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Enhancement or Transformation? A Case Study of Preservice Teachers' Use of Instructional Technology

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Instructional technology has become a crucial component of public education. Reflected in the college and career-ready standards being implemented across the United States, an emphasis has been placed on preparing students with both the literacy and technology skills needed to succeed in postsecondary education and the workforce. Though a growing body of research has studied the theory and best practices for developing students' disciplinary literacy skills in the high school classroom, research that investigates the ways preservice secondary teachers use instructional technology during their student-teaching internship is an emerging area of study. In this paper the researchers explained how they used the Substitution, Augmentation, Modification, Redefinition framework as a guide for analyzing the ways preservice English and social studies teachers used technology while completing their internship and reported those findings. The article concludes with recommendations for developing preservice teachers' use of instructional technology during their teacher education program.

Rapidly developing mobile technologies such as tablet devices and apps that are now being used in schools have changed the very essence of classroom instruction (Keengwe, 2015; Vu, McIntyre, & Cepero, 2014). Previously, teachers' use instructional technology (IT) in the classroom was limited. For example, the use of a projector or document camera to show students an example was once considered a sufficient use of IT (Liang et al., 2005; Nathan & Knuth, 2003).

The advent and adoption of new technologies have provided teachers with the opportunity to create dynamic, collaborative educational experiences for student learning (Martin & Ertzberger, 2013; Wakefield & Smith, 2012). With a growing body of literature supporting the use of IT, researchers have shifted their focus from the technologies themselves to teachers' use of them.

Specific to this literature is research focusing on preservice teachers' beliefs about using IT (Anderson, Groulx, & Maninger, 2011; Koc & Bakir, 2010; Sadaf, Newby, & Ermter, 2012) and uses of IT during their student-teaching internship (Abbitt, 2011; Hofer & Grandgenett, 2012; Pamuk, 2012). (In this context, the term *internship* refers to the student-teaching experience the preservice teachers must complete for initial teacher licensure, as required by state.)

This research reported in this paper adds to the growing body of literature. We analyzed how preservice English and social studies teachers used IT while completing their internship through the lens of Puentedura's (2009, 2010) Substitution, Augmentation, Modification, and Redefinition framework (SAMR). Specifically, we sought to answer the following questions:

1. How did preservice English and social studies teachers use IT during their internship?
2. Did the complexity of IT usage advance as preservice teachers progressed through their internship?
3. Was the IT used as a tool for promoting student learning, as a teacher resource, or as both a learning tool and a teacher resource?

The following sections will first summarize research related to preservice teachers' progression of skills for using IT during their internship before describing the SAMR framework and then explaining how it was applied in this study. The article will conclude by presenting and discussing this study's findings along with implications for teacher education programs.

Progression of Preservice Teacher Knowledge of Instructional Technologies

With the rapid development of computing technologies that ushered in the digital age, researchers have identified effective ways teachers can integrate them into their instruction (Hammond et al., 2009; Hughes, 2004; Mishra & Koehler, 2009; Swan et al., 2006). In these studies, the researchers used multiple methods to analyze how IT was used by practicing and preservice teachers.

Hughes (2004) put forward four principles for using IT across the content areas. Her first and second principles argue that a connection between the technologies themselves and professional knowledge must exist if the technologies are to be used effectively. For IT to be useful, it cannot be an "add-on" to a lesson; rather, it must be part of how the lesson is taught, which includes the instructional strategies used to teach content knowledge. These principles for integrating IT became a central focus in Mishra and Koehler's (2008) seminal Technological Pedagogical and Content Knowledge framework (TPACK).

Hughes' (2004) third guideline is to use IT as a way to first challenge and then extend professional knowledge. Though she considered both preservice and in-service teachers, Hughes focused this guideline more heavily toward preservice teachers, because they have less classroom experience. Preservice teachers tend to replicate instructional strategies they experienced (Britzman, 2003; Cherner & Curry, 2016; Lortie, 1975), so they must reflect on how they used IT while they were K-12 students and be aware if they are replicating those methods or are using technology that aligns to current best practices.

Hughes' (2004) final guideline is for teachers to use several instructional technologies in the classroom. She explained that teachers are often provided technologies for keeping attendance, tracking grades, and sharing information with stakeholders. Instructional

technologies, however, are not always as plentiful. Although this dynamic has changed since the time of Hughes' article because of the introduction of mobile technologies, her focus on instructional technology "may encourage teachers to examine technologies more thoroughly prior to adoption... because teachers will have more awareness of software and hardware that have specific advantages for student learning" (p. 355).

Providing preservice teachers with multiple experiences using IT should benefit them in that they will be exposed to more options, and their use of particular technologies may become more purposeful. Even though these guidelines were offered before smartphones and tablets were released, the idea of exposing teachers to multiple technologies continues to be used to inform current theory and practice for using IT (Ellis, Dare, & Roehrig, 2016; Gökçe, Yenmez, & Özpınar, 2016; Gökçearslan, Karademir, & Korucu, 2016).

Focusing specifically on preservice teachers' use of IT during their internship, researchers have found that they benefit from teacher education programs that model effective uses of IT (Hammond et al., 2009; Hughes, Liu, & Lim, 2016) and explicitly connecting the use of IT within TPACK's theoretical elements (Abbitt, 2011).

For example, Pamuk (2012) analyzed preservice teachers' uses of IT and suggested that they benefit from an in-depth understanding of pedagogical content knowledge (Shulman, 1986, 1987) before considering technological tools to enhance instruction. According to Pamuk, preservice teachers need a deep understanding of their content area and instructional practices before selecting and integrating IT into their instruction.

Hofer and Grandgenett (2012) reported a similar finding. They noted that preservice teachers were often capable of integrating IT into their teaching, but the quality of their instruction decreased if their pedagogical content knowledge was weak.

A crucial aspect of incorporating IT successfully is that it is used for a specific reason. Ditzler, Hong, and Strudler (2016) conducted a case study situated in eight classrooms that were part of a 1:1 tablet program, which provided all students with a tablet. They found that the number of applications (apps) used in the classroom was limited, and most apps were used to increase efficiency productivity, rather than for instructional uses. This finding means that apps were used more to improve classroom efficiency (e.g., submitting assignments, managing the classroom, and communicating with stakeholders) than to advance student learning.

Another recent study found that, "when technology is used to remodel learning routines, cognitive processes, problem solving, and teacher roles, our schools can realize the promise of technology to transform learning" (McKnight et al., 2016, p. 198). In short, IT has the potential to be a dynamic instructional tool to promote student learning, but limiting it to teacher use of efficiency tools undercuts its promise.

In all, these studies begin to document that if preservice teachers are able to use IT effectively during their internship, there are direct benefits to them developing an understanding of TPACK. This study seeks to add to that growing body of literature by using SAMR as a tool to assess if, and potentially how, preservice teachers integrate IT into their teaching while completing their internship.

SAMR as a Framework to Evaluate the Purposeful Use of IT

Using IT effectively is part of preparing students for success in college and the workforce, and understanding how IT can be used must be clarified. To support that clarification,

Cherner, Dix, and Lee (2014) developed two overarching categories for IT. First, they explained the "teacher resource" category, which is the use of IT to manage a classroom, communicate with stakeholders, grade tests, or in other ways increase teacher efficiency. Second, they described the "instructional tool" category, which refers to using IT to promote student learning by having them engage with content (e.g., articles, videos, and websites), create learning artifacts (e.g., documents, images, and presentations), or develop a skill (e.g., spell words, solve math problems, and comprehend text). Because IT can be classified in different ways, Puentedura's (2009, 2010) SAMR framework is ideal to analyze the purpose for using IT.

The Substitution, Augmentation, Modification, Redefinition Framework Defined

SAMR is a tool for analyzing the purposeful use of technology. Cochrane, Antonczak, Keegan, and Narayan (2016) explain SAMR as helping technology to "move beyond the substitution of existing educational activities and assessment practices to create new experiences previously impossible or difficult with prior technology" (para. 14). When IT is used as a substitute for paper-and-pencil experiences (PAP; in this context, the term paper-and-pencil refers to materials, resources, and other tools that exist in nondigital forms, such as reference books, basic calculators, and musical instruments.), Cochrane et al. noted that IT adds low value to a lesson. However, when IT maximizes student efficiency or allows them to have experiences that do not exist in a PAP form, the value of IT increases. As shown in Figure 1, SAMR's design focuses solely on the use of IT, without consideration of a lesson's context (as noted in Hamilton, Rosenberg, & Akcaoglu, 2016).

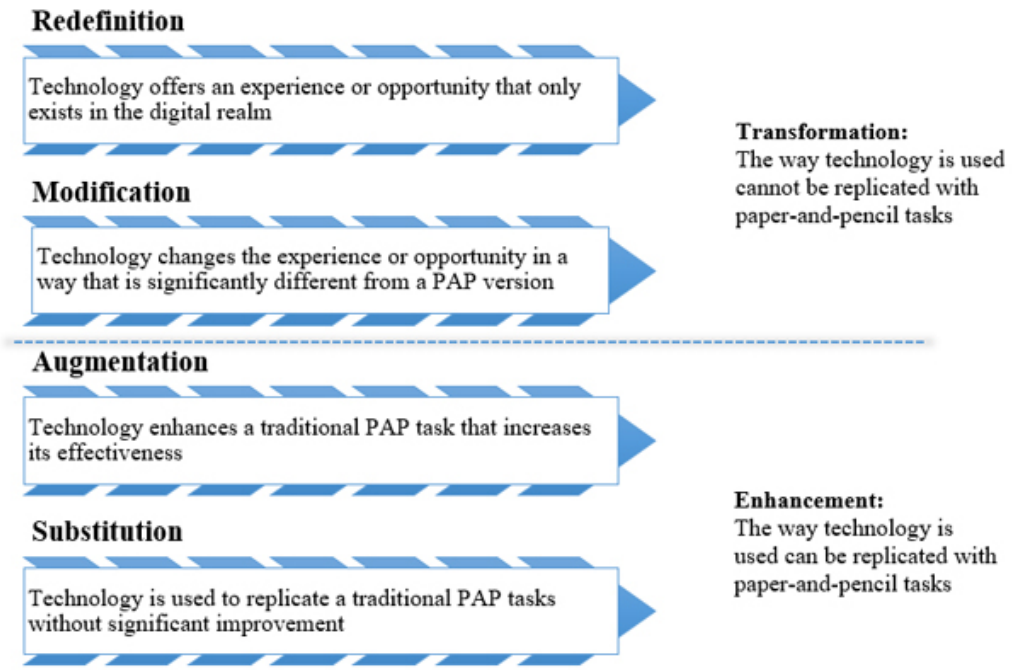

Figure 1. *The SAMR Framework.*

SAMR's structure is divided into two halves, each half with two levels. The bottom half is labeled "Enhancement" and includes the Substitution and Augmentation levels. At these levels, IT is used to either replicate a PAP task or improve the way it is completed.

Starting at the Substitution level, IT is used to replicate a PAP task. IT does not necessarily add rigor or relevancy to the task; it only digitizes the experience. For example, if students use a word processing program to type an essay instead of writing it by hand, they are engaging the Substitution level, because IT has not improved the essay other than digitalizing the process of writing it.

At the Augmentation level, IT significantly increases the productivity – in terms of both time and effectiveness – for completing a PAP task, though the task could still be completed using nondigital materials. Returning to the essay example, students would be working at the Augmentation level if they used the grammar and spell checker tools to analyze their writing for errors. The function of the tools increases the speed at which students are able to edit their paper; however, they could still make those same edits using traditional grammar books, thesauri, and dictionaries. As such, IT enhanced the writing and editing of the essay, but it did not transform it.

The upper half of SAMR is labeled as "Transformation," and it includes the Modification and Redefinition levels. At the Modification level, the experiences offered by IT are rooted in PAP tasks and materials, but they evolved into something that cannot be replicated using them. Continuing the essay example, students would be working at the Modification level if they inserted images and hyperlinks into the text; altered the text's letter font, size, and color; or added headings and different templates to change the text from an essay into a report. Altering the text in those ways has roots in PAP tasks, but it elevates it into something that is no longer replicable using those means.

SAMR's final level is Redefinition, defined by using IT to create something that exists only digitally. Redefinition would be reached if students took their essay and then transformed it into a multimedia presentation, website, or podcast, because those learning artifacts do not exist in a PAP form.

Though SAMR provides a framework for analyzing how technology is used, it has limitations. Hamilton et al. (2016) explained that teachers should not believe all IT must be used at the Modification or Redefinition levels. Rather, SAMR's value is that teachers understand and are cognizant of the different ways IT can be used.

Hughes, Liu, and Lim (2016) argued that preservice teachers need experiences using IT at SAMR's different levels during their initial teacher licensure program, so they have a deeper conceptualization for the different ways IT can be used. In turn, it will support them in using IT purposefully when they begin to plan and implement instruction during their internship.

Methodology

This research presents a case study (described by Baxter & Jack, 2008; Gerring, 2004) that analyzed how preservice English and social studies teachers used IT during their internship, which was the final experience of their initial teacher-licensure education program. We, the researchers for this study, served as both teacher educators and university supervisors to these preservice teachers, which places them on the participant-observer spectrum (Kluckhohn, 1940; Whipple, 2006).

Context

This study took place at Cherry University (CU), a pseudonym for a comprehensive, public university with a liberal arts focus located in the southeastern United States. CU's college of education prepares secondary preservice teachers in English, social studies, science, and math through its Masters of Arts in Teaching (MAT) program, and the college of education along with the MAT program are accredited by the National Council for Accreditation of Teacher Education.

The MAT faculty value the importance of preservice teachers using IT effectively, so they embed IT-based experiences within their coursework. For example, all preservice teachers create and teach a blended learning lesson in their Human Development course. In their Diversity course, the preservice teachers create and implement lessons that use tablets, apps, and websites as tools for differentiating instruction. The purpose of these activities is to expose the preservice teachers to a variety of teaching strategies that use IT as well as to the expectation that IT be used to increase student learning. Providing these experiences is crucial because CU's local partner school district is rich in technology, where the majority of the MAT program's preservice teachers complete their internship.

Tyson School District (TSD), a pseudonym for CU's main partnering district, became a 1:1 computing district during the 2012-2013 academic year, and now all of its students and teachers have access to a tablet. TSD requires its teachers regularly to implement blended learning lessons in their classroom. To ensure the quality of these lessons, teams of evaluators frequent the schools and monitor how technology is used. Because the majority of the MAT program's preservice teachers spend time in TSD schools, the MAT faculty familiarize their preservice teachers with the technologies and teaching methods commonly used in TSD.

Participants

The participants for this study included eight preservice English teachers and seven preservice social studies teachers who were enrolled in CU's MAT program during the 2015-2016 school year. All participants completed their internship during the spring 2016 semester, and their demographic data is shown in Table 1.

Table 1
Demographics of Participant

Race/Ethnicity	Gender	Age
Subject: English		
1 African-American 7 Caucasians	4 Females 4 Males	7 are between 21-25 years of age 1 is between 26-30 years of age
Subject: Social Studies		
2 African-Americans 5 Caucasians	3 Females 4 Males	6 are between 21-25 years of age 1 is between 26-30 years of age

Data Collection and Analysis

To ensure triangulation and build credibility (Cutcliffe & McKenna, 1999; Krefting, 1991), three types of data were collected for this study that included (a) The participants' lesson plans; (b) observation notes of the participants' instruction; and (c) a technology questionnaire completed by the participants. The participants wrote a lesson plan for each day they were the full-time teacher during their internship (a minimum of 35 lesson plans per participant).

For each class they taught, the participants were required to have a full lesson plan approved by their cooperating teacher, and it had to include an objective, one or more standards, instructional methods, and an assessment. The participants stored their lesson plans in Google Drive, so we had full access to them during the participants' internship.

Our observation notes were the second piece of data, and each participant was observed four times. One researcher completed the observations for the English preservice teachers and the other for the social studies preservice teachers. To record their observations, we used the form shown in Figure 2.

Figure 2. *Observation instrument.*

With this instrument, we recorded the participants' name, date of observation, and lesson objective. When either the participant or a student used IT during the lesson, we recorded it and observed how it was used. Once we understood how the IT was being used, it was assigned a SAMR level and a summary of its used was written.

In all, we recorded 130 different instances of IT being used across the 60 observed lessons. The final data collected were the questionnaires completed by the participants after their internship. The questionnaire's specific prompts were as follows:

1. How often did you use technology to project information – PowerPoints, videos, images, etc. – from the front of the room?
2. How often did you use technology for students to complete daily processing assignments, such as illustrated timelines, graphic organizers, or using educational software like iCivics or No Red Ink?
3. How often did you use technology to support students in conducting research for new information, collaborating on longer term tasks, or taking virtual tours?
4. How often did you use technology for students to create an artifact that can only exist digitally, including a multimedia presentation, podcast, website, documentary, recorded or edited music, blog, or another similar learning artifact?

In response to each prompt, the participants first identified the IT used during their internship, and then how often they used each IT by selecting:

1. Often, at least once per week;
2. Sometimes, at least twice per month;
3. Rarely, once throughout my internship; and
4. Never, I did not use this type of technology as part of my internship.

After the entire data set was recorded, we compiled a spreadsheet that listed all the IT we observed, which was organized by date and SAMR level. In addition, the participants' responses to the questionnaire were included on the spreadsheet, so we could cross-reference the data we observed with how the participants identified using the IT.

For the IT named in the questionnaire, we read the description of how it was used to inform our classification of it on the spreadsheet. This move was an intentional check for potential participant bias, as the claims made in the questionnaire about IT usage had also to be documented in our observations.

At this stage, we used our understanding of both SAMR and the lesson to confirm a SAMR level for each individual use of IT we observed. With the spreadsheet in place and our access to the lessons plans, we each began to analyze the data individually for themes and patterns. This step established preliminary findings, and the findings were important to ensure the study's direction. Hanson, Balmer, and Giardino (2011) explained, "It is not uncommon for qualitative research designs to be modified in response to unexpected events or preliminary findings... The flexibility of qualitative research can accommodate change during the study" (p. 381).

Though we classified our work as qualitative due to the act of observation and document analysis (Patton, 2005), their observations were captured as quantitative data because the classifications of IT usage aligned to SAMR took the form of tally marks on the spreadsheet. After we established patterns based in that data, we discussed complications we had while individually analyzing it. At this point, we met and implemented the following data analysis procedures.

The first level of analysis determined if the self-report questionnaire responses aligned to our overall observations, and they clearly did. The same uses and levels of IT that we observed were confirmed by the questionnaire data. For example, if we indicated that a participant often used PowerPoint electronic slideshows and CNN Student News at the Substitution level, that participant's questionnaire confirmed it. If we did not observe a participant use any IT at the Redefinition level, that participant's questionnaire indicated that IT was "rarely" or "never" used at this level. In this way, the questionnaires served to build the finding's reliability and trustworthiness.

The next level of analysis sought to identify if there was an increase regarding the sophistication of the IT used by the participants over the course of their internship. With the data compiled on the spreadsheet, we were able to capture the complexity of the IT as described by SAMR level for each observation. To do so, we assigned a point value for each of SAMR's levels (Substitution = 1 point, Augmentation = 2 points, Modification = 3 points, and Redefinition = 4 points). With these values, we assigned a score each time an IT was used by a participant or student. After the visit, we then calculated an average of those values and documented it. Once all the observations were complete, an average for each visit by participant and subject area was found, and this technique allowed for trends in how the participants used IT as their internship progressed to be identified.

Limitations

The process of analyzing and classifying the use of IT using SAMR scale is subjective. To enhance interrater reliability, we operationalized SAMR's different levels and agreed to representative examples of IT shown in Table 2 prior to observing the participants.

Table 2
Operationalizing the SAMR Framework

Category	Example 1	Example 2	Example 3	Example 4
Redefinition	Participating in game-based learning using websites and digital tools	Developing an online blog for others to read	Creating a multimedia presentation	Recording and editing music
Modification	Creating a graphic organizer that includes hyperlinks, images, and varied fonts	Searching massive databases for information	Visiting places that no longer exist (e.g., Ancient Rome, the Globe Theater)	Collaborating on a document in real time digitally
Augmentation	Viewing a video that pauses automatically to ask questions, which then scores and stores the response data	Posting to a class website	Creating an infographic	Viewing existing artifacts virtually
Substitution	Responding to an exit ticket by emailing their response to their teacher	Memorizing vocabulary terms using digital flashcards	Learning times tables and spelling	Tracing letters on a tablet

To develop Table 2, we met and discussed multiple ways IT could be used and aligned them to SAMR. This exercise, in turn, increased our understanding of SAMR's categories, and Table 2 served as guide for classifying IT usage on SAMR during this study. Though rare, when a question did arise about how a piece IT was used that did not squarely fit into Table 2, we reviewed the participants' lesson plans to gain a more detailed understanding and worked to map the IT usage onto SAMR.

Calculating averages represents another limitation, because it does not contextualize the purpose for how or why a piece of IT was used. At times, it is appropriate to use IT for enhancing a PAP activity instead of transforming it. When using IT to present information to students, it would likely be classified at the Augmentation level, because information was being shared using static images and text. As such, it would be challenging to use IT for projecting information at the Redefinition level. This dynamic can result in lessons that used IT appropriately but for specific, logical reasons were assigned a lower SAMR value.

Because this research is a case study rooted in a small sample from one preservice teacher education program, replicating this study's exact findings may prove difficult, which constitutes another limitation. The context of the study, number of participants, and the technology opportunities offered by our partnering school district must all be considered. As such, this study's findings should not be generalized.

Findings

Addressing the Research Questions

We adopted the SAMR framework to guide our analysis for the first two research questions. For the final question, we categorized the IT used by the participants as a tool for promoting student learning, as a teacher resource, or as both a learning tool and a teacher resource. This section will next present the findings for each question.

Research Question 1. How did preservice English and social studies teachers use IT during their internship? We used the SAMR framework to classify the different types of technologies used by the participants, as shown in Table 3.

Table 3
Snapshot of the Frequency With Which Technology Was Used as Categorized by SAMR Level

Participants	Substitution	Augmentation	Modification	Redefinition
English interns (n = 8)	23	30	5	1
Social Studies interns (n = 7)	29	20	17	4
Total number of uses over four observations	52	50	22	5

The most common uses of IT fell within SAMR's Substitution and Augmentation levels, and different patterns were found between the two groups of teachers. The English preservice teachers more commonly used IT for Augmentation; whereas, the social studies preservice teachers used IT more for Substitution. Data indicated that English preservice teachers were working at SAMR's Substitution level when using a projector to model skills or using an online timer to help pace their lesson.

They were working at the Augmentation level when using Google Classroom to assign and collect work from students, accessing videos from YouTube, or having students use No Red Ink and Achieve 3000 to practice grammar and reading comprehension skills. The social studies preservice teachers use of CNN Student News or a brief PowerPoint-enhanced lecture to begin class was classified as being on the Substitution level; whereas, their uses of Google Drive, EdPuzzle, Quizzes, Popplet, and Kahoot were recorded at the Augmentation level.

The major difference between the preservice English and social studies teachers was in the area of Modification. Analyzing the specific technologies, the English preservice teachers used Google Drive primarily to store readings and submit answers to questions, which was classified as Augmentation. Several of the preservice social studies teachers, though, used Google Drive to help students collaborate with peers on research projects and presentations, as well as to share their final products and present them to other students in their class, which was classified as Modification.

Google Drive has multiple functionalities and was classified differently depending on how it was used. The preservice social studies teachers also reached Modification levels more frequently when they used multiple websites, such as iCivics, StoryBoardThat, and Poster My Wall. Each of these websites transformed an activity beyond what was possible using PAP materials. In his study of preservice social studies teachers' use of IT, Hilton (2016) suggested that IT caters to the social studies due to the accessibility of digital primary and secondary resources, which is likely reflected in these findings as well.

Modification was also used to support student collaboration to complete assignments. For example, one social studies preservice teacher had her students complete a cooperative learning activity that utilized Google Drive. As review for an upcoming test, the preservice social studies teacher first created a blank Google Slides' presentation and then divided her class into small groups before assigning each group a topic and a presentation slide. The groups were tasked to supply information relevant to their topic on the slide and then present it to the class. After the presentations, students could download and save the completed presentation to study because of how the intern shared the original Google Slides presentation.

The least common use of technology was at the Redefinition level, and only five instances were recorded. One English preservice teacher had students use iMovie to develop an advertisement for a product they created. That preservice teacher required certain criteria for the iMovie (e.g., length of video, number of images in the video, and dialogue between two or more characters). However, besides those criteria, the students were able to design, edit, and present the video in anyway of their choosing, so long as it was school appropriate.

In social studies, the instances of Redefinition involved extension activities related to a topic of study. For example, one preservice social studies teacher first taught her students about different political candidates' platforms. After the lesson, she assigned students the task of writing and recording an original song that incorporated the political platform of a 2016 presidential candidate and then create a music video for their song. In both examples, students had to incorporate multimedia elements in order to produce a digital learning artifact that demonstrated both their knowledge of the content taught and how to use technology to communicate a message.

These findings indicate that the participants were still most comfortable incorporating technology at the Substitution and Augmentation levels. When IT was used at the Modification level, it was primarily related to assignments that required collaboration and research. Though a variety of creation-based apps and web-based tools exists (Cherner et al., 2014), few instances recorded students creating a lecture artifact and then sharing it with an IT other than a Google Slides presentation that featured static images and texts. Nothing is inherently wrong with this choice, but given the fact that in this context all students had immediate access to tablets, these results do indicate a need for incoming teachers to have more information about creation and presentation tools for students using the available IT.

Research Question 2. Did the complexity of technology usage advance as preservice teachers progressed through their internship? To study the second research question, we assigned each SAMR level a point value, and an average was compiled for each participant by observation based on each time an IT was used in the lesson. Using an average in this way to determine trends has limitations. For example, a penalty could potentially be placed on participants who used IT in multiple ways during an observation but who began with a PowerPoint-aided lecture and then increased the complexity of the IT throughout the lesson. We were attentive to this potential by recording each usage of IT. Though it did not contextualize the appropriateness of how the IT was used, collecting data by averages did

allow, somewhat, for trends that showed changes in the complexity of IT usage to be identified.

The data in Table 4 indicate an overall increase in SAMR averages throughout the participants' internship, with 1.69 being the average score for the first observation and 2.15 being the average score for the fourth observation. The trend toward more complex uses of IT is clearest for the preservice social studies teachers, where the averages consistently increased throughout the observations (1.69, 1.85, 2.19, and 2.30), but the data for the preservice English teachers also trended upward despite a dip in technology complexity during the third observation (1.69, 1.78, 1.46, and 2.02). These fluctuations indicate that the participants were incorporating IT into their instruction at different complexity levels throughout their internship.

Table 4
Intern Use of Technology by Observation

Intern	Observation 1	Observation 2	Observation 3	Observation 4
ENG 1 Intern	S, S, A (1.33)	S, S, M (1.67)	S, S, A, A (1.5)	S, A, M (2)
ENG 2 Intern	S,A (1.5)	A, R (3)	S, A, A (1.67)	S, A (1.5)
ENG 3 Intern	S, A (1.5)	A, A (2)	A, A (2)	A (2)
ENG 4 Intern	A (2)	S (1)	S (1)	M, M (3)
ENG 5 Intern	S, A (1.5)	S, S (1)	S, A (1.5)	S, A, A (1.67)
ENG 6 Intern	N/A	N/A	S (1)	M (3)
ENG 7 Intern	A (2)	A, A (2)	S, A (1.5)	A, A, A, A (2)
ENG 8 Intern	A (2)	N/A	S, A (1.5)	S (1)
English average	1.69	1.78	1.46	2.02
SS 1 Intern	S, S, A (1.33)	A, M, M (2.67)	S, A, M (2)	R (4)
SS 2 Intern	S, M (2)	S, M (2)	R (4)	S, A, R, R (2.75)
SS 3 Intern	S, A, A, M (2)	M, M (3)	A, A, A, M (3)	A, A, M (2.33)

SS 4 Intern	S, S (1)	S, S (1)	S, S, S (1)	S, M (2)
SS 5 Intern	S, A (1.5)	S (1)	S, S (1)	A, A (2)
SS 6 Intern	S, S (1)	S, S, A, M (1.75)	S, M (2)	S, S, M (1.67)
SS 7 Intern	M, M (3)	S, A (1.5)	A, A, M (2.33)	S, S, A (1.33)
Social Studies Average	1.69	1.85	2.19	2.30
Total Average	1.69	1.81	1.80	2.15

Note. "N/A" indicates observation not included in calculation. Technology was not available to interns during these observations, so complexity of nonexistent technology could not be determined.

Multiple potential explanations exist for this increase. First, preservice teachers at the beginning of their internship are generally more tentative, feeling out their new status as teachers by using more familiar methods and techniques before exploring advanced teaching strategies (Hughes, 2004).

Second, the context of the internship was also influential. Because many of the participants completed their internship in TSD, the district's culture for using IT innovatively coupled with its blended learning policy, 1:1 technology initiative, and IT-focused professional development offered to teachers likely encouraged the participants to explore how IT can be used more deeply as their internship progressed. For example, as they planned final projects and assessments for units they were teaching, the participants developed multimedia projects for their students instead of traditional tests and writing projects, and these findings differ from those of previous studies.

Hilton's (2016) study found that preservice social studies teachers did not increase their usage of IT based on SAMR; rather, it fluctuated based on the purpose of a given lesson. Hilton's participants were more likely to use IT at the Substitution and Augmentation levels for content acquisition and at the Modification and Redefinition levels in a later unit for skills practice. This finding lends support that IT is used at SAMR's "Transformation" level based on the purpose of the lesson (e.g., presenting information using IT versus students actively engaging IT for a specific task). In all, these findings further indicate that the participants were more likely to incorporate IT at the Modification and Redefinition levels as they progressed in their internship, which suggests that it took them time to understand and use IT with students in more than a superficial way.

Research Question 3. Was the IT used as a tool for promoting student learning, as a teacher resource, or as both a learning tool and a teacher resource? The study's final focus classified the IT used based on whether or not the participants used it as a tool for promoting student learning, a teacher resource, or both as a tool and resource. Tables 5

and 6 classified the different IT based on the hardware used to access it, the frequency of its use, and a description of how it was used.

Table 5
Technologies Used as a Tool for Student Learning

Software	Frequency of Use	Representative Example(s)
Hardware - 1:1 Devices (Tablets and Laptops)		
Google Classroom	20	Using Google Classroom to process information using an activity such as answering questions/prompts, creating presentations
Search Engines	10	Visiting popular search engines such as Google to find information about a topic
Achieve 3000	5	Software program used to monitor and support students reading comprehension skills
EdPuzzle	4	Embed questions within a video that students answer while recording data
StoryBoardThat	3	Create graphic organizers in the form of “Storyboards” that combine text and images
No Red Ink	3	Software program that teaches and reviews grammar skills
iMovie	2	Create movies that relate to a specific topic or theme
Kahoot	2	A multiple-choice, quiz-based activity that poses questions and tracks responses
iCivics	2	Game-based learning platform that teaches about federal elections and Constitutional rights
Popplet	2	Create semantic maps and/or graphic organizers in response to a topic
Make a Case	1	Presents a legal topic and multiple perspectives about how the topic could be interpreted
Easy Bib	1	Create and record reference citations
No Fear Shakespeare	1	Translate Shakespearean works into modern English and provides analysis and interpretation of the different works
Quizlet	1	Review vocabulary words for upcoming assessment
Digital Textbooks	1	Multimedia texts that include interactive maps and videos
PosterMyWall	1	Create infographics that include multimedia elements
USA Test Prep	1	Review material in preparation for upcoming AP test in U.S. history
Hardware - Projector		
Presentation Software	21	PowerPoint or Google Slide presentations used for whole-class lecture or to project daily questions

CNN Student News	9	Share current events with students and discuss them
YouTube	8	Show a video clip to the entire class related to a topic of study
Kahoot	2	Projected on the screen for the teacher, while students answer using their tablets
Hardware - Cell Phones		
Mobile Applications	2	Students used cell phones to research a topic

Table 6
Technologies Used as a Teacher Resource

Software	Frequency of Use	Representative Example(s)
Hardware1:1 - Devices (Tablets and Laptops)		
Google Classroom	24	Store, retrieve, and share documents and presentations
Hardware - Projector		
Presentation Software	17	Used as a visual aide during lesson to project an image, quote, or instructions to students.
Digital Timer	6	Used by the preservice teachers to pace the different components of a lesson or time allotted to students to complete a task
Online Name Wheel	2	Used to randomly select students to answer a question
Hardware - SMART Board		
SMART Notebook	4	Used to annotate text and conduct a “chalk talk” lesson
Hardware - Music Player		
Windows Media Player	4	Play music for students while they complete independent work
Hardware - Document Camera		
SMART Notebook	3	Annotate texts and model diagramming sentences as grammar practice

Tables 5 and 6 represent the number of times during the observations that an IT was used either for student learning (Table 5) or as a teacher resource (Table 6). In many cases, IT was used for more than one purpose. When this trend was identified, the IT used was classified in multiple categories. For example, if a participant asked students to use their tablets to access Google Drive in order to locate a reading and answer questions and then asked them to log into Achieve 3000 when they were finished, this assignment would be tallied as follows:

1. Hardware: 1:1 Device (tablet) – Google Classroom as a teacher resource (for storing, retrieving, and sharing documents)
2. Hardware: 1:1 Device (tablet) – Google as a tool for student learning (answering questions as a processing activity)
3. Hardware: 1:1 Device (tablet) – Achieve 3000 as a tool for student learning

While the same hardware was used throughout this lesson (e.g., tablets), three separate tasks that used the IT took place: (a) using Google Drive as a resource for storing and sharing documents, (b) demonstrating comprehension of a text by responding to questions, and (c) completing a reading comprehension exercise using Achieve 3000. Separating each use of IT by purpose allowed us to analyze the frequency with which IT was used to support instruction, enhance learning, or was used for both purposes.

Table 5 details uses of IT in this study specific to student learning. The participants used tablets 60 times throughout the course of the observations as tools for student learning. These uses included 17 different software applications, with Google Classroom being the most common, and it was used for a range of activities.

The participants' next most common use of 1:1 devices to promote student learning was for research assignments. At times, these research assignments were open-ended and students were given a topic and required to locate resources independently. Other times, the participants provided sample websites to help students locate high-quality resources and then build their research, and we classified both of these actions in the "search engines" category.

Finally, the participants used a variety of websites and programs to help students process a particular concept, practice grammatical skill, reading comprehension, and test preparation activities, or demonstrate knowledge of a procedure. All together, these websites and programs were used 30 times during the course of the observations.

Projectors were the second most frequently used piece of hardware, and they were recorded being used for student learning 40 times. They were often used to present information via PowerPoint and Google Slide presentations or to model and explain upcoming assignments. They were also used to show videos that connected to whole class instruction. For example, the social studies preservice teachers began class nine times by having students watch CNN Student News on the projector, in addition to the eight times they incorporated different YouTube videos into a lesson. Finally, the projector was used in combination with tablets for a Kahoot activity in which the question was projected for students and they responded on their tablets.

Cell phones were the final piece of hardware used for student learning. One of the participants, who was placed in a school with limited tablets, had his students use their cell phones to conduct research for an in-class assignment twice while being observed.

Next, Table 6 details uses of IT that served as a teacher resource. As used in this context, a teacher resource is the use of IT in order to improve the classroom efficiency for tasks like distributing materials, aiding in class discussions, and serving as tools for modeling skills. This usage is separate from IT being used for student learning, in that the benefits of using the IT are for the teacher when leading lessons, managing classes, or communicating with stakeholders.

As shown in Table 6, Google Drive was the most frequently used IT, and it was observed being used 24 times. Its main purpose as a teacher resource was for storing, retrieving, and sharing files, and it was clear that the participants were comfortable using it. These uses of Google Drive are similar to older hardcopy file-storage systems, where resources were made available offline using PAP folders for a variety of purposes.

Throughout their observations, we noted 17 times when the participants chose to project content to their whole class as a visual aide during a guided lesson. Also, digital timers and online name wheels were used as tools to pace and manage the class. SMART electronic whiteboards were used significantly less frequently. Not counting their use as a screen where lectures were projected, SMART boards were used only four times during this study, and all four uses were comparable to how a plain white board could be used.

For example, one English preservice teacher asked students to come up to the SMART board and annotate sentences, and a social studies preservice teacher used it for a chalk-talk discussion. In neither instance did the participants use any of the applicable SMART board software to enhance the lesson.

Other teacher resource hardware used included digital music players for playing music to students while they completed independent work and document cameras for modeling how to diagram/annotate text. In all, there were 60 uses of IT as a teacher resource as compared to over 100 uses of IT as a tool for student learning.

These findings indicate that the participants were aware of and able to use IT for different purposes. Google Drive was the most frequently used piece of software, and it was used both as a tool for student learning and a teacher resource. This finding was largely due to Google Drive's flexible functionalities. The most frequently used piece of hardware for student learning and as a teacher resource was the projector, and this result was likely because projectors can share information to a whole class, which makes them flexible as well. Tools that are not as flexible were used much less often.

Table 5 shows that the participants used a variety of software tools to promote student learning. However, given all the possible apps and websites available to them, the variety is not as plentiful as might be expected. Even though those ITs did not have as many flexible uses as Google Drive, the small number of them that they were recorded being used only once suggests that the participants had limited knowledge of them and how to use them. This finding aligns with other studies about the use of IT in 1:1 technology environments (Ditzler et al., 2016; Williams & Larwin, 2016), which indicates that IT could be better blended into instruction.

Implications and Recommendations for Teacher Educators

Mobile technologies are unique in that the speed of their development and growing sophistication distinguishes them from among other pieces of IT such as white boards, books, and overhead projectors. Digital technology is dynamic, fluid, and ever evolving. As such, it is inappropriate to use this study to identify a list of "best" or "top" digital

technologies for preservice teachers to learn and use during their internship. Rather, we will offer recommendations and considerations for using IT with preservice secondary teachers.

1. The majority of the IT used were at SAMR's lower levels. By far, the participants reported and were observed using IT aligned to SAMR's Substitution and Augmentation levels at much higher rates than the Modification and Redefinition levels during this study. As other researchers (Cherner & Curry, 2016; Hughes, Liu, & Lim; 2016) have found, preservice teachers tend to replicate practices they experienced as K-12 students during their teacher education process, and the participants in this study were not an exception. However, as they became more experienced and progressed through their internship, their use of IT began to shift from the Substitution and Augmentation levels to the Modification and Redefinition levels. This shift is important because it demonstrates that the participants were willing to incorporate multiple technologies into their teaching practice while completing their internship; however, they were not ready to do so at the beginning of their internship. Teacher educators can help facilitate this shift earlier in preservice teachers by providing technology-rich experiences embedded throughout teacher education programs and even into their internship, with "on-the-spot" assistance and whole-group professional development focused on methods for using a variety of apps and websites.
2. ITs with multiple uses were used more frequently than standalone ITs that had only one functionality. In this study, the preeminent piece of IT used was Google Classroom, and it was used as both a teacher resource for sharing, retrieving, and presenting information and as an instructional tool for posing questions, receiving answers, and creating presentations. The participants were more comfortable using this piece of IT and used more of its features, as reflected in the frequency of its use. This finding demonstrates that quality pieces of IT with flexible uses should be integrated into teacher education programs' coursework so the preservice teachers experience the IT as a learner before using it as a teacher. One way to do so is to use Google Classroom or a similar learning management system (LMS), such as Schoology or Edmodo, as a substitution or supplement to a college-sponsored LMS.
3. Projecting presentations is still the main use for SMART Boards. In the past decade, SMART Boards have replaced projectors in many classrooms. According to Preseton and Mowbray (2008), SMART Boards can be used to create experiential learning opportunities for students, interact with different sounds and icons, view multimedia presentations and images, annotate text, and save the content that is on the board. Gursui and Tozmaz (2010) add that SMART Boards can help provide instant feedback to students, synthesize information from multiple sources to create presentations, and support collaborative activities. In this study, the participants mainly used SMART Boards to project information to students in the forms of assignments, assessments, and presentations (see Table 6, on uses of IT as a "teacher resource"). However, with SMART Boards costing over $5,000 (Modern Chalkboard, 2013), it is concerning that the participants were using them mostly to project information to students, as opposed for text annotation, saving the information on the board, or using them to create collaborative activities. When teacher educators prepare their preservice teachers to use SMART Boards, they need to purposefully integrate and demonstrate the SMART board's advanced features in their teacher education coursework. This practice will provide the preservice teachers with a model for how SMART Boards can be used in the classroom.
4. Tablets are versatile tools and, with training, they can be used to both boost instruction and increase productivity. Since the release of the iPad in 2010 – which was followed by Google Chromebooks, Kindle Fires, Dell Venues, and

additional tablets – education has changed dramatically. Before tablets were available, teachers did not have a piece of hardware that had such flexible uses; now tablets have become the "Swiss Army Knife" of IT. Due to their flexibility, tablets can be used as both a tool for student learning and as a teacher resource, and this study documented participants using tablets for both purposes. For example, tablets were the most frequently used piece of hardware recorded in this study, and students used them to access Google Classroom, locate information online, and complete assignments that involved apps and websites. For the participants, tablets were also the most frequently used piece of IT, and they used them for storing, sharing, and retrieving information through Google Classroom, which has implications for teacher educators. First, preservice teachers need to develop their competency using tablets. This competency includes using it as a tool for learning, and being able to troubleshoot basic problems they and their students may have when using it. Next, preservice teachers need to understand the tablet's different features, such as how to download apps, bookmark websites, link different apps together, save and share images, and much more. Finally, preservice teachers need time using the tablet as a learning tool, and not for entertainment. By building these competencies in preservice teachers and allowing them these experiences, they will come to know the tablet as a dynamic tool for teaching and learning. Though the participants in this study experienced using tablets in their coursework and internship, they still tended to use them at SAMR's Substitution and Augmentation levels. Teacher education programs have an opportunity to further demonstrate innovative methods for using tablets, and other devices such as cell phones and laptops, to develop their preservice teachers' abilities for using them. As the preservice teachers move into their internship, they can also accompany their cooperating teacher to professional development sessions about best practices for using the tablets in the classroom.

5. There is a need for preservice and in-service teachers to have clear guidelines for navigating the growing variety of software programs and educational apps being developed. The field of educational apps and IT comprises a multi-billion-dollar industry (Richards & Stebbins, 2014), and new types of IT are being continuously released into that marketplace. As such, teachers are challenged to stay current with them. As shown in this study, the participants used dozens of pieces of IT during their internship. As they were novices and only a small portion of their teaching was recorded for this study, it demonstrates that a large variety of IT is being used in the classroom, which results in a need for trusted, credible resources for learning about them. Currently, there are several blogs, websites, and databases dedicated to IT, but they vary in quality. We suggest that teacher educators guide their preservice teachers to resources that use research-based evaluative criteria for analyzing different IT they recommend. Examples of these resources are App Ed Review (www.appedreview.com) and Common Sense Media (www.commonsensemedia.org). In addition, new and preservice teachers would benefit from on-site mentors who are current in new IT being developed, and who can provide ideas to help developing teachers, both preservice and in-service, in fully utilizing the capacity of IT to enhance student learning.

Conclusion

This study clearly demonstrated that the group of preservice English and Social Studies teachers who served as participants had a propensity for IT; yet, they still tended to use it mostly at SAMR's Substitution and Augmentation levels. Though the IT enhanced their efficiency, it seldom transformed their instruction. This finding is significant because students must be able to use IT flexibly as they move through their educational careers, which means teachers must incorporate IT into their instruction. As the participants in this

study were mostly using IT as a replacement for paper-and-pencil tasks, it demonstrated that they are capable of using IT to develop advanced skills in students, but that type of instruction was infrequent. Teachers educators can help facilitate that shift regarding preservice teachers' IT usage by modeling methods for using it at SAMR's Modification and Redefinition levels.

Public education in the United States is undoubtedly experiencing a shift. No longer are teachers using only PAP methods to build their students' knowledge bases and ability levels; rather, instructional methods that utilize digital devices, resources, and tools (e.g., websites and apps) are being implemented at increasing rates. However, to ensure that those technologies are being used purposefully, not just to replicate PAP tasks digitally, frameworks such as SAMR can be taught to preservice teachers while they are completing their initial teacher education program to analyze their use of IT. Therefore, as preservice teachers advance through their coursework, internship, and first years in the classroom, they will have a foundation for making informed decisions about how they and their students are using IT.

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