Building Skills and Mindsets:

The MSU Educational Technology Certificate Courses and Their Impact on Teachers' Growth as Technology Integrators

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Abstract

The Educational Technology Certificate (ETC) courses at Michigan State University are a set of three courses that can be taken as a stand-alone qualification or as the first three courses in the Master's of Educational Technology degree. Together, the courses emphasize the development of technology skills and advanced mindsets for technology integration in the classroom. In this article, we provide examples of our approach to the teaching of technology skills and mindsets in ways that are adaptable across four distinct modes of instruction (online, hybrid, overseas and face-to-face). We also present student feedback and survey data that inform a critical evaluation of the program's effectiveness. Findings suggest that the certificate courses help students to gain technological skills, to become more confident users of technology and more likely to help colleagues with tech-related questions. Interestingly, respondents also reported feeling like better teachers, in general, after taking these courses.

Keywords: certificate in educational technology, in-service teacher education, survey, technology integration, TPACK, technology skills, technology integration mindsets

Though they rarely use the language of TPACK (Mishra & Koehler, 2006) to describe their initial learning goals, incoming Educational Technology Certificate (ETC) students at Michigan State University (MSU) often cite the tensions they feel between technology, pedagogy and content, as reasons for pursuing the Educational Technology Certificate. One teacher described the tensions this way, "I want to work on ways to help enhance student achievement and understanding. I have struggled this year with finding the balance between using the technology as an enhancement and using it just to use it."

This teacher's comments remind us that technologies can be applied ad hoc, or in ways that satisfy schools' technology integration mandates on the surface, but that ultimately feel inadequate to teachers who sense there is much more to understand about technology, content pedagogy and their interactions in context (Koehler & Mishra, 2008). As Lawless and Pellegrino (2007) emphatically noted, the probability that all students in US schools have access to digital technologies is very high (National Center for Education Statistics, 2011). However, without "a teaching force equipped to use technology effectively in support of student learning" (Lawless &

Pellegrino, 2007, p. 578) there is slim hope that the students who would benefit most from these technologies will acquire the advanced skills and mindsets needed to participate fully in 21st century literacies, learning and work (e.g., Henry, 2006; Leu et al., 2009). Teacher preparation and professional development programs must, therefore, think critically about how they address the "human capital needs associated with effective use of [that] technology in the K-12 arena" (Lawless & Pellegrino, 2007, p. 578).

Inspired by the teacher cited above, her professional learning goals and the need to critically examine models of teacher education for technology integration (e.g., Betrus, 2012; U.S. Department of Education Office of Educational Technology, 2010) we decided to use our contribution to this special edition of *Tech Trends* to thoughtfully examine how we, as instructors of the ETC courses at MSU, have designed learning experiences in online and face-to-face modes of instruction that prepare teachers to support student learning through technology integration.

In what follows, we describe the ETC courses and the multiple modes of delivery that have made them widely accessible to professionals in Michigan, the US and around the world. We describe our approach to the teaching of technology integration by providing examples of learning activities that we use in face-to-face and online versions of the courses and, we share survey data and anecdotal evidence that give insight into ETC graduates' assessment of the program's impact on their professional growth as technology integrators. We also use these data to make inferences about the degree to which our model of in-service teacher education develops "the human capitol needs associated with the effective use of [technologies]" (Lawless & Pellegrino, 1997, p. 578).

The Educational Technology Certificate Courses

Course Content: Skills and Mindsets

Students earn MSU's Educational Technology Certificate by successfully completing three courses: CEP 810: Teaching for Understanding with Technology, CEP 811: Adapting Innovative Technologies in Education and CEP 812: Applying Educational Technology to Issues of Practice. Together, the courses are designed to help teachers expand their repertoire of technological skills. As they revise lesson plans to include blogs or wikis, podcasts or web-based inquiry, teachers learn a range of foundational technological skills by doing (e.g., how to embed a video on a webpage, or how to use the Internet itself as a learning tool). Importantly, ETC assignments are also designed to expand students' understanding of why they might use certain technologies versus others. Each course includes at least one evaluative assignment that requires teachers to articulate the affordances and constraints of a given technology for a given pedagogical purpose, or to consider the appropriate application of technologies for solving challenging problems of practice. In this way, the ETC courses are designed to scaffold the development of a TPACK (Mishra & Koehler, 2006) mindset, even before the framework is formally introduced through readings and lectures. In most cases, these "why" assignments ask students to embrace the logistical constraints of their unique professional contexts to devise creative, but practical, solutions that they can use themselves, with students, or colleagues. In other cases, students are asked to suspend their disbelief and imagine a teaching scenario without limits so that they are prepared to embrace, and even lead, change when it comes. Given that some ETC students assume new technology leadership roles after taking only these three courses, early programmatic emphasis on mindsets and the complexities of TPACK are essential.

Multiple modes of instruction to meet students' needs

The ETC courses can be taken (a) fully online, (b) in a hybrid summer cohort format that involves two weeks of intensive face-to-face learning on campus in East Lansing, followed by four weeks of online learning, or (c) fully face-to-face in the intensive, four-week, overseas summer program that, over the last ten years, has been offered in locations in the UK, France and Ireland. Depending on enrollment, these courses are also delivered in a (d) face-to-face evening/weekend format in convenient locations around Michigan. Some students even complete the certificate through (e) a combination of face-to-face and online enrollments. In sum, students can complete these three courses via four different modes of instruction and, if need be, combine face-to-face and online options. This kind of instructional flexibility is designed to meet the needs of busy working professionals but it also presents ETC students with a range of technology-supported modes of instruction that can be emulated in their own professional contexts.

Table 1 outlines enrollments in the ETC program for all modes of instruction since 2009-2010. In 2010-2011, 142 of 167 enrolled

Table 1. Summary of ETC enrollment by instructional mode since 2009-2010

Mode of Instruction	2009-2010	2010-2011	2011-2012
Fully Online	157	129	136
Hybrid	0	13	18
Face-to-Face	29	19	0
Overseas	14	6	14
Total	200	167	168

Note: Fully Online = all three courses taken online; Hybrid = 2 weeks in E. Lansing during the summer and 4 weeks online; Face-to-Face = evening/weekend courses offered in locations around Michigan; Overseas = 4 weeks in an overseas location.

students completed the certificate course series. In 2011-2012, 128 students finished them. Most students completed the ETC online.

Integration across multiple modes of instruction

This multi-modal approach to program design offers our students maximum flexibility and choice. The TPACK model, however, suggests that *technologies* and *context* influence *content* and *pedagogy* (Koehler & Mishra, 2008). Programmatically, we have therefore needed to consider the unique affordances of each instructional mode and design common learning experiences that can be flexibly adapted to suit each context. Each student in each version of the ETC courses therefore engages with content in ways that parallel those offered in the others – but that also account, very deliberately, for technology, location, available resources and time.

What does this look like in practice? Students in all ETC courses complete a common set of assignments. For instance, all students complete a web-based learning portfolio, a special interest group research assignment and create multiple learning experiences for their students using a range of digital tools. However, instructors shift the presentation order of course content and even combine assignments to take best advantage of each learning context.

Here is an illustrative example. The fully online version of the ETC program divides activities into three categories: *Explore, Create* and *Share*. Explore activities are online labs that scaffold students' technological skill development through structured play with a range of tools. Labs (see Appendix for a link) give a brief introduction to the tool, list resources for extended learning and provide an application task that students can try. Create activities are the graded assignments, all of which students post to their digital portfolios when complete. Share activities are opportunities to discuss and share ideas with colleagues. Sometimes, they are structured prompts based on a reading or a common learning experience; other times, they are open opportunities to share tips about a technology. Discussions happen asynchronously in MSU's course management system, but students also migrate to external platforms such as Skype and Google Hangout for synchronous sharing.

Other versions of the ETC program use this same organizational heuristic. However, due to the time constraints in the hybrid and overseas versions of the program, students often explore, create and share within a single activity. Creations are also integrated to include multiple expectations from across the three certificate courses. This means that students are required to submit fewer graded creations during the four or six weeks of these alternate format ETC programs (see appendix for links to syllabi) without compromising content. For instance, the web-based inquiry project asks ETC students to create a lesson, tailored to a grade level and content area that they teach and that integrates online research. This single assignment accounts for four curriculum expectations from two of the ETC courses. In-class exploration of various tools are necessary for its completion and the work is shared both in class and publicly on the web. Inspired by the Common Core State Standards expectations for K-12 students (NGAC & CCSSO, 2010) this assignment was recently revised to include web-based supports for online reading and new literacies skills development (Leu, Kinzer, Coiro & Cammack, 2004). Design flexibility has allowed not just for alignment across modes of instruction, but, as in this case, for updates that keep curriculum current.

To highlight the ways that the certificate courses are designed to build skills and mindsets, we outline two representative ungraded activities from the hybrid program. The first is a

unique twist on the traditional first-day-of-class introduction. The second expands the traditional readings discussion by integrating a tech tool that makes students' understanding transparent.

Example 1: The digital intro quickfire

Under the pressure of too little time (approximately one hour), *quickfires* (Wolf, 2009) ask students to play with a new technology to create something. The activities are never graded, but they serve as an essential curricular foundation in the hybrid and overseas ETC programs. The tight timeline forces students to set aside their perfectionism and accomplish what they can, given the task and contextual constraints.

On the first day of the hybrid ETC program, students build a digital introduction using Glogster (Glogster EDU, 2012). Though they ramp up precipitously in terms of difficulty over the two face-to-face weeks of the hybrid program, the first quickfire of the summer is relatively low-risk. Glogster is intuitive and, given its popularity in K-12 schools, most teachers have heard of it. Also, ETC students arrive expecting to introduce themselves in some way, so they begin in the realm of the "known." They post links to their digital introductions (Glogs) in a digital commonspace and then present their work orally, making special note of (a) what they learned about how the tool works and (b) how they would use this tool in their classrooms, if at all. Figure 1 provides an example of a student Glog.

Notice that in this activity, instructors do not teach how to use the tool. In fact, it is often the case that instructors have relatively little "how to" expertise to share. As instructors, we put ourselves in this position deliberately because it allows us to model effective strategies for independent and collaborative problem solving in a tech-rich learning environment. Quickfires give students the opportunity to explore the tool, to figure out problems, to Google answers to their questions, to apply the technology for some purpose, and then to share what they learned during whole-group discussion, or via Tweets and follow-up blog posts. The use of whole-group discussion scaffolds new technology integration mindsets because each student contributes and then listens to many options for the application of quickfire technologies in diverse professional contexts. As a result - even before TPACK (Mishra & Koehler, 2006) is formally introduced - students begin to recognize that different teachers, in different settings, with different students and different content, make different choices.

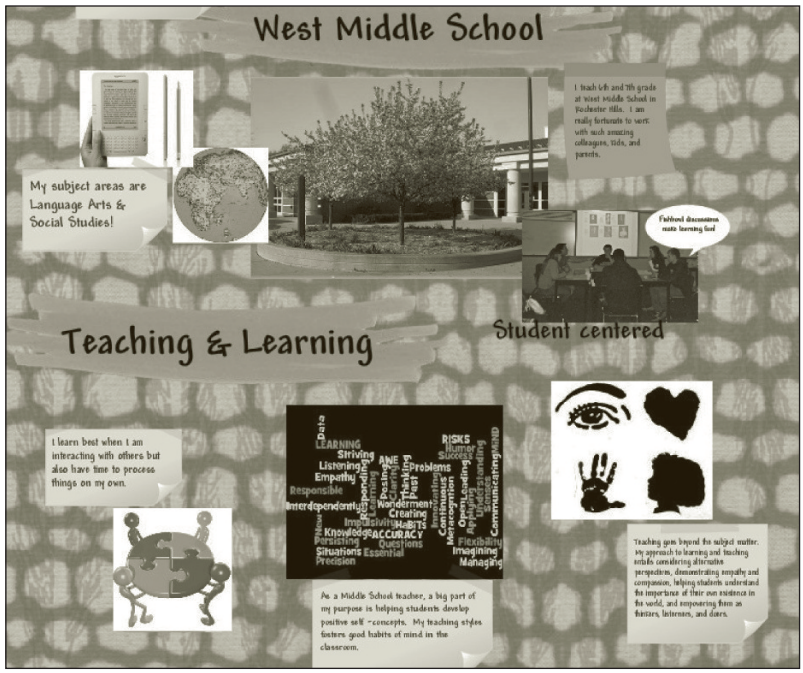

Figure 1. A digital introduction (Glog) created by an ETC student on the first day of the hybrid summer program in June, 2012.

Activity 2: Tech-supported readings discussion

Face-to-face instructional days routinely involve time for discussions of assigned academic readings. Where possible, new technologies are embedded to support students' understanding of the readings' main ideas. Using *Lino* (Infoteria Corporation, 2012), a web-based, interactive sticky-note board, students synchronously posted green sticky notes for ideas that were clear to them from their reading of Bransford, Brown & Cocking (2000), yellow notes for ideas that were not entirely clear and pink notes for ideas that they loved and wanted to remember. Overseas students used another tool, Wallwisher (Goel & Piyush, 2012), for the same purpose. Discussions of these technologies, their affordances and constraints, fed back into one of Bransford, Brown & Cocking's (2000) main assertions that "teachers must draw out and work with the preexisting understandings that their students bring with them" (p. 19). Having "drawn out" their own ideas and understandings with Lino (Infoteria Corporation, 2012), hybrid ETC students discussed whether the tool allowed for the kind of schema exploration that Bransford, Brown & Cocking (2000) recommended in the reading. Discussion focused on justifications for why, why not and whether other tools might have afforded a richer learning experience.

Does Our Approach Work?

Evidence from course evaluations

To be fair, students do not always understand why the instructors do not "teach" the technologies. For some, feedback, instructions and the parameters, in general, feel too open. One ETC student wrote the following on a course evaluation:

> I think the instructor rather ingeniously designed her course to reinforce the learning models she wants to see teachers use in their own classrooms. I definitely appreciate that. Where she might want to reconsider her teaching is in her "fuzzy" feedback. I think some of the students felt that her ideas and instructions were not as clear as they would have liked. I personally like having that kind of latitude, but not everyone responds to an instructor's open-ended instructions in the same way.

This feedback is important because it helps us to understand that for some, our approach to technology integration and instruction is not what they expect or want. Although rubrics are provided for all major written assignments (see Appendix for link) some students still want more structure. More often, though, course evaluation feedback suggests that students appreciate the opportunity to explore, create and share and that the feedback they receive is well positioned. "I really appreciated the focus on feedback and improvement. It was a great balance between pushing us and supporting us. I thought most of the lesson design was extremely engaging!"

Evidence from ETC student survey

In the fall of 2012, we surveyed ETC graduates on a range of questions designed to gauge critical indicators of programmatic success. Six hundred students who had taken the ETC courses between 2007 and 2012 were invited to participate; seventy-eight completed surveys were returned. Table 2 summarizes respondents by mode of program delivery. It also shows how many respondents had applied to the MAET degree program from the very beginning of their program (n=36) versus those who had not initially enrolled (n=42). For the ETC program, one measure of its success is the conversion rate, or the percentage of students who had not initially applied to the degree program when they began the ETC courses, but who later enrolled in the degree. Using the percent conversion for each of the five modes of instruction (n= 5 groups), which weights groups equally, the mean conversion rate is 66.8, 95% CI [36.9, 96.7]. The confidence interval is large because the sample size (5 groups) is small. Though it is difficult to know how representative this sample of respondents is of all ETC students, these data suggest that in general, two-thirds of those who experience the ETC courses go on to pursue more educational technology courses in the MAET program.

We also asked respondents to indicate whether, upon reflection, they agreed or disagreed with fourteen statements that were written to gauge the lasting impact of the ETC courses on their professional growth as technology integrators (link to survey in Appendix). Table 3 summarizes responses to five of the statements. We selected these statements from among others because they are directly aligned with our curricular focus on technology integration skill (statements 1, 3, 4) and mindset (statements 2, 5) development. The statements are provided in the notes section of Table 3.

Although sample sizes for all groups except the fully online mode of instruction are small, these descriptive data do offer some indication of the impact of the ETC courses on teachers'

Table 2. Summary of initial enrollment choice and conversion rate

Mode of Instruction	N	MAET Degree from Start	ETC only from Start	Conversion from ETC to MAET Degree
Fully Online	53	25	28	20 (71%)
Hybrid	9	4	5	4 (80%)
Face-to-face	5	1	4	2 (50%)
Overseas	8	6	2	2 (100%)
Combination	3	0	3	1 (33.3%)
Total	78	36	42	29

Note: Combination = students who took courses via more than one mode of instruction.

Table 3. Frequency and relative frequency of responses to five key impact statements

	N	1 (%) Skills	2 (%) Confidence	3 (%) Mentor	4 (%) Used	5 (%) Thoughtful
Fully Online	53	41 (77)	36 (68)	37 (70)	40 (75)	34 (64)
Hybrid	9	8 (89)	8 (89)	9 (100)	9 (100)	7 (78)
Face-to-face	5	4 (80)	3 (60)	2 (40)	3 (60)	4 (80)
Overseas	8	7 (88)	6 (75)	5 (63)	5 (63)	5 (63)
Combination	3	2 (67)	1 (33)	3 (100)	1 (33)	2 (67)
Total	78	62 (80)	54 (65)	56 (75)	58 (66)	52 (70)

Note: Parentheses indicate (relative frequency in %). Percentages rounded up when decimal ≥ to .5. Survey statements: 1. After completing the certificate courses, I felt I had more technological skills and knowledge. 2. After completing the certificate courses, I felt more confident using a wider range of technologies in my classroom. 3. After completing the certificate courses, I mentored colleagues or answered questions that helped colleagues to use technologies in their teaching practice. 4. After completing the certificate courses, I integrated new technologies in my teaching that I had never used before. 5. After completing the certificate courses, I was a more thoughtful technology integrator.

growth as technology integrators. Generally, the data are encouraging. That 80% of all respondents reported having gained technological skills and knowledge suggests that our focus on skills is, for the most part, doing what we hope. Ideally, we would like for all students to report gaining skills, but students' pre-ETC levels of technological skills and knowledge may play a significant role. It may be, for instance, that our program serves teachers who start the program with low or intermediate skills especially well, but does not serve as well those who are very technically savvy before starting the program.

We are also encouraged to learn that 75% of respondents reported mentoring colleagues on tech-related issues after taking the ETC courses. The extent to which our students are seen by their peers as technology experts and leaders is an important metric of the program's success. Though something of an inference, these data do suggest that ETC graduates are playing a part in the technology integration conversations that happen in their schools and by extension, may be influencing technology integration decisions in their buildings and districts. Though we cannot know the focus or the outcomes of these conversations, we can conclude that the sphere of influence for the ETC courses extends beyond those who completed them.

After completing the ETC courses, 70% of respondents felt they had become more thoughtful technology integrators. This finding is also encouraging, but raises important questions about the nature of respondents' thoughtfulness and the extent to which we might attribute any growth in "thoughtfulness" to the ETC courses at all. Given the complexity of the TPACK framework, it is not clear, from these data, how respondents might have qualified the word "thoughtful". Future surveys will address this issue. However, we can conclude that most respondents report giving more thought to technology integration choices post-ETC than they did pre-ETC. Our focus on the development of advanced mindsets for technology integration may therefore have contributed to this result.

Self-reports of confidence (65%) and technology use in classrooms (66%) were cited slightly less frequently than gains in skill (80%) and thoughtfulness (70%) around technology integration but paired-samples t-tests showed that the real differences between gains in skills and confidence, and between skills and actual technology integration in respondents' classrooms were not statistically significant. Given that none of these indicators improved more than others, we wonder (a) about the interactions of confidence, technology use, technology skills and integration for our students and (b) the types of professional learning activities that might strengthen all or some of these variables further. Based on evidence from studies that have examined models of in-service teacher professional development for technology integration (e.g., Hartsell, Herron, Fang, & Rathod, 2010; Shriner, Clark, Nail, Schlee & Libler, 2010; Zhao, 2007) we wonder, for instance, whether more opportunities to explicitly practice the teaching of actual lessons using a range of technologies during the ETC courses might give more students a boost in tech skill development, confidence and ultimately in their willingness to use the technologies they learn about.

On a seven-point Likert scale, the survey also asked "to what extent, if at all, did the certificate courses contribute to you feeling like a

better teacher, in general?" For the entire sample (n=78) the modal score on this question was 6. The median was also 6. The mean was 5.83 with a standard deviation of 1.09. Only one respondent gave a score of 1 (the lowest score). All other scores were 4 or above with 75% of the scores falling between 5 and 7. Although this is a very broad indicator of the program's impact, we are encouraged to see these scores clustered so dramatically toward the upper end of the seven-point distribution. In addition to boosting teachers' technological knowledge and shaping new mindsets around technology integration, these data suggest that the ETC program may support growth on an even higher plane. The greatest value in the ETC courses may not, in the end, be about the specifics of the skills or mindsets for technology integration at all. Instead, the greatest value for the most students may be in the way that this set of three courses helps teachers to transcend their professional limits overall.

Conclusion

The Educational Technology Certificate (ETC) courses at Michigan State University are designed to address teachers' pressing need for new technology skills that enable them to use a broad range of digital tools in their classrooms. The courses also aim to expand teachers' technology integration mindsets so that they can thoughtfully choose when and why to use particular technologies to address specific pedagogical objectives. An informal emphasis on TPACK (Koehler & Mishra, 2008; Mishra & Koehler, 2006) that becomes more formal and explicit through the ETC program prepares teachers to think critically about the interactions of technologies, pedagogy and content in their own professional contexts. In each of the four modes of instruction—(a) face-to-face, (b) online, (c) hybrid and/or (d) overseas—students in the ETC courses complete graded and ungraded assignments that emphasize exploration, creation and collaboration. Using examples of activities, we have demonstrated how we teach technology skills and mindsets by doing, but also how flexibility in curricular design allows us to align course delivery across modes of instruction.

Importantly, our review of survey data has provided evidence of the program's generally positive impact on teachers' growth as technology integrators. Graduates of the program reported gains in technology skills. They also reported feeling more thoughtful about their technology integration choices and having helped colleagues with technology integration. Interestingly, nearly all respondents felt that the courses had had at least a moderate impact (or better) on their overall effectiveness as a teacher. The greatest value, then, for the greatest number of teachers may be on this higher plane —in the ETC program's impact on their perception of themselves as better teachers generally. Future research will explore this finding further. Evidence from teachers' practice would be especially helpful, as would interviews that ask teachers to cite examples of improvement.

The data also revealed areas for programmatic updates. We are particularly committed to revisions that will boost student confidence and lead to even higher rates of technology integration in classrooms. Generally, our evidence suggests that the ETC program is developing a "teaching force equipped to use technology effectively in support of student learning" (Lawless & Pellegrino, 2007, p. 578).

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Appendix

Links to openly accessible resources that support the Educational Technology Certificate courses at Michigan State University.

Topic	Title	URL
Explore Activity	Wiki Lab	http://edutech.msu.edu/online/Labs/wikis/Page.html
Syllabus and Course Resources	MAET Y1 2012 Dublin	http://maetdubliny12012.wikispaces.com
Syllabus and Course Resources	MAET Y1 2012 E. Lansing	http://www.msuedtechsandbox.com/maetELy1-2012
Digital Introduction	Glog quickfires/digital-introduction	http://www.msuedtechsandbox.com/maetELy1-2012/
Ungraded Activities	Quickfires quickfires	http://www.msuedtechsandbox.com/maetELy1-2012/
Course Assignments Assignments	Overseas Cohort Assignments	http://maetdubliny12012.wikispaces.com
Survey Instrument	MAET Certificate Course Survey	http://bit.ly/13ejMse