Fall 2013

Integrating Instructional Technology into a Teacher Education Program: A Three-Tiered Approach

Elizabeth Truesdell
Department of Education, Dominican University of California, elizabeth.truesdell@dominican.edu

Rebecca Birch
Department of Education, Dominican University of California, rebecca.birch@dominican.edu

Integrating Instructional Technology into a Teacher Education Program: A Three-Tiered Approach

Running Head: Integrating Instructional Technology

Elizabeth Truesdell, Ph.D.
Rebecca Birch, Ed.D.
Dominican University of California

Abstract

This project description examines how a teacher education program integrated new instructional technology through the creation of a Technology Facilitator position in the department. The project proceeded through a three-tiered system of learning *literacy* to establish a knowledge base amongst faculty members, *augmenting* required courses to model the use of instructional technology, and finally the *transformation* of the credential program where the activity of learning can only be accomplished through leveraging technology. As a professional program housed in a liberal arts institution, this project combines aspects of the essential learning outcomes of the 21st century with the professional skills required of K-12 teachers. Also included are initial data results from student and faculty pre- and post-surveys, observations of students using new technologies in the field, and implications for similar institutions in the implementation of a three-tiered approach to technology integration through the guidance of a Technology Facilitator.

Keywords: **teacher education, instructional technology, professional development, 21st century skills**

Many teachers today are facing digital natives in the classroom. Their students do not know the world without the World Wide Web. Teachers in the 21st century are expected to harness and guide these emergent technological skills in the classroom. Despite this reality, too often pre-service teachers are not offered "adequate time to absorb, reflect about, connect with, and be supported by technology" (Edutopia.org, 2011, para. 1). Arguably, in order for teachers to obtain the level of technological expertise necessary for today's classroom, the greatest opportunity to make drastic improvements is to include this focus in pre-service education programs. It should be modeled and integrated as a common thread throughout the supervised teaching experience, not relegated to lectures on technology in a single course or through hit-or-miss training on site during their supervised teaching semester. Indeed, in the state of California, 2011 Commission on Teacher Credentialing data indicate that credential completers' weakest areas are the use of computer-based applications to help students learn curriculum subjects and the use of computer-based technology in class activities (Commission on Teacher Credentialing, 2011). This article describes one school's response to this deficit in teacher education.

Context and Background

A wooded oasis in the midst of urban sprawl, Dominican University of California is a small, private liberal arts university in the San Francisco Bay area. Driven by the institution's four core values of study, community, reflection, and service, our teacher education program strives to embody the engaged, enlightened and impassioned educator needed in the 21st century classroom. A growing consensus of administrators and faculty in liberal arts colleges and universities indicate that while the connection between higher education and the world of work involves the teaching of marketable skills specific to students' majors, it also must include 21st

century skills. "There has never been a more pressing need for graduates of liberal arts universities, for men and women who can think critically and analytically, write well, digest complex material, take a global perspective, and develop comprehensive solutions" (Chan & Derry, 2013, p. 9). This assertion is consistent with scholarship on the modern, global economic landscape. Arguably, the combination of a liberal arts education and professional programs such as nursing, occupational therapy, counseling psychology, and teacher preparation, places universities like Dominican in a prime position to prepare 21st century citizens and workers.

Despite this dedication, the department of education at the university recently experienced some major shifts in leadership, program delivery, and content due to the following factors: (a) revised state standards for teacher preparation programs; (b) an upcoming Western Association of Schools and Colleges (WASC) accreditation visit, and (c) the retirement of several key program chairs at the school. This personnel change, which included the Single Subject and Multiple Subject Credential Programs, the Master's of Science in Education Program, the Liberal Studies/Teacher Preparation Program, and the Education Specialist: Mild/Moderate Credential Program, caused new coordinators to reflect upon the status quo. For up to 40 years, the same veteran faculty members coordinated these programs with little collaboration between them. As a result of that isolation, the new coordinators quickly realized that while these programs did produce quality teachers, each program would benefit from learning from the others. Specifically, they recognized the need for more deliberate attention toward the four C's of 21st century skills: collaboration, communication, critical thinking, and creativity, as well as information, media and technology skills. These realizations led program coordinators to re-design each program to be more cohesive and interconnected, thus modeling the 21st century student outcomes we wish to impart to our credential candidates and graduate

students. This project description outlines a very deliberate approach to addressing instructional technology skills while modeling the four C's of 21st century learning.

A Review of the Literature

As noted, kindergarten through high school (K-12) teachers are faced with a growing tide of technology use in the classroom. Arguably, without explicit training in its meaningful use, technology can become a distracting toy or ineffective tool collecting dust in the back of the classroom. Our department realized this and strove to weave technology holistically into the teacher preparation program.

Enhancing Student Learning with Technology

The day of "chalk and talk" classrooms is extinct. Teacher education programs must mirror this evolution to better connect and engage the modern elementary and high school student. The ability of pre-service teachers to integrate technology into the curriculum is needed to guarantee their future success and the success of their students. To this end, many teacher education programs are concerned with how to properly provide pre-service teachers with the technology-related attitudes and skills needed to integrate technology into classroom practices (Wilson, 2003). Scholars posit that teacher education courses which expose pre-service teachers to technology play a major role in pre-service teachers' overall use of technology, and may assist them in learning to integrate technology into their future classroom practice (Collier, Weinburgh, & Rivera, 2004; Pope, Hare, & Howard, 2002).

The teacher candidates enrolled in this credential program are preparing to become teachers in grades ranging from kindergarten through high school. These teacher candidates must develop competencies across a variety of disciplines. It is essential that they develop a range of pedagogical strategies to meet the needs of their students. "Technology literacy is one

of the most important skills we can teach our students as we prepare them for future careers in a technological society" ("Driving student engagement," 2013, para. 7). The ability to integrate technology into the classroom has become an imperative for teachers at all grade levels. State standards require it and research supports its positive impact on student learning (Northeast Mississippi Technology Pilot Program, 2013). Deciding upon the appropriate use of technology is key to enhancing student learning and engagement.

The debate regarding the best method of integrating technology into the classroom is not new. In 1987, Papert coined the term "technocentric" to describe advocates' "overemphasis on the design and features of the technologies rather than the learning that they can support" (as cited in Harris & Hofer, 2011, p. 227). Increasingly, researchers have found that in order to transcend "technocentric" thinking, teachers need to center more on what the students can do with the information gained from technology, not on the quantity or ease of obtaining the information (Keengwe, Schnellert, & Mills, 2012). When this important distinction is made, students indicate more interest in the subject, more engagement, and better understanding of the learning outcome (Kvavik & Caruso, 2005).

21st Century Skills in Teacher Education Programs

Americans have a history of investing in a public education system that prepares knowledgeable and productive citizens. Accountability efforts such as the common core standards movement and the No Child Left Behind Act have further emphasized the importance of learning mastery of English, mathematics, and other core subject areas. Increasingly though, today's business and political leaders are expressing the need to address other core competencies necessary for our 21st century landscape. The skills of problem solving, critical thinking, communication, collaboration and the ability to adjust to emerging technologies have surfaced as

equally important as English and math skills (Darling-Hammond, 2006). A recent report by Pelligrino & Hilton (2012) highlights these new directions, identifying the need to focus on learning how to teach transferability of these broad skills in teacher education and professional development. "Some state and local high school reform efforts have begun to focus on a four-dimensional framework of college and career readiness that includes not only academic content, but also cognitive strategies, academic behaviors, and contextual skills and awareness" (p.16). Arguably, this approach represents a shift away from standardized testing as the sole tool to measure student and teacher success.

This enhancement of public education, which includes deeper learning and the development of transferable competencies, will require adaptations to current conceptions of what constitutes effective professional practice. This will result in reframing the purposes, structure, and organization of pre-service and professional learning opportunities (Darling-Hammond, 2006; Garrick & Rhodes, 2000; Lampert, 2010; Webster-Wright, 2009).

To accomplish this reframing of pre-service teacher education, this project reviewed current research on the subject of practice-based professional education. Scholars have recommended replacing current disjointed teacher learning opportunities with more integrated continuums of teacher preparation (Wilson, 2011; Windschitl, 2009). Teacher candidates also learn most effectively when their instructors model this collaboration and transferability. "Experiencing instruction designed to support transfer will help them [teacher candidates] to design and implement such instruction in their own classrooms" (Pelligrino & Hilton, 2012, p. 188).

Project Description

Research advocates the value of pre-service teachers observing university faculty members modeling technology in their courses to learn how technology can be effectively used to enhance instruction (O'Bannon & Judge, 2004; Schrum, Skeele, & Grant, 2003). This modeling may improve students' technology self-efficacy, technology proficiency, and their perceived usefulness of technology (Al-Ruz, & Khasawneh, 2011), as well as provide an opportunity to conceptualize how to include transferable skills in their classrooms.

Instructional Technology Grant

Prior to the Fall of 2011, the teacher preparation program at Dominican did not deliberately incorporate educational technologies across the coursework or fieldwork. Additionally, the multiple programs housed within the department did not effectively align student learning outcomes across programs or collaborate in a meaningful and consistent manner in regard to the integration of instructional technology. To address these deficits, two faculty members submitted a proposal for a university funded grant. The proposal requested the purchase of key technologies, training for these technologies, and integration of these technologies into the single subject credential classes as a pilot for the entire department. A full description of these purchases is listed in Appendix A. Anticipated learning outcomes included participants' hands-on experience with the technologies and an understanding of how to effectively model such tools in the classroom.

The grant also entailed faculty professional development for the two grant recipients to ensure effective instruction in the use of the new technology. The project pilot began at Dominican's main campus in Spring 2012 with the single subject program. By Spring 2013, the pilot began to expand to all other teaching credential programs offered at the university. The two

lead instructors of the project received training on the use of the products, trained fellow faculty members, modeled the products across the single subject curriculum, and attended CETPA (California Educational Technology Professionals Association), a K-20 educational technology association that provides leadership to the educational community.

Faculty Survey

To address the need for enhanced communication and collaboration, as well as the integration of instructional technologies in the department, the grant recipients developed a faculty technology survey. Modeling the use of one of the technologies obtained through the technology grant (CPS, or student response system), faculty (N=18) were asked a variety of questions regarding their perceived levels of competency and interest in learning new technological skills in the classroom (See Appendix B).

Applying a Likert scale, survey results indicated high percentages of very weak competencies in all but one of the categories (adequate competency in using software to create presentations). Additionally, faculty members indicated higher percentages in their desire to learn more about each of the categories. The project coordinators used these results to shape the timeline and trajectory of the technology project.

Three-Tiered Approach

The effective use of innovative technologies in higher education today requires an understanding of the significance of lifelong learning for both learners and organizations (King & Griggs, 2006). Knowing this, the project required a framework to not only begin the professional development of university faculty, but also to extend that new knowledge to teacher candidates and ultimately their students in the field. Project coordinators devised a three-tiered approach to integrating instructional technology through modeling transferability and the four

C's of 21st century learning (see Appendix C). The three-tiered approach supports the Technological Pedagogical Content Knowledge (TPACK) framework in that effective technology integration for teaching specific content requires understanding the relationship between technology, pedagogy and content (Mishra & Koehler, 2006). The three-tiered approach applied this relationship, stretching from our faculty, to required coursework, to the field.

The literacy process for credential candidates began in "Using Technology in the Classroom*",* one of the core courses, and continued across the remaining credential courses. Appendix D details the holistic and deliberate integration of the new technologies, leading to the culminating and transformative use of technology in the professional teaching website assignment. Through this course, students began to master the four C's by learning methods of how to teach and learn in the classroom. "It is the process of learning, not the content of learning that addresses the 4 C's" (Kolk, 2011, para. 1). For instance, students collaborated on course projects and were expected to creatively use innovative technologies, communicate their reflections on their experiences, and then problem solve, revise, and re-teach lesson plans. All of these steps and artifacts are documented and shared in their professional teaching website.

To begin, the literacy process (Tier One) began with professional development opportunities for the grant recipients. The two faculty members participated in webinars on the use of new technologies, attended the annual CETPA conference, and spent two semesters practicing with the new technologies independently. Subsequently, the grant recipients began to augment their own curriculum and instruction as a pilot for the entire department (Tier Two). This initial integration began in the "Using Technology in the Classroom" course and extended to the "Secondary Curriculum and Instruction" courses. After one year of this pilot, the two

faculty members began to conceive the transformation of the single subject credential program by aligning the use of instructional technologies with anchor assignments, student learning outcomes, and fieldwork expectations (Tier Three, and four C's). Twenty-first century learning skills are not about learning how to use technology or teaching with the tools, it is about the student creating and constructing with technology (Kolk, 2011), as our credential candidates do with the creation of their own professional teaching website.

As the pilot year of the project concluded, the two faculty members used the information gleaned from the faculty and student surveys to shape the progression of the project across all programs in the department. At this point, the literacy component began with faculty-led professional development retreats on creating websites, using student response systems, using iPads and interactive mobile white boards, and using applications for flipped classrooms and digital storytelling. Through this process faculty shared thoughts and worked together while linking learning across the disciplines. Faculty also collaborated with special education specialists to explore assistive learning applications in classrooms.

Upon learning literacy, faculty members then were encouraged to "check out" the new technology hardware to augment their own instruction. At this point, both teacher candidates and university faculty members were in the augmentation phase of the project. Faculty began to try new approaches with their instruction. They modeled the use of the technologies while teacher candidates implemented the same technologies in the field. As teachers move along the continuum, computer technology becomes more important in the classroom while simultaneously becoming invisibly woven into the demands of good teaching and learning. Both our three-tiered approach and the Substitution Augmentation Modification Redefinition Model (SAMR) share the second tier, or augmentation phase (SAMR, 2013). This phase can use

technology to accomplish traditional tasks, but the real learning gains are a result of engaging students in learning experiences that could not be accomplished without technology. While transformation and full engagement in all of the 4 C's are not yet achieved in all programs, all faculty members are working toward that goal in the 2014/15 academic year by modeling the single subject credential program's approach. Just as with the SAMR model, transformation involves the creation of new tasks deemed inconceivable in the past.

Technology Facilitator

Initially, the two grant recipients instigated and piloted the department-wide three-tiered process toward integrating and transforming the use of technology. It became evident that to be successful, a position needed to be created to organize and maintain the momentum initiated by the grant received. Thus, a three-unit Technology Facilitator position was created and supported by department administration.

The primary purpose of this position is to provide collaboration, consultation, and support for faculty and students across all programs. This includes faculty training, piloting and integrating new technologies into department coursework, tracking data on the use of new technologies, redesigning the curriculum to seamlessly incorporate new tools, and to support supervisors and student teachers in the use of new technologies in the field. In essence, the Technology Facilitator guides faculty and credential candidates through the technology project using the four C's of 21st century learning.

Results of the Pilot

Faculty began collecting data upon receiving the technology grant through pre- and post-surveys of the pilot group, 28 credential candidates. Credential students took a survey before beginning the "Using Technology in the Classroom" course and after completing the course.

The purpose of this survey was to measure beginning credential candidates' perceived levels of proficiency using instructional tools and their level of interest in learning more about using technology in the classroom. The results of this pilot group shaped the future direction of the project for all other credential programs in the school.

Appendix E, Table 1 displays the student skill level regarding general technology use. Prior to taking the "Using Technology in the Classroom" course, data indicated students were typically comfortable with basic internet and productivity tools (i.e. word processing, PowerPoint). The proficiency was lowest for skills using the interactive white boards and student response systems. Post-survey results show a significant increase in proficiencies, especially given that an *introduction* to technology literacy was the main goal in this first semester course. Additionally, credential candidates were surveyed regarding their interest in learning more about various instructional tools obtained through the technology grant. Table E2 charts the responses, indicating urgent to more urgent interest to learn more.

The project also piloted the use of the CPS (student response system) during credential candidates' student teaching in the field. Student teachers across content areas used the CPS as a formative assessment tool throughout their lessons. Both the credential candidates and their secondary students offered feedback after the lessons, signifying increased student engagement and achievement.

Implications and Conclusion

Transformation can be a difficult concept to make tangible, and in the case of instructional technology, it is ever-evolving. Our three-tiered approach to integrating and ultimately transforming our use of technology reflects that continuous cycle of literacy,

augmentation and transformation. Initial data results indicate a need and interest in the process as well. These factors have directed our future direction with the project.

The appointment of a Technology Facilitator position in the department has enabled faculty to collaborate as they move through the three tiers and provide needed training and oversight. It has also allowed faculty to investigate emergent technologies such as assistive technology for special education students and faculty, assessment software to accompany the interactive white boards and student response systems, BYOD (Bring Your Own Device) to interact with the assessment software, and targeted tablet applications for interactive and recordable whiteboards, photo stories, presentations, video lessons, flipped classrooms, and assistive learning. Considering faculty members come to the process with varying levels of comfort and competency, the facilitator differentiated the professional development for each faculty member. Arguably, without this kind of guidance and structure the department would not be able to intentionally secure successful and sustainable professional development in the growing world of instructional technology.

Transformation has also manifested itself in the field. The student teachers' lesson and unit planning has been altered to reflect that goal. Specifically, the student teachers are expected to select and adapt instructional tools to address students' varying learning styles and abilities, use instructional tools to engage students, and reflect upon the use of instructional tools.

While we will continue to evaluate and expand the Dominican technology project, the next phase is to establish a Technology Implementation Model with interested sister institutions. Development of this model includes identification of key stakeholders through the description of project coordinators, vision/goals/strategies specific to each institution, professional development plans as a result of a needs assessment/ inventory, and a plan for continual evaluation. Key

components of the model are a position description of the Technology Facilitator, faculty training, a required educational technology course, alignment of curriculum to emerging technologies and best practices, pre- and post-survey assessments, new technologies modeled in the classroom, and the integration of an instructional technology requirement in student teacher fieldwork.

This project started small, with two participating faculty members receiving an institutional grant to purchase key technologies and receive training. It has hence expanded into a departmental commitment to a cyclical three-tiered approach to implementing instructional technology and the appointment of a Technology Facilitator to oversee the project. Rooted in the 21st century learning goal of transferability, this project represents an effort toward sustainable change through a cultural shift in a teacher education program that historically did not embed technology in a meaningful way, and serves as a model for similar programs.

References

Al-Ruz, J. A., & Khasawneh, S. (2011). Jordanian pre-service teachers' and technology integration: A human resource development approach. *Educational Technology & Society, 14*(4), 77–87.

Chan, A., & Derry, T. (Eds.). (2013). Proceedings from Rethinking Success: *From the Liberal Arts to Careers in the 21st Century.* Wake Forest University, North Carolina.

Clemmons, K., & Hayn, J. (2009, March). *Why we can't live without our document cameras: Effective classroom strategies to integrate technology and interactive instruction.* Paper presented at the Society for Information Technology & Teacher Education (SITE) International Conference 2009, Charleston, SC.

Collier, S., Weinburgh, M. H., & Rivera, M. (2004). Infusing technology skills into a teacher education program: Change in students' knowledge about and use of technology. *Journal of Technology and Teacher Education, 12*(3), 447–468.

Darling-Hammond, L. (2006). Constructing 21st-century teacher education. *Journal of Teacher Education, 57*(3), 300-314.

Doceri. (2013). http://www.doceri.com

Driving student engagement and test scores with Insight 360. (2013). Retrieved from https://docs.google.com/a/dominican.edu/file/d/0B9hraOiOBQoGcXZzR2lidFZEbjA/edit

Edutopia. (2011). Why integrate technology into the curriculum?: The reasons are many. Retrieved from http://www.edutopia.org/technology-integration-introduction

Garrick, J., & Rhodes, C. (2000). *Research and knowledge at work: Perspectives, case studies, and innovative strategies.* London, England: Routledge.

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

Keengwe, J., Schnellert, G., Mills, C. (2012). Laptop initiative: Impact on instructional technology integration and student learning. *Education and Information Technologies, 17*(2), 137-146.

King, K., & Griggs, K. (Eds.) (2006). *Harnessing innovative technology in higher education: Access, Equity, Policy, and Instruction*. Madison, WI: Atwood.

Kolk, M. (2011). The 21st century classroom – where the 3 R's meet the 4 C's! Retrieved from http://web.tech4learning.com/blog-0/bid/45149/The-21st-century-classroom-where-the-3-R-s-meet-the-4-C-s

Kvavik, R. B., & Caruso, J. B. (2005). ECAR study of students and information technology, 2005: convenience, connection, control, and learning. EDUCAUSE Center for Applied Research (ECAR) Volume 6**.** Retrieved from https://net.educause.edu/ir/library/pdf/ers0506/rs/ers0506w.pdf.

Lampert, M. (2010). Learning teaching in, form, and for practice: What do we mean? *Journal of Teacher Education, 61*(1-2), 21-34.

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

Northeast Mississippi Technology Pilot Program. (2013). Retrieved from http://www.einstruction.com/research-and-funding/case-studies.

O'Bannon, B., & Judge, S. (2004). Impacting partnership across the curriculum with technology. *Journal of Research on Technology in Education, 37*(2), 198–211.

Pelligrino, J., & Hilton, M. (2012). *Education for life and work: Developing transferable knowledge and skills in the 21st century.* Washington, D.C.: National Academies Press.

Pope, M., Hare, D., & Howard, E. (2002). Enhancing technology use in student teaching: A case study. *Journal of Technology and Teacher Education, 13*(4), 573–618.

SAMR Model. (2013). Retrieved from http://www.hippasus.com/.

Schrum, L., Skeele, R., & Grant, M. (2003). One college of education's effort to infuse technology: A systematic approach to revisioning teaching and learning. *Journal of Research on Technology in Education, 35*(2), 226–271.

Webster-Wright, A. (2009). Reframing professional development through understanding authentic professional learning. *Review of Educational Research*, *79*(2), 702-739.

Wilson, E. (2003). Pre-service secondary social studies teachers and technology integration: What do they think and do in their field experiences? *Journal of Computing in Teacher Education, 20*(1), 29–39.

Wilson, S. (2011, May). *Effective STEM teacher preparation, induction, and professional development.* Paper presented at the NRC Workshop on Highly Successful STEM Schools or Programs. Retrieved from http://www7.nationalacademies.org/bose/Successful_STEM_Schools_Homepage.html

Windschitl, M. (2009, February). *Cultivating 21st century skills in science learners: How systems of teacher preparation and professional development will have to evolve.* Paper commissioned for the NRC Workshop on Exploring the Intersection between Science Education and the Development of 21st Century Skills, Washington, D.C. Retrieved from http://www7.nationalacademies.org/bose/WindschitlPresentation.pdf [June 2011].

World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education (E-LEARN). (2011). Retrieved June 11, 2013, from http://editlib.org/p/39076.

World Conference on Educational Multimedia, Hypermedia and Telecommunications (EdMedia). (2012). Retrieved June 12, 2013, from http://editlib.org/p/40913.

Appendix A

Grant Expenditures

The project included exposing credential candidates to educational technologies currently in use in K-12 and higher education settings. The grant enabled faculty to purchase the following:

1. Mobi-Views - Provides the function of a fixed interactive white board at a fraction of the cost of such an item. Instructors have complete freedom to move around the classroom without having to return to their computer during the lesson.

2. CPS Pulses (Student Response Systems) - Used to fully engage all students and assess learning. Facilitate greater student-teacher interaction in a dynamic learning environment that encourages class discussion and participation.

3. Elmo Document Cameras - A document camera is a tool to help teachers create visually interactive lessons to engage many types of students in learning, i.e. students with spatial and kinesthetic learning styles, English Language Learners, students in Exceptional Education programs, and struggling readers (Clemmons and Hayn, 2009).

4. Five iPads - The Apple iPad has been one of the most quickly adopted digital technologies in recent history. More than 1.5 million iPads are used specifically for education and more than 20,000 educational applications have been created (EdMedia, 2012). The learning impact of the iPad for students with special needs has been gaining great attention in education. Reports have testified how these students can benefit from the integration of the iPad into their learning (E-LEARN, 2011).

5. Doceri - A professional iPad interactive whiteboard and screencast recorder with sophisticated tools for hand-drawn graphics and built-in remote desktop control. The instructor

can create lessons, presentations and graphics and share them as still images, PDFs or audio/video screencasts (Doceri, 2013).

Appendix B

Faculty Technology Survey[1]

Table B1: Competency Levels

1 Very weak
2 Moderately weak
3 Adequate
4 Moderately strong
5 Very strong

Topic	Competency
Creating a classroom website	1 2 3 4 5 *41% 12% 29% 6% 12%*
Using software to create presentations (Prezi, PowerPoint, Keynote)	1 2 3 4 5 *6% 6% 41% 35% 12%*
Using interactive white boards for mobility in the classroom (Mobi, Doceri, ShowMe, Explain Everything)	1 2 3 4 5 *53% 29% 12% 0% 6%*
Using interactive white boards to promote student engagement (Mobi, Doceri, ShowMe, NearPod, Explain Everything)	1 2 3 4 5 *59% 24% 12% 0% 6%*
Using applications for video lessons/online/flipped classes (EduCreations, ShowMe, Doceri)	1 2 3 4 5 *53% 24% 18% 6% 0%*
Using applications for digital storytelling (Photo Story, Haiku Deck, Sonic Pics)	1 2 3 4 5 *65% 18% 0% 12% 6%*
Using Student Response Systems to enhance student engagement (CPS, Socrative, Insight 360)	1 2 3 4 5 *65% 12% 12% 12% 0%*
Using Student Response Systems as an assessment tool (CPS, Socrative, Insight 360)	1 2 3 4 5 *59% 12% 29% 0% 0%*
Using Assistive Learning Applications in the Classroom	1 2 3 4 5 *59% 35% 6% 0% 0%*

[1] Because the statistical software used, e-Instruction CPS v3.5, rounds up, some rows add up to 101%.

Table B2: Interest in Learning

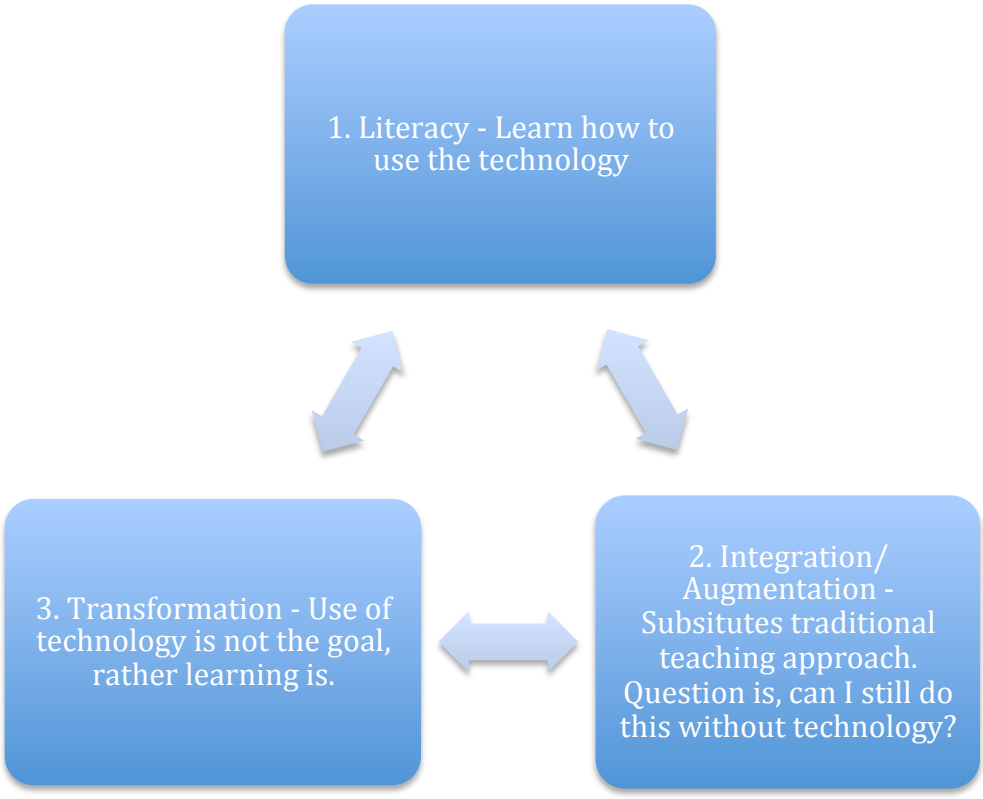
1 Not interested
2 Less interested
3 Adequately interested
4 Moderately interested
5 Strongly interested

Topic	Interest
Creating a classroom website	1 2 3 4 5 *12% 24% 6% 12% 47%*
Using software to create presentations (Prezi, PowerPoint, Keynote)	1 2 3 4 5 *12% 18% 29% 0% 41%*
Using interactive white boards for mobility in the classroom (Mobi, Doceri, ShowMe, Explain Everything)	1 2 3 4 5 *18% 12% 24% 18% 29%*
Using interactive white boards to promote student engagement (Mobi, Doceri, ShowMe, NearPod, Explain Everything)	1 2 3 4 5 *12% 18% 18% 18% 35%*
Using applications for video lessons/ online/flipped classes (EduCreations, ShowMe, Doceri…)	1 2 3 4 5 *0% 6% 18% 24% 53%*
Using applications for digital storytelling (Photo Story, Haiku Deck, Sonic Pics)	1 2 3 4 5 *12% 12% 41% 0% 35%*
Using Student Response Systems to enhance student engagement (CPS, Socrative, Insight 360)	1 2 3 4 5 *6% 6% 24% 12% 53%*
Using Student Response Systems as an assessment tool (CPS, Socrative, Insight 360)	1 2 3 4 5 *0% 12 18% 12% 59%*
Using Assistive Learning Applications in the Classroom	1 2 3 4 5 *6% 24% 12% 12% 47%*

Appendix C

Three-Tiered Approach

Table C1: Three Tiers of Instructional Technology Integration

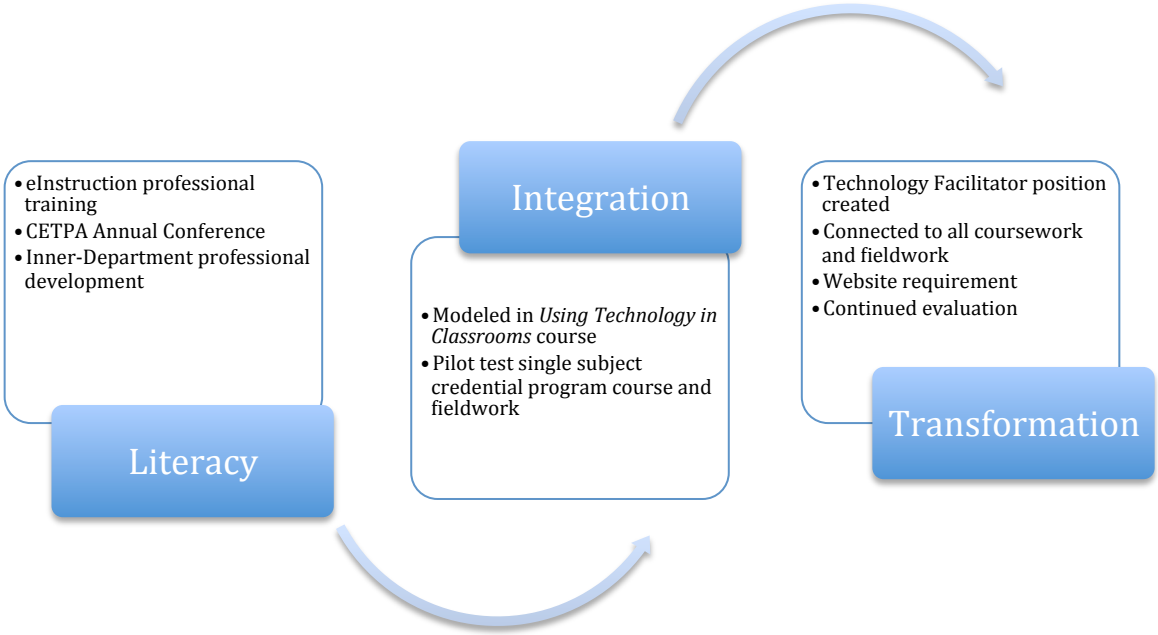


This is a cyclical process as new, emergent technologies are constantly on the horizon. To accomplish the three tiers, one must transfer and leverage the four C's of 21st century learning (Communication, Collaboration, Critical Thinking, and Creativity).

Appendix D

Literacy to Transformation in Course and Fieldwork

Table D1: Roadmap to Level Three



Appendix E

Student Survey Results

Table E1: Student Skill Levels – Instructional Technology

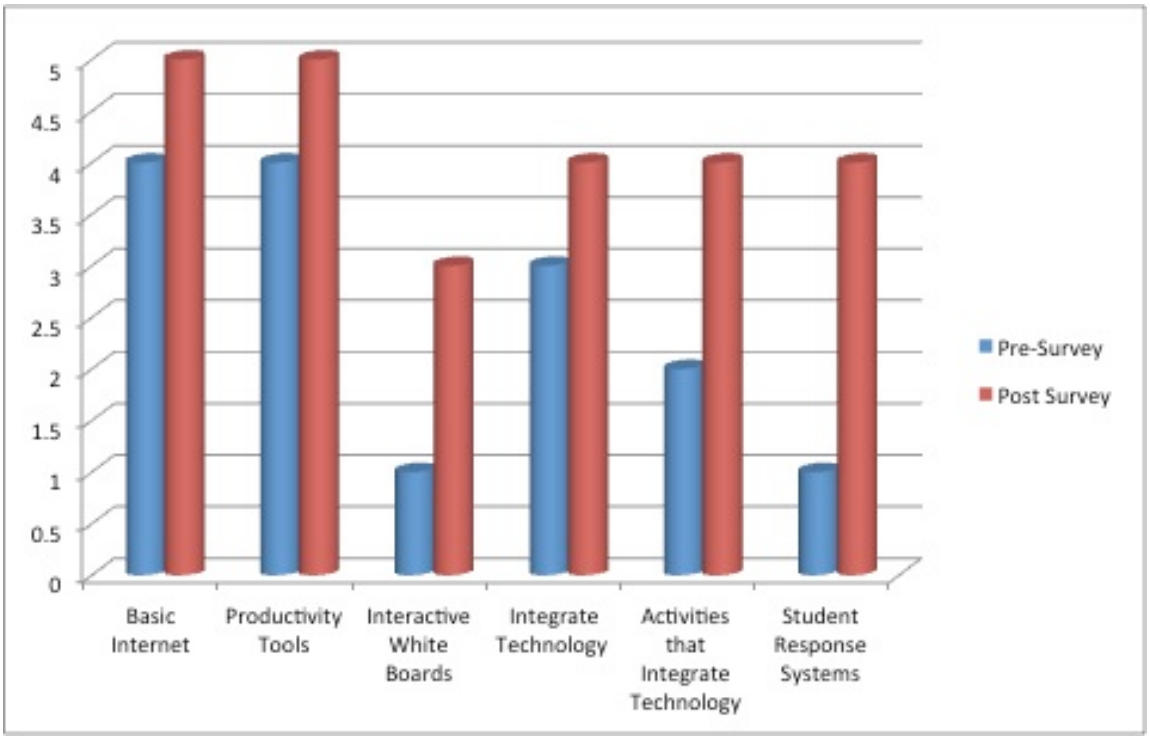


Table E1 displays the student skill level regarding general technology use. Proficiency was measured using a Likert scale with 1 very weak to 5 very strong

Table E2: Interest in Learning More

Table E2 measures the level to which credential candidates were interested in learning more about various instructional tools. Responses were measured by Likert scale of 1 (Less Urgent) to 5 (More Urgent).

Elizabeth Truesdell, Ph.D., is an Assistant Professor of Education at Dominican University of California in San Rafael, California, where she coordinates the Single Subject Credential and the Master's in Education programs. Her professional interests include effective professional development for new and continuing teachers, and the implementation of 21st century skills in teacher education programs.

Dr. Rebecca Birch has a diverse educational background as an instructor, facilitator and administrator. Educational technology has always been a passion and for the last 16 years she has been actively involved in the field. She currently is the Technology Facilitator and Instructional Technology Adjunct Professor for the School of Education at Dominican University in San Rafael, California.