Shifting the Gaze: (Mis)Using Actor-Network-Theory to Examine Preservice Teachers' Uses of Digital Technologies

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This paper responds to the recent call for technoskeptical or critical studies of educational technology in the classroom. The authors intentionally push against more established theoretical frameworks used in the field of teaching with technology by testing Latour's Sociology of Translation or Actor-Network-Theory (ANT) to shift the gaze away from solely knowledge-based or dispositional accounts of teachers' use of digital technologies within the social studies. When used alongside qualitative methods, ANT sensibilities open up an analytical middle ground between sociocultural and sociomaterial perspectives to help illuminate new perspectives regarding how certain forms of digital technologies are favored over other technologies by social studies preservice teachers within the contexts of their internship classrooms over time and space.

The recent call for technoskepticism focusing on "media ecology and critical theories," by the coeditors of *CITE Journal-Social Studies Education* (Krutka et al., 2020, para. 14,) is an intriguing invitation to bring new perspectives to conversations about social studies and technology (see also Lee & Hicks, 2006). The call should be a generator of opportunities for inquiries that explore the relationship – in theory and practice – between technology, teaching, and learning.

We appreciate the merit and intention of the editors' call. We also think that in being responsive to such a call creating a strong and theoretically playful (but aware) foundation from which to define such positions is important. This is especially so in a field that has previously been labeled theoretically underdeveloped (Doolittle & Hicks, 2003) and in its adolescence (Berson & Balyta, 2004), or as we contend, a field that somewhat favors and uncritically accepts one overarching framework: technology, pedagogy, and content knowledge (TPACK; see Bull & Bell, 2009; Colvin & Tomayko, 2015; Gómez, 2015; Hammond & Manfra, 2009; Manfra & Spires, 2013; Regan et al., 2019).

This assertion does not imply a total absence of literature critical to or questioning of the TPACK framework (see Archambault & Barnett, 2010; Graham et al., 2012). Even within *CITE Journal* some early advocates suggested that over time a number of concepts and frameworks, including TPACK, have undergone "conceptual dilution" through the process simply of becoming popular go-to frameworks or Christmas baubles (Bull et al., 2019). Interestingly, the solution offered within such critical pieces is to go back to the original source, rather than questioning its continuing viability or suggesting shifting frameworks for new perspectives to appear (as in Brantley-Dias & Ertmer, 2013; Bull et al., 2019).

While the call for technoskepticism has great potential, its success will depend on how ready, willing, and able the field is to reimagine the landscape and rules of the game of scholarship and scholarly publishing. Starbuck (2006) noted that in many fields the game itself, defined by its communities of practice, can succumb to or implicitly favor safe, conservative, and noncritical approaches in research papers by tenured and untenured researchers who

> have investments in existing methods and theories. Researchers are all too aware that their high statuses depend on their mastery of relevant knowledge, meaning the knowledge already at hand, and radically new knowledge could render them obsolete and displace them from control. (p. 87; see also Wellington and Nixon, 2005)

Abbott (2008) similarly suggested that the perpetuation of established and safe knowledge and approaches is in part the result of the repetition in citations, theories, and frameworks in subsequent articles published by the field. Abbott (2008) likened such ventriloquations to Christmas balls or "star systems." That is to say, agreed upon works or ideas must be acknowledged (and maybe even read) within communities in order to be accepted for publication. Such star systems become what Abbott referred to as "generational paradigms" that carry with them the power to shape scholarship in such a way that other approaches remain or become peripheral.

To take up the challenge of the call for scholarly dialogue that might currently be peripheral or on the penumbra of current literature within our field, we suggest the Sociology of Translation or Actor-Network-Theory (ANT; see Latour, 2005). It offers several useful propositions for playfully and critically pushing the boundaries of our own and others'

previous descriptions of preservice social studies teachers' uses of digital technologies (Hicks & van Hover, 2014) [a].

We are particularly drawn to ANT because it offers interesting ways to unpack and describe ontological assumptions about the integration of technologies into pedagogy and classroom activity more generally. It also allows us to explore questions without depending on or simply reverting to explanations that evaluate such integration as a strength or deficit of teachers' knowledge and skills.

Latour's discussion (2005) offered three propositions for complicating scholarship on technology and social studies education: the value of embracing controversy and uncertainty (especially around accepted and normalized constructs of the social world), consideration for the agency (not to be confused with power or intention) of nonhuman objects and how to trace them in social relations, and the methods for problematizing frameworks, contexts, and interactions.

By borrowing from ANT sensibilities this papers *revisits* data from cohorts of preservice social studies teachers collected within the same ecology of school divisions over a 10-year period to illuminate the relational complexity of technology use in social studies classrooms. Initial data analysis revealed cohort after cohort gravitating toward the use of very specific forms of digital technologies to support a traditional genre of teaching – what DeWitt (2007) referred to as "technology enhanced traditionalism" – while only occasionally using (or attempting to use) other digital technologies that could be argued to facilitate student-centered inquiry-based instruction.

In our analysis we revisited how and why 10 cohorts of preservice teachers remained pedagogically consistent while mediating and making sense of a changing set of digital technologies during a period when a great deal of funds and rhetoric surrounded the integration of technology into classrooms. We intentionally pushed away, however, from such established theoretical frameworks as TPACK and tested ANT as an analytical process to shift the gaze away from solely knowledge-based/dispositional accounts of teachers' use of digital technologies within the social studies. ANT sensibilities, we contend, open up an analytical middle ground between sociocultural and sociomaterial/technical perspectives to help illuminate new or sustained associations among certain forms of digital technologies and why some are favored over others by social studies preservice teachers within the contexts of their internship classrooms over time and space (see Fenwick & Edwards, 2010, 2012; Fenwick & Landri, 2014).

Technology Integration and the Antecedent Subject Subculture

Within social studies, the literature is replete with examples of the disconnect between the realities of the social studies classroom and the idealism of advocates for digital technologies who are waiting for the metaphorical giant to awaken and improve teaching and transform students' learning experiences (Bolick, 2017; Friedman & VanFossen,

2010; Green et al., 2014; Hicks & van Hover, 2014; Swan & Hofer, 2008, Wright-Maley et al., 2018). Ongoing optimism toward the potential of digital technologies was reflected in multiple kinds of scholarship, including the publication (Kajder & Hicks, 2000; Mason et al., 2000) and republication of guidelines for using digital technologies (Hicks et al., 2014); research examining the impact of content-specific technology enriched methods courses and professional development initiatives (Franklin & Molebash, 2007; Kormos, 2019; Millman & Molebash, 2008; Stevens et al., 2018; Theobald & Luckowski, 2013; Wilson & Wright, 2010); and detailed cases and examples of how teacher education programs can strengthen the link between technology, pedagogy, and content (Brush & Saye, 2009, Manfra & Holmes, 2020; Manfra & Spires, 2013).

As Zhao et al. (2002) suggested, however, while it is easy to "talk about a 'technology revolution'" (p. 512), little evidence is available demonstrating that digital technologies have led to ambitious educational changes, especially within the field of social studies (see Beeson et al., 2014; Bolick, 2017; Berson & Balyta, 2004; Swan & Hofer, 2008; Wright-Maley et al., 2018). In light of a persistent "fundamental conviction that the value of digital technologies will eventually be vindicated," where "much of the language about emerging technologies is (inevitably) forward looking" (Convery, 2009, p. 30), a corresponding body of literature has emerged to complicate our understandings.

Researchers continue to (a) identify and explain the barriers to technologies' natural integration in schools (Hutchison & Woodward, 2018; Tarman et al., 2019;), and (b) explore why, when used, digital technologies typically support a durable, recognizable, and repeatable teacher-centered model of instruction, designed to transmit a "set of undisputed, authoritative stories" to students as an uncritical chronicling of events (Cherryholmes, 2006, p.6; Hicks & van Hover, 2014). Brush and Saye (2009) recognized that the pace of change within social studies classrooms as a whole is slow, which can serve as a stumbling block to providing even the most knowledgeable, skilled, and well-prepared teacher candidate room to grow within the internship setting. They noted,

> One major issue involves the types of models preservice teachers are exposed to in their field placement experiences. As with many teacher education programs, we are not always able to select field placements that provide optimal technology integration experiences for our preservice teachers. (p. 55)

For many who continue to advocate for the integration of digital technologies in social studies classrooms, research reflecting its limited use by practicing teachers provokes a sense of incongruence, especially from those who view technology as a way to teach students the critical skills for the office of citizen (Cantu & Warren, 2003; Green et al., 2014; Kormos, 2019).

Research has identified different barriers that prevent, or block, meaningful technology integration in classrooms (Ertmer et al., 2012; Hew & Brush, 2007; Sheffield, 2011; Zhao 2007). This work provides snapshots of external (first order barriers) and internal/dispositional

barriers (second order barriers) that are situated at particular points in time (See Ertmer et. al, 2012). According to this literature, barriers to technology integration and, by implication, pedagogical transformation, are many:

> The great barriers to technology integration reported by teachers, were not enough computers or outdated computers, lack of release time for teachers to learn how to use computers or the Internet, and lack of time in schedule for students to use computers in class.... Increasingly, teachers cite high-stakes testing demand as barriers as well. (Bolick, 2010, p. 287)

Zhao's (2007) study of social studies teachers' perceptions of technology integration to support student inquiry following professional development work identified other barriers, including classroom management concerns, teachers' resilient perception that digital technologies were "something extra" (and enjoyable) but not a necessity, and the type of content that they were teaching (p. 328). Similarly, Sheffield's (2011) study of social studies teachers' technology integration found that, while teachers held positive attitudes toward the use of digital technologies, they resorted to teacher-centered uses them. Sheffield identified multiple barriers to technology integration to support student inquiry: teachers' comfort with technology, the functionality of technologies as impacted by district policies regarding Internet access, firewalls, ability to load software, and the availability of laptops where priority for their use was given to test preparation.

Beyond the field of social studies, Blundell et al. (2020) also considered how teachers' expertise, perceptions and beliefs shaped their decisions around technology use. And, many researchers have pointed to teacher knowledge – specifically the presence, absence, and sophistication of teachers' technological pedagogical content knowledge, or TPCK – as a factor that influences (and inhibits) technology integration (Beeson et al., 2014; Brantely-Dias & Ertmer, 2013; Hofer & Grandgenett, 2012; Mishra & Koehler, 2006). In its model, however, TPACK situates knowledge of content, pedagogy, and technology, as well as the knowledge that exists in their intersections, within a broad definition of context.

Effective technology integration for pedagogy around specific subject matter requires developing sensitivity to the dynamic, transactional relationship between these components of knowledge situated in unique contexts. Individual teachers, grade-level, school-specific factors, demographics, culture, and other factors ensure that every situation is unique, and no single combination of content, technology, and pedagogy will apply for every teacher, every course, or every view of teaching. (Koehler, 2012).

What can be learned, then, if we leverage analyses to deconstruct these contexts? What if we undertake to describe and trace the myriad associations, transactions, and relations among all actors (including nonhuman objects) as equally important in our understanding of how technology functions in the classroom landscape?

Hilton (2016) captured some of this tension when noting that discussions with participating social studies teachers indicated that TPACK did not seem to account for some of the contextual complexities that played important roles in their decision-making. Similarly, Tondeur et. al (2017) found in their meta-analysis on teacher beliefs and technology that context, while an important theme in decision-making, requires further exploration.

Hew and Brush (2007) noted deep complexity in determining and operationalizing what they considered to be "the final frontier in our quest for technology integration" (p. 242). While they called for more work to explore the relationship among first and second order barriers to technology integration, they noted that little explicit work had been done to unpack how and why the antecedent subject subculture of the disciplines affects the types and uses of digital technologies by teachers. Goodson and Mangan (1995) identified key characteristics that are repeated and recognizable across classrooms within a subject (the antecedent subject subculture). While making clear that within the subject subculture there is "ample room ... for expressions" of teachers' pedagogical philosophy and pedagogical approach (p. 615), they contend that the key features of pedagogical performances for social studies (history, geography, sociology, government) included the following:

1. Content-orientated. Generally larger class sizes. Teacher talk dominates.
2. "Socratic" method is frequently cited by teachers. This is taken to mean:
   o Classroom lectures, often overlapping with reading assignments;
   o Frequent questioning of students during in-class reviews; and
   o Repetition of material in several media, including examination questions
3. A generally formal classroom format. Students usually sit in rows, face front, and work independently. Teachers tend to maintain an atmosphere of quiet, and group attention to a single task. (pp. 615-16)

The effect of antecedent subject subcultures should be examined in relation to the ways teachers use digital technologies. Illuminating how certain forms of digital technologies gain more traction than others in classroom instruction is needed. In a middle ground between sociocultural and sociomaterial perspectives is the potential to trace how teachers and technologies come together to produce recognizable and repeatable instructional performances over time and space.

Our choice to shift the gaze away from the privileged agency of human actors is a deliberate one, because it allows us to explore more deeply the mediations and translations that occur in classrooms. This approach is discussed in detail in the theoretical framework that follows.

Theoretical Framework: The Sociology of Translation/ANT

Within the field of educational research is a growing body of literature suggesting that a reliance on sociocultural theories – writ large –allow us to tell only half of the story of the complex relational process of social negotiation and enculturation at work in education (Fenwick & Edwards, 2010, 2012; Moberg, 2018; Sørenson, 2009; Waltz, 2006; Wieszaczewska 2018). Sociocultural theories typically privilege human intent and action; within such theoretical frameworks, the analytic emphasis is on individuals acting-with-mediational-means. That is, humans have agency to act upon each other as well as on nonhuman objects, materials, and things in the performance of their everyday activities.

Through such a stance the concept of curriculum gatekeeper (Thornton, 2005) emerges – where teachers make minute-to-minute (and class-period-to-class-period decisions) regarding how best to interpret standards and marshal available resources and strategies to provide instruction for their students within the contexts of their classrooms. Also through this stance such rhetoric as *educational innovation*, *technologies for learning*, and the concept of *technological affordance* has gained traction (see Fenwick & Edwards, 2010; Wright & Parchoma, 2011).

The language of educational technology positions material things such as digital technologies as

> subaltern, … simply present. … Contained by human intention, be it user, designer or manufacturer, … tools remain an extension of, container for, or reliable iteration of the work that people do. … [As a result] educators and researchers are particularly quick to frame up new technologies as useful, subservient objects. (Waltz, 2006, p. 54-56)

This stance assumes that digital technologies are ready to be appropriated and used by the knowledgeable teacher or that technology in and of itself can transform student learning. Fenwick and Edwards (2010) suggested that this stance, in turn, fosters a problematic container-seed conception with any educational innovation. Educational innovations are viewed as seeds dropped into the "preexisting context of the school or school division" (p. 102). Within the container of the school, the seed (innovation) is naturally expected to flourish when nourished (acted upon) by knowledgeable and skilled teachers – or when handed to "digital native" students who learn from the innovation without the teacher.

Any impediment to an innovation's growth is viewed as a barrier or stumbling block to successful implementation. Whether identified as an *intrinsic or extrinsic barrier,* the uncritical commonsense implication is that barriers can be overcome by individuals with mediational means. It is presumed that further professional development can fix any dispositional or training deficits or that shifts in resource allocation will address structural issues.

Diffusion theory (Rogers, 1995; see Bolick, 2017) begins to unpack some of these barriers and to contextualize them in larger systems of schooling

and society. Bolick (2017) called for a new lens for technology research that should be expanded to convey the *essential role* (emphasis added) technology is playing in society and in schools (p. 513). However, we are intrigued by pushing that boundary even further than the consideration of early adopters, innovators, early majority, late majority, and laggards.

Notice this stance is still an embodied analytical one, in which technology is enacted through human agents. If we look to better understand *the role* technology is playing in schools (and it is a complex one) then we need an analytical stance that makes space for agency in the associations among all kinds of actors, including nonhuman ones.

Privileging human intention and agency, Sørenson (2009) suggested, reveals "a blindness toward the question of how educational practice is affected by materials" (p. 2). What gets left out or lost within the story of "the construction of the social" (how activities emerge in the performance of individuals' daily lives) is any recognition of the "legitimate building materials involved. This literature does not interrogate the ways in which things are *constitutively social...* and that society is constitutively artifactual" (Waltz, 2006, p. 52). Law (1992) clearly illustrated this point by asserting,

> Perhaps it is only in lovemaking that there is interaction between unmediated human bodies — though even here the extra-somatic usually plays a role too, But the general case, and the one pressed by actor-network theory, is this. If human beings form a social network it is not because they interact with other human beings. It is because they interact with human beings and endless other materials too. And, just as human beings have preferences — they prefer to interact in certain ways rather than in others — so too do the other materials that make up the heterogeneous networks of the social. Machines, architecture, clothes, texts — all contribute to the patterning of the social. And ...if these materials were to disappear then so too would what we sometimes call the social order. (p. 382)

This perspective suggests that our daily interactions at work, in school, and at home with other people are entwined and mediated through material objects or technological artifacts (Law (1992). Agency is not solely a human attribute, as Fenwick and Edwards (2010) explained: "Material things are [also] performative: They act together with other types of things and forces, to exclude, invite and regulate particular forms of participation" (p. 7).

Such a sensibility reflects what Latour (1987, 2005) referred to as the principle of *symmetry* between the interactional effects of human and nonhuman materials in the constitution and reconstitution of peoples' daily practice. The principle of symmetry recognizes (a) the ways human actors make meaning and ascribe significance, intention, and utility to specific material objects in terms of how they choose to use, experience, and transform material objects (*interactivity*); and (b) the constitutive role of material objects as "mediators of practice ... in which the sensuous qualities of material objects are recognized" and either invite or inhibit

"human actors to use them and act with them, to perform their 'scripts' or to ignore them...(*interobjectivity*)" (Kalthoff & Roehl, 2011, p. 467).

From this perspective, what is typically viewed as teacher agency becomes visible as "an effect of different forces, including actions, desires, capacities and connections that move through [the teacher], as well as the forces exerted by the texts and technologies in all educational encounters" (Fenwick & Edwards, 2010, p. 21). Thus, within the social studies classroom, nonhuman objects – texts, resources, technologies, policy documents, the way the classroom desks are positioned in relation to the whiteboard or smartboard, and even the availability of 1:1 devices and software within – work on teachers and students, as teachers and students work on nonhuman objects. They come together, they *translate* each other, in order to produce particular forms of actions and activities that when stabilized are accepted as the normalized way of operating.

As an example, consider this observation from a preservice teacher, "J" (2009-2010):

> Technology that benefitted the most was the projector. I presented almost all of my notes using the PowerPoint (PPT) and projector. This worked well for a number of reasons. First it saved me time. Once I had outlined a chapter on my computer, I only needed to copy the outline into a PPT presentation. Second, using PPT enabled me to add spectacular images and videos to my notes. This really added some 'spice' to plain-old lecture notes and I think it aided students' understanding to be able to connect a visual to the things we were discussing.

Theoretical models (such as TPACK) that seek to illuminate the agency or knowledge and beliefs of individuals reveal important insights into this candidate's knowledge of pedagogy and technology, and importantly, the intersection represented by technological pedagogical knowledge. When the descriptive gaze is shifted using an approach like ANT, a complex and fluid combination of associations is revealed.

The projector and software can occupy an equal position in an association that also catches up in its threads the preservice candidate, a personal computer, a process for notetaking, the creative work of photographers and documentarians, a search engine that makes resources available and easily accessible (for uses that may well extend beyond the intent of their creators), a textbook, and the students – all of which are engaged in the interactions and translations that constitute teaching and learning. Focusing solely on the candidate's knowledge and decision-making (and relegating other associations to the context) allows the conclusion that the instruction was the result of a preservice teacher's ideas, skills, beliefs, and understanding of how technology should be leveraged and a determination/evaluation of its quality.

Analyzing the comment through the lens of ANT reveals associations between the computer, the visual supports, the projector, the software, and the candidate, all of which shape an emerging practice by which lectures are transformed into multimedia experiences for students. Whether such a transformation realizes the ambitions of

authentic engagement with technology is less important than how those associations generated shifting processes for creating an instructional experience. By probing more deeply into *the how*, the field might identify what conditions (and associations) make what kinds of change more or less likely.

The network is extended further in this example by including the hardware (and associated costs) that makes the internet available to the candidate and the human resources within and beyond the school district who chose the Internet provider, acquired and installed the technology (including the textbook), allocated the funding for it, and made available the resources to be found on the internet, to name just a few of the linked connections.

While this complexity has the potential to become overwhelming, it is important to continue exploring tools and frameworks that better explain such associations and how they do or do not become stable. Within and through these relations systemic inequities, institutional barriers or supports, and predictable routines of instruction are constructed.

In seeking to understand how teachers make sense of and use (and not use) specific digital technologies in the production of their everyday pedagogical practices, materials and nonhuman objects such as digital technologies as mediators of practice must be part of the equation alongside the antecedent subject subculture. This approach can help unpack and trace the complexity of the relationships of influence between social studies teachers' performances and decision-making within their classrooms and the role (or absence of) specific digital technologies in that performance.

In this study, we used this sensibility to provide illustrative examples from data collected over 10 years to begin to make visible the negotiations and interactions between humans and material objects that resulted in the emergence of a stable set of pedagogical practices favoring a specific range of digital tools over others within standards-based classrooms.

Methods

In preparing this article we drew on archival qualitative data from a 10-year qualitative study of graduate-level preservice social studies teachers that investigated how they make sense of themselves as users of digital technologies in their classrooms. This case study was bounded by time and space and was designed to provide multiperspective explanations of events; present detailed insights into the essence of schooling; and show how complex processes and relations fit together and develop over time.

Context

The participants (cohorts of secondary social studies preservice teachers) were enrolled in an accredited 5th-year graduate secondary history and social science licensure program (Grades 6-12) within a large land-grant university in the Mid-Atlantic Region of the US. Graduates earn a masters of education degree in curriculum and instruction and postgraduate professional licensure in history and social science, Grades 6-12.

The program is comprised of professional studies licensure coursework as well as a series of classes and field experiences that focus on the teaching of social studies. State licensure requirements mandate that students complete a minimum of 300 hours in the schools over the fall and spring semesters, with 150 hours defined as direct teaching. In their field placements, students learn to teach within a very particular context – a state in which history and social sciences are tested through the use of high-stakes, fact-recall, multiple-choice examinations.

In the program, all students complete two intensive social studies methods courses (fall and spring semesters) and a connected course titled Teaching Inquiry in the Digital Humanities (fall semester). The digital humanities course is guided by the belief that teachers are curricular-instructional gatekeepers (Thornton, 2005) and explores how to critically evaluate emerging technologies for instructional uses, the literacies they evoke (and potentially, supplant), and openings for discipline specific content exploration and inquiry within authentic classroom contexts (see Brush & Saye, 2009; Kajder & Hicks, 2011; Mason et al., , 2000).

Data Sources and Analysis

Data were collected during methods courses and internships during the fall and spring semesters. Systematic data collection started in 2001 and continued through 2011 from a total of 94 preservice teachers (Table 1).

Table 1 Number of Participants by Cohort Year

Cohort Year	Number of Students
2001-2002	7
2002-2003	9
2003-2004	10
2004-2005	13
2005-2006	11
2006-2007	8
2007-2008	8
2008-2009	7
2009-2010	13
2010-2011	8
Total:	94

Data collection included the following: preservice teacher reflections and online discussions, audiotaped classroom discussions, interviews, classroom observations of lessons, and the collection of lesson/unit plans (see Table 2).

Table 2 Data Collection

Type of Data	Description
Weekly Video and Blog Reflections (fall and spring semester)	• Students complete weekly blog or video blogs that reflect on their experiences. These were archived, indexed, and transcribed (see Appendix A for prompts).
Curriculum Map & Unit Outlines (spring semester)	• Prior to beginning student teaching, students submit instructional sequence/plan for their time in the teaching internship. Approved by cooperating teacher and university supervisor.
Classroom Observations (fall and, predominantly, spring semesters)	• Students submit lesson plans and related materials for the observed lesson; • Observer takes detailed field notes (teaching activity, instructional design, implementation)
Post-Observation Interviews (spring semesters)	• 10-20 minute recorded conversation to reflect what went well, what didn't, changes for next time.
Final Reflections (cumulative; collected at end of spring)	• Series of reflective essays. Prompts focus on use of standards, instructional design, use of digital technologies (see Appendix B for prompts)
Electronic Portfolios (prepared using evidence from fall and spring semester; final catch of evidence to document proficiency)	• Capstone experience of all students. Evidence to document abilities to meet NCSS standards and InTASC standards. Included artifacts, reflection, and video-taped presentation.
In-Class Discussions (fall and spring semester)	• 2 small-group recorded discussions focused on technology; • End of Semester audio-recorded whole class discussion (see Appendix C for prompts)

Data were obtained with an archival data request, and data analysis took place after the students graduated from the program. The data collected were not originally intended for publication. The lead researcher designed and taught the courses in addition to supervising the students' field experiences (and continues to do so). Analyzing it each year was part of the cycle of reflection and revision that is fundamental to continuous improvement and reflects the researcher's personal and professional interest in how pedagogy changes over time.

At the time, we were seeing few and limited longitudinal studies of teacher preparation programs and how students' work with technology shifted (or did not), as supporting new and intensive looks at integration was becoming increasingly accessible and well funded (Crowe, 2004; Doppen, 2004; Wilson, 2003). After 10 years, a rich historical look emerged of moments in time across a decade of implementation that could yield insights into how preservice teachers encountered and integrated technology into their practice at the moment that practice really began – teacher preparation. Observations, postobservation interviews, and final reflections were especially useful in carrying out the analysis.

We organized the data corpus, then engaged in multiple readings of data. Analysis began by opening up the data to such typical questions as follows:

- What themes emerged across participants?
- What themes emerged across cohorts?
- How does the story explain how events came about and why they came about?

We identified themes emerging from the data and identified codes, then began hand coding by theme, comparing and contrasting reactions and responses to these themes. This work led to an examination of how participants each told their story, how they referred to themselves and others, where they began and ended their stories, and how they talked about their choices and decisions regarding their understandings and uses of digital technology (Coffey & Atkinson, 1996; Polkinghorne, 1995).

Only after presenting and publishing papers based on this typical phase of analysis did we revisit the data and begin to leverage and play with the ideas of ANT. As we investigated the stories and the positioning of a host of factors, we began to see traces of activity that connected nonhuman material with humans in all kinds of complex ways. We began to see symmetries among the actors, both human and not.

As we followed actors of all kinds, we began to see associations that were deeply enmeshed with the antecedent subject subculture. What followed was a new and extensive phase of analysis in which we began to describe these traces of activity in deeper detail in an effort to better understand the associations in the network that shaped classroom instruction. All of these connections were intriguing glimpses into a social world that was markedly more dynamic and fluid than a teacher with a certain skill set or belief system enacting an instructional experience for students.

We agree with Latour's (2005) argument that this work can be potentially overwhelming in its scope and that certain decisions necessarily impose a level of artifice on the subsequent explanations or analysis (p. 133). However, when considering our data through these lenses, we learned so much about how the social world of the classroom is produced.

Fenwick and Edwards (2010) noted that researchers must carefully select what is to be traced and then follow it in careful detail (p. 150). As we chunked, labeled, coded, and studied our descriptions, we began to identify initiators, practices, and resources (p. 154), and we began to find evidence that spoke to our underlying questions: Why is the integration of technology into teaching methods so variable? What movements and activities become durable and what actors are more or less relevant? What nonhuman material is more instrumental in transforming activity or practice?

As we studied our descriptions and used Law's (2004) technique of "looking down," we too, found intriguing :a concern with the sensuous materiality of practice and the scale-destabilizing implications of this materiality" (p. 21). PowerPoint electronic slideshows and projectors occurred as powerfully stable actors that could be traced in a host of different activities, narratives, and instructional artifacts – a reflection of their significance. Yet, other applications like VoiceThread or Prezi web-based presentations were much more ephemeral, traces that disappeared almost as quickly as they appeared, regardless of the emphasis embedded in assignments to push into more constructivist learning experiences.

Our human actors were just as complicated, in some moments talking about the power of new technologies and in others explaining their retreats into the familiar and positioning the challenges they experienced firmly in the location and movements of such activities – not in their own decisions. The findings that follow describe the symmetries, transformations, mobilizations and enduring practices constituted by the tracings carried out during our analysis.

Findings

Analysis of more than 10 years of data indicated that most preservice teachers gravitated toward digital technologies that could successfully meet the habituated rhythms of the school period and day while also garnering their respective students' tacit – or explicit – approval. The visible and available digital "infrastructural elements of practice" (Star, 1999, p. 380) that the preservice teachers considered trustworthy, safe, and sustainable digital technologies were the projectors, the internet-based teacher's classroom computer, and presentational software such as PowerPoint, Prezi, and SMART notebook.

While the use of these specific digital technologies of choice became increasingly sophisticated over the course of the study, the data revealed a sameness to preservice teachers' approaches – that is, condensed and chunked content pulled from textbooks and enhanced curriculum guidelines placed into a presentation augmented with aesthetically pleasing animation, images, video and audio clips, and teacher-led review

games supported by the use of student response and/or clickers. For the majority of preservice teachers across the cohorts, the use of PowerPoint and Prezi presentation software was the storyline of technology use, the thread that held the narrative of their technology use together.

Students' assignments indicated that the preservice teachers consistently emphasized the potential of digital technologies to engage in best practices in social studies and believed themselves ready, willing, and able to use technology. Yet classroom observations and subsequent reflections on practice revealed that uses of technology specifically designed to promote inquiry, engagement, and critical thinking were, for the most part, rare or one-time incidents (see Manfra & Hammond, 2010).

The negotiations and interactions between humans and material objects seemed to yield a stable set of pedagogical practices that favored a specific range of digital tools over others within standards-based social studies classrooms. Material objects, including digital technologies, the textbook, local and state standards documents, end-of-course tests, the school calendar, and even the set-up of the room, all played a mediating role in shaping classroom interactions and power structures between teacher and student.

The observed material objects appeared to play as much of a constitutive role as the human actors in shaping the pedagogical activities, routines, and interactions within the social studies classroom. In the sections that follow, we begin with the theme that emerged from data analysis – that of technology-enhanced traditionalism (see DeWitt, 2007). We then shift to an exploration of the *how* by describing the interplay between digital technologies as material objects and human actors within a field that has an accepted and recognizable genre of teaching.

Technology Enhanced Traditionalism Over Time and Space

The data indicated that, over time, in interviews and reflective journals the preservice students' consistently articulated the belief that technology could be used in ways that reflected best practice in social studies, constructivist approaches that had the potential to engage students in the learning process. S (2003-2004), for example, stated,

Web inquiry projects allow a student to experience history from their own perspective. They are able to ask questions and find solutions. Encouraging inquiry is an effective way of fostering a variety of forms of development within a student. Ideally, using technology and having students that [are] as familiar (if not more so) with the technology as I am, means that I can create a learning environment that is enjoyable and inviting for the students.

Many of the participants were observed teaching or could describe how they used digital technologies in ways that, as the quote above indicates, reflect best practices. R (2010-2011) used arc view from ESRI to explore fault lines and where earthquakes occur. J (2010-2011) introduced Diigo to help students collect and take notes in preparation for a mock trial of Galileo Galilei.

M (2009-2010), in a lesson on landmark Supreme Court cases dealing with the freedom of religion, used polleverywhere.com to "create a poll for each case in which [she] asked if the Court should rule the case constitutional or unconstitutional." These examples put the cognitive load on the students, with the teacher serving as facilitator.

However, the data corpus revealed that these instructional uses of technology reflected the exception rather than the rule. It became evident that these were flashes of brilliance, the one cool thing done during the internship. They were not sustained, not representative, but points of light or points of the participatory.

While such magical moments were common enough, we did not find evidence of durable change that would destabilize the predominance of teacher-directed pedagogy in the classroom within and across the preservice teachers' experiences. The most frequent use of technology involved digital technologies that allowed the preservice teachers to take chalk-and-talk to new, more sophisticated aesthetic levels. As J (2008-2009) noted, "We all use technology to one degree or another, largely as presentations — thank you, PowerPoint."

Participants hailed PowerPoint (PPT) slideshows as a transforming, efficient, and liberating tool, as a mechanism that brought authenticity, visuals, color, and pleasure to the students, while allowing the novice teachers the opportunity to organize meaningful instruction, content, directions, and a perception of being with it. S (2003-2004), for example, stated, "By using technologies I am able to bring history out of the textbook. I am able to revolutionize the teaching process. PowerPoint enables a student to see a work of art be it in oils or photography."

The preservice teachers viewed their technology-enhanced coverage as different, engaging, current, efficient, powerful, and increasingly expected by the students. As S (2003-2004) reflected, "I keep referring to Power Points, because this is how I most often utilized technology in my classroom. I was able to create interactive lectures that integrated images, video, and audio that the textbook was unable to offer." G (2005-2006) said,

> After I decided to bring technology into the classroom by actually bringing an LCD projector into the classroom and using a PowerPoint lecture, I saw boldly the power of technology. Students came up to me and thanked me for changing the way in which they were taught. One student remarked that these presentations were the best thing about the class. Teaching is about sparking student interest. The use of PowerPoint presentations with their emphasis on technology and the ability to use images, pictures and documents to highlight lecture points has a huge potential of sparking that interest.

G's (2005-2006) quote highlights a common theme that, in his view, the use of PowerPoint slideshows had the potential to serve as a powerful tool for fostering student motivation and interests.

Regardless of how dazzling a presentation might be, the chosen and consistent pedagogy of the majority of participants across time and space with the PowerPoint slideshow was coverage (delivering testable content) in an efficient manner. H (2008-2009), when discussing his planning process, noted that he created notes directly from the Standards of Learning (SOLs; for Virginia) and "supported these notes with extensive PPTs of images, key facts, data, and more. In addition, I used lots of video clips that I pulled from United Streaming, TeacherTube, and YouTube." He added, "I found this [approach] worked very well and allowed me to meet my objectives and cover the SOLs."

Similarly, PowerPoint-enhanced lecture provided many participants with an "optimized" way to organize and present material to students in a timely, controlled, and efficient manner. As K (2003-2004) reflected,

> I noticed that even the simple use of PowerPoint has helped to maintain pace, organization, and creativity within my lessons. I use the PowerPoint almost as a lesson plan, the first slide will have my "Just Do It," then my big question and objectives will follow to help introduce the lesson. This helps me to follow my lesson more easily and improves the flow for the rest of the class.

Few preservice teachers questioned the utility of the PowerPoint slide show. M (2004-2005) acknowledged he became so dependent upon it as a script to share information that it limited his ability to ask questions or move around the room. He suggested that he could overcome these issues by inserting questions within his PowerPoint slideshow and purchasing a "wireless clicker" so he could move the slides from anywhere in the room while he lectured.

Similarly J (2002-2003) acknowledged that at times the PowerPoint slideshows served "as a crutch." It was easy for him to present material from the slideshow and play the role of knowledgeable content specialist. J (2010-2011) recognized that he used Prezi slideshows as a "way to merely convey...information."

The PowerPoint slideshow co-existed with projectors and/or Smartboard electronic whiteboards, and the preservice teachers used the words interchangeably. As T (2009-2010) reflected,

> My use of the projector was also affected by student expectations. It seemed that most of the students expected teachers, myself included, to use some kind of PowerPoint presentation on a fairly regular basis. ... I observed that students generally behaved better and paid more attention.

This ability to project and elegantly present content from the textbook and SOL guides also led to the creation, by preservice teachers, of digital videos. The students who attempted a digital video talked about their projects in a similar vein to PowerPoint or Prezi slideshows — an aesthetically pleasing experience that could interest, or even, enthrall students.

M (2005-2006) explained,

> I had the idea to create a video for World War II that went over the same events from the D-Day invasion to the end of the war. The video took me hours to create and I put a lot of thought into how I should present the material so students would best learn it. I remember the students being transfixed to the screen when I played it for them… this was a rewarding experience to see how they became interested in and wanted to discuss issues they saw from the video. … I think that this use of technology helped the students get involved in their learning.

M (2005-2006) used the words "transfixed" and "rewarding" in his reflection; he chose the content to be included in the video and believed it was a positive learning experience, as students paid attention to and wanted to talk about the video.

Similarly, T (2005-2006) used digital technologies to create a music video. He explained how they used images of historical events from Google and then layered current music into the video to engage students:

> Just about everyone enjoyed seeing history portrayed as a music video. The reasons this got across to students was because it mirrored something that would be seen on MTV rather than mirroring an old-fashioned Ken Burns documentary that would be seen on the History Channel.

Implicit in T's (2005-2006) statement is a desire to be relevant, to be cool and with it, so students pay attention to the content. Yet, the music video remained a pedagogical approach that emphasized presentation of teacher-created content — the stuff of social studies. These approaches all represented cases of technology enhanced traditionalism — digital technologies used to present content to students who would learn it. It seemed that certain technologies (electronically slideshows, occasionally alongside digital videos) mutually supported and invited a particular type of teaching and fulfilled the expectations of the preservice teachers of what a teacher should look like and sound like. While the teachers initially articulated an openness to doing inquiry, they retreated to the familiar once in the classroom.

In summary, the increasing level of media convergence allowed each cohort of preservice teachers to begin to create increasingly sophisticated and aesthetically pleasing presentations. The result, as detailed across many studies of social studies classrooms, was that "the primary use of all of this technology and media access is teacher lecture" (Stoddard, 2010, p. 273, see also Haydn, 2013).

The most technologically rich of these lectures were supported with media-rich electronic slideshows or embedded digital videos. Observations indicated, however, that the expectations for students remained much the same as the expectations of generations of students before. That is, when the teacher presented content and wrote on the chalkboard, students should listen and take notes.

But why? Why, in a teacher education program that emphasized technology use to promote constructivist approaches and student-centered inquiry, in a time of the emergence of Wi-Fi, Web 2.0 technologies, iPad initiatives, course management systems, and more, did the participants rely so heavily on presentational software and revert to lecture?

Analysis of data certainly revealed many individual stumbling blocks to meaningful technology integration: the contextual (e.g., high stakes tests, standards-based settings, or socioeconomic status of the student body), the educational (e.g., not enough time in teacher preparation or the apprenticeship of observation), the practical (e.g., access to technology), the philosophical (e.g., sense-making about the role of the teacher, student, or content), the interactional (e .g., cooperating teachers who refused to use technology or reactions of their students in class when technology was used), and the technological (e.g., fear of technology or failure and success of technology). These associations influenced how, when, and why the preservice teachers fell into the rituals of the antecedent subject subculture and offered a readily available and supportable explanation as to why they retreated to the familiar. These barriers, often identified and described in the literature seemed, however, unable to fully explain the relational mechanisms that shaped teachers' uses of digital technologies or the contextually specific interactional relationships between digital technologies and teacher practice within a specific discipline.

Symmetry and Translation Between Human and Material Objects

Analyzing these data in terms of symmetry and translation, two elements within ANT, adds a new layer to the story and shifts the focus from barriers to ways the material and human objects translate each other – contextualize each other – within the antecedent subject subculture. The material objects (the teachers' computer, the presentation software on the computer, the electronic whiteboard, the clicker or mouse, the textbook, the local and state standards documents, the set-up of the desks facing the whiteboard, the quality of bandwidth within the school, policies regarding computer lab use, firewalls, and access to images and videos through free and subscription based sites at home and in school) all play a mediating role in shaping classroom interactions and power structures between teachers and student.

Without those material objects networked over time and space, the patterned nature and order to learning and teaching would not exist. Material objects, thus, play as much of a constitutive role as the human actors in shaping the pedagogical activities, routines, and interactions within the classroom and beyond.

The go-to digital tools used by these teachers all shared similar qualities to one of educations' most successful technologies — the blackboard (see Krause, 2000). Much like the chalkboard and later the overhead projector, media delivery technologies such as electronic slideshows mutually encourage and support a specific form of teaching. Electronic slideshows can be seen as a stabilized and nonthreatening technology that

meets the expectations of teachers and students within a field that emphasizes the telling of the tale of the past, present, and future. These media delivery technologies have seductive qualities for classrooms because they support a pedagogical performance that emphasizes content coverage and control.

Electronic slideshow presentations, just like the use of the chalkboard and overhead, become part of the "optic system of the classroom" (Kalthoff & Roehl, 2011, p. 461). An electronic slideshow makes visible, accessible, and available the authoritative and official knowledge about which students need to know and take notes. The electronic slideshow (or digital video) itself clearly documents the teacher's work to identify what information or knowledge must be presented in the most memorable and efficient manner for the students. The slideshow presentation reinforces the cadence of instruction by signaling to the students what is important; and its importance is reinforced by teacher talk that directly connects to individual slides. The electronic slideshow emerges as a vital prop that can sustain and legitimize a teacher's performance.

In contrast, other digital tools such as flowgram, VoiceThread, Google Earth, SmartBoard Activities, Edmodo, and Diigo when used, proved less stable, too flexible, too risky and, as a result, failed to gain traction with both teachers and students and often resulted in frustrated pedagogical performances. For many, this flexibility (or lack of stability) between content, teacher, student, and tool inhibited or pushed against their understandings of what it means to be a good teacher of social studies. As a result, such excursions into the unfamiliar terrain of participatory technologies, student-driven projects, and trips to the computer lab left preservice teachers wary and unsure of their pedagogical performance.

It becomes easy to question the relevance, utility, and efficiency of certain digital tools that take time to use, are themselves resisted by either the technological infrastructure or school policies, and prove distracting or initially puzzling for students because they do not support the recognized and repeatable ways of doing social studies. Also, throughout their internships, preservice teachers' lack of trust in other digital technologies was compounded by their recognition (or lack of recognition) of the abilities of their students, whom they assumed were ready, willing and able to use their *natural* digital abilities, interests, and skills in the social studies standards-based classrooms.

Questions regarding student behavior, attitude and their abilities (or inabilities) to use digital technologies served as a point of resistance to preservice teachers' willingness to implement student-centered uses of digital technologies in a timely fashion. Many of the preservice teachers did not feel they could afford the time to teach students how to use digital technologies when they already felt the push to cover the standards in time for an impending end-of-year high stakes test.

The data consistently yielded examples of students making at least one attempt to apply their inquiry-focused methods course instruction to their teaching in the field. However, almost as consistently, they reflected that the challenges they encountered supported their retreat to the familiar, safe, stable, and seductive tools of the trade that supported the antecedent

subject subculture. We analyzed in considerably more depth three examples of how this retreat, when magical moments of early adoption (to borrow from diffusion theory) ultimately unfolded into straight-forward experiences, restablized the antecedent subject subculture.

The following illustrative cases highlight these themes, examples of preservice teacher trying something new, something student-centered and inquiry based, encountering resistance, and retreating to the familiar. For example, in her sixth-grade teaching internship A (2008-2009) decided to do a student-centered project with VoiceThread, focusing on the main events and battles of the Civil War. She envisioned a situation where "the students narrate an image after researching about each particular event or battle. And they narrate an image that represents that event or battle, using the application called voice thread." In describing what happened, she said,

Well, the research went wonderful, the kids were really into it, they were really enthusiastic about not having to learn about civil war events and battles through lecture or through reading the textbook. And we went through and they were narrating and excited about seeing their voice thread on the Internet, and then voice thread did not work. And after some deliberation we decided that this was due to the lack of bandwidth. Because I have noticed that if you get to the school at 7 o'clock in the morning the internet is much faster than it is say at 8:30 when everyone at the school is trying to be on the Internet at the same time or using the Internet at the same time. So that probably caused some problems with trying to record onto the Internet.

As it was spring break and the students were midway through the project, A (2008-2009) explained that

> the first thing we will do getting back from spring break will be to use PowerPoint to do the narration, because it is much more reliable at this point. Especially, since the computer usages is so high in the middle school right now …[because of SOL benchmark testing].

As a result of this, A (2008-2009) experienced a sense of resistance:

> We didn't have wireless connection so bringing my laptop to school was useless. Whenever we wanted to use YouTube we had to come in early and stream the video before everyone arrived to use their computers. If we failed to do this then we risked crashing the school server and angering the rest of the school with our use of technology. This became a real hindrance throughout the day because you had to be careful about whether or not you closed the YouTube window. If you did then the other classes would miss out on the opportunity to view that video.

A (2008-2009) came to favor teaching approaches that "required little complications and headache… I would rather students focus on the information as opposed to watching me fiddle with cables and chords." Certain technology inhibited coverage of content and interfered with her

"normal routine." In this case, to position these technology issues as context is to reduce the complexity as well as the agency of the tool to shape the people and their learning.

A (2008-2009) presents a case of someone who attempted to use *other digital tools*, a preservice teacher who tried to implement a student-centered project that involved students conducting research and creating a narrative using digital technologies. However, the school infrastructure pushed back — resisted A's attempts — and she retreated to PowerPoint, a reliable stable technology and teaching approaches that required fewer "complications."

To conceptualize this process as a symmetry between interactivity and interobjectivity, between teacher (human) and technologies (nonhuman materials), makes space for a capable and ambitious preservice teacher who consistently adapted as she encountered challenges to do what she thought was best for meeting the instructional and students' needs. This description is much more dynamic than reducing it to A's (2008-2009) lack of resilience or expertise for navigating the challenges of her context.

In B's case, the digital technology featured in his 10th-grade World History class was Prezi web-based presentation software. In an observation of B (2010-2011), who was teaching a lesson on the role of new technologies in World War I, students completed a graphic organizer while B (2010-2011) talked through the content in his Prezi. In a postobservation reflection, B (2010-2011), a teacher who prided himself on becoming a savvy and polished user of digital technologies in his teaching, noted,

> I am feeling the standards rush. ... I feel the coverage rush, that I am covering something and not really going in-depth on it. ... [The observed lesson] was the best lesson I have given all year. It was a Prezi about the technologies used in World War I. It was a way to draw them into the war. ... Students completed a technology grid, which was a series of questions based on a Prezi on the different technologies [used in World War I]. ... And I really liked this, and most kids had something in every single box.

He also noted that this Prezi established him as the "cool" teacher, as it included video and supporting images to help illuminate key content from the SOLs. He reflected,

> The first thing I do is look at the SOL standards so the content stays true to the history of the past. Prezi serves as a grip for them to remember. ... Prezi really draws the kids in, the motion draws their eyes to the screen.

B (2010-2011) tried to use this same tool in a student-centered project on the topic of events of World War II, but the results were different; the technology he was so comfortable with in his day-to-day teaching resisted his efforts, and he retreated to the familiar.

After using a Prezi presentation to cover the causes of World War II, where once again his students filled in slot notes (fill-in-the-blank fact recall notes), B (2010-2011) then introduced a project:

> For World War II, you will be teaching the class. You have been given the SOL standards, and your presentation should go above and beyond that. You will be creating a Prezi to give your presentation on a question about World War II.

The questions focused on the causes of the war, the participants in the war, major battles, outcomes, and postwar period. B (2010-2011) made a video about how to use a Prezi presentation for students to watch. He described the next steps by saying,

> Monday they brainstormed, they got a frame about the question they were going to answer about World War II. Tuesday and Wednesday they created Prezis and Thursday and Friday they presented to the class and they were the experts. And what I found is that most of the Prezi's did not go where I wanted them to.

In an observation of the student presentations, it became evident the students only drew information from the SOL guide they were given with the assignment, and to some degree, their textbook. And while students completed slot notes at their desks, filling in information from presentations by other groups, it took a great deal of time. B (2010-2011) become discouraged with the basic content and lack of video and images that he felt added value to his presentations and was absent from theirs.

As a result in one class B (2010-2011) decided against student presentations and took the students' Prezi presentations and "redid them." As he noted, he "edited them and threw in some videos and explained stuff a lot more." The mentor teacher and preservice teacher both expressed disappointment at the amount of time spent on this project – several days of class on a topic he could have "done in a day." In his interactions with standards, end-of-year tests, and a push to cover content at a rapid pace, B (2010-2011) chose Prezi as a technological tool and used it repeatedly after his first successful lesson.

The tool allowed for coverage of content, allowed him to focus his students on the content, and the reaction of the students reinforced his behavior. Within the social studies classroom, Prezi had certain seductive qualities and promise that supported the transmission and transfer of content. However, when students were asked to do the same thing, the seductive power of Prezi dissipated, as the relationship between teacher, student, standards, technology and associated links to images, videos, and social studies content, school time, and use of classroom space shifted: Disappointment followed because of the time it took in terms of the school calendar and the resulting chunks of information within the presentation parroted back from standards documents with no depth or connection.

In a third example, D (2009-2010) summed up many of these same themes by observing,

> I fear that this happens to a lot of technology that could be a great tool in the classroom; we use them and think they are cool when we first discover their uses, and then we tend to break into our old habits without them.

She said this in reference to her use of Edmodo early in her student teaching placement, on which she reflected:

> It was so motivating to see students posting on Edmodo telling each other about how close they are to being done with a project, egging other students to complete their assignments on time. ... Students were posting links to news stories about things we had discussed in class. ... It helped prove that students were doing research on their own outside of the classroom.

D (2009-2010) continued:

> Unfortunately, as class started moving, Edmodo became a second thought for both me and the students. I would remember to check the website maybe once every two weeks, and there would be maybe one or two students' post. What was once a great tool was forgotten. ... The same problem occurred when using the SmartBoard. ... Many students loved the opportunity to draw ... or simply get to click the SmartBoard. ... Unfortunately, having a student come up to the board and sit down and then having another student repeat the process tends to take a fair amount of time, consequently, during lessons that time was limited.

D (2009-2010) described her retreat to "bad habits" from other approaches, as the sense of utility between tool and teacher was missing with Edmodo. The technology did not fit; while it did not create resistance per se, it simply did not persuade and failed to offer the promise of a stable tool within the classroom. Rather Edmodo slipped from view and got lost in the seductive glow of electronic slideshows, a tool that offered immediate satisfaction and allowed D (2009-2010) to cover content and control the pace of instruction.

In sum, these and other cases highlight how the symmetry between the material objects (the electronic slideshow, the bandwith, the laptops, the electronic whiteboard, the clicker or mouse, the textbook, the local and state standards documents, the end-of-course test, etc.) all play a mediating role in shaping classroom interactions and power structures between teachers and students.

Discussion and Conclusion

In their chapter in the *Handbook of Research on Teaching*, Barton and Avery (2016) called for the social studies field to avoid the trap of unquestioningly and uncritically relying on accepted or established frameworks to guide research and analysis and, instead, begin to look consciously beyond the boundaries of our own professional research communities (see Mason, 2018). A similar perspective is reflected in the call from the *CITE Journal* social studies education editors.

None of us claim to be theorists. We also recognize that our work only scratches the surface of the potential of what ANT can do in terms of tracing network effects. However, our initial explorations of data using ideas like symmetry and translation have inspired us to think in new ways about how the social can emerge in our descriptions rather than be defined or determined by ourselves as researchers. And when that "social" emerges, ANT sensibilities can (a) complicate the narrative that privileges teachers as beacons of change who have only to become skilled and knowledgeable enough to navigate their contexts and adopt constructivist approaches that leverage technologies in creative ways, while (b) avoiding the pitfalls of determinist constructions that would have us privilege the role of nonhuman objects/material to cause, initiate, or drive change (Mason, 2018).

The significance of this work is that it offers a new critical trajectory for analysis that moves away from teacher knowledge-based frameworks and dispositional analyses of teachers' use of technology. Such frameworks too easily take on an evaluative and deficit-based approach that blames teachers and their lack of knowledge for not using digital technologies to transform the classroom (see Brantley-Dias & Ertmer, 2013). Principles of symmetry and translation also serve to move the field away from discussions of the ubiquity and affordances of digital technologies.

Technological deterministic stances easily succumb to the rhetoric of transforming education via improved access and increased bandwidth or actual hardware and software. Such explanations serve to mask inequities, offer quick-fixes and reductive solutions, and often leave teachers and students struggling to use these technologies within their own disciplines. Even ensuring preservice teachers' access to practica with online delivery components (see 2022 proposed revisions to Council for the Accreditation of Educator Preparation licensure standards) risks reinforcing the notion that sophisticated technology work is most effeciently (re-)produced through teachers being taught the particulars of the technological tools and methods. This expectation is a heavy burden for teachers, especially for our newest and most vulnerable ones.

Rather, our findings highlight a sense of continuity, stability, and ubiquity of *specific* digital technologies within the social studies and then seek to puzzle through how and why these preservice teachers successfully and skillfully used certain technologies over other technologies across time and space. Within the ecology of these social studies classrooms, presentational tools serve as the central point of passage through which all relations within and outside the classroom accumulate.

The principles of symmetry and translation can help researchers, educators, and policy makers avoid succumbing to reductionist perspectives that overemphasize either the agency of material objects or the primacy of human actors. Such perspectives deny the complexity of teaching and learning (as well as learning to teach), while often undergirding expensive educational policy trajectories

In seeking to understand how teachers make sense of and use (and not use) specific digital technologies in the production of their everyday pedagogical practices, the concept of digital technologies as mediators of

practice must be part of the equation alongside the antecedent subject subculture. Only then can researchers begin to unpack and trace the complexity of the relationships and networks of influence between social studies teachers' performances and decision-making within their classrooms and the role or absence of digital technologies or other nonhuman material in that performance.

What does this mean for teacher educators? If social studies educators are open to such sensibilities, we will begin to recognize the power of humans and nonhuman actants coming together to shape our daily performances. Perhaps we can develop a more critical eye toward reductive efforts to understand and evaluate teachers' practice based on such constructs as TPACK. Such constructs typically ignore the nature of individual disciplines and associated pedagogical practices, the relational effects of students, policies, and other material objects, and the diversity of technological tools available (see Brantley-Dias & Ertmer, 2013).

Shifting the theoretical gaze provides the space to question and push against policy initiatives and technodeterministic rhetoric regarding the affordances of all digital technologies. Within the all-important integrated technology-enriched content methods courses, it suggests more time needs to be spent discussing why certain technologies become such powerful stabilized tools for teachers and others do not. It demands that teacher educators pay attention to more than just building preservice teachers' pedagogical intentions/ambitions to utilize digital technologies and their instructional and personal confidence with digital technologies (see Millman & Molebash, 2008; Sadaf et al., 2012). We must explicitly introduce them theories like ANT so they begin to map and compare the multiplicities of networks within which they move.

With this sensibility/awareness, they may start to recognize how they shape and are shaped by a myriad of associations with both human and nonhuman actors and, further, how they might begin to complicate, translate, and maybe destabilize the antecedent subject subculture through their own associations. At the very least, by forefronting how students learn within the social studies, what social studies looks like, and the extent to which specific tools are translated into student learning, we introduce more systematic and sophisticated understanding of the purpose for integrating specific technologies. We must deconstruct context so that we can better describe and understand the myriad mediations and translations that constitute teaching and learning in the classroom and beyond.

Within an era of the College, Career, and Civic Life (C3) Framework for Social Studies State Standards that value disciplinary inquiry, it also becomes important to look for ways to destabilize specific forms of social studies teaching with (and without) specific digital technologies that do not support such learning and to understand the complex environments in which they are enacted. While our middle ground is murky, complex, and difficult to analyze, it is also playful, optimistic, and full of potential for redefining how we see, study, and teach about learning and technology in the social studies classroom.

Further, the *theoretical* work we do in this middle ground better equips us to consider positions like technoskepticism (or other critical frameworks) because we have unlocked and peered inside the normalized adoption of certain tools and practices; practices that have become taken for granted, stabilized, or black boxed (Fenwick & Edwards, 2010, p. 4). Such tightly ordered interactions suggest translations have been perfectly achieved into a typification of teaching and learning, in this case, in the social studies. It is these "tightly ordered, stable and prescriptive networks where translations appear perfectly accomplished" and firmly set that need to be explored in much deeper and reflexive ways (Fenwick & Edwards, 2010, p. 16).

Just as we were at the beginning of our first research into these questions, once again we are experiencing rapid changes in the availability and use of technology in classrooms within and across multiple contexts. Tracing associations and activities that are emerging with initiatives like 1:1, the rise of the Microsoft and Google certified educators, and blended learning alongside the historical patterns we found when projectors, electronic whiteboards, and teacher computers were introduced into the classroom is an intriguing proposition for exploring the durability or flexibility of these networks.

Current and proposed revisions to licensure regulations now include preparation for online and hybrid delivery, signaling that the network may already be less stable with the potential for more complex moments of translation within and through the network(s). Layered onto this (in)access to technology for students (and often families) is a catastrophic global pandemic (COVID-19) that could potentially serve to further destabilize traditional antecendent subject subculture with widespread, at least temporary, moves to online and hybrid instruction in K-12 schools. If, and how, these potentially destabilizing actors create shifts in the pedagogical models commonly occurring in social studies clasrooms remains to be seen. To understand such complex associations of actors, activity, and change, the field will need robust theoretical approaches now more than ever. Context and multiplicities are moving to center stage and we look forward to reconceptualizing teachers', students', and families' technology work using the sensibilities of ANT that we have begun to explore with our first decade of data.

Doing so offers so much opportunity for richer discussion and description, including about how network activity may be more fluid and flexible than we take for granted. ANT, like most approaches and theories, is not without its critics. Some even question if it is theory at all, including ANT's architects/forebearers likeLatour (2005) and Law (1992; see also Law, 1999, 2007; Law & Hassard, 1999: Law & Singleton, 2013).

ANT, despite the word theory in its name, is seen more as a fluid and flexible constellation of tools or method of analysis. It can generate opportunities to disrupt and reframe the ways relations of human and nonhuman entities can be seen and described as they come together (however temporarily) to form associations and mediations that produce agency, routines, or ideas, in the taken-for-granted typifications of practice that constitute everyday activities.

However, we value its sensibilities and ways of thinking that emphasize description and the intellectual processes it offers to slow down explanation and provide a vocabulary for interpretation only after careful attention has been paid to the flow of activities between and among human and nonhuman agents. Clearly, other theories and tools exist that work toward similar goals; Social Constructivism, ethnomethodology, Social Activity Theory, Social Constructionism, Symbolic Interactionism could alone, or in conjunction with ANT, serve as portals into inquiry to explain the why and how of the relationship between technology use and teaching and learning. This paper is meant to destabilize the networks of research that currently unquestioningly rely on Christmas balls/star systems such as TPACK to achieve value for publication. In doing so, we hope our response to the call for technoskeptical studies will challenge the field to create generative opportunities for using more diverse theoretically rich and methodologically aware approaches, as we collectively develop the requisite foundation for such important scholarship.

Notes

[a] We have chosen to point out the challenges of applying Actor-Network-Theory by offering "(mis)use" in our title as deliberate wordplay. Critics and contributors, and even forebearers, contend that ANT is difficult to summarize and explain. It refuses to be reified into a single established identifiable theory or method. It has been referred to by different names, and it is a slippery set of sensibilities. Once you think you have it yourself, ideas and associations themselves evolve and shift. Researchers, too, form part of the web of relations and associations, so ideas, routines, and protocols continue to emerge. Therefore, even as it frustrates with its blurry descriptions and messy analysis, it cannot help but intrigue as it pushes one to rethink and problematize taken-for-granted assumptions that reproduce the status quo in the classroom or in the research (See Cressman, 2018; Latour, 2005).

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Appendix A
Weekly Blog Reflections

1. What resources, tools, standards are utilized in your planning and how?
2. How do you decide what content to teach?
3. What instructional strategies do you use and do these tools and strategies vary in different classes, how do they locate tools and why?
4. How do you decide what resources to use? What informs how you approach your activities?
5. What do you want to try but do not feel ready to? What hampers certain activities and why?
6. With whom do you talk about instruction, what expectations are you trying to meet?
7. What process do you use to produce a plan for instruction and what processes go into reflecting success of activities and strategies?

Appendix B
Final Reflections

1. To what extent do you feel digital technologies can impact social studies teaching and learning? Do you feel using such technologies allows you to teach differently from how you were taught?
2. What events from this year regarding either the cost or potential of technology within the social studies classroom remain with you and will influence how you will use technology in the future?

Appendix C
In Class Discussion Prompts

Small Group Topics

1. What is a digital native? Do you consider yourself to be a digital native?
2. How were digital technologies used in your social studies classrooms and in what ways do you think you might use digital technologies in your future classrooms?

Whole Class Discussion Prompt

Describe and discuss your own experiences and understandings of the potential and provisos of digital technologies in light of your own teaching experiences.