Investigating Tech-savvy Preservice Teachers' Technology Integration Knowledge, Beliefs, and Intentions: Overcoming Barriers

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What are the barriers to teachers' technology integration?

- Major barriers teachers include: lack of resources, support, knowledge, beliefs, and self-efficacy about technology (Hew & Brush, 2007)

- First-order and second-order barriers to technology integration (Ertmer, 1999)

- First-order barriers can be addressed: the availability of resources and support is increasing (Ertmer & Ottenbreit-Leftwich, 2010; Hixon & Buckenmeyer, 2009)

- Second-order barriers difficult to change (perhaps due to experienced teachers' existing beliefs or lack of knowledge) (Ertmer, 2005; Ertmer et al., 2012)

What are the barriers to beginning teachers' technology integration?

- Teacher education programs influence beginning teachers technology use (Smarkola, 2008; Tonduer et al., 2016)

- Student teaching has large impact on teacher's technology practices and beliefs (Sang, Valcke, van Braak, & Tonduer, 2009; Smarkola, 2008)

- First-year teachers encounter barriers using technology (Hazzan, 2003)

- Internal factors: knowledge, beliefs, intentions, practices – to overcome external barriers (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012)

- Professional development and support needed for internal factors (Ertmer, Ottenbreit-Leftwich, Sadik, Sendurur, & Sendurur, 2012)

What's the purpose of this study?

- Are technology savvy teachers able to overcome barriers in student teaching and induction teaching years?

- We investigated how teachers' knowledge, beliefs (self-efficacy, value), and intentions evolved from teacher education programs through student teaching and the induction years

Methods

Research Design

- Multiple case-study design (Yin, 2003)
- Exploratory, longitudinal (~3 years)
- Evolution of technology integration knowledge, value beliefs, self-efficacy beliefs, and intentions, and eventual practices of 4 secondary pre-service → beginning teachers
- Impact of school contexts/experiences

Research Questions

- How does knowledge, self-efficacy beliefs, value beliefs, and intentions evolve in four technology-savvy pre-service teachers with regards to integrating technology into their core secondary subject areas?

- How do these teachers evolve as a result of their teaching contexts and experiences?

- How are teachers' beginning practices influenced by their first classroom experiences?

Participants

- 4 undergraduate students in a Computer Education Licensure (CEL) Program

- CEL is an add-on licensure program (21 credits)

  - Undergraduate students already in teacher education program

  - Social studies (1), Math (2), English Language Arts (1)

- Potential roles/jobs:

  - Computer applications teacher, computer science teacher, technology coordinator, district tech-person, coordinator or facilitator, managing a school or corporation's tech resources, computer labs and equipment

Additional Coursework and Field Experiences

- **W200:** Using Computers in Education
- **W210:** Survey of Computer-Based Education*
- **W220:** Technical Issues in Computer-Based Education
- **W310:** Computer-Based Teaching Methods*
- **W435:** Technology Leadership in K-12*
- **W410:** Practicum in Computer-Based Education*

- *Course included field experiences

Data Collection

- Document Analysis: E-Portfolios
  - To identify knowledge gains and gaps
  - Include interview questions based on analysis
- Interviews
  - All interviews ranged between 50-80 minutes
  - 1: Face-to-face, 2 & 3: online
- Interview focus
  - Educational technology knowledge, self-efficacy, beliefs, intentions, practices

Major Teaching License + CEL

| ePortolio Analysis | Interview-1 |

Student Teaching Experience

Interview-2

2 years teaching experience

Interview-3

Interview Questions

- Knowledge

  - Follow up on ePortfolios and discussion about the student products?

- Beliefs

  - What are the best ways to use technology in your subject area? Provide an example(s).

  - Scenarios

    - You are a first-year teacher in a rural area school, just graduating from IU with your CEL. The principal has explained that some teachers in this building prefer not using technology in their classes. She wants you to deliver a professional development talk discussing the advantages and disadvantages you see in using technology. What would you focus on during this talk?

Interview Questions

- Self-efficacy
  - How prepared do you feel to use technology in your subject area?
- Intentions
  - How do you plan on using technology in your student teaching?
  - Scenarios
    - You are a first-year with a CEL license, your administrator has asked you to provide a technology integration professional development workshop to other [*insert subject area here*] teachers in the district. What would you teach them? How would you teach them?
- Self-rate question (1, not comfortable | 5, very comfortable)
  - Word-processing, Presentation, Spread Sheet, Web Development, Audio Editing, Movie Editing, Image Editing, Blog Development, Wiki Development, Basics of Computer Programming, Hardware Basics.

Data Analysis

- Within-case analysis (Yin, 2013): Individually for each participant following a comparison of the analyses as a team

- Cross-case analysis (Yin, 2013): Look across all four cases to find emerging themes that transcended all cases

- Themes:
    - VB: value beliefs
    - SE: self-efficacy
    - K: knowledge
    - IP: intentions and practices

Results

Sam
(Secondary Social Studies)

Kristy
(Secondary Math)

Kara
(Secondary Math)

Bridget
(Secondary English Language Arts)

Knowledge

Knowledge increased over 3 stages, depending on exposure to technology experiences

Knowledge

- Change in Knowledge
  - Classroom technology management (all)
  - Technology integration pedagogy
- Changes Due to…
  - Self-exploration
  - Mentors
  - Environments

How did teachers' knowledge change?

- Classroom technology management (all)
  - Learned how to manage computers/iPads/technology with students in the classroom.
  - Bridget Example:
    - 1st Interview. "The distraction factor is the only thing that I'm leery of at this point. I don't think students should have technology at their fingertips all the time because of it's a welcome distraction. I can't expect the freshmen who don't want to be there to have that self control. I am not comfortable with my students using it as a distraction tool like when I am in front of the class lecturing. Having it, so readily accessible scares me."
    - 3rd interview. Bridget was flexible. Managing students on iPads with multiple projects. Became a part-time technology coach for her building.

- Pedagogy
  - Evident from the variety of technologies used and applied in their classrooms

Where did the teachers' knowledge development come from?

□ Self-exploration (all)

  ▫ SAM

  ■ 1st: "In [the educational technology courses], I learned the tools. And even before that, I would always find stuff and collect them but that's really where I learned most of the Web 2.0 tools and all the technology stuff."

  ■ 3rd: Social Studies from his social networking communities. "it's just me searching around. I do look at Pinterest once and awhile. I still have my teachers on Twitter that I use…I check Twitter a lot. Mostly I have a Twitter app on my Mac for school. I leave that open. When I have some time, I just put up a chair and will read a couple of tweets at a time."

Where did the teachers' knowledge development come from?

- Mentors
  - Student teaching mentors
  - Colleagues
    - *"there's another teacher in the building, she's on it. She's our teacher of the year last year. She uses a lot of technology, so we talk sometimes… She uses Remind, so I started to use Remind. And the other engineering teachers are also very on top of things. So mostly from my fellow teachers is where I heard about different things. That's my biggest resource, finding new programs or anything."* (Kristy, 3rd)

Where did the teachers' knowledge development come from?

- Environment
  - Resources
  - School culture
  - *"I'm realizing now that I have to use technology, it's not even a choice. I have a Promethean board that is here [in the middle of my whiteboard space], so I don't have any choice but to use it because it's stuck right in the middle of my board. And then we have My Big Campus, that's what this school uses. And I have to post my homework and stuff on it - you have to use it."* (Kara, 3rd)

Self-Efficacy Beliefs

- Generally increased with exposure to other teachers, contexts, and due to experiences.

- All identified as very well- or well-prepared to teach with technology.

Self-Efficacy Beliefs

- Generally increased w/exposure to teachers & experiences
- All self-identified as 'very well-prepared' or 'well-prepared' to teach with technology
- When rater lower…
  - Too much time passed since last use
  - They didn't know, what they didn't know
- When rater higher…
  - Actual implementation increased confidence
  - Knew more than most other teachers

Self-Efficacy Beliefs

- Confident in abilities to adopt new technology tools (all)
  - *There was a science conference last week. They showed us Kahoot and I was like this is so easy, I can do this. Besides that, sometimes I see other teachers doing things that I pick up, mainly stuff that I've known already or random things that I find (Sam, #3).*
- Report proficiency in most technologies used (all)
  - Or they became proficient
  - *I feel confident using pretty much everything you put in front of me. I feel confident to use. (Kristy, #3)*
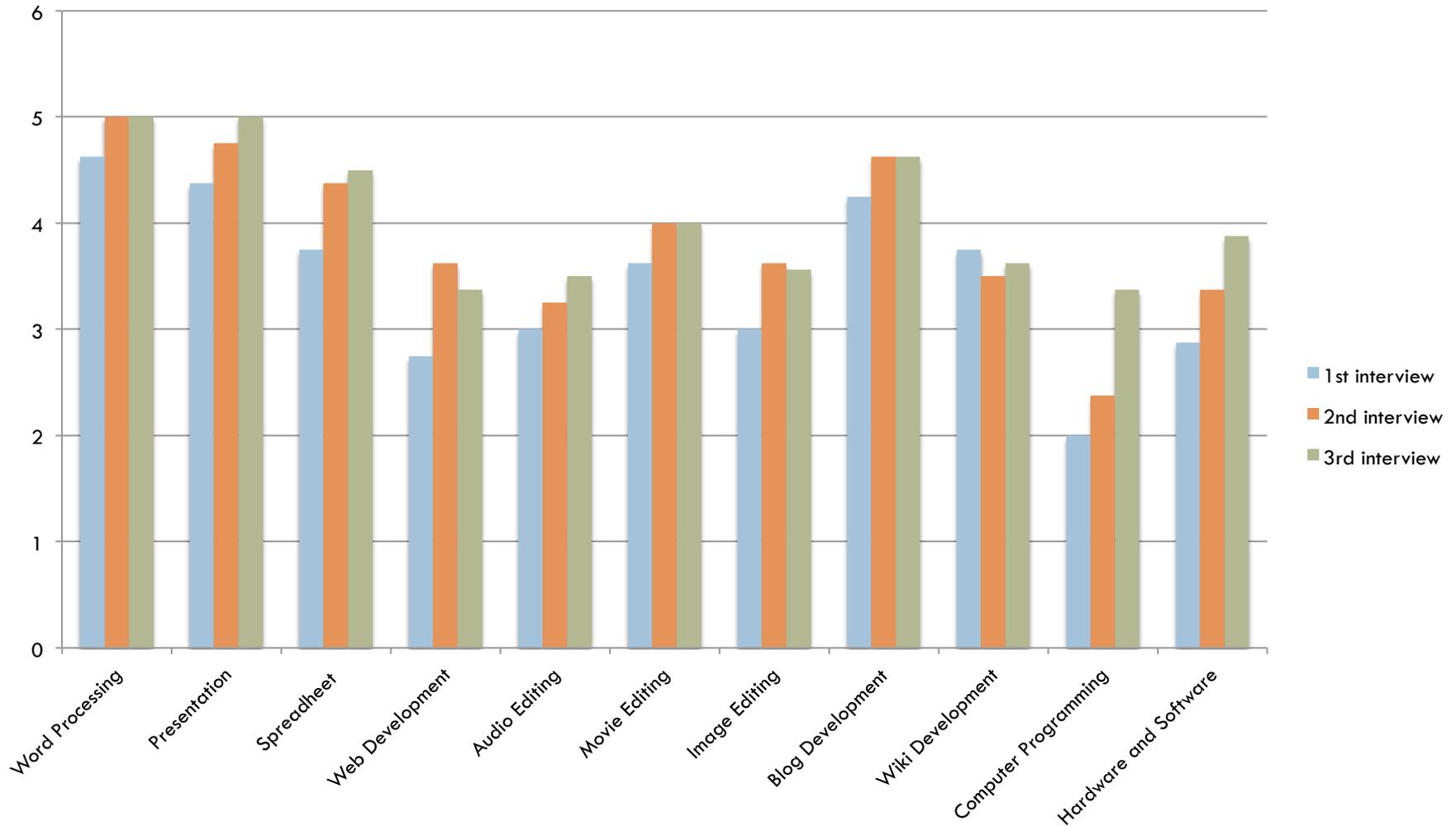
Self-Efficacy Beliefs

- Lack of confidence in pedagogical knowledge/teaching with technology (2)
  - *The hard part for me would be, how do I use this effectively to teach whatever I'm teaching…. The pedagogy would be probably my weakest spot, whereas the content is high and the technological side is high. (Kristy, #3)*
- Confidence slightly reduced based on negative (or failure) experiences (2)
  - *I was limited by the resources. Now that we have 30 Chromebooks, they work great, but the lack of Google accounts is difficult because we can't really use them. They took away our old Mac laptops. We had really old crappy Mac Laptops, but at least those had word and pages on it and we could still save to our flash drive. Now with the Chromebooks, they don't have an account, so I haven't had them do anything typed because they don't have access…it's too difficult to manage (Sam, #3)*

Self-Efficacy Beliefs

- Nervous about losing control in class (2)
    - Students not paying attention.
    - Phones being a disaster
- Able to fix their own technology problems (1)

Self-Efficacy Beliefs

Self-Efficacy Beliefs

- When rated **<u>lower</u>** on successive interview, teachers indicated that it had been some time since they had used the software and would need to reacquaint themselves first.

  - *"It had a reverse effect because while I was in Arizona. I didn't use technology and there was no motivation for me to use it cause it was not available. And now I have it all and I'm like OK. I can do it again." (Kara, #3)*

Self-Efficacy Beliefs

- When rater **lower** on successive interview, they realized there was more technology out there after student teaching (more software programs, great capabilities of software) and they need to find out more before teaching that topic.

  - *"And it's just …what do you do…and I think googling it is the best thing in the world for everything. But, you can't say you can know everything. Cause a lot of things you just can't be trained for. Really…how skillful are you at learning technology is really what you need to be comfortable with." (Kristy, #3)*

Self-Efficacy Beliefs

- When rater **<u>higher</u>** on the successive interview, after teaching it during student teaching/their own classroom, they feel more confident:

  - *"more comfortable using technology to teach than I was before. Definitely feel more comfortable…I think I just understand ins and outs of school technology better, like the policies and the back end of it. What goes on in a school network, what goes on in having student accounts and how that works. I think I understand that more. More patient with technology problems that I didn't expect. So I'm learning to double plan - what happens if this doesn't work, and this is my back up plan." (Bridget, #2)*

Self-Efficacy Beliefs

- When rater **<u>higher</u>** on the successive interview, they realized they knew more than most other teachers.

  - *"I took more of a lead like doing new technology things. My mentor, she'd taught for a long time, had her ways already figured out. So I took more lead in there and did workshops with the kids. I think I probably understood the Microsoft Office a little better than she did especially for something like Access and Excel" (Kristy, #2)*

Value Beliefs

Became more diverse and sophisticated.

Pedagogical Value Beliefs

- Positive view of technology

- Teachers' value beliefs did not change dramatically, but evolved in their specificity and detail with each passing interview.

- Beliefs evolved due to real world limitations (e.g., culture, student capabilities, availability of resources) and included more mature, contextual examples.

Pedagogical Value Beliefs

- Positive attitude towards technology (all)
  - This started at the beginning. Fairly obvious – self-enrolled in CEL.
  - *Even if I hadn't had the CEL I still would probably use a lot of technology just because I, it's who I am and how I live my life, but the CEL has given me a rationale for it and a solid reason to say why I'm using this technology and options. I know how to use it effectively (Sam, #3)*

Pedagogical Value Beliefs

- Technology should save time (all)
  - E.g., for classroom management
  - *That is doing something you can't really do without technology. Anything that makes life more efficient. So like checking an homework, my mentor uses, pulls a PDF and turns it a chart students, writes grades, goes from that and puts it in echo, which is less cumbersome than writing it on paper, easier to use, efficiency, effectiveness and enhancement. (Kristy, #1)*
- Technology has to be worth it (all)
  - E.g., it can't take up too much time for teachers
  - *We had old, crappy Macbooks. It was barely worth turning them on. Most of the time you would have to plug in just to turn them on. And if the charger would move a little bit, it just shut down. It was not worth it. (Sam, #3)*

Pedagogical Value Beliefs

- Technology can increase engagement/entertainment
  - *I set up this wiki, and they were going to write their own poem at the end of it and put it on there, so I was being obnoxious saying you're going to be published authors on the internet, you're going to be famous, just like to play up, I think they all knew I was faking it but, it helps motivate them a little bit. (Sam, #1)*

Pedagogical Value Beliefs

- Project-based learning, student-centered learning (2)
  - *Even just using graphic technology in my ipad, showcase, like here is a graph, zoom out, whereas graphing by hand. So like interactivity, like play around give them an applet, something like that, so that they can get their hands on, even without totally understanding what the concept is, they can see how things work. Interactive, hands-on are the best way (Kristy, #1)*
- Get more sophisticated and diverse pedagogical beliefs (all)
  - Integration of quizzes, PBL, eLearning days. Their language changed/evolved.

Intentions & Practices

The availability of technology in their experiences influences their intentions to use technology in practice. The more technology available to them, the stronger intentions of different ways of using technology.

Intentions & Practices

- External factors - Context (resources & support) can impact practices.
  - *Last year I tried some using Khan Academy. It's somewhat similar to this and have videos that you can watch and problems to do. But didn't get very far cause 1) Youtube was blocked, so you couldn't watch videos at school, and then 2) a lot of students have access on their phones, but don't have a computer at home. So the Khan Academy is not the best on the mobile device. (Kristy, #3)*

Kara – Intentions / Practices

ST: Navaho Reservation

- No technology
- Graphing calculators (used 2X)

Induction: 1:1 Thinkpads, iPads, Chromebooks, Promethean, software, eLearning days

- MyBigCampus, post worksheets & keys, submit homework
- Digital textbook
- Geogebra (student &teacher)
- iPad app: iXL (drills)
- Project-based learning: Excel (walmart ads for discount calculations)
- eLearning days
- Videos

Sam – Intentions / Practices

ST: New Tech High (1:1 Laptops)

- Project-based learning
- Daily use
- Announcements, attendance, grading, resources, materials

Induction: Old Macbooks, Smartboard

- Teacher-led activities
- Student research, writing
- Google Maps/Earth
- Student cell phones
- Intentions w/ Chromebooks for student-centered

Kristy – Intentions / Practices

ST: New Tech High (1:1 Laptops)

- Project-based learning
- Daily use
- Announcements, attendance, grading, resources, materials

Induction: No wifi, Promethean Board, few desktops

- Daily teacher-led presentations (Promethean, Prezi, Virtual manipulatives)
- Phones (calculator, picture of math problems, Remind)

Bridget – Intentions / Practices

ST: (1:1) ELA and Tech Coach

- ELA
  - Intentions to be creative
  - Limited by curriculum consistency w/other teachers
- Tech Coach
  - Creative, wide range

Induction: Old iPad cart, shared laptop cart, ELA slow computer lab, response clickers

- Blogs (sustained silent reading)
- MobyMax (remedial ELA) - daily
- Intention to design webquest (time barrier)
- Bell work (clickers) – daily
- Student multimedia presentations (books, poems)
- Student created audiobooks
- Student research

Discussions and Implications

Why do you think two of the beginning teachers struggled with technology integration?

Same courses, similar field experiences, different resource availability

Discussion Summary

- Knowledge
  - Change in classroom management & technology integration pedagogy
  - Changed influenced by self-exploration, mentors, or environment
- Self-efficacy beliefs
  - Remained fairly high/consistent, increased due to coursework/experience
- Value beliefs
  - Increased in detail and were more realistic
  - Evolved based on teachers, student, curriculum interactions (Smarkola, 2008)
- Intentions → Practices
  - Changed due to contextual factors
    - Resources
    - School Culture
    - School Policies

Discussion Questions

- Why do you think two of the beginning teachers struggled with technology integration?
  - *Same courses, similar field experiences, different resource availability*

Discussion Questions

□ If expert technology-using teachers can overcome barriers, why can't beginning teachers? Is there anything we can do to better support beginning teachers?

Implications

- Relationship between knowledge, beliefs, intentions, and practice

  - Using technology in field experiences is critical (Alexander & Kjellstrom, 2014; Smarkola, 2008; Tonduer et al. 2016)

  - Necessary to build positive knowledge, beliefs, and intentions before entering field experiences (Abott & Faris, 2000; Anderson & Maninger, 2007; Hazzan, 2003; Smarkola, 2008)

  - With strong second-order (internal) factors, by providing technology examples, intentions may increase.

  - However, external barriers may prevent some intentions from becoming practices.

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Questions

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Sam

- Overview
  - Secondary Social Studies
  - ST: New Tech High (1:1)
  - Induction: Mt. Clair, NJ (old mac laptops, SmartBoard)
- Knowledge
  - Most gained during TE & ST
- Self-efficacy beliefs
  - High, stronger as exposed to other teachers & practices
- Value beliefs
  - Evolves from ease/efficient to include visualization, images, engagement
- Intentions/practices
  - High intentions. Practices depended on resources.

Kristy

- Overview
  - Secondary Math
  - ST: New Tech High | Induction: Low SES, urban
- Knowledge
  - High knowledge. Learned from CEL & mentor teachers
- Self-efficacy beliefs
  - High, but humble. Teaches other teachers.
- Value beliefs
  - Supplemental technology tools for calculating, graphing, and visualization. Saves time.
- Intentions/practices
  - Practices heavily dependent on resources. Practices decreased during induction.

Kara

- Overview
  - Secondary Math
  - ST: Navaho reservation | Induction: suburban IN, 1:1
- Knowledge
  - Dramatic increase during induction. eLearning leader.
- Self-efficacy beliefs
  - High, especially once eLearning leader.
- Value beliefs
  - Evolves to include more diverse visualization examples, drill/practice, communication tools
- Intentions/practices
  - Practices dramatically increased with resources.

Bridget

- Overview
  - Secondary English
  - ST: ELA & eLearning coach (1:1) | Induction: Rural, Low SES
- Knowledge
  - Dramatic increase from ST: eLearning.
- Self-efficacy beliefs
  - Dramatic increase from ST: eLearning.
- Value beliefs
  - Increased in sophistication/diversity.
- Intentions/practices
  - High intentions, but constrained during ST. Increased during induction.

- Barriers
  - *And I have four computers in my classroom for just PCs. I had to grease some palms to get them. But the kids would use them…not specifically my students, but a student comes in to type a paper or get on the Internet to do some research or something for them to use.*
  - *I mean a very simple way like kids using a calculator on their phone. It's right there, is useful, they all have it. Sometimes I have kids take a picture of the Math problems. I don't assign books, so I said "Ok, you'll get your phone out and take a picture of the problems you do, so you can do this at home" Or I would also have a paper copy available. So if they don't have a phone, they can use that. Beyond using as a calculator in my Math class, I haven't come up with any good uses for it. I do use Remind, so I'll send text message reminder to my kids about different things coming up.*