A total of 69 (57/5%) of preservice teachers explained that technology had a huge impact toward learning and teaching in the 21st century; therefore, it became the appropriate tool that teachers would use for enhancing creativity in students in the 21st century as well. In addition, these preservice teachers believed the use of technology in a lesson would provide an opportunity for students to expand their knowledge, allow creative experiences, and increase motivation in developing creative ideas; these are important aspects that encourage students to have a better comprehension of the main concepts of creativity. However, according to the results, one of the 69 preservice teachers was concerned about using technology to enhance creativity. This preservice teacher suggested that teachers needed to make sure they chose the right technology, appropriate for all types of learners.

Examples of preservice teacher opinions regarding the importance of technology toward learning and teaching creativity are displayed below:

> Creativity is a huge part of learning, and so enhancing creativity through technology has been a fantastic way to integrate this new generation into the educated population. (Participant 8561)

> Technology can spark new ideas of how to assemble things in various creative and surprising ways. This is something I will transfer to my classroom to generate a creative process. Technology not only allows students to think differently, but it allows them the opportunity to be creative because they are able to explore more options and take the time they need. Students are able to take the learning into their own hands and figure out what to do instead of just being told what to memorize, which I believe is the most effective way of learning. To empower my students I will let them learn things at their own pace and let them explore different ways by providing multi-media tools. Through the incorporation of technology the students' creativity will be enhanced and will be more relevant to their generation. (Participant 4388)

> Technology gives excellent opportunities to transfer creativity to 21st century learners and enhance their creativity. Most students have access to technology and bring experience to the classroom, but many do not know they have tools to dive into the creative world. Introducing students to new websites and hardware gives them tools to tap into the creative world. Today many websites are interactive, creating opportunity for learning to be fun. This is creativity at its best. Students can create original work online and the creativity options are unlimited. (Participant 0653)

The preservice teachers also suggested two effective ways of using technology for enhancing creativity to students in the 21st century. The first way was to use technology as a good resource. There were 15 from 69 (21.73%) preservice teachers who suggested teachers should use technology as a good resource for expanding student creativity knowledge and allowing them to experience creativity as well. Sample responses about using technology for expanding student knowledge from the reflection papers are displayed below:

> Technology is a very good resource in which to present creativity to students. It allows students to expand their knowledge and discover answers to questions that they might have that expand further than the assignment. (Participant 2672)

> Technology has become almost an essential part of society, and I feel as though many students will not be able to learn if technology is not somehow a part of what they are learning and experiencing in the classroom. I think this can enhance their creativity because they are learning in a way that is important to them and they can use that to expand what they already know and create something new from it. (Participant 8084)

> Transferring the knowledge of creativity can be hard, but I feel like through the many uses of technology that students will be using in the classroom their creativity will expand. Allowing students to get a hands-on experience will help them get used to being creative. Then incorporating a creative project into the lesson plan with, once again, using technology will allow students to expand their creativity even more. (Participant 5101)

The second way was to use technology for increasing student motivation. Motivation was an important key for enhancing creativity because it not only made students feel more comfortable about learning, but it also engaged them to continue

developing their creative projects. There were 23 from 69 (33.33%) preservice teachers who suggested teachers should use technology to increase motivation for students within a classroom. They explained that by using technology for increasing student motivation productively, teachers should integrate technology that students were interested in, such as video games, iPads, or videos, in conferences in learning activities. Sample responses that mentioned using technology to create students' motivation are displayed below:

> I would transfer my knowledge gained from this project on creativity with 21st century learners to enhance their creativity by integrating things that interest my students. For example, if I have a student that really enjoys video games then I could find a way to integrate some sort of video game into whatever lesson is being taught. (Participant 9489)

> Using technology in school may encourage students to get used to technology in daily life, so they can learn whenever and wherever they like, then school is no longer the only good place for studying. In this case, studying will became part of students' life, but not part of their job. (Participant 1861)

There were 9 (13.04%) preservice teachers from this group who pointed out that most students in the 21st century were interested in technology; therefore, if teachers incorporated technology within a classroom, it would be a positive way to encourage students to keep studying and participating in a classroom. Examples of responses about technology for increasing motivation within a classroom are as follows:

> I also learned that creativity can be brought out by integrating new technologies into the classroom where the students are allowed to think outside the box and they are always interested if there is technology around. (Participant 7127)

> I will transfer the knowledge of creativity I learned from the project with the 21st century learners because I know how to create different activities for students involving technology that will promote learning in a fun environment. (Participant 6786)

Nevertheless, there was one preservice teacher in this group who said that technology could not be used for transferring creativity to students. This person believed

technology could not create creativity, and it would be difficult to teach creativity to students. The response from the preservice teacher is displayed below:

> It's nearly impossible to have children enhance their creativity through technology. Twenty-first century learners may learn well through technology but in my opinion, creativity cannot be incorporated very well into technology. Technology cannot always allow creativity, and when it does, it is very rarely original. I feel that creativity is something that people make themselves and technology is merely a means through which to express said creativity. (Participant 2737)

Teacher Roles

There were 54 (45%) of the preservice teachers who pointed out that the role of teachers was another important aspect for successfully transferring and promoting creativity to future students. They suggested three important roles that teachers needed to do when they wanted to promote creativity to their students: being a role model for students, giving opportunities for students to express their creativity, and increasing student confidence in working and developing creative ideas.

Teaching to be role model for students. There were 10 of 54 (18.52%) preservice teachers who believed that creative teachers would inspire students to be creative people in the future. Sample preservice teachers' opinions are displayed below:

> I will have many responsibilities as a teacher and being a role-model is one of them. I think that by providing a creative learning environment, the students in my classroom will enhance their creativity. (Participant 0485)

> As teachers it is our jobs to teach students how to fully develop those creative ideas so they can be successful in today's world. (Participant 6187)

> I think that I can enhance students' creativity by being creative as a teacher. If a teacher is constantly looking for new and interesting ways to do things and teach things, their students will most likely begin to be more creative themselves. Students typically follow the example of their teachers, so if a teacher is being innovative in their teaching, students will be more innovative in their learning and in the projects that they create. I think it is very important that teachers to not get

> stuck in a rut, but that they constantly practice creativity, so that their students learn to do the same. (Participant 4761)

Giving opportunities to students. There were 19 (35.18%) preservice teachers in this group who suggested teachers should give opportunities to students in expressing their creative ideas and allowing them to work on projects of interest to them. They indicated that creating an open classroom was the first strategy that helped students share their creative ideas with other people. Giving freedom was the second strategy that encouraged students to work on topics or areas of interest to them. These two strategies were important and should be included in a lesson plan to effectively promote creativity of future students. Sample responses of preservice teachers are as follows:

> We need to allow the students to express themselves and their creativity however they like. We must first set the guidelines and scaffold the process, then allow the students to take the wheel and learn to their creative side. They need to be able to collaborate with their classmates and explore uncharted areas. (Participant 1234)

> I plan on transferring my knowledge of creativity that I learned from the project with 21st century learners to enhance their creativity by giving them free time to express themselves through whatever way they choose. Creativity is not learned, it is experienced and felt through an individual. I plan to tell my learners that they should do something that is meaningful to themselves and allow them to empty their brains onto a blank canvas and share their original ideas . . . I just want my learners to know most of all that they should create things that express themselves and create meaning that they believe in. (Participant 5475)

> I will create an open and interactive classroom that benefits the students in ways they can relate to and feel safe saying their ideas. With their confidence, they will be able to start the creative process, and all kinds of new doors in their education will open to them. To enhance their creativity further, I will transfer my knowledge of learning styles to change up my technology integration to fit all types of learners and their unique styles. (Participant 4675)

Increasing confidence. There were 14 (25.94%) preservice teachers in this group who explained that developing student creativity took a lot of time and effort, and teachers needed to support and encourage them to keep working on their creative

projects. They indicated that positive reinforcement was the correct strategy that increased student confidence and engaged students to work on their creative projects. Sample responses about giving support of preservice teachers are as follows:

> I think that as long as the teacher supports their ideas and asks them questions to improve their ideas or even to give them more ideas is also another way students can learn. Teachers have such an impact on how students think and act. Giving them examples and ideas can let the students brain just burst with creative ideas. (Participant 0411)

> Overall, students can be creative if just shown. Teachers have the wonderful opportunity to show students that they can be creative with anything (even history), if they just put their mind to it. (Participant 7306)

> I think I would allow for students to be creative. I would let them try new things within the classroom that might not be exactly what I had asked for. I think it's also very important to use positive reinforcement. Letting a student know that their idea is innovative and creative thinking might help their confidence level and allow them to be more experimental and creative with future assignments. (Participant 7675)

The data clearly showed the preservice teachers realized the importance of creativity to human lives, and they wanted to transfer the knowledge that they learned from participating in the Creative Technology Integration Project to their future students. The results showed that preservice teachers had several ideas in transferring creative knowledge. However, most of them indicated that the most effective approach to promote creativity for their students in the future was to use and apply the four abilities of the creative process into lesson plans.

CHAPTER V

CONCLUSIONS AND RECOMMENDATIONs

Introduction

The purpose of this study was to examine the effect of the four abilities of the creative process toward the development of technology integration and creativity of the preservice teachers, participants, who enrolled in an online foundation education technology course. The study also explored how the preservice teachers transferred and applied the four abilities of the creative process they learned from participation in this study to their future students. This chapter presents the review of the findings, discussion, limitations, implications, and suggestions for future research studies.

Review of Findings

Q1 Does preservice teacher knowledge about technology integration change after they recognize the four abilities of the creative process?

For the first research question, the results of a repeated–measures ANOVA showed that the knowledge within the TPACK framework increased after the preservice teachers, participants of this study, recognized the four abilities of creative process. The mean scores of three TPACK–Second Revised surveys indicated that the preservice teachers had more positive perspectives toward their technology integration skills and felt more confident about their abilities in using and integrating technology into an instruction as well. The reflections from the preservice teachers demonstrated that they

had better understanding about technology integration after they recognized the four abilities of creative process. They could provide detailed information that clearly explained what technology integration was and also were able to apply strategies for integrating technology into a lesson for enhancing learning and teaching successfully after the Creative Technology Integration Project was completed.

Q2 How do the four abilities of the creative process encourage preservice teachers to have a better knowledge regarding technology integration?

According to the results from the reflection papers, most of the preservice teachers indicated that fluency, flexibility, originality, and elaboration really encouraged them to have better and new ideas in choosing and using technology that provided the most advantages to students and teachers. Moreover, these four abilities made them realize the importance of technology toward learning and teaching, which inspired them to integrate more technology in their future classrooms. The scores of preservice teachers' lesson plans were evidence that supported the results from the reflection papers. The scores showed that the preservice teachers were able to develop high-quality lesson plans containing essential technologies that were appropriate from students and effectively enhance students' learning.

Q3 Does preservice teacher knowledge about the four abilities of the creative process change after they complete the Creative Technology Integration Project?

The results indicated there were significant improvements in reports on the four abilities of the creative process after the Creative Technology Integration Project was completed. The descriptive findings represented that the preservice teachers had more confidence with their creative capacity, belief, and techniques. However, the results showed that the preservice teachers did not have better perspectives in using or

consulting people to facilitate their creative works after the Creative Technology Integration Project was completed.

The results of both reflection papers clearly showed that the preservice teachers still had the same perspectives toward the importance of creativity toward learning and teaching before and after they participated in the Creative Technology Integration Project. They agreed that creativity was the factor that drove students to learn, and it also helped teachers to have new ideas in developing their lesson plans and to discover proper strategies to be used to enhance students' learning successfully as well.

Q4 How do preservice teachers transfer their knowledge regarding the four abilities of the creative process into their future classrooms to promote student creativity?

The reflections from preservice teachers showed that there were three major approaches that they would use to transfer and promote creativity to future students. First, they preferred to apply and use the four abilities of the creative process into their lessons for promoting creativity of their future students. Second, the preservice teachers said that they would incorporate technology into lesson plans. They believed that the use of technology in a classroom would provide experiences of creativity to students. It also expanded their creative knowledge to increase their motivation in developing their creative ideas. The role of teachers was the last approach for being used to transfer knowledge of creativity. The preservice teachers suggested three essential roles that teachers needed to do in a classroom for promoting students' creativity: being a role model for students, providing opportunities to students to express their creativity, and increasing students' confidence toward their creative ideas and capacities.

Discussion of Technology Integration Knowledge

The results clearly showed that the preservice teachers had better recognition about concepts of technology integration after they completed the Creative Technology Integration Project. They defined technology integration as the use of technologies that correspond with a student's needs to create meaningful learning within a classroom, which is similar with Okojie et al. (2006), who defined technology integration as a process of using existing tools or various types of technology to support meaningful student learning. Keywords, such as a student's need or meaningful learning, that the preservice teachers included in the definition also represented they recognized the concepts of optimal technology integration, which refers to the use of technology that fits with the backgrounds of all students to encourage them to be proactive in using technology to support their learning (Dillon-Marable & Valentine, 2006).

The increasing scores of the TPACK surveys showed preservice teachers were able to negotiate the relationships of all knowledge within the TPACK framework (Mishra & Koehler, 2006). This also represented that the preservice teachers could comprehend the concepts of true technology after they participated the study. As Koehler (2011) stated, true technology integration refers to the way that teachers understand and negotiate the relationships between the types of knowledge within the TPACK framework.

The preservice teachers realized that technology was important for enhancing learning and teaching. They explained that technology was the tool that should be used in every steps of the learning process. As Speaker (2004) supported, technology is part of learning improvement. Moreover, it was the proper tool for promoting essential skills,

such as communication, cooperative perspectives, and self-esteem. This is similar to Lee, Waxman, Wu, Michko, and Lin (2013), who said that technology is the best tool for using to enhance basic skills and factual learning. It is the proper tool for motivating students, supporting life-long learning, and increasing flexibility in education programs as well (Ertugrul, 2011).

In terms of teaching, the preservice teachers confirmed that technology integration was the essential skill that teachers needed to have, and experiences about technology were necessary for teacher preparing programs. Their reflections are consistent with Okojie et al. (2006), who stated that technology integration is considered a part of the instructional preparation process, and it is necessary for teachers to have a proper plan for using technology in their classrooms (Gulbahar, 2007). Furthermore, Lee et al. (2013) supported professional development and teacher preparation should include technology and pedagogical practices for preservice and in-service teachers in teaching and learning with technology.

The preservice teachers also believed that technology was the key for improving teacher professional performances because it offered more options and materials for teachers to use for teaching in a classroom. Karami, Karami, and Attaran (2013) conducted a study, and the results presented that trainee teachers who used technology developed more professional content knowledge and teaching skills than those who merely employed technology.

The results of this study showed the preservice teacher had more confidence about their technology integration skills after they participated in this study. They were able to recognize all of the important elements of optimal technology integration, choose

appropriate technology to support learning and teaching, and also realize the advantages and importance of technology toward learning and teaching.

Discussion of Creativity Knowledge

Kumar and Holman (1997), who designed the Creativity Styles Questionnaire–Revised survey, described that higher scores in the survey demonstrate better perceptions of people toward their creative abilities. Therefore, in this study, the preservice teachers had more positive perspectives toward their creative knowledge after they learned and experienced the four abilities of the creative process. They realized that creativity was the essential skill for all people. As Esquivel (1995) supported, creativity is an essential aspect of the human experience and it serves as a useful pedagogy to promote lifelong learning (Tsai, 2012).

There were three approaches that the preservice teachers would use for promoting creativity to their future students. First, they would apply the four abilities of the creative process into lessons for promoting creativity because they thought that these skills were important factors for increasing creativity. As Shively (2011) stated, fluency, flexibility, originality, and elaboration are essential for promoting creativity because these skills allow people to be able to think divergently, analyze and synthesize the problem, enact self-planning, and evaluate (Cropley & Urban, 2000).

The preservice teachers thought that integrating technology into a lesson was another way to motivate students to develop creativity. This is consistent with the results of the Jamieson-Proctor and Burnett (2002) study that indicated the purposeful integration of computer technology with an intervention program positively affects the personal creativity characteristics of students. Being a role model was the last approach

for promoting creativity. The preservice teachers believed that teachers had a strong influence toward the development of students' creativity within a classroom. They suggested that teachers should give opportunities to students to express creative ideas and also increase their confidence about their creativity abilities as well. As Kampylis et al. (2009) stated, "Teachers' roles in the development of primary school students' creativity is very important, because they act as role models and mentors and spend a considerable amount of time with students" (p. 15). Teachers play a significant role in fostering the development of creative abilities, and they can promote creativity through their attitudes, learning environment they create, instructional approaches, and their relationship or interaction with their students (Esquivel, 1995).

The results clearly showed that the preservice teachers felt more comfortable and confident with their creative knowledge after they had learned and experienced the four abilities of the creative process. However, they did not consult more people to improve their creative works before and after the study was completed. The reason to explain this situation is that the researcher assigned the preservice teachers to participate in same groups until the Creative Technology Integration Project was completed. Therefore, it may have made them feel that they did not have a chance to discuss or exchange feedback with new people to develop their creative works. Nevertheless, the data did not show the preservice teachers consult fewer people when they wanted to develop their creative works; rather, most of them agreed that consulting people was the way to improve their creative ideas and works before and after the study was completed.

Discussion of Technology Integration and the Creative Process

The study showed that the four abilities of the creative process encouraged the preservice teachers to be critical in choosing and using proper and effective technology to enhance student learning in a classroom. The preservice teachers explained that the creative process looked like a technology planning that guided them to know how to incorporate technologies with teaching approaches to enhance learning successfully. Gulbahar (2007) described that technology planning really helps teachers to integrate technology into instruction because it allows them to allocate time for the administrative and academic activities effectively and productively. It is also useful for teachers to identify directions and see where they are doing and where they want to be to create activities that maintain a technology-rich educational environment *(Guidebook for Developing an Effective Instructional Technology Plan,* 1996).

The four abilities of the creative process also made the preservice teachers to recognize the concept of effective teaching. Christenbury (2010) described that effective teaching occurs when teaching directly responds to students, school, and societal needs. Teachers need to be open and flexible to modify and change their instruction that relates to their students (Dacey, 1989). The reflection from the preservice teachers indicated that the four abilities of the creative process helped them to have new ideas for integrating various technologies into a lesson plan, notice technological problems, and be aware about integrating appropriate technology into a lesson.

The high-quality lesson plans that preservice teachers created are evidence to prove that the four abilities of the creative process encouraged them to create lesson plans that were consistent with the NETS–S and also contained the four characteristics of

optimal technology integration (Dillon-Marable &Valentine, 2006). Most of their lesson plans included appropriate and essential technologies for teaching and learning, contained effective learning technologies that fit with the needs of students from diverse backgrounds, and also supported students to achieve the goal of the lesson.

The results clearly show that all of the activities, content, and assignments of the Creative Technology Integration Project are effective for using to promote technology integration and creativity. The results demonstrated that technology integration and creativity supported each other. Technology is an effective tool for using to promote creativity. Also, creativity helps teachers to have better ideas and be critical in choosing or integrating new technologies into instruction appropriate for supporting student learning in 21st century successfully.

Limitations of the Study

One limitation was the instruments that the researcher used in this study are self-assessment, therefore, did not directly measure development of technology integration and creativity knowledge of the preservice teachers; rather, they measured the improvement of their belief toward their technology integration and creativity knowledge during the time they participated in this study. Also, creativity is arbitrary, which is difficult to examine, and there is no valid instrument that measures the knowledge of creativity of people.

Implications

This study can provide guidelines for teacher preparation programs to develop a course that promotes both creativity and technology integration skills for preservice teachers. Instructor or teacher preparation programs can apply the learning materials,

assignments, and activities of the Creative Technology Integration Project to be tools for providing experiences and practices about technology integration and creativity to their preservice teachers to prepare them to be ready for teaching students in the 21st century classrooms. As Diana (2013) stated, teacher education programs are now challenged with the goal of developing the next generation of teachers who are capable in integrating technology. Effectively integrating technology into teacher education courses would offer preservice teachers a chance to obtain valuable learning experience and practice with the various types of educational technologies. Furthermore, Abdallah (1996) stated, most teachers would teach as they were taught, and prospective teachers who trained in thinking and teaching creatively would be better prepared to show the same creative characteristics in their classrooms.

Recommendations for Future Research

This study did not study an effect of educational backgrounds of preservice teachers toward their belief about technology integration and creativity abilities; therefore, the first recommendation for future research studies is to examine an effect of an educational background of preservice teachers toward their belief in technology integration and creativity abilities. The researcher believes that different content areas may have limitations of numbers of available technology usage within a classroom for teaching and learning and also perspectives of their creativity.

Another recommendation for future research is to investigate how preservice teachers integrate technology into lessons and how they transfer and promote creativity to students in a real classroom and also in different cultures after they recognize the four abilities of the creative process. A future study may include an investigation of the effect

of cultural differentiations toward the levels of technology integration and perceptions of creativity of preservice teachers and students within a classroom.

Summary

The purposes of this study were to explore and examine how the four abilities of the creative process affected technology integration and creativity of preservice teachers who enrolled in an online course. The findings of this study not only responded to the research questions, but the problems of technology integration and creativity that were mentioned in the problem statement as well.

The problem of technology integration was most teachers only added technology rather than integrated technology into their instruction (Beaver & Moore, 2004; Liu & Johnson, 2003). The findings of this study indicated that the preservice teachers knew how to integrate technology rather than add technology into a lesson plan. They considered the advantages of the technology toward student learning in which it assisted them to choose and integrate the right technology into their lessons. As a result, at the end of the Creative Technology Integration Project, most of them were able to create high-quality lesson plans that contained all four characteristics of the optimal technology integration.

The problems of creativity were that teachers did not have experience about the creative process (Loveless et al, 2006), and they only recognized approaches for teaching for the best learning results rather than teaching for the discovery of new knowledge and creative ideas (Brinkman, 2010); therefore, it was difficult for them to recognize how to promote creativity to their students. The findings of this study showed that the preservice teachers had valuable learning experiences about the creative process, and they had

opportunities to practice, think, and create creative products that encouraged them to recognize the ways to promote creativity to their future students successfully as well.

REFERENCES

Abdallah, A. (1996). Fostering creativity in student teachers. *Community Reviews, 14,*52–58.

AL-Bataineh, A., & Brooks, L. (2003). Challenges, advantages, and disadvantages of instructional technology in the community college classroom. *Community College Journal of Research and Practice, 27*, 473–484.

Allen, I. E., & Seaman, J. (2011). *Going the distance: Online education in the United States, 2011*. Retrieved from http://sloanconsortium.org/publications /survey/going-distance-2011

Al-Musawi, A. S. (2011). Redefining technology role in education. *Creative Education, 2*(2), 130–135.

Amabile, T. (1996). *Creativity and innovation in organizations* (Report No. 9-396-239). Boston, MA: Harvard Business School.

Archambault, L. M,. & Barnett, J. H. (2010). Revisiting Technological Pedagogical Content Knowledge: Exploring the TPACK framework. *Computers & Education, 55*(4), 1656–1662.

Baytak, A., Tarman, B., & Ayas, C. (2011). Experimenting technology integration in education: Children's perceptions. *International Electronic Journal of Elementary Education, 3*(2), 139–151.

Beaver, R., & Moore, J. (2004). Curriculum design and technology integration: A model to use technology in support of knowledge generation and higher-order thinking skills. *Learning and Leading with Technology, 32*(1), 42–50.

Bing, W., & Ai-Ping, T. (2008). The influence of national culture toward learner's interaction in the online learning environment: A comparative analysis of Shanghai TV University (China) and Wawasan Open University (Malaysia). *The Quarterly Review of Distance Education, 9*(3), 327–339.

Brinkman, D. J. (2010). Teaching creatively and teaching for creativity. *Arts Education Policy Review, 111*, 48–50.

Britten, J. B., & Cassady, J. C. (2006). Technology integration assessment instrument: Understanding planned use of technology by classroom teachers. *Computers in the Schools, 22*(3–4), 49–61.

Carney-Strahler, B. (2011). Wikis: Promoting collaborative literacy through affordable technology in content-area classrooms. *Creative Education, 2*(2), 76–82.

The Centers for Quality Teaching and Learning. (2011). *The 21st century classroom series: Use your teacher workdays to create 21st century classrooms.* Retrieved from http://www.qtlcenters.org/programs/21ccs.htm

Christenbury, L. (2010). The flexible teacher. *Educational Leadership, 68*(4), 47–50.

Computer-assisted instruction. (2009). In *Britannica Concise Encyclopedia*. Retrieved from http://www.credoreference.com.source.unco.edu/entry/ebconcise/computer_assisted_intruction

Craft, A. (2006). Creativity in schools. In N. Jackson, M. Oliver, M. Shaw, & J. Wisdom (Eds.), *Developing creativity in higher education: An imaginative curriculu*m (pp. 19–28). Oxon, England: Routledge.

Cropley, A. J., & Urban, K. K. (2000). Programs and strategies for nurturing creativity. In K. A. Heller, F. J. Mönks, R. Subotnik, & R. J. Sternberg (Eds.), *International handbook of giftedness and talent* (pp. 481–494). Oxford, England: Elsevier.

Dacey, J. S. (1989). *Fundamentals of creative thinking*. Lexington, MA: Lexington Books.

Diana, T. J. (2013). Microteaching revisited: Using technology to enhance the professional development of pre-service teachers. *The Clearing House: A Journal of Educational Strategies, Issues and Ideas, 8*(4), 150–154.

Dillon-Marable, E., & Valentine. T. (2006). Optimizing computer technology integration. *Adult Basic Education, 16*(2), 99–117.

Dobbs, R. R., Waid, C. A., & Carmen, A. D. (2009). Students' perceptions of online courses: The effect of online course experience. *The Quarterly Review of Distance Education, 10*(1), 9–26.

Dockstader, J. (1999). Teachers of the 21st century know the what, why, and how of technology integration. *Technological Horizons in Education, 26*(6), 73–75.

Driscoll, M. P. (2005). *Psychology of learning for instruction* (3rd ed.). Boston, MA: Pearson Education.

Ertmer, P. A., Ottenbreit-Leftwich, A. T., Sadik, O., Sendurur, E., & Sendurur, P. (2012). Teacher beliefs and technology integration practices: A critical relationship. *Computer & Education, 59*, 423–435.

Ertugrul, U. (2011). The examination of online self-regulated learning skills in web-based learning environments in terms of different variables. *The Turkish Online Journal of Educational Technology, 10*(3), 278–286.

Esquivel, G. B. (1995). Teacher behaviors that foster creativity. *Educational Psychology Review, 7*(2), 185–202.

Gibson, S., & Oberg, D. (2004). Visions and realities of Internet use in schools: Canadian perspectives. *British Journal of Educational Technology, 35*(5), 569–585.

Gnezda, N. M. (2011). Cognition and emotion in the creative process. *Art Education, 64*(1), 47–52.

Graham, C. R. (2011). Theoretical considerations for understanding technological pedagogical content and knowledge (TPACK). *Computers & Education, 57,* 1953–1960.

Guidebook for Developing an Effective Instructional Technology Plan. (1996, Spring). Prepared by graduate students at Mississippi State University (revised). Retrieved from http://www.nctp.com/downloads/guidebook.pdf

Guilford, J. P. (1956). Structure of intellect. *Psychological Bulletin, 53*, 267–293.

Gulbahar, Y. (2007). Technology planning: A roadmap to successful technology integration in schools. *Computers & Education, 49*, 943–956.

Heinich, R., Molenda, M., Russell, J. D., & Smaldino, S. E. (2001). *Instructional media and technologies for learning* (7th ed.), Englewood Cliffs, NJ: Prentice Hall.

Hew, K. F., & Brush, T. (2007). Integrating technology into K-12 teaching and learning: Current knowledge gaps and recommendations for future research. *Educational Technology Research Development, 55*, 223–252.

Hsu, S. (2010). The relationship between teacher's technology integration ability and usage. *Journal Educational Computing Research, 43*(3), 309–325.

International Society for Technology in Education. (2000). *National Educational Technology Standards (NETS) for teachers.* Retrieved from http://cnets.iste.org/teachers/

International Society for Technology in Education. (2011). *Advancing digital age learning.* Retrieved from http://www.iste.org/standards/nets-for-students.aspx

Jamieson-Proctor, R., & Burnett, P. C. (2002). Elementary students, creativity, and technology: Investigation of an intervention designed to enhance personal creativity. *Computers in Schools, 19*(1-2), 33–48.

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

Karami, M., Karami, Z., & Attaran, M. (2013). Integrating problem-based learning with ICT for developing trainee teachers' content knowledge and technology skill. *International Journal of Education and Development using Information and Communication Technology*, *9*(1), 36–49.

Kaufman, J. C., Plucker, J. A., & Baer J. (2008). *Essentials of creativity assessment.* Hoboken, NJ: Wiley.

Keengwe, J., & Onchwari, G. (2009). Technology and early childhood education: A technology integration professional development model for practicing teachers, *Early Childhood Educational Journal, 37*, 209–218.

Keengwe, J., Onchwari, G., & Wachira, P. (2009). Computer technology integration and student learning: Barriers and promise. *Journal of Science Education and Technology,17*(6), 560–565.

Kim, K. H. (2006). Can we trust creativity tests? A review of the Torrance tests of creative thinking (TTCT). *Creative Research Journal, 18*(1), 3–14.

Koehler, M. (2011, May). *What is TPACK?* Retrieved from http://www.tpck.org

Krentler, K. A., & Willis-Flurry, L. A. (2005). Does technology enhance actual student learning? The case of online discussion boards. *Journal of Education for Business, 80*(6), 316-321.

Kridel, C. (Ed.). (2010). *Encyclopedia of curriculum studies* (Vol. 1). Thousand Oaks, CA: Sage.

Kumar, V. K., & Holman, E. R. (1997). Creativity Styles Questionnaire–Revised [Survey instrument]. *Creativity Research Journal, 10*(1), 51–58.

Lee, Y. H., Waxman. H., Wu, J.-Y., Michko, G., & Lin, G. (2013). Revisit the effect of teaching and learning with technology. *Educational Technology & Society*, *16*(1), 133–146.

Leonard, J., & Guha, S. (2001). Education at the crossroads: Online teaching and students' perspective on distance learning. *Journal of Research on Technology in Education, 34*(1), 52–57.

Liu, L., & Johnson, L. (2003, January). *A technology integration model and weak areas*. Poster session presented at the International Conference on Education, Honolulu, HI.

Loveless, A., Burton, J., & Turvey, K. (2006). Developing conceptual frameworks for creativity, ICT, and teacher education. *Thinking Skills and Creativity, 1,* 3–13.

Low, A. (2006). Creative thinking. *World Futures, 62*, 455–463.

Lubart, T. I. (2001). Models of the creative process: Past, present and future. *Creativity Research Journal, 13*(3), 295–308.

Massialas, B. G., & Zevin, J. (1983). *Teaching creatively: Learning through discovery.* Malaba, FL: Robert E. Krieger.

McEwen, B. C. (2008). Preparing teachers for the 21st century classroom [Editorial]. *The Delta Pi Epsilon Journal, L*(10), 1–3.

Means, B. (1994). Introduction: Using technology to advance educational goals. In B. Means (Ed.), *Technology and education reform: The reality behind the promise* (pp. 1–22). San Francisco, CA: Jossey-Bass.

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

Muirhead, B. (2007). Integrating creativity into online university classes. *Educational Technology & Society, 10*(1), 1–13.

National Council for Accreditation of Teacher Education. (1997). *Technology and the new professional teacher: Preparing for the 21st century classroom.* Washington, DC: Author.

Okojie, M. C. P. O., Olinzock, A. A., & Okojie-Boulder, T. C. (2006). The pedagogy of technology integration. *The Journal of Technology Studies, 32*(2), 66–71.

Partnership for 21st Century Skills. (2011). *Framework for 21st century learning.* Retrieved from http://www.p21.org/overview/skills-framework/352

Recesso, A., Wiles, D., Venn, M., Campbell, W. A., Jr., & Padilla, M. (2002). *Teacher induction and technology integration: Is there a critical element missing in existing induction models?* Retrieved from ERIC database. (ED 467502)

Richey, R. C., Klein, J. D., & Tracey, M. W. (2011). The *instructional design knowledge base: Theory, research, and practice*. New York, NY: Routledge.

Roblyer, M. D. (2006). *Integrating educational technology into teaching* (4th ed.). Upper Saddle River, NJ: Pearson Education, Merrill.

Runco, M. A. (2009). Divergent thinking. In *Encyclopedia of giftedness, creativity, and talent.* (Vol. 1, pp. 252–253). Thousand Oaks, CA: Sage.

Saebo, A. B., McCammon, L. A., & O'Farrell, L. (2007). Creative teaching—teaching creativity. *Caribbean Quarterly, 53*(1/2), 205–215.

Schmidt, D., Baran, E., Thompson, A., Koehler, M. J., Shin, T, & Mishra, P. (2009, April). *Technological Pedagogical Content Knowledge (TPACK): The development and validation of an assessment instrument for preservice teachers.* Paper presented at the 2009 Annual Meeting of the American Educational Research Association, San Diego, CA.

Serce, F. C., Swigger, K., Alpaslan, F. N., Brazile, R., Dafoulas, G., & Lopez, V. (2010). Online collaboration: Collaborative behavior patterns and factors affecting globally distributed team performance. *Computers in Human Behavior, 27*, 490–503.

Shaheen, R. (2010). Creativity and education. *Creative Education, 1*(3), 166–169.

Shively, C. H. (2011). Grow creativity. *Learning and Leading with Technology, 38*(7), 10–15.

Sivin-Kachala, J., & Bialo, E. (2000). *2000 research report on the effectiveness of technology in schools* (7th ed.). Washington, DC: Software Publishers.

Smaldino, S. E., Lowther, D. E., & Russell, J. D. (2012). Achieving 21st century learning environments. In A. Lewis (Ed.), *Technology in education* (pp. 115–144). Boston, MA: Pearson Learning Solutions.

Smith, P. A., & Owens, E. W. (2010). Examining barriers to integrate technology in elementary teacher education programs. *Journal of Technology Integration, 2*(1), 59–74.

Speaker, K. (2004). Student perspective: Expectations of multimedia technology in a college literature class. *Reading Improvement, 41*, 241–254.

Sternberg, R. J. (2006). The nature of creativity. *Creativity Research Journal, 18*(1), 87–98.

Treffinger, D. J., Isaksen, S. G., & Dorval, K. B. (2000). *Creative problem solving: An introduction* (3rd ed.). Waco, TX: Prufrock Press.

Tsai, K. C. (2012). The necessity of creativity development in adult learners for lifelong learning. *International of Learning & Development, 2*(94), 170–176.

Urban, K. K. (2007). Assessing in creativity: A componential model. In A-G Tan (Ed.), *Creativity: A handbook for teachers* (pp. 167–184). Toh Tuck Link, Singapore: World Scientific Publishing.

Venezky, R. L. (2004). Technology in the classroom: Steps toward a new vision. *Education, Communication & Information, 4*(1), 3–21.

Vidal, R. V. V. (2009). Creativity for problem solvers. *Journal of Knowledge, Culture and Communication, 23*, 409–432.

Walters, W. (2004). Infusing technology into any instructional program "5W/5E." *Virginia Society for Technology Education, 19*(1), 17–25.

Wilen-Daugenti, T. (2009). *.edu: Technology and learning environments in higher education.* New York, NY: Peter Lang.

Willis, J. (2007). Creating a working model for technology integration through a lesson planning WebQuest. *Electronic Journal for the Integration of technology in Education, 5*, 25–33.

Zimmerman, B. J. (2002). Becoming a self-regulated learner: An overview. *Theory into Practice, 41*(2), 64–70.

APPENDIX A

INSTITUTIONAL REVIEW BOARD

UNIVERSITY of
NORTHERN COLORADO

DATE:	November 5, 2012
TO:	Watsatree Diteeyont, PhD Candidate
FROM:	University of Northern Colorado (UNCO) IRB
PROJECT TITLE:	[386838-2] Examination of Creativity and Development of Technology Integration Skill of Preservice Teachers within Online Education
SUBMISSION TYPE:	Amendment/Modification
ACTION:	VERIFICATION OF EXEMPT STATUS
DECISION DATE:	November 5, 2012

Thank you for your submission of Amendment/Modification materials for this project. The University of Northern Colorado (UNCO) IRB verifies that this project is EXEMPT according to federal IRB regulations.

Hello Watsatree -
Thank you for submitting the revised consent form with clear data storage information as well as recruitment email scripts.

Please note that your email script states "content" form instead of "consent form". This needs to be changed before your use the script.

Based on these revisions and additional materials, your application has been verified exempt. Please be sure to use all revised and additional material in your actual data collection.

(UNCO IRB is now using "verification" instead of "approval" for exempt IRB reviews. You may now commence.)

Don't hesitate to contact me with any IRB-related questions or concerns.

Best wishes with your research.

Dr. Stellino

We will retain a copy of this correspondence within our records for a duration of 4 years.
If you have any questions, please contact Sherry May at 970-351-1910 or Sherry.May@unco.edu.
Please include your project title and reference number in all correspondence with this committee.

This letter has been electronically signed in accordance with all applicable regulations, and a copy is retained within University of Northern Colorado (UNCO) IRB's records.

APPENDIX B

GENERATE IDEA PLAN TEMPLATE

Topic:

Content Area:

Standards (Content & NETS-S):

Objective:

Please list possible technologies and reasons of choosing to integrate these technologies into your lesson plan.

Technologies (Tools)	Websites	Reasons

APPENDIX C

LESSON PLAN TEMPLATE

Grade level: _____ Subject: _____

Topic of lesson plan: _____

Objective:	Educational standards (content and NETS–S)

Content knowledge	Provide information of subject matter taught in instruction (CK)

List of technologies and websites	Reasons (Answers need to relate to six questions below) These questions are from Technology Integration Planning model (TIP) a. Are technologies and websites good solutions for learning problems or approaches for enhancing learning effectively? Why? b. Are the technologies and websites consistent with the objectives? How? c. Are technologies and websites appropriate for supporting? Why? d. Are technologies and websites appropriate for strategies? Why? e. Are technologies and websites appropriate for using in instruction and classroom? Why? f. How technologies and websites work well for support learning of learners?

Provide short descriptions of you use technologies and websites in your classroom.	How can you use these technologies and websites for enhancing teaching and learning (TPK) and also demonstrate concepts of subject matters (TCK)?
Learning activities	Provide descriptions of how you organize, adapt, and present particular aspects of subject matter in an instruction (PCK) and strategiew that you will use in instruction (PK)?
Evaluation	Indicate assessments or approaches of how you assess learners.

APPENDIX D

TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) SURVEY

TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) SURVEY

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
TK (technology knowledge)					
1. I know how to solve my own technical problems.					
2. I can learn technology easily.					
3. I keep up with important new technologies.					
4. I frequently play around with technology.					
5. I know about a lot of different technologies.					
6. I have the technical skills I need to use technology.					
CK (content knowledge)					
• Mathematics					
7. I have sufficient knowledge about mathematics.					
8. I can use a mathematical way of thinking.					
9. I have various ways and strategies of developing my understanding of mathematics.					
• Social studies					
10. I have sufficient knowledge about social studies.					
11. I can use a historical way of thinking.					
12. I have various ways and strategies of developing my understanding of social studies.					

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
• Science					
13. I have sufficient knowledge about science.					
14. I can use a scientific way of thinking.					
15. I have various ways and strategies of developing my understanding of science.					
• Literacy					
16. I have sufficient knowledge about literacy.					
17. I can use a literacy way of thinking.					
18. I have various ways and strategies of developing my understanding of literacy.					
PK (pedagogical knowledge)					
19. I know how to assess student performance in a classroom.					
20. I can adapt my teaching based upon what students currently understand or do not understand.					
21.I can adapt my teaching style to different learners.					
22. I can assess student learning in multiple ways.					
23. I can use a wide range of teaching approaches in a classroom setting.					
24. I am familiar with common student understandings and misconceptions.					
25. I know how to organize and maintain classroom management.					

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
PCK (pedagogical content knowledge)					
26. I can select effective teaching approaches to guide student thinking and learning in mathematics.					
27. I can select effective teaching approaches to guide student thinking and learning in literacy.					
28. I can select effective teaching approaches to guide student thinking and learning in science.					
29. I can select effective teaching approaches to guide student thinking and learning in social studies.					
TCK (technological content knowledge)					
30. I know technologies I can use for understanding and doing mathematics.					
31. I know technologies I can use for understanding and doing literacy.					
32. I know technologies I can use for understanding and doing science.					
33. I know technologies I can use for understanding and doing social studies.					
TPK (technological pedagogical knowledge)					
34. I can choose technologies that enhance the teaching approaches for a lesson.					
35. I can choose technologies that enhance student learning for a lesson.					
36. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.					

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
37. I am thinking critically about how to use technology in my classroom.					
38. I can adapt the use of the technologies I am learning about to different teaching activities.					
39. I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.					
40. I can use strategies that combine content, technologies, and teaching approaches that I learned about in my coursework in my classroom.					
41. I can provide leadership in helping others to coordinate the use of content, technologies and teaching approaches at my school and/or district.					
42. I can choose technologies that enhance the content for a lesson.					
TPACK (technology pedagogy and content knowledge)					
43. I can teach lessons that appropriately combine mathematics, technologies, and teaching approaches.					
44. I can teach lessons that appropriately combine literacy, technologies, and teaching approaches.					
45. I can teach lessons that appropriately combine science, technologies, and teaching approaches.					
46. I can teach lessons that appropriately combine social studies, technologies, and teaching approaches.					

	Strongly disagree	Disagree	Neither agree or disagree	Agree	Strongly agree
Models of TPACK (faculty, PreK–6 teachers)					
47. My mathematic education professors appropriately model combining content, technology, and teaching approaches in their teaching.					
48. My literacy education professors appropriately model combining content, technology, and teaching approaches in their teaching.					
49. My science education professors appropriately model combining content, technology, and teaching approaches in their teaching.					
50. My social studies education professors appropriately model combining content, technology, and teaching approaches in their teaching.					
51. My instructional technology professors appropriately model combining content, technology, and teaching approaches in their teaching.					
52. My educational foundation professors appropriately model combining content, technology, and teaching approaches in their teaching.					
53. My professors outside of education appropriately model combining content, technology, and teaching approaches in their teaching.					
My PreK–6 cooperating teachers appropriately model combining content, technology, and teaching approaches in their teaching.					

	25% or less	26 – 50%	51 – 75%	76 – 100%
Models of TPACK				
55. In general, approximately what percentage of your teacher education professors have provided an effective model of combining content, technology, and teaching approaches in their teaching?				
56. In general, approximately what percentage of your professors outside of teacher education have provided an effective model of combining content, technology, and teaching approaches in their teaching?				
57. In general, approximately what percentage of the PreK–6 cooperating teachers have provided an effective model of combining content, technology, and teaching approaches in their teaching?				

APPENDIX E

TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK)–REVISED SURVEY

TECHNOLOGICAL PEDAGOGICAL CONTENT KNOWLEDGE (TPACK)–REVISED SURVEY

Questions	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I know how to solve my own technical problems.					
2. I can learn technology easily.					
3. I keep up with important new technologies.					
4. I frequently play around with technology.					
5. I know about a lot of different technologies.					
6. I have had sufficient opportunities to work with different technologies.					
7. I have sufficient knowledge about the content that I am going to teach.					
8. I have various ways and strategies of developing my understanding of the content that I am going to teach.					
9. I know how to assess student performance in a classroom.					
10. I can adapt my teaching based upon what students currently understand or do not understand.					
11. I can assess student learning in multiple ways.					
12. I can use a wide range of teaching approaches in a classroom setting (collaborative learning, direct instruction, inquiry learning, problem/project-based learning, etc.)					
13. I am familiar with common student understanding and misconceptions.					
14. I know how to organize and maintain classroom management.					
15. I know how to select effective teaching approaches to guide student thinking and learning in the content that I will be teaching.					

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
16. I know about technologies I can use for supporting understanding and doing in the content I will teach.					
17. I can choose technologies that enhance the teaching approaches for a lesson.					
18. I can choose technologies that enhance students learning for a lesson.					
19. My teacher education program has caused me to think more deeply about how technology could influence the teaching approaches I use in my classroom.					
20. I am thinking critically about how to use technology in my classroom.					
21. I can adapt the use of the technologies I am learning about to different teaching activities.					
22. I can teach lessons that appropriately combine the content I am going to teach, technologies, and teaching approaches.					
23. I can select technologies to use in my classroom that enhance what I teach, how I teach, and what students learn.					
24. I can use strategies that combine content, technologies, and teaching approaches I learned about in my coursework to in my classroom					
25. I can provide leadership in helping others to coordinate the use of content, technology, and teaching approaches at my school and/or district.					
26. I can choose technologies that enhance the content for a lesson.					

APPENDIX F

CREATIVITY STYLES QUESTIONNAIRE –REVISED

CREATIVITY STYLES QUESTIONNAIRE –REVISED

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I consider myself to be a creative person.					
2. I am engaged in creative types of work on a regular basis.					
3. Creative ideas simply occur to me without even thinking about them.					
4. I typically wait for a flash of inspiration before I begin working.					
5. I would describe my style of creativity as erratic or nonsystematic.					
6. I have had insights, the sources of which I am unable to explain or understand.					
7. I believe in unconscious processes that facilitate my creative work.					
8. In my work there are often long gaps during which I have no motivation.					
9. I have been able to use many ideas for creative work that have occurred in my dreams.					
10. I must be emotionally moved to be creative.					
11. I have to be in the right mood or feeling to do creative work.					
12. When I get a new idea, I get totally absorbed by it until I have pursued it completely.					
13. I feel that new ideas possess me and guide me through to completion almost automatically.					
14. I believe that creativity comes from hard work and persistence.					
15. My creativity comes from careful planning and forethought.					
16. I practice being creative.					

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
17. My creativity comes from self-discipline.					
18. I attribute my creativity to divine inspiration.					
19. I tend to lose my sense of time when I am engaged in creative work.					
20. I keep a pen/notepad/tape recorder handy to record new ideas as they occur.					
21. I often let my mind wander to come up with new ideas.					
22. I typically create new ideas by systematically modifying (substituting, rearranging, elaborating, etc.) an existing idea.					
23. I typically create new ideas by combining existing ideas.					
24. When I examine existing products, I usually critically evaluate them to see how I can improve them.					
25. I have often gone back to ideas that I have rejected before.					
26. I am always thinking (fantasizing) about how to do everyday things differently.					
27. I typically modify an existing idea only slightly, one step at a time.					
28. I deliberately reject or ignore conventional or already accepted ideas to come up with new ideas.					
29. I often look for new ideas outside of my own field and try to apply them to my own.					
30. I tend to work on many ideas simultaneously.					
31. I often use the technique of brainstorming to come up with new ideas.					
32. I have maintained a notebook/diary of new ideas I would like to pursue.					

Question	Strongly agree	Agree	Neutral	Disagree	Strongly
33. When I am generating new ideas, I do not tend to evaluate them until I have generated many ideas.					
34. I do a lot of experimentation (trial and error) to come up with a new workable idea.					
35. When I get stuck, I tend to leave the idea for a while, do something else, before returning to work on it.					
36. I take walks to come up with new ideas.					
37. I read widely to come up with new ideas.					
38. When I have a new idea, I tend to discuss it with someone to determine its potential for success.					
39. When I get stuck, I consult or talk with other people about how to proceed.					
40. I am at my creative best when I work alone.					
41. I am at my creative best when I work with one other person.					
42. I am at my creative best when I work in a group.					
43. I am secretive about my new ideas.					
44. I typically show my creative products to other people.					
45. I typically isolate myself from other people when I am working on creative ideas.					
46. I typically isolate myself from other people to come up with new ideas.					
47. I have often pursued bad or unworkable ideas for a long time.					
48. I usually have a lot of both workable and unworkable ideas.					
49. I work most creatively when I have deadlines.					

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
50. If I do have a concrete (visible) creative product to show (e.g., written composition, work of art, music, etc.), then I think I have failed.					
51. I enjoy the process of creating new ideas whether they lead to a final product or not.					
52. When I have completed a creative product, I am unable to start on a new project for a long time.					
53. I think a final product that is not readily observable through the senses can emerge in a creative act.					
54. I have set aside a particular place (or places) for creative work.					
55. I have set aside a particular time (or times) for creative work.					
56. I have a particular place (or places) where I do most of my creative thinking.					
57. I have a particular time (or times) during the day when I do my creative thinking.					
58. I tend to smoke (cigarette, pipe, cigar) before beginning creative work.					
59. I tend to drink tea/coffee/other drinks with caffeine before beginning creative work.					
60. I tend to smoke frequently when engaged in creative work.					
61. I tend to drink a lot of tea/coffee/other drinks with caffeine when engaged in creative work.					
62. I ordinarily smoke after I have worked on my creative idea(s) for a designated period of time.					
63. I ordinarily drink tea/coffee/other drinks with caffeine after I have worked on my creative idea(s) for a designated period of time.					

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
64. I reward myself in some way after I have worked on my creative idea(s) for a designated period of time.					
65. I tend to do my creative work in a quiet place.					
66. I typically have background music when I am engaged in creative work.					
67. I use alcohol to get into a mood for creative work.					
68. I use mind altering substances (other than alcohol) to get into a creative mood.					
69. I typically start my creative work with a prayer.					
70. I typically meditate before beginning my creative work.					
71. I tend to snack when I am engaged in creative work.					
72. I have a favorite tool (a certain pen/ easel/thinking cap, etc.) without which I would find it hard to concentrate when I am engaged in creative work.					
73. I have a favorite amulet or clothing that I wear when I am engaged in creative work.					
74. I tend to use my visual sense a lot in my creative work.					
75. I tend to use my sense of hearing a lot in my creative work.					
76. I tend to use my sense of touch a lot in my creative work.					
77. I tend to use my sense of taste a lot in my creative work.					
78. I tend to use my sense of smell a lot in my creative work.					

APPENDIX G

CREATIVITY STYLES QUESTIONNAIRE –SECOND REVISED

CREATIVITY STYLES QUESTIONNAIRE
–SECOND REVISED

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
1. I consider myself to be a creative person.					
2. I am engaged in creative types of work on a regular basis.					
3. I believe creativity comes from hard work and persistence.					
4. My creativity comes from careful planning and forethought.					
5. My creativity comes from self-discipline.					
6. I typically create new ideas by systematically modifying (substituting, rearranging, elaborating, etc.) an existing idea.					
7. I typically create new ideas by combining existing ideas.					
8. When I examine existing products, I usually critically evaluate them to see how I might improve them.					
9. I have often gone back to ideas that I have rejected before.					
10. I am always thinking about how to do everyday things differently.					
11. I deliberately reject or ignore conventional or already accepted ideas to come up with new ideas.					
12. I typically modify an existing idea only slightly, one step at a time.					
13. I often look for new ideas outside my own field and try to apply them to my own.					
14. I tend to work on many ideas simultaneously.					
15. I often use the technique of brainstorming to come up with new ideas.					

Question	Strongly agree	Agree	Neutral	Disagree	Strongly disagree
16. When I generate new ideas, I do not tend to evaluate them until I have generated many ideas.					
17. I do a lot of experimentation (trial and error) to come up with a new workable idea.					
18. I read and do research widely to come up with new ideas.					
19. When I have a new idea, I tend to discuss it with someone to determine its potential for success.					
20. When I get stuck, I consult or talk with other people about how to proceed.					

APPENDIX H

TECHNOLOGY INTEGRATION ASSESSMENT INSTRUMENT (TIAI)

TECHNOLOGY INTEGRATION ASSESSMENT INSTRUMENT (TIAI)

Dimension	Technology not present	Non-essential technology component	Supportive technology component	Essential technology component
Planing (material, equipment, etc.).	No mention of technology.	Uses technology in lesson not related to addressed standards.	Uses computer to plan for lesson. Make mention of necessary equipment and technologies for replication purposes.	Computer is essential to planning lesson (e.g., WebQuest). Equipment and technologies are built into lesson design and objectives and discussed within context of the lesson and not as an external component.
Standards (content standards per grade level and content area).	No mention of technology or content standards.	Uses computer to plan for lesson.	Uses technology supports or promotes the acquisition of standards in the lesson, but is not directly tied to the standards themself.	Technology use in the lesson is directly linked to one or more standard, making acquisition of that standard possible.
Standards (NETS-S).	No mention of technology or NETS.	NETS are presented, but not identified or embedded into the lesson as a learning goal. NETS addressed are not up to expected grade level.	NETS are present, but not identified or embedded into the lesson as a learning goal. NETS are grade- level appropriate.	NETS are present and integrated into grade-level appropriate learning goals.
Attention to student needs.	No mention of technology.	Technology is not used in an adaptable fashion. All students use the same technology tools or complete the same technology tool or technology-based activity.	Technology can be modified by the teachers or students to meet the needs of students from diverse back-grounds.	Technology is the only means this lesson can be adapted to meet the needs of students from diverse back-grounds; that is, the technology tool or activity is designed to be adaptive.

Dimension	Technology not present	Non-essential technology component	Supportive technology component	Essential technology component
Implementation (use of technology in learning).	No mention of technology.	Technology is not expected to directly impact learning.	Learning is impacted in time, quality, or wealth of resources by the use of technology.	Technology impacts learning by presentation, products, or processes.
Implementation (use of technology in teaching).	No mention of technology.	Lesson uses technology, but does not impact implementation (product-oriented technology).	Lesson is facilitated with technology, but learning goals could be achieved without technology in place (process-oriented and/or product-oriented technology.	Equipment and technologies are built into lesson design and objectives and discussed within the context of the lesson and not as external components. Lesson requires use of technology (process and products are dependent upon technology).
Assessment	No mention of assessment or technology.	Technology is not used in the assessment component (neither the use of technology nor a product of technology.	Technology-based product is assessed or technology application is used to deliver and/or score the assessment instrument. A similar assessment could be replicated without technology.	Technology products and/or processes are directly accessed, or assessment relies upon use of technology for delivery or collection. Identified assessment could not be conducted without technology. NETS are identified as part of assessment.

APPENDIX I

MAUCHLY'S TEST OF SPHERICITY AND TESTS OF WITHIN–SUBJECTS EFFECTS OF TECHNOLOGY PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) FRAMEWORK

Table 8

Mauchly's Test of Sphericity and Tests of Within–Subjects Effects of Technology Pedagogical Content Knowledge (TPACK)–Revised Surveys

Within–subjects effect	Mauchly's W	Approx. χ^2	*df*	Sig.	Epsilon Greenhouse-Geisser	
Time	.737	31.722	2	.000	.792	
Source		**Type III *SS***	***df***	***MS***	***F***	**Sig.**
Time	Sphericity assumed	4.804	2	2.402	21.419	< 0.0001
	Greenhous-Geisser	4.804	1.584	3.033	21.419	< 0.0001
	Huynh-Feldt	4.804	1.604	2.995	21.419	< 0.0001
	Lower-bound	4.804	1.000	4.804	21.419	< 0.0001
	1 vs 2 administration		1	5.914	20.852	0.178
	2 vs 3 administration		1	0.201	1.839	< 0.0001
Error (time)	Sphericity assumed	23.548	210	0.112		
	Greenhous-Geisser	23.548	166.285	0.142		
	Huynh-Feldt	23.548	166.409	0.140		
	Lower-bound	23.548	105.000	0.224		
	1 vs 2 administration		105	0.284		
	2 vs 3 administration		105	0.109		

APPENDIX J

MAUCHLY'S TEST OF SPHERICITY AND TESTS OF WITHIN–SUBJECTS EFFECTS OF ALL TYPES OF KNOWLEDGE WITHIN TECHNOLOGY PEDAGOGICAL CONTENT KNOWLEDGE (TPACK) FRAMEWORK

Table 9

Mauchly's Test of Sphericity and Tests of Within–Subjects Effects of All Types of Knowledge Within Technology Pedagogical Content Knowledge (TPACK) Framework

	Approx. χ^2	*df*	*MS*	*F*	*p*
Technology knowledge	4.281	2			0.118
Tests of within–subjects effects: Time					
Sphericity assumed		2	2.406	19.080	< 0.0001
Huynh-Feldt		1.958	2.458	19.080	< 0.0001
1 vs 2 administration		1	4.635	22.176	<0.0001
2 vs 3 administration		1	0.736	2.934	0.090
Error (time)					
Sphericity assumed		201	0.126		
Huynh-Feldt		205.546	0.129		
1 vs 2 administration		105	0.209		
2 vs 3 administration		105	0.251		
Content knowledge	5.439	2			0.066
Tests of within–subjects effects: Time					
Sphericity assumed		2	3.406	15.769	< 0.0001
Huynh-Feldt		1.937	3.516	15.769	< 0.0001
1 vs 2 administration		1	6.377	14.677	< 0.0001
2 vs 3 administration		1	1.142	3.297	0.072
Error (time)		210	0.216		
Sphericity assumed		203.409	0.223		
Huynh-Feldt		105	0.435		
1 vs 2 administration		105	0.346		
2 vs 3 administration					

(table continues)

Table 9 (continued)

	Approx. χ^2	*df*	*MS*	*F*	*p*
Pedagogical knowledge	5.406	2			0.067
Tests of within–subjects effects: Time					
Sphericity assumed		2	1.783	17.172	< 0.0001
Huynh-Feldt		1.938	1.840	17.172	< 0.0001
1 vs 2 administration		1	3.057	15.406	< 0.0001
2 vs 3 administration		1	0.764	4.427	0.038
Error (time)					
Sphericity assumed		210	0.104		
Huynh-Feldt		203.468	0.10		
1 vs 2 administration		105	0.198		
2 vs 3 administration		105	0.173		
Pedagogical content knowledge	5.107	2			0.078
Tests of within–subjects effects: Time					
Sphericity assumed		2	4.425	14.559	< 0.0001
Huynh-Feldt		1.909	4.554	14.559	< 0.0001
1 vs 2 administration		1	6.377	9.902	0.002
2 vs 3 administration		1	2.726	5.694	0.019
Error (time)					
Sphericity assumed		210	0.304		
Huynh-Feldt		204.013	0.313		
1 vs 2 administration		105	0.644		
2 vs 3 administration		105	0.479		

(table continues)

Table 9 (continued)

	Approx. χ^2	*df*	*MS*	*F*	*p*
Technology content knowledge	17.566	2			< 0.0001
Tests of within–subjects effects: Time					
Sphericity assumed		2	7.154	19.505	< 0.0001
Huynh-Feldt		1.757	8.142	19.505	< 0.0001
1 vs 2 administration		1	8.491	10.188	0.0002
2 vs 3 administration		1	5.896	13.143	< 0.0001
Error (time)					
Sphericity assumed		210	0.367		
Huynh-Feldt		184.527	0.417		
1 vs 2 administration		105	0.833		
2 vs 3 administration		105	0.449		
Technology pedagogical knowledge	20.238	2			< 0.0001
Tests of within–subjects effects: Time					
Sphericity assumed		2	3.423	30.869	< 0.0001
Huynh-Feldt		1.725	3.970	30.869	< 0.0001
1 vs 2 administration		1	8.056	36.129	< 0.0001
2 vs 3 administration		1	0.405	2.888	0.092
Error (time)					
Sphericity assumed		210	0.111		
Huynh-Feldt		181.075	0.129		
1 vs 2 administration		105	0.223		
2 vs 3 administration		105	0.140		

APPENDIX K

MAUCHLY'S TEST OF SPHERICITY AND TESTS OF WITHIN–SUBJECTS EFFECTS OF CREATIVITY STYLES QUESTIONNAIRE– SECOND REVISED SURVEY

Table 10

Mauchly's Test of Sphericity and Tests of Within–Subjects Effects of Creativity Styles Questionnaire–Second Revised Survey

Within–subjects effect	Mauchly's W	Approx. χ^2	*df*	Sig.	Epsilon Greenhouse-Geisser	
Time	.997	.317	2	0.854	.997	
Source		**Type III *SS***	***df***	***MS***	***F***	**Sig.**
Time	Sphericity assumed	4.208	2	2.104	38.444	< 0.0001
	Greenhous-Geisser	4.208	1.584	2.110	38.444	< 0.0001
	Huynh-Feldt	4.208	2.000	2.104	38.444	< 0.0001
	Lower-bound	4.804	1.000	4.208	38.333	< 0.0001
	1 vs 2 administration		1	4.302	39.871	< 0.0001
	2 vs 3 administration		1	0.518	4.439	0.036
Error (time)	Sphericity assumed	11.711	214	0.055		
	Greenhous-Geisser	11.711	213.364	0.055		
	Huynh-Feldt	11.711	214.000	0.055		
	Lower-bound	11.711	107.000	0.109		
	1 vs 2 administration		107	0.108		
	2 vs 3 administration		107	0.115		

APPENDIX L

MAUCHLY'S TEST OF SPHERICITY AND TESTS OF WITHIN–SUBJECTS CONTRASTS OF ALL GROUPS WITHIN CREATIVITY STYLES QUESTIONNAIRE– SECOND REVISED SURVEY

Table 11

Mauchly's Test of Sphericity and Tests of Within–Subjects Contrasts of All Groups Within Creativity Styles Questionnaire–Second Revised Survey

Group	Approx. χ^2	*df*	*MS*	*F*	*p*
Creative capacity	4.936	2			0.085
Tests of within–subjects effects: Time					
Sphericity assumed		2	2.979	16.238	< 0.0001
Huynh-Feldt		1.947	3.060	16.238	< 0.0001
1 vs 2 administration		1	6.375	16.768	<0.0001
2 vs 3 administration		1	0.602	2.052	0.155
Error (time)					
Sphericity assumed		214	0.183		
Huynh-Feldt		208.324	0.188		
1 vs 2 administration		107	0.380		
2 vs 3 administration		107	0.293		
Beliefs in unconscious process	0.538	2			0.764
Tests of within–subjects effects: Time					
Sphericity assumed		2	4.987	17.168	< 0.0001
Huynh-Feldt		2.000	4.987	17.168	< 0.0001
1 vs 2 administration		1	13.26	23.440	< 0.0001
2 vs 3 administration		1	0.175	0.282	0.596
Error (time)		212	0.290		
Sphericity assumed		212	0.290		
Huynh-Feldt		106	0.566		
1 vs 2 administration		106	0.622		
2 vs 3 administration					

(table continues)

Table 11 (continued)

Group	Approx. χ^2	*df*	*MS*	*F*	*p*
Use of techniques to facilitate creative works	0.023	2			0.989
Tests of within–subjects effects: Time					
Sphericity assumed		2	1.847	27.740	< 0.0001
Huynh-Feldt		2	1.847	27.740	< 0.0001
1 vs 2 administration		1	3.468	26.318	< 0.0001
2 vs 3 administration		1	0.615	4.549	0.035
Error (time)					
Sphericity assumed		212	0.067		
Huynh-Feldt		212	0.067		
1 vs 2 administration		106	0.132		
2 vs 3 administration		106	0.135		
Use of people to facilitate creative works	9.869	2			0.007
Tests of within–subjects effects: Time					
Sphericity assumed		2	0.396	1.488	0.228
Huynh-Feldt		1.866	0.424	1.488	0.229
1 vs 2 administration		1	0.336	0.487	0.487
2 vs 3 administration		1	0.458	0.980	0.324
Error (time)					
Sphericity assumed		212	0.266		
Huynh-Feldt		197.81	0.285		
1 vs 2 administration		106	0.690		
2 vs 3 administration		106	0.467		