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Teacher Educator Technology Integration Initiative: Addressing the Technology Preparation Gap

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This article documents how our college sought to address a technology integration preparation gap, with the implementation of the Teacher Educator Technology Integration initiative. We draw upon findings from an external program review that was commissioned to evaluate the initiative, including the type of support provided to teacher educators and how their participation in the initiative changed their technology integration practices based on the TETCs. This article outlines how our college came to identify the need for the Initiative, describes the frameworks and structures of the Initiative's pilot year with four discipline area licensure programs, and details adjustments made to continuously improve the professional development experiences designed during the pilot. In our findings section, we describe three components of the Initiative that were responsible for teacher educators' successful learning: (1) developing trusting relationships through coaching; (2) the use of situated learning that incorporated key strategies that were found to be effective in the literature; and (3) technology integration professional development focused on developing mindsets and skillsets. In addition to these three components, we determined that it was critical for college leadership to build a scale up timeline and a sustainability plan alongside the professional development work to ensure the Initiative's success.

INTRODUCTION

K-12 educators are ramping up technology use in their classrooms, including developing 21st century skills in students (Delgado, Wardlow, McKnight, & O'Malley, 2015; Varier, Dumke, Abrams, Conklin, Barnes, & Hoover, 2017), expanding the boundaries of schools beyond physical structure through online/hybrid/blended learning (Delgado et al., 2015) and designing learner-centered learning experiences (Varier et al., 2017). With increased technology integration expectations, we need to consider how we prepare teacher candidates (hereon known as TCs) with the technology integration knowledge and skills they need as they participate in their licensure program work. Research has shown that a critical factor influencing new teachers' adoption and integration of technology in their teaching and learning practices is the quantity and quality of pre-service technology experiences included in their preparation programs (Agyei & Voogt, 2011). A 2006 study of programs at 4-year degree granting institutions showed that all programs reported instructing TCs how to integrate technology into practice (Kleiner, Thomas, & Lewis, 2007). Yet, it is clear that teacher licensure programs have developed a variety of ways to prepare future teachers to use and integrate technology.

The College of Education and Human Development at the University of Minnesota (hereafter known as CEHD) follows a common approach found at other institutions over the last ten years: TCs are required to complete a technology integration course to fulfill graduation requirements. Currently, this is a stand-alone course taught by staff within our learning technology program area. Despite dedicated coursework for technology integration, only 56% of CEHD TCs "agree" or "strongly agree' that their preparation program prepared them to use technology effectively to enhance student achievement in their future classroom (Project Tomorrow, 2017, see https://tomorrow.org/speakup/speakup_data_findings.html). Further, course instructors received feedback from cooperating PK-12 school personnel indicating that our candidates needed enhanced instruction within their preparation programs, focused on how to teach in 1:1 classrooms and enrich curriculum via the affordances offered through technology (K.Randell, M. Eberhart, M. Odima, personal communications, June 26, 2017, July 6, 2017, & July 7, 2017, respectively). Overall, these survey and interview results are linked to a core problem identified by Foulger, Buss, Wetzel and Lindsey (2012): Stand-alone classes in technology within teacher preparation programs often do not result in integration in content or discipline area coursework, and thus in candidates' teaching and learning practices.

In the Fall of 2016, CEHD sought to address this technology integration "preparation gap" within our teacher education initial licensure program. We were influenced by the findings of researchers, including Kay (2006), who noted that the way to prepare candidates to effectively teach using technology integration is to focus on first preparing teacher educators to feel competent in integrating technology into their practice. To that end, a committee of faculty—drawn from around the college and with expertise in teacher preparation, technology integration in formal and informal PK-12 learning environments, and academic technology—was charged with investigating technology integration in teacher educator preparation and sharing what they learned with leadership in the college. As a part of their research, these colleagues reviewed state and national standards around technology integration (e.g., International Society of Technology in Education [ISTE], 2019; Council for the Accreditation of Educator Preparation [CAEP], 2019; and Interstate Teacher Assessment and Support Consortium [InTASC], 2011), interviewed teachers and principals, reviewed models of teacher preparation programs at other institutions, compiled TC survey data, and surveyed teacher educators (e.g., licensure area program leads—LPLs) about their technology use and needs during discipline-specific methods coursework. In the Spring of 2017, a formal task force of teacher educators from several discipline areas across the college was charged with taking the work of the committee that compiled this background information, and moving forward on specific ideas by developing an action plan. Task force colleagues met with college leadership to discuss the report findings, visited schools with strong 1:1 programs, worked with technology experts from outside the university, and participated in a year-long pilot initiative focused on technology integration teaching and learning for teacher educators. In the remainder of this article, we describe the components of this pilot effort, how the initiative was enacted, and results from the pilot year. We also share challenges and ideas we gleaned for sustainability.

The Teacher Educator Technology Integration Initiative

The Teacher Educator Technology Integration initiative (hereafter known as the Initiative) was collaboratively designed by and for teacher educators. The overall goal of this initiative is to provide all teacher educators, instructors, and supervisors in our preparation program with a year-long professional development experience and follow-up sessions. The senior associate dean for the college, who provides shared leadership for the Ini-

tiative, describes it as developing key teaching and learning practices with our teacher educators, such as: "modeling mindful, innovative, flexible uses of meaningful technology integration…. [Our teacher educators] believe in helping TCs develop student-centered and adaptive pedagogies." Overall, the initiative experience focuses on creating a common knowledge base and language for teacher education faculty and staff around technology integration, as well as providing situated, discipline area specific professional development and coaching for these university colleagues. In the following section of this article we describe several frameworks, sets of principles and typologies, and professional development design components that undergird the Initiative.

Developing A Common Knowledge Base and Language

Research has shown that how a person defines technology, influences their use of technology (Ertmer, 1999). With this understanding, several literature-based frameworks were introduced to Initiative participants to enable them to develop a common understanding of: (a) what technology integration is, and (b) why educators would want to integrate technology into their practice.

First, the Department of Education's (DoE's) Office of Educational Technology invited schools of education willing to make a public commitment to four principles (Educational Technology in Teacher Preparation Challenge, 2016, see https://tech.ed.gov/edtechtprep/), to attend an Innovators' Summit and Briefing in December 2016. We attended this meeting, signed the pledge, and embraced the following principles as guideposts for our future work:

1. Focus on the active use of technology to enable learning and teaching through creation, production, and problem solving.
2. Build sustainable, program-wide systems of professional learning for higher education instructors to strengthen and continually refresh their capacity to use technological tools to enable transformative learning and teaching.
3. Ensure pre-service teachers' experiences with educational technology are program-deep and program-wide rather than one-off courses separate from their methods courses.
4. Align efforts with research-based standards, frameworks, and credentials recognized across the field.

In addition to using the DoE's principles, we drew upon the PIC-RAT Matrix (Kimmons, 2016) to undergird our work. This framework, adapted from the RAT technology integration research conducted by Hughes, Thomas, and Scharber (2006), helped us explain how to meaningfully think about integrating technology into the classroom. This is because the PIC-RAT Matrix takes into consideration how teachers use technology compared to traditional practices, and how students use the technology to support their learning. The framework provides structure around technology integration discussions by asking two questions: 1) What is the student's relationship to technology? And 2) How is the teacher's use of technology influencing traditional practice? These two questions are mapped on a two-dimensional grid with question 1 mapped along the Y-axis with three possible responses (passive, interactive, and creative) and question 2 mapped along the X-axis with three possible responses (replaces, amplifies, transforms). Figure 1 provides an illustration of the PIC-RAT framework. The purpose of the matrix is not to help educators identify which practice is best. Instead, educators are challenged to make sure they are differentiating how they are integrating technology into the classroom.

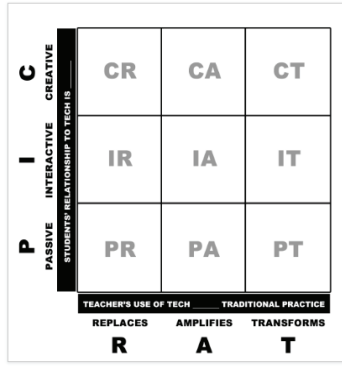

Figure 1. PIC-RAT Framework. This image is licensed under a CC BY 3.0 license by Dr. Royce Kimmons.

A third source we used in our Initiative design process was the Visitor-Resident typology (White & Cornu, 2011). This conceptual framework is a way to think about online engagement, specifically how people move between being a "visitor" or "resident" of online spaces, and which people engage differently based on the purpose of the interaction (e.g., personal or professional use). Although White and Cornu (2011) used this concept for

online engagement, we applied this typology when thinking about technology integration. Specifically, the ideas were helpful in explaining to teacher educators why their TCs—who were constantly using technology—found it difficult to apply their personal use "resident technology using status" when switching to tasks requiring professional use. This typology also helped us explain to instructors the nature of their role: Teacher educators are pedagogues who can help candidates shift their technology practices from personal to professional uses in seamless ways.

Situated Professional Development and Coaching

With an influx of technology integration expectations, professional development efforts are being implemented to help PK-12 teachers integrate technology for teaching and learning. We drew upon these ideas for our work with teacher educators at the university level. We also used ideas we gleaned from conversations with PK-12 colleagues as we designed teacher educator learning sessions. For example, one way that technology integration can be taken up by educators is through situated professional development (Kopcha, 2012). Bradshaw (2002) found that, "the link between staff development and implementation is not automatic. Workshops and conferences, by themselves, do little to ensure that technology will be used in our schools and classrooms in ways that improve student learning" (p. 132). Because situated professional development "focuses on particular technology needs that teachers would like to learn and integrate into their classroom as opposed to dictating particular technology competencies that a teacher must exhibit and possess," (Sugar, 2005, p. 550) it can be a pragmatic way to link development and implementation.

An important aspect of the situated professional development model is the use of an instructional technology coach. Our initial research confirmed this, indicating that the professional development and ongoing coaching required for teacher educators across a school year required that we create a new position and hire an instructional technology coach, referred to as the *Initiative Coordinator*. The need for this specialized position became clear after our PK-12 school visits to technology-rich sites and our review of the literature on successful technology integration efforts. Coaching has been taken up as an effective form of professional development (Sugar, 2005; Huston & Weaver, 2008; Kopcha, 2012; Devine, Meyers, & Houssemand, 2013; Desimone & Pak, 2017; Gibbons & Cobb, 2017). The coaching literature draws on, and incorporates research on effective professional devel-

opment practices for educators. While most educational coaching literature focuses on content or discipline area instructional coaching, we used ideas from this research to support instructional technology coaching. Essentially, we position the use of technology for teaching and learning as being similar to coaching someone in a specific content or discipline by focusing on process and skills and not just on the technology tools. Yet, we seek to accomplish this by always considering how teaching and learning is unique within each discipline area. In addition, because teacher educators in specific discipline areas were working together with a teacher educator instructional technology coach within the Initiative, we found that a co-constructed coaching model worked best. By this we mean a model where the coach and those being coached each bring specific knowledge and skills to the table, equalizing the power balance and allowing all to learn and support each other within interactions. During the pilot of the Initiative, we wanted to examine how the Initiative Coordinator would work with and coach teacher educators from four different discipline areas (Arts in Education, Elementary Education, Science Education, and Special Education), and how these interactions would impact individuals as they were introduced to new technology integration ideas.

The Initiative Pilot

Our institution has 13 program areas in teacher education. While the overall goal was to have all TCs graduate with teaching and learning experiences grounded on technology integration, starting a major initiative with all program areas would have been difficult from an administrative and programmatic perspective. Instead, we decided to conduct a pilot of the Initiative with a subset of four initial licensure program areas: Arts in Education, one cohort (out of 4) of the Elementary Education program, Secondary Science, and Special Education. A total of 27 teacher educators participated across these program areas and these educators impacted the learning of approximately 100 teacher education candidates. To support each teacher educator, individuals were given a stipend as well as funding for technology requests based on their disciplinary needs. Funds were provided by an Archibald Bush Foundation grant and discretionary funds and resources from our dean. For more information about the participants, please refer to Table 1.

Table 1
Initiative Participants by Licensure Program Area (N=27)

Licensure Area	Number of Participants	Number Who Taught a Methods Course	Number who were Clinical Supervisors
Arts in Education	8	4	4
Elementary Education	10	6	4
Secondary Science Education	6	3	3
Special Education	4	2	2

Note. The total number of participants in the second column equals 28 because one of the 27 participants is a teacher educator in both the Elementary Education and Secondary Science Education licensure program.

Summer Learning Experience

The Initiative pilot began in the Summer of 2017 with the *Summer Learning Experience*. This workshop brought together license area program leads from the four programs (Arts in Education, Elementary Education, Secondary Science, and Special Education), university methods course instructors, and clinical supervisors who worked with candidates in PK-12 school settings during practica and student teaching. The *Summer Learning Experience* was developed by the instructional designers in the college and the Initiative Coordinator. To design the workshop, the planning team reviewed the data used as the rationale for the Initiative, as well as reports and scholarship about technology integration principles and standards described earlier in this article. This team also reviewed technology integration workshop topics at statewide teaching and learning conferences for PK-12 audiences and conducted interviews with seven individuals working in PK-12 schools, with roles ranging from a high school principal to a 5th grade classroom teacher, to the director of teaching and learning in one of the state's largest school districts. The planning team also reviewed technology integration plans from several local districts and thought about how these plans—constructed for classroom teachers working with PK-12 students—could inform professional development designed for teacher educators working with TCs. Finally, the planning team drew upon the knowledge, skills, and attitudes related to technology that all teacher educators need—as identified in a seminal piece published by the *Journal of Technology and*

Teacher Education (Foulger, Graziano, Schmidt-Crawford & Slykhuis, 2017). Specifically, the "Teacher Educator Technology Competencies" and related criteria within that article were used to inform the topics addressed, conversations, and activities within the summer and subsequent year-long professional development sessions.

Initiative professional development workshops addressed the following:

- Exploring technology integration strategies using a set of national principles and a common framework.
- Engaging with licensure program area peers on technology integration.
- Developing instructional plans that include modeling instructional use of technology by the teacher educator to foster the development of discipline-specific, technology-integrated lesson plan(s) by TCs.
- Constructing new insights into what and how technologies are being used in K-12 classrooms in Minnesota to enable our initial licensure programs to be responsive to the needs of our PK-12 partners as we prepare candidates they hire.

Before the summer sessions formally began, participants were given access to a support site on the university's learning management system. Teacher educators were enrolled as students, where they had access to resources to help develop a common understanding of the Initiative philosophies and frameworks, as well as the workshop agenda. The Initiative Coordinator and workshop team began with the US Department of Education Educational Technology in Teacher Preparation Challenge Four Guiding Principles, described and listed in an earlier section of this article, as a framework for common understanding among the four discipline areas.

The *Summer Learning Experience* took place over three 6-hour days. The first day was focused on developing a common understanding of the issues related to preparing future teachers to teach in technology-rich environments. During the second day, participants learned about real-life examples of technology integration and instances of PK-12 educators who were using technology integration in their field. On the third day, participants had the opportunity to develop a technology integration goal and begin planning towards this goal as an individual or team. The session topics that guided our work during the *Summer Learning Experience* are summarized in Table 2.

Table 2
Description of Initiative pilot year Summer Learning Experience activities

Activity	Description
Invited Speaker	A principal at a local high school with a robust technology integration initiative spoke to the initiative group about the efforts of teachers and leaders in the high school to transform curricula.
Technology Integration Framework	The guiding technology framework, PIC-RAT (Kimmons, 2016), was introduced to teacher educators to create a common understanding and vocabulary for colleagues to use throughout the project.
App Evaluation and Exploration	The "App Evaluation Checklist," was developed to evaluate apps to use in the classroom. The checklist was designed to guide teacher educators in asking key questions including: Does the app (a) align with learning goals? (b) provide a new way for candidates to demonstrate understanding? (c) allow ease of use? (d) include the use of help resources?
Invited Panel	A panel of classroom teachers in districts with 1:1 initiatives shared stories of their journey with technology integration and provided advice regarding implementation strategies.
Planning with Licensure Area Teacher Educators	Time was provided for teacher educators to meet, reflect, and discuss what they had learned from the Summer Learning Experience and how it might impact their courses and activities in the coming year.
Reflection	Time was provided for individual reflection each day during the Summer Learning Experience
Goal Setting	Teacher educators were asked to connect what they had learned in the workshop with specific ways they planned to conceptualize their discipline-specific methods courses using technology integration ideas.

Continuing Professional Development During the Pilot Year

Professional development continued beyond the summer workshop and into the academic school year. The exact nature of Fall 2017 and Spring 2018 semester sessions was shaped by the needs of teacher educators, as determined during and after the *Summer Learning Experience*. Specifically, after spending three days with the participants, listening to their questions and their team planning conversations, and reading their reflections, the Initiative Coordinator developed the next phase of professional development (PD) called: *Learning Experiences* and *Brown Bag Sessions*. These informal PD forums became the primary method for group learning across the discipline areas during the school year. In addition, discipline-specific groups of teacher educators met with the Initiative Coordinator and she helped them plan their technology integration strategies and activities in more focused and personal ways. Individual meetings and coaching sessions were also

held with individual teacher educators. Table 3 provides more description for the multi-focused *Learning Experiences* and *Brown Bag PD Sessions*.

Table 3
Description of Learning Experiences and Brown Bags

	Length	Session Topics
Learning Experiences	Two and a half hour sessions offered twice each semester	Session 1: Articulating a Tech-Integration Teaching Philosophy Session 2: Provide Multiple Means of Engagement (the "why" of learning) Session 3: Providing Multiple Means of Action and Express (the "how" of learning) Session 4: Reflection on Technology Integration (the "what" of learning)
Brown Bags	Hour-long sessions offered twice in the fall semester and three times in the spring.	Brown Bag 1: AirServer Brown Bag 2: Google Slides App and Creating Multiple Access Points with QR codes or Short URLs Brown Bag 3: Designing a HyperDoc Activity Brown Bag 4: Padlet and Spark Pages Brown Bag 5: Tips and Tricks for Google Apps and the LMS

Individual and program area coaching. Coaching is a key component to the Initiative and was offered to all teacher educators within the pilot initiative. The Initiative Coordinator was available to meet with program areas as a group, or she met with small groups or with individuals. One required component of the Initiative was that each teacher educator was asked to commit to meeting with the Initiative Coordinator individually at least three times. We did not prescribe how teacher educators might use the coaching that was offered. Instead, the Initiative Coordinator and the licensure program leads worked together to decide how to structure the coaching with discipline area colleagues. Coaching sessions were intentionally flexible in order to meet the varying needs of the pilot program participants. For example, colleagues within one discipline area asked the Initiative Coordinator to meet with their team regularly every two weeks, while other groups initiated meetings as needs arose.

Co-Teaching and modeling. As an outgrowth of the coaching offered, some teacher educators chose to co-teach newly designed technology integration lessons with the Initiative Coordinator. Other teacher educators chose to have the Initiative Coordinator come into their methods classes and

model technology integration lessons and activities for TCs. The exact way that co-teaching was taken up was determined through conversations and consultation with each of the teacher educators, and was based on individual preferences and needs.

The Initiative Pilot Program Evaluation

The senior associate dean of the college hired researchers from the Center for Applied Research and Educational Improvement (CAREI) to conduct an independent evaluation of the pilot of the Initiative. This study utilized an evaluation case study approach to describe and analyze the Initiative. Yin (2014) defined case study research as "an empirical inquiry that investigates a contemporary phenomenon (the 'case') in-depth and within its real-world context, especially when the boundaries between phenomenon and context may not be clearly evident" (p. 16), and where multiple sources of evidence are used for in-depth data collection. Data analysis focused on individual teacher educators and disciplinary teams of teacher educators as the units of analysis. Embedded case studies involved units of analysis at more than one level (Yin, 2014).

The purpose of the evaluation was threefold: 1) to document the major activities that occurred in the pilot, 2) to measure changes in teacher educators' capacity to integrate technology into their methods courses, and 3) to identify the strengths of the pilot's implementation, as well as opportunities for improvement (Ingram, 2018). To measure the change in teacher educators' capacity to integrate technology into their methods courses CAREI developed an online retrospective pre-/post-survey, based on 7 of the 12 TETCs articulated by Foulger et al. (2017). The survey included side-by-side multiple-choice questions for each competency. Each criterion for the seven competencies was identified with the following options: not developed, underdeveloped, competent, very strong, outstanding.

Five of the areas on the survey were omitted because they were not specifically addressed during initial Initiative planning sessions. TETC's *not* measured were:

- Teacher educators will use effective strategies for teaching online and/or blended/hybrid learning environments (TETC #7).
- Teacher educators will use technology to connect globally with a variety of regions and cultures (TETC #8).
- Teacher educators will address the legal, ethical, and socially responsible use of technology in education (TETC #9).

- Teacher educators will engage in ongoing professional development and networking activities to improve the integration of technology in teaching (TETC #10).
- Teacher educators will engage in leadership and advocacy for using technology (TETC #11).

Addressing all 12 competencies in the pilot program would have been overwhelming content and training for teacher educators with varying levels of technology competencies to begin with. Explicit focus on competencies that integrated pedagogy and content with technology created a low-risk entry point for many teacher educators and allowed the Initiative Coordinator and instructional design team to build common background knowledge with teacher educators before challenging them to stretch their comfort level with technology integration. The summer sessions grounded teacher educators in the common frameworks and language that were used in the Initiative to discuss technology integration. The year-long sessions built on the common background knowledge constructed during the summer sessions.

Evaluation results suggest that the Initiative was highly effective in supporting participating teacher educators "to take up and model innovative pedagogy and lesson planning using motivating and meaningful technologies" (Ingram, 2018, p. 6). Specifically, the survey results, based on a completion rate of 56%, indicated that the teacher educators' competence increased in each of the areas measured by the survey. Surveys were completed voluntarily and done after the end of the school year. Some teacher educators were no longer under contract (e.g., adjunct faculty), and some teacher educators were graduate students and completion of the survey competed with wrapping up coursework and summer plans. In addition, some teacher educators were not on campus full-time and did not have access to their university-sponsored emails after the end of the school year. That said, even with only 56% completion rate, the survey did include at least one person from each program area, and a mix of teacher educators who held roles as licensure program leads, instructors, and/or supervisors. In summary, we believe that caution should be taken when generalizing these results beyond the Initiative teacher educators who completed the survey and interview.

What follows in Table 4 are pre- and post-survey data results that show growth in teacher educator's perspectives related to their technology integration competencies.

Table 4
Change in Teacher Educators' Level of Competence (N=11) Based on TETCs

Teacher Educator Technology Competencies	Before Initiative % (Competent, Very Strong, or Outstanding)	Current % (Competent, Very Strong, or Outstanding)
TETC 1. Teacher educators will design instruction that utilizes content-specific technologies to enhance teaching and learning:		
a) Evaluate content-specific technology for teaching and learning	27%	80%
b) Align content with pedagogical approaches and appropriate technology	27%	90%
c) Model approaches for aligning the content being taught with the appropriate pedagogy and content	36%	70%
TETC 2. Teacher educators will incorporate pedagogical approaches that prepare TCs to effectively use technology:		
a) Model using technology for *accessing* information	54%	70%
b) Model using technology for *analyzing* information	18%	70%
c) Model using technology for *creating* information	36%	80%
d) Model using technology for *evaluating* information	45%	60%
e) Assist TCs with evaluating the affordances of content-specific technologies to support student learning	27%	70%
f) Assist TCs with the selection of content-specific technologies to support student learning	27%	90%
g) Assist TCs with the use of content specific technologies to support student learning	36%	70%
h) Facilitate opportunities for TCs to practice teaching with technology	27%	80%
TETC 3. Teacher educators will support the development of the knowledge, skills, and attitudes of TCs as related to teaching technology in their content area:		
a) Support TCs' alignment of content with pedagogy and appropriate technology	18%	70%

Teacher Educator Technology Competencies		Before Initiative % (Competent, Very Strong, or Outstanding)	Current % (Competent, Very Strong, or Outstanding)
b)	Provide opportunities for TCs to reflect about their attitudes about using technology *for teaching*	18%	70%
c)	Provide opportunities for TCs to reflect about their attitudes about using technology *for their own learning*	18%	70%
d)	Provide opportunities to develop TCs' efficacy about using technology in their teaching	18%	87%
TETC 4. Teacher educators will use online tools to enhance teaching and learning:			
a)	Enhance teaching and learning in my course by *communicating* using online tools	45%	90%
b)	Enhance teaching and learning in my course by *collaborating* using online tools	36%	70%
c)	Design instruction using online tools	36%	80%
TETC 5. Teacher educators will use technology to differentiate instruction to meet diverse learning needs:			
a)	Design instruction that integrates technology to meet the needs of diverse learners	27%	80%
b)	Demonstrate using assistive technologies to maximize learning for individual student needs	9%	30%
c)	Model integrating technology to differentiate instruction	9%	70%
d)	Provide opportunities for TCs to create learning activities that integrate technology to differentiate instruction	27%	60%
TETC 6. Teacher educators will use appropriate technology tools for assessment:			
a)	Integrate technology to assess TCs' competence and knowledge	36%	90%
b)	Model a variety of assessment practices that integrate technology	36%	70%
c)	Provide opportunities for TCs to integrate appropriate technology for assessment	18%	90%

Teacher Educator Technology Competencies		Before Initiative % (Competent, Very Strong, or Outstanding)	Current % (Competent, Very Strong, or Outstanding)
TETC 12. Teacher educators will apply basic trouble-shooting skills to resolve technology issues:			
a)	Apply basic troubleshooting skills to *configure* digital devices for my teaching	45%	60%
b)	Apply basic troubleshooting skills to *operate* digital devices during my teaching	45%	70%
c)	Model basic troubleshooting skills during my teaching	45%	70%
d)	Find solutions to problems related to technology integration by using a variety of resources	45%	60%

Note. Adapted from *Teacher Educator Technology Integration Pilot: Final Evaluation Report*, by D. Ingram, 2018, Center for Applied Research and Educational Improvement, College of Education and Human Development, University of Minnesota.

Ingram (2018) wrote, "When interpreting these results, it is important to keep in mind that the Initiative professional development was not explicitly designed to effect change in these competencies because they only became available in Fall 2018. Nonetheless, because the Initiative developers aimed to design the pilot based on current research in technology integration and faculty development, it is likely that the Initiative was implemented in a manner consistent with the Teacher Educator Technology Competencies, as the survey results suggest" (p. 52). Key evaluation findings indicate that the highest areas of growth—as determined by teacher educators' ratings of feeling "competent," "very strong," or "outstanding" when they rate their abilities and skills in technology integration in various categories—were in the following areas:

- *Teacher educators will use appropriate technology tools for assessment*. Findings indicate that the Initiative teacher educators' feelings of competency grew from 30% (before the Initiative) to 83.3% (after participating in the summer and year-long professional development session). This results in 53.3% positive growth or change from pre to post assessment.
- *Teacher educators will support the development of the knowledge, skills, and attitudes of TCs as related to teaching technology in their discipline area.* Findings indicate that the Initiative teacher

educators' feelings of competency grew from 18% (before the Initiative) to 74.25% (after participating in the summer and year-long professional development sessions). This results in 56.25% positive growth or change from pre to post assessment.

We consider these two findings to reflect critical skills we wanted Initiative teacher educators to take up, with feelings of confidence in changing educators' practices trending in the direction we sought when beginning the Initiative.

Other findings indicate that five sub-competencies on the survey measuring TETCs show a 60% or more change pre- and post-Initiative, based on teacher educators' self-reported competencies. These positive growth trajectories, or post-Initiative survey findings, included the following competencies:

- Provide opportunities for TCs to integrate appropriate technology for assessment (72%)
- Provide opportunities to develop TCs' efficacy about using technology in their teaching (69%)
- Align content with pedagogical approaches and appropriate technology (63%)
- Assist TCs with the selection of content-specific technologies to support student learning (63%)
- Model integrating technology to differentiate instruction (61%)

Of interest to us was evidence that teacher educators had taken up discipline-specific technology integration teaching and learning practices and were using these to shape new curriculum and teaching activities within their methods coursework. Specifically, we noted that methods coursework was designed to be specific to the appropriate selection of technology integration practices that matched discipline-specific teaching goals and PK-12 learners' needs. For example, one science teacher educator drew upon iPad measuring tools and designed activities to model these for TCs who then took these ideas and used them in classroom activities and practica lessons with middle and high school youth. Two special education teacher educators focused on revamping their course curriculum to include helping candidates learn about data collection tools using tech applications. The teacher educators modeled how to use these tools and asked candidates to collect their own assessment data during one-to-one tutoring sessions with special education PK-12 youth. The candidates then designed differentiated lessons for their young learners based on the data.

The pre and post survey of teacher educators' competencies in the TETCs also showed one area where the majority of participants had not yet

reached levels of "competent," "very competent," or "outstanding." Ratings of the competency "Demonstrate using assistive technologies to maximize learning for individual student needs," indicated that only 9% of teacher educators rated their competency as "very competent," or "outstanding" before the Initiative, and only 30% rated these areas as "very competent," or "outstanding" when completing the post-Initiative survey. This finding is understandable as this competency is one of the most challenging for all teacher educators. Overall, in all other competency areas measured using the TETC survey, the majority of teacher educators rated themselves as "very competent," or "outstanding" after the Initiative professional development summer and year-long experience.

The CAREI evaluator triangulated the survey data by interviewing teacher educators to help us understand how specific individuals took up technology integration knowledge, skills, and dispositions. The purpose of the semi-structured interviews was to collect information about 1) how the teacher educators integrated technology into their methods courses, 2) how their confidence or comfort with integrating technology may have changed during Initiative, 3) which aspects of Initiative were most helpful for their learning, and 4) which aspects of Initiative could be improved to increase its effectiveness. Nine teacher educators volunteered to reflect on their experience. The constant comparative method (Patton, 2015) was used to analyze the interview data.

The types of technology integration embraced by teacher educators and how they and/or their TCs used the technology varied within and across discipline areas. Findings indicated that there were some commonalities in practices such as the use of AirServer, Google Slides, and iPad applications to allow clinical supervisors to easily capture photos and short video clips of TCs in their placement classrooms and then annotate those data and share them with the candidate. Discipline-specific technologies were also reported such as the use of probes by science educators to record lab experiments using the iPads, and data collection tools used by special education colleagues to measure and record reading and math learning prior to and after instruction. In addition to the variety of technology integration that occurred, it is important to note that many of the teacher educators continued to learn and integrate new technology tools throughout the pilot that were specific to their discipline as they expanded their awareness of possibilities through the Initiative's ongoing professional development offerings. Initiative participants who taught courses in both the Fall and Spring semesters often deepened their use of an application or technology tool based on their initial experience in their fall course. This finding strengthens the idea that pro-

fessional development and learning processes for teacher educators—like candidates—cannot be a one and done experience. Ongoing, spiraled, and deep experiences for teacher educators—developed individually and with others—allowed growth to flourish.

Along with depictions of what technology integration looked like, the interviews also provided insight on the particular components of the Initiative that teacher educators noted as most helpful for their learning. The following recurring themes were identified:

- Time to plan and learn together as a program area during the three-day workshop in July 2017, as well as ongoing opportunities to learn together at the *Learning Experience Sessions* throughout the school year.
- The Initiative Coordinator's pedagogy, including her use of modeling, which the teacher educators said made it easier for them to repeat or modify the technology integrated learning activities within their own classrooms.
- The Initiative Coordinator's modeling of what it is like as an instructor to not have some technology work as you had planned during a lesson and what to do next.
- Valuable support from other staff in the instructional design team (Ingram, 2018, p. 7).

Overall, the combination of survey data and interview findings indicate that the Initiative pilot–with appropriate ongoing improvements as it was rolled out—made a difference in the quantity and quality of technology integration employed by teacher educators and the candidates they taught. In addition, our interview data indicated that the self-efficacy of teacher educators also grew as they significantly changed their teaching practices. By the end of the pilot year, all program areas had heard of the Initiative, were aware of some of the programming, and many had TCs asking to participate.

Initiative Year 1

In May 2018, we launched the Initiative Year 1, which expanded to include 13 discipline areas and 115 teacher educators. The Initiative programming retained most components from the pilot year, adjusting some activities based on what we learned worked or did not. For example, we were more intentional designing technology integration activities that combined foundational knowledge content (e.g. PIC-RAT) with a common set of pedagogical practices and technology tools that cut across the discipline areas.

Yet, we still made space for discipline-specific technology integration practices and adaptations as needed, in order to respect the learning goals in particular program areas. We also modeled vulnerability and flexibility when technology did not work as intended, and used those opportunities as teachable moments. Most importantly, we gave more time and space for Year 1 teacher educators to share and learn from each other's experiences, as well as from teacher educators who had been in the pilot. The *Summer Learning Experience* and the commitment to year-long professional development, including coaching and co-teaching, remained key elements of the Initiative. Below we briefly describe the scale up of Initiative Year 1.

Summer Learning Experience

The *Summer Learning Experience* facilitators addressed the TETCs more systematically during scale-up programming because our pilot year data confirmed that these competencies were "developed to support the redesign of teaching in teacher education programs so that all teacher educators are prepared to model and integrate technology in their teaching" ("Teacher Educator Technology Competencies," n.d.). During the summer, teacher educators were given a copy of the TETCs and asked to discuss them in small groups. Responses to the competencies were overwhelmingly positive. An instructor participating in the experience suggested that discipline area teams select one competency and focus their goal planning for the year primarily around that chosen competency. Based on this discussion, each teacher educator was given a form and asked to respond to the following questions on last day of the *Summer Learning Experience*: 1) What is your technology integration goal for the year? 2) What TETCs does your goal align to? and 3) What resources will you need to accomplish this goal? Workshop facilitators collected, analyzed, and used the responses to prepare for initial discipline area team meetings and continuous support throughout the year.

With the growth of participants in the Initiative, the *Summer Learning Experience* was offered twice during the summer, once in May and once in August. This allowed teacher educators a choice on when to attend and made personalizing support for attendees more manageable. The first day set the stage for why the Initiative was created and had teacher educators start thinking about their role with technology integration in teacher education. The second day allowed teacher educators to explore the foundational content of the Initiative (e.g. PIC-RAT) through technology integrated ac-

tivities. The third day was focused on developing goals and action plans for technology integration in the upcoming school year. Table 5 provides a list of session topics for the Year 1 *Summer Learning Experience*.

Table 5
Description of the Initiative: Year 1 Summer Learning Experience Activities

Activity	Description
Overview of Technology Integration	Teacher educators started the activity by reflecting on a technology that impacted their learning. Then they were presented with a timeline of digital educational technologies that have influenced the educational landscape and discussed the impact these technologies may have on PK-12 students and their TCs. We ended the activity with data-driven dialogues based on survey data from our TCs in regard to their technology integration learning experiences and various technology standards/competencies from various agencies.
Panel Discussion	Pilot year teacher educators shared their stories of success and struggles with technology integration their first year in the initiative.
Program Area Discussion	First, each program area identified and reflected on their current technology integration practices. Then they brainstormed what they envisioned technology integration could look like in their program areas.
Defining Technology Integration	To create a common language on what was meant by technology integration, each program area discussed and defined their own definition for technology integration.
PIC-RAT Framework	The PIC-RAT Framework was introduced to teacher educators.
School Year Action Plan	Teacher educators created their own goals and action plan in regard to technology integration for themselves and as a program area.

Continuing Professional Development During Year 1

Due to the size of the scale up, we decided not to offer large group *Learning Experiences* and *Brown Bag* sessions. Instead, as teacher educators shared the goals for their respective discipline area, we created specific learning experience-style exploration of pedagogy topics that were tailored

to these discipline-specific goals. Components of the year-long sessions are described below.

Individual and discipline area coaching. With the additional program areas added, another coach was hired to support the work of the Initiative Coordinator and meet the growing needs of teacher educators. The two coaches initially met with each discipline team in the fall to establish a mutual understanding of the team's goal and their action plan (developed around the TETCs). The coaches communicated with the program leads before meetings to go over the team's meeting agenda as well as what support the coach could offer. Based on the goals and needs of the team, coaches played a spectrum of roles ranging from observer to instructor in the meetings. The TETCs created coherency for the Initiative across the various discipline area teams and provided focus and consistency in the ways the coaches worked amongst teams and individuals. For example, because all of the elementary education teacher educators were working towards the same TETCs program wide, coaches were able to encourage instructors to build upon each other's technology integration work. As a result, coaches often worked not only with teams, but with individual instructors to support them in their technology integration. At times, coaching sessions overlapped into methods classroom space in the form of co-teaching or leading technology integration lessons and reflections with TCs. Overall, the Initiative scale-up year revealed challenges to ramping up so quickly with all program areas. The increased coaching load stretched our Initiative Coordinator, additional coach, and instructional design team. Despite these challenges, the scale up appears to be successful. We attribute this to the continuous modifications we are making—simultaneous with implementation—without compromising quality professional development for individual discipline areas or teacher educators.

Summary

Teacher educators in both the pilot year of the Initiative as well as the Initiative Year 1 stated that the Initiative supported their technology integration growth. Participants increased their competencies in integrating technology to support instructional practices, as well as helping their TCs develop discipline-specific technology integration pedagogies. Moving from the pilot year to Year 1, components of the Initiative were adjusted to accommodate the growth of the program. This led to the decision to focus on providing only discipline-based support vs. holding large-group, across-discipline-

area PD sessions. For example, each discipline area determined meeting dates and agendas that met the goals and needs of specific individuals and the whole program area. These discipline-specific sessions were opportunities for colleagues to share how they were working to integrate technology, to engage in learning opportunities with technology, or to work on a scope and sequence of their technology integration efforts. The agendas for these meetings were co-designed by members of the discipline area. Individual coaching and co-teaching occurred outside of this time. In the Initiative Year 1 we also incorporated the TETCs into both the professional development and goal setting that occurred. In addition, the competencies became a benchmark that discipline areas revisited throughout the year to measure their progress and to "stay the course."

Modeling of technology integration was still provided during coaching and co-teaching sessions. In fact, the scale up year of the Initiative Year 1 saw an increase in coaching and co-teaching opportunities. During the pilot year we recorded 94 coaching interactions; in the scale up year, 84 interactions were documented in just one semester. Discipline areas that participated in the pilot year, or had instructors from the pilot year, also engaged in more co-teaching opportunities than those who did not participate in the pilot. This seems to indicate teacher educators' growing comfort with coaching, and their embracing of coaching as a needed and desired component of professional development, as they worked towards technology integration goals.

Overall, the Initiative evaluation data indicated growth in teacher educators' perceptions of their competencies related to technology integration on both the survey and in their interview comments. The competency that showed the most growth was teacher educators' feelings of confidence that they could support the development of the knowledge, skills, and attitudes of TCs as these novices were learning to use technology integration within their discipline area coursework. This result directly aligns to the vision set forth for the Initiative.

Discussion and Recommendations

In this article we describe several conceptual, design, and implementation elements we found to be effective in the pilot and the Initiative Year 1. We want to focus on three components of the Initiative that we believe were responsible for our teacher educators' successful learning. This information could be useful for colleges and teacher educators interested in designing technology integration initiatives for teacher preparation programs.

First, our findings suggest that a focus on developing trusting relationships through coaching was key to the success of the initiative. Coaching was originally cited as important because of the interwoven relationship it has with situated professional development. Several research studies also acknowledge coaching as an effective form of professional development (Sugar, 2005; Huston & Weaver, 2008; Kopcha, 2012; Devine et al., 2013; Desimone & Pak, 2017; Gibbons & Cobb, 2017). Desimone and Pak (2017) stated that coaching was "consistent with research-based ideas of effective professional development, specifically with its fulfillment of five key features of effective teacher learning—content focus, active learning, duration, collective participation, and coherence" (p. 8). Through coaching, we found that teacher educators were more willing to take risks with coaches they trusted and had built relationships with (Sugar, 2005; Huston & Weaver, 2008; Kopcha, 2012). As Huston and Weaver (2008) explained, "…because of its non-evaluative and confidential nature, [coaching] also provides a relatively safe opportunity for faculty members to shine a critical light on their teaching and the assumptions they take for granted" (p.13). Also, having a coach present in the classroom decreased the amount of risk educators felt they were taking when they tried something new with technology. A coach's pedagogical background was an important factor in the growth of the instructors' competencies, meaning, the coach was deemed effective because she knew how to teach candidates in discipline specific ways (Huston & Weaver, 2008). This was highlighted in participant interview comments as well as the fact that when a coach modeled an integration task, teacher educators felt the task was easier to replicate.

Second, teacher educators engaged in situated learning that incorporated key strategies that were found to be effective in the literature: content focus, active learning, duration, collective participation, and coherence (Garet et al., 2001; Desimone, 2009; Desimone & Pak, 2017). The majority of discipline-based teams attended the summer learning experience together (collective participation). They were given time to reflect on what they learned about technology as it pertained to their courses and candidates (content focus and coherence). During these sessions, educators engaged in discussion, reflection, situated activities, and play and learn sessions to create links between theory and their own practices (active learning). Situated professional development also gave them discipline-specific support throughout the summer and subsequent academic year via coaching (content, coherence, duration).

Last, technology integration professional development for teacher educators should be focused on developing mindsets and skill set, not solely

focused on specific technology tools. Experiences need to be grounded on building mindsets and skill sets that can be transferred, regardless of the tech tools available at particular moments or in various contexts (or not). Focusing on a growth mindset allowed the Initiative coaches to model the idea that momentary defeats and frustrations are times of growth and reflection. Teacher educators affirmed these ideas during interview comments, stating that the coaches modeled how to encounter technology mishaps as well as successes. This focus helped to address a challenge to creating and sustaining effective technology integration in teacher education as identified by Kolb, Kashef, Roberts, Terry, and Borthwick (2018): "vision from and action by leadership in teacher education to develop effective digital technology" (p. 3). With the focus on developing mindsets and skill sets, recognized frameworks (e.g. PIC-RAT) were identified to be used within the Initiative, examples of effective technology integration practices were modeled, a culture of learning through play and making mistakes were established, and most importantly teacher educators were provided time, tools, training, and team collaboration time (Kolb et al., 2018).

Along with these three components, we determined it was critical for college leadership to build sustainability planning into our work. The Initiative was initially funded with grant monies from an Archibald Bush Foundation grant and discretionary funds from our dean's office. By showing positive changes in the practices of teacher educators, and having these colleagues share specific instances of their technology integration with college leadership during formal presentations, the dean appropriated recurring college monies to sustain significant components of the Initiative. In addition, we retained the Initiative Coordinator role through a position realignment process and refocused the instructional design team in ways that allowed them to support the Coordinator and the teacher education program as we scaled up. We also realigned student tech fees to support the purchase of iPads. The Initiative is also a collaboration between CEHD, the College of Liberal Arts, and the College of Food, Agriculture, and Natural Sciences—the latter two colleges also preparing TCs in methods coursework yet working with us in pedagogy and licensure preparation. Overall, with creative reallocation of personnel and resources, and costs shared between the three colleges, the Initiative is now a sustainable program.

As we reflect on our work, we are pleased that the Teacher Education Technology Integration (TETI) initiative at the University of Minnesota, designed to be an integral part of our teacher preparation redesign grant project, has now become a signature feature of our teacher education programming. Evidence suggests that by focusing on discipline- specific technology

integration professional development for the instructors who teach methods classes and the supervisors of clinical experiences, the goals of the Initiative were integrated throughout the entire program including student teaching. To date, we have, and are continuing to provide, professional development to over 112 teacher educators in six different departments, who in turn, have influenced the teaching of over 380 teacher candidates. Vision, team work, scaffolded risk-taking, personalized coaching, and collegiality characterized this initiative. In the end, it took hard work on the part of faculty, the technology professional development team, and college leaders to see this initiative come to fruition. We look forward to our continued learning.

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