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TEACHERS’ PERCEPTIONS OF ESRI STORY MAPS AS EFFECTIVE TEACHING TOOLS

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by

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DEDICATION

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ABSTRACT

The purpose of this study was to explore teachers' perceptions of Esri Story Maps as effective teaching tools. Story Maps are a relatively new web application within Esri's web-based GIS platform, ArcGIS Online. They combine digitized, dynamic maps with other story elements (i.e., title, text, legend, popups, and other visuals) to help the creator effectively convey a message. The relative ease associated with using and creating a Story Map as well as the simple, non-technical interface makes them ideal for use as an educational technology. Survey data were collected at several professional development events in the spring of 2014 in Columbia, SC where a total of forty-two participants were introduced to the concept of a Story Map and then given a hands-on demonstration on how to use the web application. Analysis revealed that the participants perceived Story Maps to be user-friendly, interactive, and engaging. They felt their students would enjoy using the technology and even articulated that Story Maps could help present materials that meet academic standards. Furthermore, they conveyed a willingness to collaborate with colleagues to create interdisciplinary Story Maps as teaching tools. Participants expressed more neutral sentiments concerning the ease with which they created a web map and navigated ArcGIS Online and therefore communicated a slight preference for using pre-made Story Maps over creating their own. Several obstacles stand in the way of successful implementation, including inadequate technology resources at schools, a need for additional training, and a lack of time. It is recommended that teacher preparation programs begin using GIS and Story Maps as teaching and learning tools for

preservice teachers. Additionally, professional development for inservice teachers should focus on the specific pedagogical applications of the educational technology and not just the technical skills required to operate Story Maps. It is also recommended that local, professional GIS users provide sustained technical support and serve as mentors to educators looking to use GIS and Story Maps in their classrooms.

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CHAPTER 1

INTRODUCTION

1.1 OVERVIEW OF TOPIC

Storytelling is a fundamental part of human nature. From intricate drawings on cave walls to juicy gossip at local coffee shops, humans have used stories to relate to their world and communicate experiences to others for thousands of years. While many people may immediately envision oral or textual stories, a variety of other approaches, including maps, can serve as powerful storytelling mediums. The visual nature of maps makes them ideal for communicating spatial stories in ways that engage the reader and bridge linguistic and cultural divides. Recent advances in data availability and digital technologies, including geographic information systems (GIS), the Internet, mobile communications, and "cloud"-based data storage, have put countless maps in the hands of millions of people and have also revolutionized the way people create and understand map-based stories.

Esri, a globally recognized supplier of Geographic Information Systems (GIS) software, has increasingly been focusing their efforts on developing web-based GIS. With ArcGIS Online, Esri's web-based mapping platform, users are able to easily access and share data, maps, and applications in the cloud. Some of the most exciting web-applications that have developed from these efforts are Story Maps, which combine digitized, dynamic maps with other story elements (i.e., title, text, legend, popups, and other visuals) to help the creator effectively convey a message. "They [Story Maps] present geographic information with the goal of informing, educating, entertaining, and involving their audiences" (Esri Story Maps Team 2012, 1). While the actual creation of a Story Map requires some technical ability, Esri designed the interface for non-technical audiences.

Industry professionals as well as many researchers and educators are pushing for more substantial use of GIS in K-12 classrooms as a means to improve the current state of geography education in the United States. Although the 2001 Elementary and Secondary Education Act (i.e., No Child Left Behind) identified geography as one of the nine core academic subjects, no federal funding was allocated to improve the quality of instruction or curriculum materials. Given this current state of affairs, it is not surprising that the majority of American students are geographically illiterate. According to the 2010 National Assessment of Educational Progress (NAEP), also known as "The Nation's Report Card," fewer than 30% of students in the United States demonstrated proficiency in geography (National Center for Education Statistics 2011). This statistic is quite alarming considering that, in addition to its criticality in personal decision-making that requires spatial reasoning, geographic literacy is incredibly important in our increasingly globalized world. From business to defense intelligence and environmental protection to social welfare, the global interconnectedness of current and future affairs demands a society trained in geography. Accordingly, numerous geography-dependent careers exist and are being created in both the private and public sectors. Without a workforce that is properly trained in geographic concepts and skills, these rapidly developing jobs will go unfilled.

Although it may help students learn geographic content and develop spatial thinking skills while utilizing real-world applications, incorporating GIS into an existing curriculum requires the dedication of a significant amount of time and effort by the teacher and administration (Kerski 2003; Baker 2005; Meyer et al. 1999). In addition to learning a new technology, teachers must find the time and desire to incorporate GIS into their existing curricula as well as develop new lesson plans featuring GIS. In an educational realm dominated by high-stakes testing and scripted curricula, teachers are increasingly restricted in terms of time and creativity (Brand and Triplett 2012). The idea of incorporating a complicated educational technology into a curriculum that is already stressed for time may receive a cool reception by educators. If the GIS technology was approachable, however, and allowed teachers to collaborate while meeting standards across subjects, perhaps teachers would be more willing to pursue a novel teaching method. Relatively easily constructed and user-friendly, Esri Story Maps may prove to be effective interdisciplinary teaching and learning tools for K-12 classrooms. Teachers' opinions and perceptions of Story Maps are of the utmost importance; without clear benefits and curriculum relevance, demonstrated ease of construction, and enthusiastic support, teachers are unlikely to employ this new educational technology.

1.2 RESEARCH QUESTIONS

Several studies have examined the use of desktop GIS, while relatively few studies have considered web-based GIS applications. Additionally, studies often focus on student learning as opposed to teacher reception. Using a three-part survey, this research aims to answer the following questions:

1. What are teachers' perceptions of Esri Story Maps as effective teaching tools?

a. Are Story Maps viewed as an enhancement to existing instruction?

b. If so, are Story Maps viewed as having interdisciplinary applicability?

c. If so, are teachers willing to work collaboratively with others to create interdisciplinary Story Maps?

2. What are the challenges associated with creating and using a Story Map in a K-12 classroom?

a. Which obstacles do teachers identify when developing Story Maps?

b. Which obstacles do teachers identify as potential problems when using Story Maps in their classrooms?

c. Would teachers support Story Map development by students? If so, which grade level is appropriate?

1.3 RELEVANCE OF STUDY

The results of this study will inform the software developers and the Story Maps team at Esri about how teachers perceive the Story Map product as an educational technology. The teachers' opinions garnered from the surveys will allow these parties to design effective Story Maps and templates that meet the needs and desires of teachers. For example, if teachers express that they would be more likely to utilize the product if it can be easily created within ArcGIS Online using an interactive builder, software developers and the Story Maps team should focus their efforts on developing Story Map builders that are simple to learn and easy to use. In addition, the results of this research will aid GIS education consultants in the creation of effective lesson plans by understanding how teachers perceive the benefits and challenges of incorporating Story Maps into the classroom as a teaching and learning tool.

While the analysis of the surveys will generate recommendations for those developing the web-based applications and associated educational materials, the process of administering the surveys will also benefit the participants (i.e., teachers) as they will receive a formal introduction to Story Maps. The participants will explore a pre-made Story Map that is aligned to state and national academic standards, and they will also learn how to create a Story Map using the ArcGIS Online interactive builder. These participants should be able to integrate basic Story Maps in their respective curricula after attending the professional development workshop.

Chapter 2

Literature Review

2.1 GIS in Education

2.1.1 Current State of Geographic Literacy

The 2010 National Assessment of Educational Progress (NAEP), also known as "The Nation's Report Card," revealed that fewer than 30% of students in the United States tested at or above the proficient level in geography. At the 12th grade level in particular, only 21% of students scored at or above proficient, while 30% scored below basic (National Center for Education Statistics 2011). If applied to reading, these results would indicate that 70% of high school graduates would be "unable to read a newspaper editorial and identify the assumptions, evidence, and causal connections in its argument" (Schell, Roth, and Mohan 2013, 20). In our increasingly globalized world, these statistics are especially unsettling. Although the No Child Left Behind (NCLB) Act identified geography as one of nine core academic subjects, the law did not designate a specific federal funding allocation nor did it implement programs to further K-12 geography education. NCLB, the name given to the 2002 reauthorization of the Elementary and Secondary Education Act (ESEA) of 2001, designated millions of federal dollars to the other eight subjects, including reading, English, math, and science, to be applied to teacher training, development of instructional materials, and other educational resources. Unfortunately, the discouraging testing results may partially reflect the fact that geography has not received any financial support from the federal government.

The lack of geography teaching and learning in our K-12 classrooms is alarming as 21st century civic life and careers increasingly demand a geographically literate society. Personal decision-making requires daily spatial reasoning, whether it is deciding on a method of transportation to work and the appropriate route to take or choosing where to do your grocery shopping and what produce you will purchase (National Research Council 2006). Although seemingly insignificant at the individual scale, these decisions, made by millions of people every single day, have far-reaching environmental, cultural, and economic implications. In addition to personal decision-making, the democratic nature of our society requires that we make collective decisions concerning public health, environmental protection, social welfare, and international affairs. Without a solid foundation of geography education, however, our nation will struggle to critically analyze the spatial dimensions of local and global matters. The 70% of high school graduates that are geographically illiterate lack the skills necessary to understand and thrive in our diverse and changing world.

Given the inability of most high school graduates to communicate well across cultures, compete in an international economic system, adapt to and protect changing environments, and understand how actions in one place inevitably impact another place, it is not surprising that these citizens will be unqualified for a growing number of geography-dependent careers. Federal, state, and local governments rely heavily on geographically literate employees (United States Department of Labor 2010). From emergency preparedness to urban planning to national security, individuals trained in spatial skills and concepts are invaluable and highly sought-after. This is also the case in the private sector where real estate agents, farmers, GIS analysts, and numerous other professions utilize geographic training on a daily basis. The paucity of graduates possessing geographic knowledge and skills is not lost on employers. We as a society must dramatically improve the state of geography education in our country in order to prepare these students for careers that require spatial knowledge and responsible decision-making in the 21st century.

2.1.2 Incorporation of GIS in Classrooms

The incorporation of geographic information systems (GIS) in K-12 classrooms is increasingly viewed as a means to promote spatial thinking skills and geographic knowledge (Bednarz 2004). The current educational consensus urges educators to pursue inquiry-based instruction where students construct their own knowledge through student-led research and real world experiences (NGSS 2013). GIS, a combination of hardware and software that displays, manages, manipulates, and analyzes spatially-referenced datasets, seems like a natural fit for constructivist learning environments as it urges students to think critically, use real-world data, and connect the analyses to their own communities. GIS is predominantly used in geography and science classrooms, but it can also support lessons in history, social studies, language arts, and mathematics, among other subjects (Baker et al. 2012).

The benefits of using GIS in K-12 classrooms have been articulated in numerous studies. Audet and Paris (1997) reported that the teachers surveyed saw value in GIS as an educational tool because it enriches problem-solving through spatial data analysis, engages students, and supports cross-curricular connections. While more often used for secondary education, using a simplified GIS in primary grades can enrich students' learning of geography, improve map skills, encourage collaboration and critical thinking, and promote enhanced student engagement (Shin 2006; Keiper 1999). Similarly, in a nationwide survey of high school teachers who owned a GIS package, Kerski (2003) found that GIS provided real-world relevance, increased student interest, and afforded interdisciplinary education. While the majority of teachers agreed that GIS makes a significant contribution to learning, almost half of the responding teachers were still not utilizing GIS in their curricula. This survey was administered to teachers who already owned a GIS package, so one may safely assume that the 95% of high schools that do not own a GIS package are not implementing the technology in their classrooms. The paucity of teachers utilizing GIS may be due to barriers in its adoption and implementation within K-12 classrooms, including a lack of training for educators, a shortage of time to prepare lessons that integrate GIS, and the complexity of the software (Kerski (2003). Learning the software, maintaining adequate information technology (IT) support, finding time in an already segmented school day schedule to teach complex lessons, developing relevant instructional materials, and garnering support from the administration are also challenges that impede the adoption and implementation of GIS by K-12 educators (Baker 2005; Audet and Paris 1997; Meyer et al. 1999; Bednarz and Audet 1999; Bednarz and Ludwig 1997).

Many of the challenges that have been identified pertain to the use of desktop GIS. The recent development and implementation of web-based GIS, although not heavily studied, may be gradually alleviating some of the concerns, especially as Internet access in schools is no longer a novelty. Whereas desktop GIS requires substantial support from IT staff to update operating systems, install the latest version of the costly GIS software, and maintain a seamless network system, web-based GIS only requires a functioning computer with high-speed internet access and adequate bandwidth. Although there are challenges to using this method, Baker (2005) found that less time, commitment, and energy was required to learn web-based GIS; in addition, the simpler functionality and interface was better suited for K-12 classrooms as desktop GIS has a number of advanced tools and functions that are only utilized by professionals. The need for simple, ready-to-use GIS products is even more important for elementary school teachers who do not specialize in specific content areas (Shin 2006; Keiper 1999). "With decreased technical and cartographic complexity, the need for teacher training becomes substantially less or can be refocused on the larger educational goals of supporting instructional and assessment strategies while using geotechnologies" (Baker 2005, 46). Henry and Semple (2012) drew similar conclusions.

As educational budgets have been inconsistent in recent years and teachers are increasingly pressed for time, web-based GIS provides a cheaper and more accessible alternative to desktop GIS. Teachers, not having to devote as much time to learning the mechanics of the software, can focus their efforts on integrating the technology into the classroom in a manner that supports inquiry-based learning techniques.

The interdisciplinary nature of GIS, both desktop and web-based, is one of the most appealing factors. The cross-curricular connections made by using GIS in the classroom could not be more alluring given the current educational climate. Under the provisions of No Child Left Behind, high-stakes testing has led to scripted curricula and rote memorization (Vogler and Virtue 2007). Teachers struggling to work within their limited schedules to structure lesson plans that meet the rigorous academic standards set forth by NCLB may place value in crafting cross-curricular activities that meet multiple standards across various subjects. Savage (2011) provides the following definition for cross-curricular teaching and learning: "A cross-curricular approach to teaching is characterized by sensitivity towards, and a synthesis of, knowledge, skills, and understandings from various subject areas. These inform an enriched pedagogy that promotes an approach to learning which embraces and explores this wider sensitivity through various methods." While cross-curricular teaching methods require more time, resources, flexibility, cooperation, and support than traditional teaching methods, the benefits are immense. As opposed to teaching subjects in isolation, interdisciplinary education provides real-world applicability as concepts and processes are linked across subjects. This more relevant approach to education heightens student engagement and provides for an active learning environment (Jacobs 1989; Savage 2011; Brand and Triplett 2012).

Although GIS is often used within the confines of a single academic subject, and frequently in only a single lesson (Kerski 2003), some studies have examined the cross-curricular potential of GIS in the K-12 classroom as it straddles and dissolves the borders between geography, cartography, psychology, remote sensing, mathematics, Earth science, biology, computer science, education, reading, and other fields (Baker et al. 2012; Duke 2013). Hagevik (2011) reports that during an interview about the implementation of geospatial technologies in the classroom following a professional development program, one teacher commented on how her students, in addition to enjoying the lessons, received unintentional geography and math content. This teacher planned to continue learning about geospatial technologies and was anxious to develop cross-curricular lessons and projects (Hagevik 2011). Audet and Paris (1997, 295–296) found that teachers valued GIS as an educational tool because it supports interdisciplinary education, and teachers at a particular middle school communicated that "GIS has become the hub of the wheel that ties together all areas of the curriculum." A recently published lesson plan by Mitchell et al. (2012) for high school educators showed that GIS can be a tool to tie together multiple themes across a curriculum. The interdisciplinary lesson plan highlights the Tappan Zee Bridge in New York and uses Google Earth and web-based GIS to demonstrate how the interplay of physical geography and politics played a substantial role in selecting its site (Mitchell, Cantrill, and Kearse 2012).

Scholars and educators have heavily studied the educational value of GIS. Although a fundamental technology to geography scholars, businesses, governments, and a multitude of other sectors, educators may perceive GIS simply as another innovative teaching resource in a long line of new educational technologies. Therefore, reviewing more generally the literature on factors associated with technology adoption and implementation in the classroom is critical to the current study.

2.2 EDUCATIONAL TECHNOLOGY

Educational technology refers to "a combination of the processes and tools involved in addressing educational needs and problems, with an emphasis on applying the most current tools: computers and other technologies" (Roblyer 2006, 9). Educators striving to meet the needs and better the learning outcomes of their students must consider the characteristics that define the current student population. Commonly referred to as "digital natives", students in today's classrooms have never known a world without computers and the internet (Prensky 2001). Consequently, educators, information technology specialists, administrators, curriculum designers, and a host of other involved parties are seeking more information about functional and accessible educational technologies as well as the means by which these technologies are successfully implemented.

This effort to integrate educational technologies into the classroom is underscored by standards, formerly known as the National Education Technology Standards (NETS), developed by the International Society for Technology in Education (ISTE). The ISTE Standards for Students are designed for "evaluating the skills and knowledge students need to learn effectively and live productively in an increasingly global and digital world", while the Standards for Teachers are designed for "evaluating the skills and knowledge educators need to teach, work and learn in an increasingly connected global and digital society" (International Society for Technology in Education 2008). Technology integration is critical to the success of today's students, and this is heavily reinforced by the literature on educational technology.

2.2.1 Technology Adoption Theories

The extensive literature on educational technology must be prefaced with explanations of the frameworks and models that have established context for expected human behavior and acceptance of technology. Understanding these theories could help explain differences in educators' perceptions, attitudes, and practices regarding the adoption and implementation of educational technologies such as GIS and Esri Story Maps.

The frameworks for technology acceptance and adoption are rooted in the concept of self-efficacy, which suggests that the strength of an individual's beliefs concerning their competence in a particular area or ability to reach a goal strongly influence their behavior, choices, and likelihood of success (Bandura 1977). Relating this concept to the current research, an educator with a higher level of self-efficacy regarding GIS as an educational technology may be more likely to adopt and implement the technology in their classroom.

Building upon the idea of self-efficacy, the Theory of Reasoned Action posits that an individual's chosen behavior can be predicted by their intention to perform the behavior. This intention is a function of their attitude toward the behavior and their beliefs regarding how people they care about will view the behavior (Ajzen and Fishbein 1980). This psychological approach informs a narrower model designed specifically for technology called the Technology Acceptance Model, which is a framework for understanding how and the extent to which an individual comes to accept and engage with a technology (Davis 1989). The model aids in understanding the reasons why a user accepts or rejects a technology and how system design features moderate this acceptance. The two key variables that influence an individual's intention to use a technology are its perceived usefulness and perceived ease of use. Davis defines perceived usefulness as "the degree to which a person believes that using a particular system would enhance his or her job performance"; in contrast, perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (1989, 320). A longitudinal survey of 107 technology users uncovered that perceived usefulness more strongly influenced users' intentions than perceived ease of use. According to Davis et al. (1989, 1000), "Users may be willing to tolerate a difficult interface in order to access functionality that is very important, while no amount of ease of use will be able to compensate for a system that doesn't do a useful task." This emphasizes the importance of creating a technology that, in addition to having an easy to use interface, is practical, performance-based, and allows users to accomplish tasks.

Extensions of the basic Technology Acceptance Model, such as the Unified Theory of Acceptance and Use of Technology (UTAUT), were developed to include additional variables. After reviewing several extant models of user acceptance, the UTAUT of Venkatesh et al. (2003) identifies four constructs that are critical in directly determining user acceptance and behavior: performance expectancy, effort expectancy, social influence, and facilitating conditions. Venkatesh et al. defines performance expectancy as “the degree to which an individual believes that using the system will help him or her to attain gains in job performance” (2003, 447), while effort expectancy is defined as “the degree of ease associated with the use of the system” (2003, 450). Social influence is defined as “the degree to which an individual perceives that important others believe he or she should use the new system” (2003, 451), and facilitating conditions are defined as “the degree to which an individual believes that an organizational and technical infrastructure exists to support use of the system” (2003, 453). Venkatesh et al. also suggest that, although meaningful, a user’s attitude toward use (i.e., overall reaction to using the technology), self-efficacy, and anxiety do not directly determine intention.

Empirical testing of the UTAUT revealed that gender, age, experience, and voluntariness moderate the impact of the four identified constructs on usage intention and behavior. For example, behavioral intention was moderated by age such that younger workers were more strongly influenced by performance expectancy. Experience, on the other hand, moderated behavioral intention such that older workers and those with limited experience were more strongly influenced by effort expectancy. Furthermore, age and experience moderated usage such that older workers were more strongly affected by facilitating conditions (Venkatesh et al. 2003).

The previously discussed models attempt to explain how a multitude of variables affect technology acceptance and usage. It is also critical to examine the ways in which new technologies disseminate across a population to better understand how educators may or may not accept and implement educational technologies like GIS and Esri Story Maps. Rogers' (2003) Diffusion of Innovations Theory seeks to explain the reasons and rates at which innovations, such as new ideas and technologies, diffuse across populations. Rogers establishes that adoption occurs in five stages: knowledge, persuasion, decision, implementation, and confirmation. In the context of an educational technology, the potential adopters (e.g., teachers) first collect information after an initial exposure to the technology sparks interest. The well-informed adopters grow increasingly interested and begin to consider whether the value of the new technology outweighs existing approaches and is worthy of their investment of time and energy. After adopting the new technology, they implement it to varying extents related to how they perceive its usefulness and innovative value. Finally, the adopters confirm whether or not they will continue using the technology.

The Diffusion of Innovations Theory addresses the rate at which users adopt an innovation (e.g., new educational technology) by defining five adopter categories: innovators (2.5%), early adopters (13.5%), early majority (34%), late majority (34%), and laggards (16%) (Rogers 2003). Innovators, for example, are first to adopt an innovation and are more likely to take risks. At the other end of the spectrum, Laggards are last to adopt an innovation and are often averse to change. Rogers also defines five characteristics that play an important role in an individual's decision to adopt or reject an innovation: relative advantage, compatibility, simplicity, trialability, and observability. Relative advantage refers to the benefits a user would experience with a newly adopted innovation over their existing approach, while compatibility refers to the degree to which an innovation is compatible with an adopter's existing lifestyle and needs. Simplicity concerns the perceived ease of use of the innovation, and trialability refers to how easily an adopter can test and experiment with the innovation. Finally, observability concerns the degree to which an innovation is visible to others (Rogers 2003). Jwaifell and Gasaymeh used these five attributes of innovation in their examination of English teachers' perceptions and usage of interactive whiteboards (IWB) in Jordan and found that all five attributes "played key roles in motivating or encouraging the participant teachers to use IWB during their teaching" (2013, 147).

2.2.2 Successful Educational Technologies

Research in the fields of human psychology and behavior informed extensive work regarding perceptions, acceptance, and adoption of technology. The current study speaks specifically to teachers' perceptions of Esri Story Maps as an innovative educational technology, so it is crucial to examine research regarding particular educational technologies and the factors leading to their successful implementation.

Interactive whiteboards are a fairly established 21st century educational technology that are rapidly supplementing or replacing traditional whiteboards and chalkboards in classrooms as they may be utilized as a "traditional whiteboard, a large digital convergence facility or a highly sophisticated digital teaching hub" (Lee and Winzenried 2009, 166). Multiple studies have considered the use of IWBs and have found that their interactive, engaging, and multisensory nature plays an integral role in teaching and learning in technology-rich classrooms. In addition to incorporating a range of educational technologies (e.g. whiteboard, television, video, overhead projector) and serving as a potential time saver for teachers, IWBs support multiple learning styles and allow for use by both teachers and students (Abuhmaid 2014; Jwaifell and Gasaymeh 2013). According to Lee and Winzenried (2009), the success of IWBs can be attributed to the fact that they were developed specifically for teaching and learning in the classroom. Unlike other educational technologies that were first developed for the mass market and then imported into classrooms (e.g., television, overhead projector), IWBs were created with specific pedagogical uses in mind, which provided for a smoother and well-received transition among teachers.

Online learning activities, which can serve as supplements to traditional instruction by encouraging a blended learning environment, are also growing in popularity as internet access becomes ubiquitous in schools and universities. Research by López-Pérez et al. (2013) performed during the 2009-2010 academic school year sought to examine the relationship between university students' final grades and their voluntary use of online learning activities. The study found that performing these activities resulted in an improvement in students' final grades. López-Pérez et al. (2013) concluded that online learning activities are best suited for improvement in student learning outcomes when they are used as an enhancement to the traditional learning process to facilitate comprehension of content and concepts and not just to encourage simple memorization.

Expanding on online learning activities, digital storytelling is a fairly recent addition to some classrooms. Digital storytelling requires the incorporation of digital cameras, camcorders, editing software, and computers to construct a meaningful story. Essentially, the user combines the art of storytelling with a range of simple multimedia to publish a short, amateur video on a particular topic. Daniels (2013) utilized digital storytelling as a means for pre-service teachers to apply content methodology and critically reflect on a service-learning project between the urban university and an elementary school. In addition to supporting teacher education and ISTE standards, using digital storytelling as an innovative reflective process appealed to multiple learning styles and greatly enhanced the learning experience. Similarly, Sadik (2008) sought to understand the extent to which the production of digital stories enhanced authentic learning experiences for students. The 13-15-year-old students produced digital stories about various academic subjects with the assistance of their trained teachers. The study found that students "were encouraged to think more deeply about the meaning of a topic or story" and were provided a unique opportunity to "acquire new media literacy and IT skills" (Sadik 2008, 502). Thus, Sadik suggests using "digital storytelling as an e-portfolio tool of formative assessment for learning" (2008, 503). This effective use of educational technology clearly prompted students to exhibit dedication to the task and pride in their learning.

Many studies have also examined the most recent trends in educational technology: incorporating smartphones and social media into traditional classroom instruction. In a 2012 study, primary school age students were assigned 3G-enabled smartphones on a 1:1, 24x7 basis, fostering personalized learning and a seamless learning process design (Song, Wong, and Looi 2012). Students were led through outdoor activities that focused on the life cycles of specific plants and animals and were encouraged to take pictures and videos, visit applicable websites, and create short animations about what they had learned. Song et al. (2012) found that the mobile learning environment and goal-based, experiential learning approach contributed to increased student engagement as the divides between school, home, and leisure faded. Additionally, the personalized learning afforded by this approach increased students' agency in their learning. The effective use of smartphones by primary school age students is echoed by Forzani and Leu's (2012) call for the integration of digital technologies in primary school classrooms. In addition to supporting multiple learning styles with interactive technologies, Forzani and Leu argue that integrating these skills is especially important to provide equity and opportunity to economically disadvantaged students.

Similar results were found in studies of social media integration in high school classes. Students using Twitter in a high school social studies class found it to be enjoyable, engaging, and collaborative (Bull and Adams 2012). The use of Twitter allowed for expanded creativity and supported multiple learning styles. Furthermore, students were afforded the opportunity for personalized learning experiences as they used Twitter as a supplement to traditional instruction, both inside the classroom and at home. Comparable results were reported in a study of students' perceptions of Facebook as an extension to traditional learning approaches in a precalculus class (Haygood and Bull 2012). Students expressed positive sentiments regarding the educational value of

Facebook but confirmed that it could only be used successfully as a complement to traditional classroom instruction.

Successfully integrated educational technologies share several common themes that are effectively summarized by Kearsley and Sniderman's (1998) engagement theory. In creating a framework for technology-based teaching and learning, Kearsley and Sniderman conclude that "students must be meaningfully engaged in learning activities through interaction with others and worthwhile tasks" (1998, 20). These necessary components, summarized by Relate-Create-Donate, suggest that educational activities: "1. occur in a group context (i.e., collaborative teams); 2. are project-based; and 3. have an outside (authentic) focus" (1998, 20). Many of the previously discussed cases on successful educational technology integration described applications that were collaborative, project-based, and practical.

Research has clearly demonstrated ways in which educational technologies are best suited to improve students' learning outcomes. However, simply providing an innovative technology to a classroom does not guarantee successful implementation. Teachers, not students, are the initial adopters and play a key role in effectively integrating new educational technologies into existing instructional approaches. Therefore, in an effort to avoid potentially wasteful investments, it is of utmost importance to study and understand the factors that affect teachers' perceptions of educational technology adoption.

2.2.3 Factors Affecting Adoption Of Educational Technology

Although studies concerning human behavior and technology adoption and diffusion are useful in this context, research pertaining specifically to educational technology conditions and obstacles is even more valuable. For example, Ely (1999) documented eight conditions that emerged as facilitative for the implementation of educational technology: 1. Dissatisfaction with the status quo; 2. Existence of knowledge and skills; 3. Availability of resources; 4. Availability of time; 5. Rewards or incentives exist; 6. Participation; 7. Commitment; and 8. Leadership. Similarly, Badia et al. (2013) surveyed primary and secondary teachers in technology-rich classrooms to better understand teachers' perceptions of the factors affecting technology use. They identified five important factors, including utility and educational setting of the technology, support for the teacher in the use of the technology, teacher's self-perceived expertise in the educational use of the technology, availability and access of the technology in the classroom, and technology access outside the classroom. Badia et al. concluded that "In their decision-making, teachers value first, the extent to which technology acts as a lever to improve their students' quality of learning, and to what extent its use fits in with the teaching methods and curricular skills they want to develop" (2013, 801). Furthermore, a 2008 study of university instructors explored how computer self-efficacy, computer anxiety, and experience with the use of technology influenced instructors' intention to use a specific educational technology (Ball and Levy 2008). They found that computer self-efficacy had the strongest impact on instructors' intention to use.

Similar studies focused more explicitly on conditions that inhibit the implementation of educational technology. Analysis of a 2013 survey of university faculty revealed two principal barriers to the adoption of learning technologies: structural constraints and perceived usefulness (Buchanan, Sainter, and Saunders 2013). Structural constraints refer to conditions within the educational institution, such as the provision of resources and technical support, which provide educators with the tools necessary for successful adoption and implementation. Perceived usefulness pertains to the degree to which a new technology would help the instructors create and accomplish an effective educational activity. Ertmer (1999) reviewed the literature on technology integration obstacles and developed two distinct categories: first-order and second-order barriers. First-order barriers are extrinsic to teachers and usually refer to missing or inadequate resource provision (e.g., time, support, training, equipment). These barriers are relatively easy to measure and can be eliminated with improved allocation of time and money. Second-order barriers, on the other hand, are intrinsic to teachers and refer to teachers' attitudes, beliefs, knowledge, and skills regarding technology use. These barriers are more difficult to quantify and more challenging to overcome as they are personal and often deeply embedded.

Research has clearly documented a multitude of factors to consider when integrating technology into a classroom and seems to point toward four key focuses: technology in preservice programs, professional development for inservice teachers, mentoring, and support.

During a study of preservice teachers regarding their confidence, perceptions, and ideas for using educational technologies, Nadelson et al. found that "experience learning with technology is highly influential on the technologies preservice teachers perceive they will use for instruction." Furthermore, "participants were likely to select those technologies that they were more experienced with to accomplish a wide range of learning objectives…" (2013, 87). Students felt favorably toward the educational use of some technologies that were not implemented in their classes (e.g., tablets), indicating that some of their skill acquirement is occurring outside of the formal classroom. However, Nadelson et al. argues that, aside from the mainstream technologies that dominate preservice education, “if we want teachers to use new technologies for instruction they will likely need to explicitly experience learning and teaching with the technology, which may need to be an integral part of their preparation programs or to ongoing teacher professional development programs” (2013, 87).

For inservice teachers who did not acquire skills pertaining to specific educational technologies during their preservice programs, professional development is critical for successful technology integration. Analysis of a 2012 survey of K-12 teachers regarding beliefs, perceptions, barriers, and support needs for creating technology-enhanced, learner-centered classrooms found that technology integration training often focuses too heavily on developing technology knowledge and skills while failing to devote adequate time to content and pedagogical application (An and Reigeluth 2012). In addition to creating stronger links among technology, pedagogy, and content, participants desired more meaningful professional development workshops that are customized to various learning styles, hands-on, and learner-centered. Walker et al. (2012) echoed these findings during their 2012 study comparing the impact of two technology professional development designs. The first design (tech-only) focused entirely on developing technology knowledge and skills for integration with existing pedagogies, while the second design (tech+pbl) focused on combining new technology skills with learning a new, problem-based learning (PBL) pedagogy. Teachers were surveyed on pre-post gains concerning knowledge, skills, and technology integration, while students were surveyed on self-reported improvements in behavior, knowledge, and attitudes. The tech+pbl group reported greater gains in self-reported knowledge compared to the tech-only group. Students of tech+pbl teachers exhibited gains in all three outcomes, while students of tech-only teachers just improved in attitudes. With regards to professional development, Walker et. al recommended that specific pedagogical applications be paired with training in technology skills.

Furthermore, the literature indicates that professional development should be sustained over time (Walker et al. 2012). Abuhmaid's study (2014) of teachers' perspectives of IWBs revealed that teachers often receive an initial training on pertinent technological skills after the IWB is installed. The teachers, however, felt that this was insufficient and did not address effective utilization of the technology. Abuhmaid recommends ongoing training that assists teachers in reaching the full potential of IWBs as a teaching and learning tool rather than simply dropping the IWB in a classroom and training teachers only on the technological skills required to operate it. Relatedly, Guskey's (1986) model of teacher change through staff development suggests that successful professional development, in addition to being specific with practical applications for the classroom, requires consideration of three principles. First, change is a gradual and sometimes challenging process for teachers. Second, teachers should receive regular feedback regarding student learning progress. Lastly, teachers should be provided with sustained support and follow-up after an initial training (Guskey 1986).

In addition to professional development, various forms of mentorship support the successful integration of educational technologies. In a 2008 study of barriers facing teachers attempting to develop technology-enhanced, problem-based learning in their classrooms, researchers found that the most significant difference between expert and typical teachers was the level of collaboration with other teachers (Park and Ertmer 2008). An and Reigeluth (2012) drew a similar conclusion, suggesting that building communities of practice and social networks would help teachers explore new education methods and provide continuous support outside of professional development. Furthermore, Abuhmaid advocated for mentors during the integration of IWBs as they "can foster and nurture teachers' progression with IWBs from the technology itself to its pedagogical implementation" (2014, 83).

Finally, multiple channels of support are essential for successful educational technology integration. Technical support, for example, refers to adequate institutional and infrastructural resources that provide for a seamless teaching and learning environment (Buchanan, Sainter, and Saunders 2013; Kotrlik and Redmann 2009). Without proper provisions of technical support, teachers are prone to abandoning an innovative educational technology (Abuhmaid 2014). Additionally, support from administrative staff greatly influences technology adoption (Ritchie 1996). Following a 2009 study of technology adoption by secondary teachers, Kotrlik and Redmann conclude that "Major responsibility for leadership, training, technology, and technical support must be taken by schools systems as they work to reduce or eliminate barriers to technology integration" (2009, 57). As principals and other administrative staff influence technology adoption in their schools, Waxman et al. (2013) suggest that principal preparation programs devote discussion to technology leadership. Moreover, schools should prioritize principals' attendance of technology training so they may serve as more effective technology leaders.

2.3 CRITIQUES OF EXISTING RESEARCH

Much of the existing research on GIS in educational settings has studied the use of desktop GIS, specifically in secondary school classrooms and within particular academic subjects. Research has also focused on student learning as opposed to teacher reception. Relatively few studies, on the other hand, have explored web-based GIS or the application of GIS to primary school classrooms and cross-curricular lessons (Baker et al. 2012). Given the novelty of Esri's ArcGIS Online and the related web applications, few studies from the fields of GIS or educational technology have examined Story Maps, which combine digitized, dynamic maps with other story elements (i.e., title, text, legend, popups, and other visuals) to help the creator effectively convey a message. As more educators are realizing the interdisciplinary value of ArcGIS Online and Story Maps in classrooms, both at the K-12 and university-levels (Duke 2013; Esri 2013), it is necessary to design a study that assesses the extent to which teachers perceive Story Maps as effective teaching tools. In order to perfect the technology and create useful educational materials, we need to understand how teachers perceive the functionality, applicability, and collaborative, interdisciplinary potential of Story Maps. Furthermore, we need to identify the challenges related to creating and using Story Maps and the associated threshold at which teachers will build or encourage their students to build their own Story Maps for unique lesson plans and projects.

2.4 CONTRIBUTION OF NEW RESEARCH

In addition to studying a new web application and educational technology, this research will work toward filling some of the research gaps and recommendations identified by geography education professionals. The Road Map for 21st Century

Geography Education Project, funded by a 2-year, $2.2 million grant from the National Science Foundation (NSF), was a collaborative effort of four national organizations: the American Geographical Society (AGS), the Association of American Geographers (AAG), the National Council for Geographic Education (NCGE), and the National Geographic Society (NGS). This project brought together geographers, educators, and researchers and formed three committees: the Committee on Instructional Materials and Professional Development, the Assessment Committee, and the Geography Education Research Committee. Each Committee produced a distinct report with recommendations to improve the state of K-12 geography education in the United States; some of these recommendations will be partially addressed by this research. The Geography Education Research Committee recommends that research follow interdisciplinary approaches as well as builds partnerships with formal and informal educators (Bednarz, Heffron, and Huynh 2013). The Story Map created for exploration will meet standards from multiple subjects, and the process of creating content will require communication and cooperation between the University of South Carolina and the informal educators at Congaree National Park. The Committee on Instructional Materials and Professional Development recommends that instructional materials highlight geography issues across subjects and are designed to be learning tools for teachers. Furthermore, the Committee recommends the design and implementation of professional development programs, including those for preservice teachers, which emphasize geography teaching. Tools and examples should be designed and disseminated to inspire and support educators, developers, and policy makers (Schell, Roth, and Mohan 2013). The interdisciplinary Story Map created for this study will be presented and demonstrated at professional development workshops attended by educators, and the demonstration on how to create your own Story Map will allow participants to gain the skills necessary to implement the new teaching method in their classrooms.

The survey analysis will provide valuable insight into the benefits and challenges associated with adopting and implementing Story Maps in the classroom as perceived by educators. This information could be used to inform software developers, education technology specialists, the Esri Story Maps team, and GIS education consultants as to what investments would be best suited to foster GIS in education (Baker et al. 2012). As is the case with most instructional technologies, teacher acceptance and enthusiasm governs the degree to which new teaching methods are incorporated into an existing curriculum (Guskey 1986). Teachers, often weary of change, will not accept and implement new technologies and teaching methods, including GIS, if the reward to investment ratio is too low. In other words, if it takes too much time and effort to learn the new technology and incorporate it into existing lesson plans, and if the interdisciplinary benefits are not clearly defined and explicitly demonstrated, teachers will not invest the necessary resources for successful implementation (Baker et al. 2012). As K-12 education is increasingly dominated by standards-based lessons that aim to prepare students for high-stakes testing, it is imperative that the curriculum relevance of GIS teaching tools is demonstrated during professional development events (McClurg and Buss 2007). In his study of over 1,500 high school teachers who owned a GIS package, Kerski (2003) reported that only one teacher decided to use GIS in the classroom because of its ability to meet academic standards. If teachers do not see the connections to standards afforded by GIS, implementation in the classroom will be slow and perhaps nonexistent. Kerski recommends that the "approach to GIS in education should not be, 'How can we get GIS into the curriculum?' but 'How can GIS help meet curricular goals?'" (Kerski 2003, 135). This study will investigate teachers' perceptions of a Story Map that has been aligned to state and national academic standards and will gauge the threshold for classroom implementation as identified by the participants.

CHAPTER 3

METHOD

3.1 INTRODUCTION TO METHOD

This study was designed to better understand teachers' perceptions of Story Maps as effective teaching tools. Before collecting data, a sample Story Map was created showcasing Congaree National Park's Boardwalk Tour. This Story Map served as a final, polished product that the participants could examine at the beginning of the workshop. After constructing this Story Map, a detailed tutorial, complete with step-by-step instructions and corresponding screenshots, was developed to aid the participants in the process of creating their own Story Map that mimicked the Congaree National Park example. The survey was designed specifically for this study and was composed of a variety of Likert statements and open-ended questions.

Multiple Story Map workshops were held in the spring of 2014 in Columbia, South Carolina for K-12 and informal educators. Participants were selected on the basis of their availability and willingness to complete the survey. During each workshop, participants were first introduced to the concept of a Story Map and encouraged to explore the Congaree National Park example. The majority of the allotted time was spent walking the participants through a hands-on demonstration on creating your own Story Map. Surveys were administered at the conclusion of the workshop.

Survey data were analyzed and graphed with multiple approaches, including analyses based on a Technology Profile, Age, and Education Type in addition to content analyses of the responses to the open-ended questions. Results and discussion are reported in the following chapters.

3.2 STORY MAP DEVELOPMENT

In conjunction with the staff and informal educators at Congaree National Park and experts from the University of South Carolina, a Map Tour Story Map was created within Esri's ArcGIS Online highlighting the park's boardwalk tour (Figure 3.1).

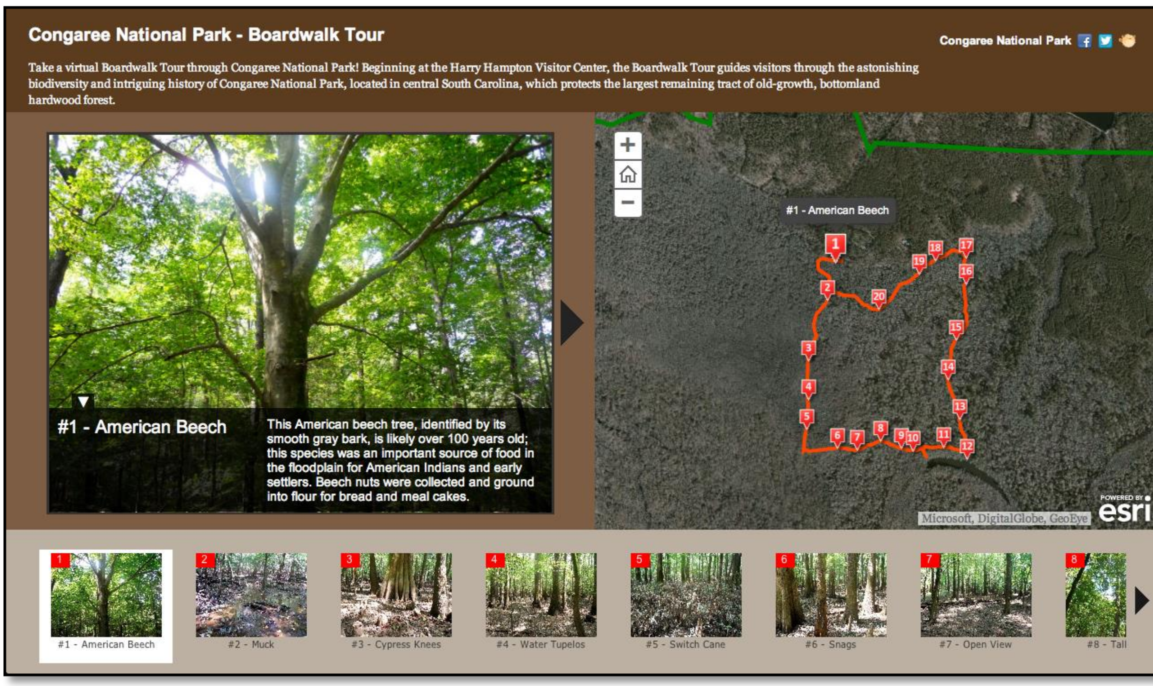

Figure 3.1 Screen capture of Congaree National Park Map Tour Story Map

Located in central South Carolina, Congaree National Park is the largest remaining contiguous tract of old-growth bottomland hardwood forest in the southeastern United States. The 2.4 mile elevated boardwalk loop allows visitors to experience an array of native flora and fauna as well as a variety of characteristic floodplain features while minimizing negative impacts on the environment. Twenty markers spaced along the boardwalk correspond to a numbered tour brochure that highlights and describes specific biological, ecological, and historical topics. From bald cypress knees and an oxbow lake to trees felled by Hurricane Hugo and remnants of old moonshine stills, this boardwalk tour was easily transformed into a Map Tour Story Map that was later used as an example in the Story Map workshops for educators.

Construction of the Story Map required GIS shapefiles of the boardwalk loop and park boundary as well a GPS location, photograph, and descriptive title and caption for each of the twenty markers. Shapefiles for the rivers of South Carolina and the state outline also added context to the Story Map. River and state outline shapefiles were obtained from the University of South Carolina GIS Data Server & Clearinghouse, while researchers at the University of South Carolina provided the boardwalk and park boundary shapefiles. Copies of the tour brochure, which offered descriptions for each marker, were acquired at the Harry Hampton Visitor Center at the entrance to the park, while GPS locations and photographs were obtained specifically for the creation of this Story Map and the subsequent educator workshops. After creating a web map within ArcGIS Online using an imagery basemap overlaid with the boardwalk, park boundary, river, and state outline shapefiles, the web map was saved and published as a Map Tour Story Map web application. Using the interactive builder, the twenty markers were placed at their appropriate locations along the boardwalk and were supplemented with the corresponding photographs and captions. The Story Map was created and hosted within the University of South Carolina's organizational ArcGIS Online account.

The themes highlighted along the boardwalk tour lend themselves nicely to South Carolina state standards and literacy skills in science and social studies as well as national geography standards, while the method for delivering the information (i.e., the Story Map web application) meets a variety of state and national standards in English language arts, Internet safety, and technology skills (Table 3.1).

Table 3.1 Sample of academic standards supported by the Story Map

South Carolina – 3rd Grade Science	Standard 3-3: The student will demonstrate an understanding of Earth's composition and the changes that occur to the features of Earth's surface. (Earth Science)
South Carolina – 3rd Grade Social Studies	Standard 3-1: The student will demonstrate an understanding of places and regions in South Carolina and the role of human systems in the state. Literacy Skill: Recognize maps, mental maps, and geographic models as representations of spatial relationships.
South Carolina – 3rd Grade English Language Arts	Standard 3-6: The student will access and use information from a variety of sources.
South Carolina – Internet Safety (Grades 3-5)	Media Literacy – Standard 2: Students use critical thinking and evaluation while incorporating appropriate digital tools and resources into their education.
Geography for Life – National Geography Standards (4th Grade)	Geography Standard 4: The physical and human characteristics of places
International Society for Technology in Education (ISTE) Standards for Students	3. Research and Information Fluency: Students apply digital tools to gather, evaluate, and use information.

Within the current educational climate, the importance of meeting standards with new lessons and educational technologies cannot be overstated. Educators are likely to dismiss an instructional material or technology that does not in some way help them to meet standards as they are under immense pressure to fully prepare their students for high-stakes testing.

3.3 STORY MAP TUTORIAL DEVELOPMENT

The Congaree National Park Map Tour Story Map served as an example of a final, polished product for the educators participating in the Story Map workshops. A detailed, step-by-step tutorial document was developed to help guide them through the process of creating a similar Story Map. As most participants were unfamiliar with ArcGIS Online, this eight-page tutorial included a list of seven important tasks along with screenshots and thorough instructions for completing each task (Appendix A). The tutorial was created according to a standard workflow within a public account of ArcGIS Online. Although users are only able to minimally customize their Story Map web applications in the public account, a public account is free and therefore easily accessible to all educators.

The first task for the creation of a Story Map was to upload photographs to a photo-sharing site such as Flickr, Picasa Web/Google+, or Facebook. Unlike the organizational account of ArcGIS Online, which allows users to host their photographs as a feature service within the Esri cloud, public account users must host all of their Story Map photographs on a photo-sharing site or elsewhere on the internet (e.g., on their personal website through the school district). To conserve time and avoid complications, photographs were selected and uploaded to a publicly accessible Flickr account prior to the workshops.

Creating a public account on ArcGIS Online was the second task in the tutorial; screenshots and accompanying instructions guided participants through the steps of navigating to "http://www.arcgis.com" and generating a public account with their own usernames and passwords.

Task three instructed the participants to create a new web map that would support the story they want to tell with an appropriate basemap and applicable data layers. The imagery basemap was used in the final Congaree National Park Story Map, although the participants were encouraged to explore all nine basemap options so that they may begin brainstorming ideas for future Story Maps (Figure 3.2).

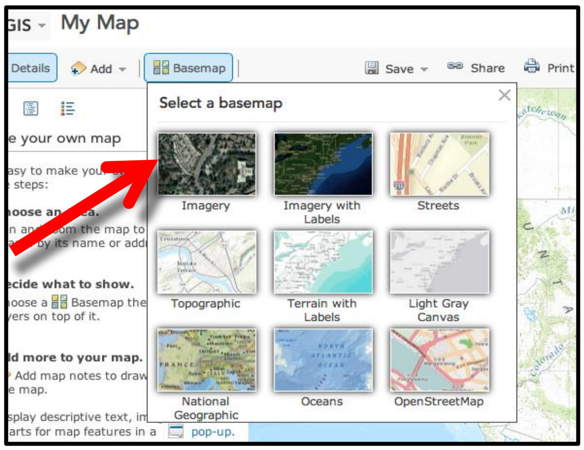

Figure 3.2 Basemap options in ArcGIS Online

The tutorial detailed two different methods for adding data layers to the basemap, including searching for layers that were already hosted on ArcGIS Online and adding layers from files that were downloaded from an outside source. The Congaree National Park boardwalk and boundary shapefiles were uploaded to ArcGIS Online and made publicly available prior to the workshops, so the participants simply had to search for the keyword “Congaree” and add the appropriate layers to the map (Figure 3.3).

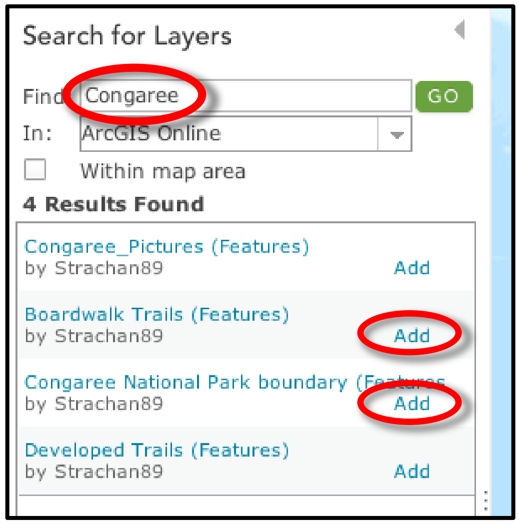

Figure 3.3 Adding layers hosted in ArcGIS Online

The South Carolina rives and state outline shapefiles, however, were not yet hosted on ArcGIS Online. Each participant downloaded these files from the University of South Carolina GIS Data Server & Clearinghouse and then added them to their web map. After customizing the color, width, and transparency of each layer, participants populated the metadata and saved their web maps.

Sharing the web map as a Map Tour Story Map was the fourth task in the tutorial. The Map Tour is currently one of many web application templates available to public account users. Once the Map Tour Story Map was saved and published, participants were instructed to view the application and begin the fifth task of using the interactive builder to integrate photographs and text. The interactive builder prompted participants to import photographs from their chosen photo-sharing site (e.g., Flickr) and place those photos at their approximate location on the map (Figure 3.4).

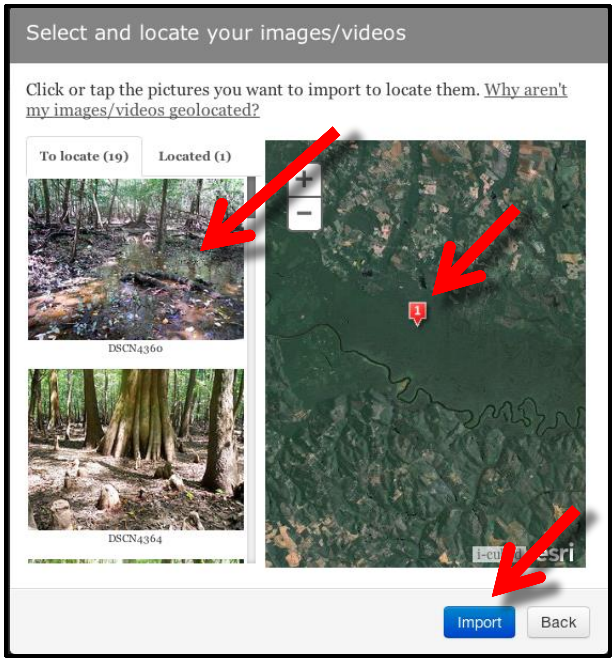

Figure 3.4 Locating and importing photographs

This step could be bypassed if the photographs had been uploaded to the photo-sharing site with their locational (i.e.: Exif) data. Once the photographs were imported as markers on the map, the instructions guided participants through the process of adding a title and caption to each marker. To demonstrate the range of functionality within the Story Map web application, participants also learned how to change the media for a marker from a photograph to a YouTube video (Figure 3.5).

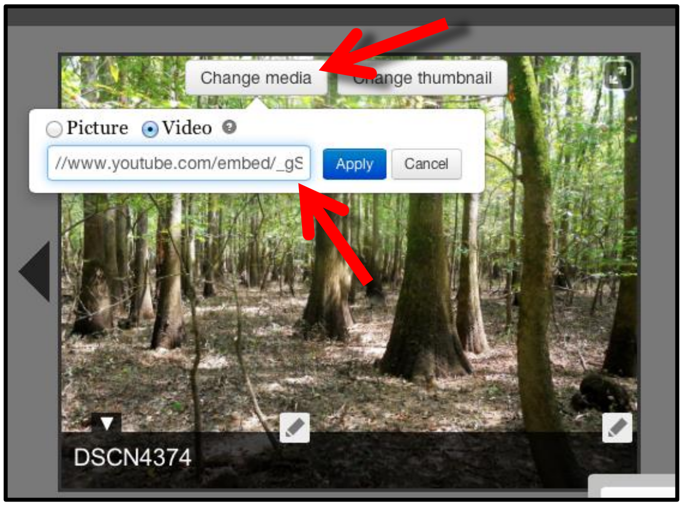

Figure 3.5 Changing the media to a YouTube video

Additionally, participants were encouraged to examine the variety of customization options located under the "Settings" tab. Options included altering the application layout, colors, extent, and zoom level of the Story Map. Task six emphasized the importance of populating the metadata for the Story Map web application, including a descriptive summary and applicable tags, while task seven allowed the participants to view and interact with their newly created Story Map.

3.4 SURVEY DESIGN

In an effort to establish an understanding of educators' attitudes toward and perceptions of Story Maps as effective teaching tools, a survey was designed and administered to participants at the conclusion of the workshops (Appendix B). Institutional Review Board (IRB) approval was granted in December of 2013 for this instrument. The survey was composed of three distinct sections. Section one gathered profile data about the participant including their age, the number of years they have been teaching, and the current grade level(s) and subject(s) they are teaching. In addition, participants were asked to choose a response of low, medium, or high for their comfort level teaching with technology, the level of technical support available at their school, and their level of experience with geospatial technologies. The profile data served as independent variables for the subsequent survey analysis.

Section two related to the *use* of Story Maps and was composed of six statements with Likert-scale responses and two short response questions. The Likert items pertained to the ease of use, interactive and engaging nature, and predicted student enjoyment of Story Maps as well as the educators' thoughts on the potential to use them to meet academic standards and present interdisciplinary material. A final Likert item aimed to determine educators' propensity for collaborating with colleagues to use Story Maps as a teaching tool. The short response questions asked educators to record their likes and dislikes regarding the *use* of Story Maps and to note potential ways in which they would use Story Maps in their own classrooms.

The third section of the survey, composed of seven statements with Likert-scale responses and two short response questions, sought to identify the challenges associated with *building* Story Maps and to gauge the threshold for educator buy-in. The Likert items pertained to the ease of navigation within ArcGIS Online, the simplicity of creating a web map, and the level of enjoyment when building a Story Map with the interactive builder. In addition, Likert items determined educators' propensity for using either pre-made or custom built Story Maps in their classrooms, students' capabilities to create Story Maps, and the increased likelihood of using Story Maps in the classroom pending an additional professional development workshop. The short response questions asked educators to record their likes and dislikes concerning the *creation* of Story Maps as well as perceived obstacles that would limit their ability to use Story Maps in their classrooms.

Overall, this survey was designed to gather foundational data concerning educators' perceptions of Esri Story Maps as effective teaching tools. Creating two separate sections that addressed the *use* of Story Maps and the *creation* of Story Maps allowed for a better understanding of how educators may or may not employ this new educational technology in their own classrooms. Specifically, the survey provided the data necessary to answer these important research questions: 1) Will educators only use Story Maps in their classrooms if they are "off-the-shelf", prepackaged, and aligned to standards? 2) Are educators willing to try creating their own Story Maps using the ArcGIS Online hosting service and interactive builder? 3) Will they work collaboratively with colleagues to develop interdisciplinary Story Maps? 4) When will the required construction time, skills, and effort become too much for a teacher to manage given their already overcrowded schedules?

3.5 PARTICIPANT RECRUITMENT AND WORKSHOP PROCEDURE

As this research aimed to study K-12 teachers as well as informal educators, data were collected in Columbia, South Carolina at multiple professional development workshops for educators from across the state of South Carolina (Table 3.2). A convenience sampling strategy was employed given the limited scope and extent of this research, and 42 total surveys were collected. The first workshop was held during the South Carolina Geographic Alliance (SCGA) hosted AP Human Geography conference on January 18, 2014 and was attended by 21 AP Human Geography teachers. The second workshop was hosted by the Environmental Education Association of South

Carolina (EEASC) and brought together 15 local environmental educators on February 24, 2014. A third workshop at Geofest, a biannual SCGA conference composed of K-12 educators and pre-service teachers interested in geographic education and skills training, hosted four participants on March 22, 2014. A fourth, personalized workshop was held for two pre-service teachers on April 16, 2014.

Table 3.2 Research sample composition

Event	Sample size	Subjects taught	Grade levels taught
AP Human Geography conference	21	AP Human Geography, History, Social Studies, Government	8-12
Environmental Education Association of South Carolina	15	Environmental Science, Conservation, Natural History, Forestry, Ecology	Informal, K-adult
Geofest	4	English, Social Studies, World Geography, Civics, History	7-11
Personal workshop	2	All (pre-service)	Elementary

Each workshop was allotted approximately one and a half hours of time and was conducted in a very similar manner with participants at their own computer workstations. Workshop participants were first asked about their prior knowledge of geographic information systems (GIS) and then introduced to the concept of a Story Map with a short Powerpoint presentation. The last slide of the presentation contained URL links to Story Maps that were selected with each specific audience in mind. After exploring these web applications on the main projector screen, participants were encouraged to visit ArcGIS Online and browse the Story Map gallery on their own computers to familiarize themselves with the interface and begin brainstorming ways in which these could be used as effective teaching tools in their own classrooms. After five to ten minutes of browsing the gallery, participants were anxious to delve a bit deeper and learn how to actually create a customized Story Map.

Each participant received a copy of the tutorial document (Appendix A) for reference during the workshop, but most participants preferred to follow along with verbal and visual directions as the same Story Map was created on the projector screen. A variety of questions, concerns, and ideas were posed and discussed throughout the hands-on demonstration, and participants were encouraged to keep note of their thoughts and transcribe them on the subsequent survey. Again, the tutorial took participants through the process of uploading photos to a photo-sharing site, creating a public account on ArcGIS Online, creating a web map and adding data layers, sharing that web map as a Map Tour Story Map, using the interactive builder to incorporate photos and text into the map, populating the metadata, and viewing the final application.

The survey (Appendix B) was administered to participants at the conclusion of the workshop. Participants were asked to give their honest opinions and provide their thoughts in as much detail as possible.

3.6 DATA ANALYSIS

3.6.1 DATA ENTRY

Forty-two surveys were collected from the workshop participants. Each Likert item and question was assigned a unique code associated with its content. Survey data were then recorded in a spreadsheet with the coded questions placed at the top of each column and survey responses occupying the rows. Profile data from section one of the survey (age, number of years teaching, current grade level(s) teaching, current subject(s) teaching) were recorded as written by the participants. Regarding their comfort level teaching with technology, the level of technical support available at their school, and their level of experience with geospatial technologies, a response of “low”, “medium”, or “high” was recorded as a score of 1, 2, or 3, respectively. In sections two and three of the survey, responses to the Likert items were entered as a score of 1 for “Strongly Disagree” up to a score of 5 for “Strongly Agree”. All responses to the four open-ended questions were transcribed exactly as written by the participants. Instances where a survey response was unclear will be discussed within the following description of the applicable analysis.

The Likert item responses were analyzed and graphed in three different manners. A Technology Profile Analysis grouped participants into categories and compared their responses to the Likert items based on their self-reported comfort level teaching with technology, level of technical support available at their school, and level of experience with geospatial technologies. An Age Analysis analyzed responses between participant categories based on age, and an Education Type Analysis examined responses with regard to the participant’s role either a formal or informal educator. The written responses to the open-ended questions were evaluated and grouped into identified themes corresponding to each question.

3.6.2 Technology Profile Analysis

The Technology Profile Analysis compared Likert item survey responses among three different groups. Surveys were placed into one of three groups based on a summative score of the responses to the technology profile statements in section one of the survey (i.e.: comfort level teaching with technology, level of technical support available at school, and level of experience with geospatial technologies). This analysis was loosely inspired by the Diffusion of Innovations Theory, which documents the stages of innovation adoption and classifies individuals into adopter categories based on their degree of innovativeness (Rogers 2003). Participants were placed into three groups based on the scores of their technology profile statements: 1) the Enthusiast group (score = 8-9; n=4), 2) the Pragmatist group (score = 5-7; n=31), and 3) the Laggard group (score = 3-4; n=7). The Enthusiast group comprised a relatively small portion of the total sample population, but the data garnered from this group was still very valuable because it represents the most innovative educators who serve as leaders in their schools concerning the incorporation of educational technologies such as GIS. Slightly changing the score ranges (e.g., score range of 7-9 for Enthusiasts) would not appreciably affect the results. One survey participant circled Medium and High for the technical support statement and Low and Medium for the geospatial technologies statement. Both responses were moved to the middle answer of Medium and therefore given a score of 2 for each statement. Examples of technology profile group assignments can be found in Table 3.3.

Table 3.3 Technology Profile groups

Group	Sample Size (n)	Technology Profile Score Range	Example Score Combination
Enthusiasts	4	8-9	Teaching with technology: High (3) Technical support: High (3) Geospatial technology: Medium (2) **TOTAL SCORE: 8**
Pragmatists	31	5-7	Teaching with technology: Medium (2) Technical Support: High (3) Geospatial technology: Low (1) **TOTAL SCORE: 6**
Laggards	7	3-4	Teaching with technology: Low (1) Technical Support: Medium (2) Geospatial technology: Low (1) **TOTAL SCORE: 4**

These different technology profile groups slightly resemble the age analysis groups, which are discussed in the following section. For example, the Enthusiast group is composed of participants that are concentrated in the younger categories (i.e., 21-30 and 31-50 groups), while the Pragmatist and Laggard groups have representation in all three age categories.

After respondents were assigned to their appropriate group, cumulative group responses to each Likert item were displayed and evaluated in bar graphs. The response options (i.e., Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree) were arranged along the X-axis, while percent response occupied the Y-axis. Graphing the responses in this manner allowed for comparison and evaluation among the three groups.

In addition, the mean response value of each group's members to each technology profile statement was calculated and reported in Table 3.4. This type of analysis attempted to create a more informative technology profile by revealing and answering questions about the overall strengths and weaknesses of each group.

Table 3.4 Average scores per group for technology profile statements

	Teaching with technology	Level of technical support	Experience with geospatial technologies
Laggard	1.9	1.2	1
Pragmatist	2.3	2.3	1.5
Enthusiast	3	3	2.8

3.6.3 Participant Age Analysis

The Age Analysis compared Likert item survey responses among three different groups. Surveys were placed into one of three groups based on their self-reported age. Groups were created for ages 21-30 (n=14), ages 31-50 (n=17), and ages 51 and older (n=11). One survey participant did not report an age. They did, however, report that they had been teaching for over thirty years. Because of this response, the survey was placed in the 51 and older age group as the participant was most likely at least 51 years old. After the surveys were assigned to their appropriate group, cumulative group responses to each Likert item were displayed and evaluated in bar graphs in a manner similar to the Technology Profile Analysis.

3.6.4 Education Type Analysis

The Education Type Analysis compared Likert item survey responses between two different groups. Surveys were placed into one of two groups based on the type of educator providing the responses. Participants from the AP Human Geography conference, Geofest, and personal workshop for pre-service educators were placed in the

Formal group, indicating that they are formal educators who usually teach within a classroom-based environment. The Formal group (n=27) was composed of elementary, middle, and high school educators who taught a variety of subjects, including AP Human Geography, social studies, government, English, and history. The participants from the Environmental Education Association of South Carolina were placed in the Informal group, indicating that they are informal educators who usually teach outside of a formal classroom setting. The Informal group (n=15) was composed of educators who taught environmental science, conservation, natural history, forestry, and ecology to all ages, including K-12 and adult learners, at local environmental organizations. The survey responses were graphed and examined in a manner similar to the previous methods of analysis.

3.6.5 Content Analysis

The open-ended questions allowed participants to express unique ideas and concerns in their own words. The four questions asked participants to record their likes and dislikes regarding the use of Story Maps, plans for using Story Maps in the classroom, likes and dislikes regarding the creation of Story Maps, and concerns over potential obstacles that would limit their ability to use Story Maps in the classroom. Analysis of the responses to each open-ended question required multiple read-throughs to begin identifying emerging themes. Many surveys had multiple pieces of feedback within a single response and could be classified under multiple themes. Each piece of feedback was therefore treated as an individual response, so the total number of responses to each open-ended question was higher than the total number of participants. The original list of emerging themes was condensed to 6-8 themes per question, and the individual pieces of feedback were classified into the appropriate theme. A complete list of identified themes for each question and examples of feedback theme classification can be found in Tables 3.5, 3.6, 3.7, and 3.8. Each theme was then tallied and reported as a percentage of the total number of responses to the open-ended question. A bar graph for each open-ended question presented the themes along the X-axis and the percent of responses along the Y-axis. The themes most often noted by participants were displayed evidently in this type of analysis.

Table 3.5 Themes and sample classification for Open-ended Question One

Question	Identified Themes	Sample Feedback Classification
Additional thoughts about what you did or did not like about *using* Story Maps?	Generally positive	"Loved it!" (1-5)*
	Easy/simple	"Much more user friendly than some of the other GIS software I've seen." (1-4)
	Applicable to K-12 & beyond	"Can see applicability at all levels of education for K-graduate school and beyond" (2-7)
	Time consuming	"…very willing to do that if I'm ever given time" (1-18)
	Engaging & interactive	"…presents information in an engaging manner" (2-1)
	Like multimedia inputs	"I really like that you can embed videos." (2-2)
	Generally hesitant	"Due to limited technology resources, I'm unsure of my availability to use it in school." (3-4)
	Difficult without tech experience	"If not tech savvy, this could be overwhelming." (1-1)

**Numbers within parentheses are survey identifiers.*

Table 3.6 Themes and sample classification for Open-ended Question Two

Question	Identified Themes	Sample Feedback Classification
How would you plan to use Story Maps in *your* classroom? (i.e.: specific topic, subject, lesson, student projects)	Lectures/presentations	"I can see adding them as part of powerpoint lectures much like video downloads." (1-10)
	Student projects	"Have students create culminating projects for learning units." (3-2)
	Outreach/web content	"To show successes of energy projects over time" (2-3)
	Use pre-made SMs	"I will use Story Maps gallery…" (1-3)
	Non-tested areas	"Would LOVE to do end of school (after AP) project…" (1-21)
	Unsure	"Not sure." (1-14)

Table 3.7 Themes and sample classification for Open-ended Question Three

Question	Identified Themes	Sample Feedback Classification
Additional thoughts about what you did or did not like about *creating* Story Maps?	Generally positive	"I enjoyed creating a story map…" (4-1)
	Difficult without tech experience	"I would need additional help because my computer skills are not great." (2-4)
	Like step-by-step instructions	"I did like the tutorial pages that came along with the instruction." (1-9)
	Interactive	"…makes lessons more intriguing." (4-2)
	Time to create	"The traditional schedule I am on will limit completing Story Maps in one class period…" (1-7)
	Generally hesitant	"I would need to use this several times before I could answer…" (1-18)
	Simple	"Thought it was easy to navigate…" (4-2)
	Like that SMs are web-based	"I really like that it is web-based." (1-17)

Table 3.8 Themes and sample classification for Open-ended Question Four

Question	Identified Themes	Sample Feedback Classification
Additional thoughts about obstacles that would limit your ability to create or use Story Maps in your classroom?	Lack of technology at school	"We are not a one-to-one school (laptop or iPad/kid ratio is low) so getting lab time would be key." (1-4)
	Need more training	"Just a little more training and application." (1-2)
	Lack of time	"Time will limit me most of all" (2-1)
	School filters	"Photo file sharing; limited website (school district blocking)…" (1-9)
	Too difficult for students	"I do believe students may find this difficult…" (1-1)
	Level of tech support at school	"Level of tech support when I get 'stuck'." (1-18)

3.7 SUMMARY OF METHOD

The creation of the Congaree National Park Story Map as well as the Story Map tutorial was critical for ensuring successful workshops. Participants with a background in both K-12 and informal education attended professional development workshops and gained hands-on experience exploring ArcGIS Online, finding and gathering data, and creating their own web maps and Story Maps. The survey data provided by the participants at the close of the workshops was analyzed in multiple ways and afforded numerous results that help to establish a better understanding of teachers' perceptions of Story Maps as effective teaching tools.

CHAPTER 4

RESULTS

4.1 REPORTING RESULTS

The survey feedback and responses to the open-ended questions suggested that the participants felt very favorably toward Story Maps as an enhancement to existing instruction. They viewed them as user-friendly, engaging and interactive, and enjoyable for students. Participants also felt strongly that Story Maps could support the presentation of collaborative, interdisciplinary materials that meet academic standards. Despite praising the simplicity of Story Maps and their applicability to the classroom, participants raised a number of concerns that could serve as implementation obstacles. A shortage of technology at school, a need for additional training, and a lack of time were the most often cited impediments. Nevertheless, participants could foresee their students possessing the aptitude to develop Story Maps and indicated a higher likelihood of using Story Maps in the classroom pending additional professional development workshops.

The Story Map workshop and survey were specifically designed to provide the data necessary to answer the following research questions:

1. What are teachers' perceptions of Esri Story Maps as effective teaching tools?

a. Are Story Maps viewed as an enhancement to existing instruction?

b. If so, are Story Maps viewed as having interdisciplinary applicability?

c. If so, are teachers willing to work collaboratively with others to create interdisciplinary Story Maps?

2. What are the challenges associated with creating and using a Story Map in a K-12 classroom?

   a. Which obstacles do teachers identify when developing Story Maps?

   b. Which obstacles do teachers identify as potential problems when using Story Maps in their classrooms?

   c. Would teachers support Story Map development by students? If so, which grade level is appropriate?

The Technology Profile, Participant Age, Education Type, and Content Analyses provided a variety of lenses through which to examine the data and therefore afforded a wealth of valuable findings. Each research question will be answered with general findings from the sample as a whole as well as findings from each method of analysis, if applicable, in the following sections. Discussion of these results is offered in the subsequent chapter.

4.2 Research Question 1

4.2.1 Research Question 1a

Multiple sections of the survey, including four Likert items and two open-ended questions, provided insight into teachers' views of Story Maps as an enhancement to existing instruction. Ninety-five percent of the participants chose Agree or Strongly Agree in response to the item "Story Maps are user-friendly" (n=41). Similarly, 98% of the participants chose Agree or Strongly Agree regarding the item “Story Maps are interactive and engaging” (n=42). Few substantive differences in responses among subgroups to these two items were found within the Technology Profile, Participant Age, or Education Type Analyses.

Concerning the item “My students would enjoy using Story Maps” (n=39), 87% of the participants chose Agree or Strongly Agree. When examined by Education Type (Informal n=12), 92% of the Informal group picked Agree of Strongly Agree. These educators, who do not necessarily interact with students within a formal classroom and may not teach on a regular basis, still believed that students would enjoy using Story Maps. The Technology Profile Analysis (Enthusiast n=4; Pragmatist n=30; Laggard n=5) revealed that, when divided into the three groups based on the technology profile statements, the Laggard group was more likely to express neutral sentiments regarding the potential for their students to enjoy using Story Maps. Forty percent of the Laggards selected Neutral, while only 20% selected Strongly Agree. Comparatively, none of the Enthusiasts and only 7% of the Pragmatists chose Neutral, while 75% of the Enthusiasts and 67% of the Pragmatists chose Strongly Agree (Figure 4.1).

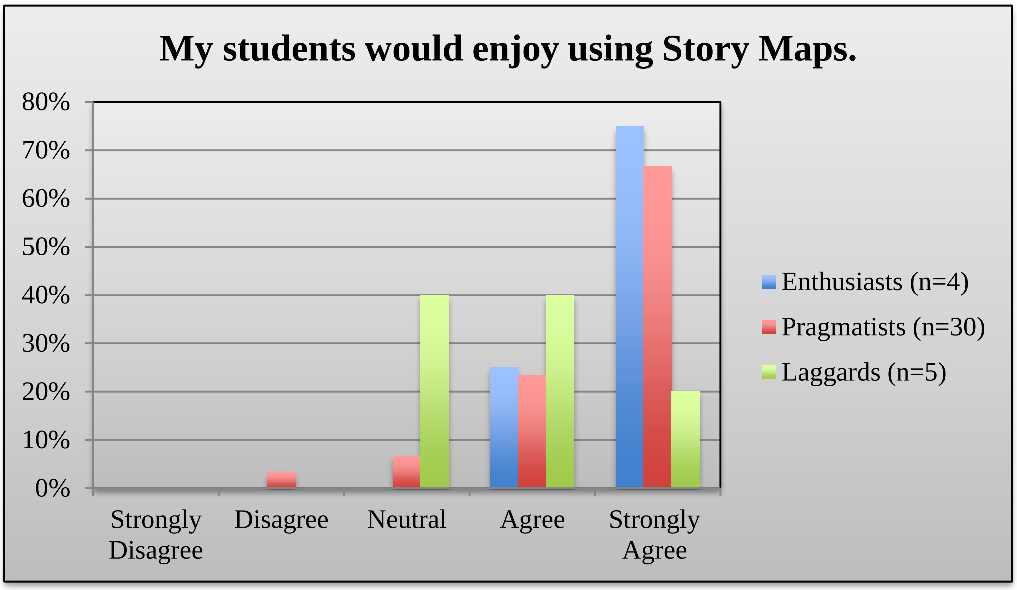

Figure 4.1 Technology Profile survey responses to "My students would enjoy using Story Maps."

When prompted with the item "Story Maps can help me better present material that meets academic standards" (n=40), 85% of the participants selected Agree or Strongly Agree. Similar to projected student enjoyment (Informal n=13), 77% of the Informal group chose Agree or Strongly Agree. Again, even informal educators, who may not be as familiar with academic standards as formal educators, see the potential for Story Maps to serve a role in today's standards-based classrooms.

The Content Analysis of the open-ended questions provided additional insight into the teachers' views of Story Maps as an enhancement to existing instruction. When asked about their likes and dislikes concerning the use of Story Maps, participants provided comments such as:

"This is a great way to make learning interactive (2-4)"

"Much more user friendly than some of the other GIS software I've seen (1-4)."

"I like the ability to add pictures and video to the map. I like the stream lined buttons (1-17)."

"Highly interactive and easy to use; relevant to any profession or teaching application (2-14)."

Less positive feedback included remarks such as:

"If not tech savvy, this could be overwhelming. Also time consuming (1-1)."

"Time is the biggest issue in AP. Other, non-tested areas, might work better (1-15)."

Of the total number of responses (n=59), 20% were generally positive, 19% commented on how Story Maps were relatively easy and simple to use, and 17% stated that Story Maps were applicable to K-12 classrooms as well as a variety of other educational settings. Twelve percent expressed that Story Maps were engaging and interactive, and 8% praised the ability of Story Maps to incorporate multimedia. Participants began to express reluctances, however, as 12% of the responses felt that Story Maps were time consuming, 5% worried that the technology could be difficult if one lacked technical experience, and 7% provided generally hesitant comments (Table 4.1).

Table 4.1 Likes and dislikes concerning the use of Story Maps

Question	Identified Themes	Percent of Total Responses
Additional thoughts about what you did or did not like about *using* Story Maps?	Generally positive	20%
	Easy/simple	19%
	Applicable to K-12 & beyond	17%
	Time consuming	12%
	Engaging & interactive	12%
	Like multimedia inputs	8%
	Generally hesitant	7%
	Difficult without tech experience	5%

When asked about their plans for using Story Maps in the classroom, participants provided ideas such as:

> "I will use Story Maps gallery and when I am more confident with the site, try simple maps with my students (1-3)."
>
> "I can see adding them as part of powerpoint lectures much like video downloads. I can also see using them as a project base for my students to create on the current subject being discussed (1-10)."
>
> "I assist teachers in developing outdoor classrooms, nature trails, public gardens, and see story maps as useful for all these venues (2-7)."

Of the total number of responses (n=55), 36% indicated that Story Maps could be used to supplement existing lectures and presentations, and 25% suggested utilizing them within student projects. Using Story Maps for community outreach via web content was proposed in 24% of the responses, while 9% of the responses indicated a plan to use pre-made Story Maps found in the ArcGIS Online gallery. Four percent of the responses specified using Story Maps for non-tested areas of the curriculum, and only 2% expressed uncertainty as to how Story Maps could be used in the classroom (Table 4.2).

Table 4.2 Plans for using Story Maps

Question	Identified Themes	Percent of Total Responses
How would you plan to use Story Maps in *your* classroom? (i.e.: specific topic, subject, lesson, student projects)	Lectures/presentations	36%
	Student projects	25%
	Outreach/web content	24%
	Use pre-made SMs	9%
	Non-tested areas	4%
	Unsure	2%

Overall, the participants responded favorably and felt that Story Maps were user-friendly, interactive and engaging, enjoyable for students, and able to help in presenting material that meets academic standards. Although concerns began to emerge, participants provided positive feedback and generated many ways in which they could use Story Maps in their classrooms. These results indicate that the participants feel that Story Maps could enhance existing instructional methods.

4.2.2 Research Question 1b

Although the majority of participants feel that Story Maps could enrich existing instruction, it was critical to uncover their views of Story Maps as having interdisciplinary applicability. Interdisciplinary teaching methods may require increased time and cooperation from educators, but they provide a more practical and engaging education for students. The previous section confirmed that a strong majority of participants, including the informal educators, agreed that Story Maps could help them better present material that meets academic standards. In addition, the following item stated "Story Maps could be used to present material from a variety of subjects (i.e., interdisciplinary) (n=42). All participants chose Agree or Strongly Agree, with 79% choosing Strongly Agree. Few substantive differences in responses among subgroups to these two items were found within the Technology Profile, Participant Age, or Education Type Analyses. This finding supports the use of geospatial technologies such as Story Maps as an interdisciplinary tool in many kinds of classrooms.

4.2.3 Research Question 1c

Constructing interdisciplinary teaching materials, such as Story Maps, requires cooperation amongst multiple educators. Participants were therefore prompted with the item "I would collaborate with fellow teachers to use Story Maps as a teaching tool" (n=40). Encouragingly, 98% of the participants chose Agree or Strongly Agree. The Technology Profile Analysis (Enthusiast n=4; Pragmatist n=31; Laggard n=5) revealed that 100% of the Enthusiasts chose Strongly Agree, while only 45% of the Pragmatists and 40% of the Laggards made the same selection (Figure 4.2).

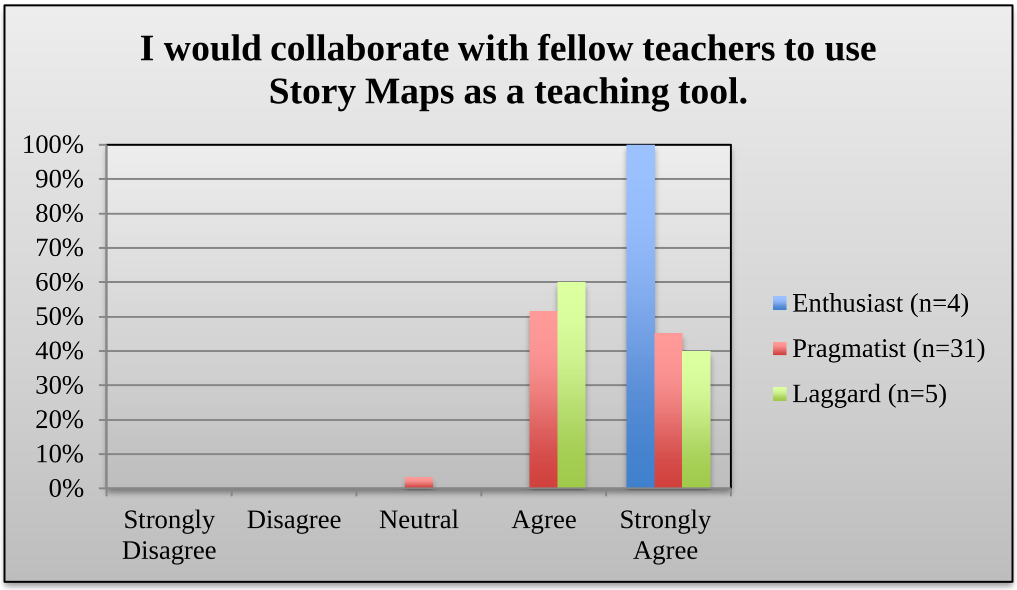

Figure 4.2 Technology Profile survey responses to "I would collaborate with fellow teachers to use Story Maps as a teaching tool."

This strong propensity to collaborate with fellow educators on an interdisciplinary Story Map may speak to the Enthusiasts' experience with technology and availability of technical support at school.

4.2.4 Overall Findings for Research Question 1

Given the survey feedback and responses to the open-ended questions, the participants expressed an overwhelmingly positive perception of Story Maps as effective teaching tools. This new web application was viewed as user-friendly, engaging and interactive, and enjoyable for students. Furthermore, the participants affirmed that Story Maps could be used to present standards-aligned materials as well as collaborative, interdisciplinary lessons. Participants praised the simplicity and multimedia capabilities of Story Maps and began brainstorming ways in which they could be used in the classroom. Unfortunately, the participants identified a number of obstacles, discussed in the following section, which may hinder the adoption and implementation of Story Maps by educators.

4.3 RESEARCH QUESTION 2

4.3.1 RESEARCH QUESTION 2A

The participants identified numerous challenges concerning the creation and use of Story Maps in the classroom. Thoughts pertaining to the actual process of developing Story Maps were expressed with responses to multiple items and one open-ended question. Regarding the item "ArcGIS Online is intuitive and easy to navigate" (n=40), 65% of the participants chose Agree while 12% chose Neutral or Disagree. Similarly, 65% of the participants chose Agree and 10% chose Neutral in response to the item "It was easy to create a web map" (n=40). The responses to these two items shifted more toward a neutral stance than most of the previous items, but this is not unusual considering that most participants had never before explored ArcGIS Online. Given that this was the initial exposure for most participants, the survey responses are still encouragingly positive. Few substantive differences in responses among subgroups to these two items were found within the Technology Profile, Participant Age, or Education Type Analyses.

Content Analysis of an open-ended question provided useful feedback regarding obstacles and facilitating elements for developing Story Maps. When asked about their likes and dislikes concerning the process of creating Story Maps, participants provided comments such as:

"Like with anything similar to this, time is needed to play around and learn. Not hard to do, just foreign. Also, sitting down, planning data, finding it, remembering how everything works takes time (1-1)."

"We had really good step-by-step instruction, but I would have been very daunted by prospect of creating on my own (2-1)."

"Story Mapping is a brilliant way to allow online use of maps and a cheap way for teachers to give environmental lessons (2-13)."

"I like how it's interactive and how it would provide students with a visual on what they're learning (1-16)."

"My only concern is introducing students to ArcGIS that have little prior knowledge of technology. It would be implemented slowly with ultimate success (3-4)."

"This was a great introduction. I would need additional help because my computer skills are not great (2-4)."

Of the total number of responses (n=56), 36% were generally positive. Thirteen percent specified that they appreciated the step-by-step instructions, and 13% liked that the process and product were interactive. Seven percent felt that it was simple, and 3% liked that Story Maps are web-based. Concerns arose, however, as 14% of the responses expressed that the process could be difficult if one lacks technical skills, and 7% felt that the process was too time consuming. Generally hesitant sentiments were provided in 7% of the responses (Table 4.3).

Table 4.3 Likes and dislikes concerning the creation of Story Maps

Question	Identified Themes	Percent of Total Responses
Additional thoughts about what you did or did not like about *creating* Story Maps?	Generally positive	36%
	Difficult without tech experience	14%
	Like step-by-step instructions	13%
	Interactive	13%
	Time to create	7%
	Generally hesitant	7%
	Simple	7%
	Like that SMs are web-based	3%

Despite any hesitancies or obstacles identified by the participants, 97% of the participants chose Agree or Strongly Agree in response to the item "I enjoyed building a Story Map with the interactive builder" (n=39).

Overall, the participants responded favorably to the process of developing a Story map. Although this was the first exposure to ArcGIS Online, participants felt that the web-based interface was fairly intuitive, interactive, and easy to navigate. Concerns emerged, however, citing a lack of time and technical knowledge as hindrances to creating a Story Map. Additional obstacles relating to the use of Story Maps in classrooms are discussed in the following section.

4.3.2 Research Question 2b

Participants identified multiple obstacles that would be problematic for implementing Story Maps in their classrooms. Content Analysis of an open-ended question revealed comments such as:

> "I do believe my students may find this difficult, need to keep it simple. My biggest obstacle though is the lack of technology at my school (1-1)."

"Computer access is limited at my school. Time constrains would also be a consideration (1-2)."

"Utilizing student captured images with certain internet filters can be problematic. Our district currently blocks Picasa, Facebook, and Flickr (1-11)."

"Level of tech support when I get 'stuck'. Number of computers available in my school is very limited (1-18)."

"The only obstacle is a lack of technology in my school & technology knowledge of my students (3-4)."

Of the total number of responses (n=37), 30% cited a lack of technology at their school as a major obstacle. Twenty-four percent communicated a need for additional training, while 19% noted a lack of time. Sixteen percent revealed that school-imposed Internet filters would inhibit their ability to include Story Maps in their classrooms, and 8% felt that creating Story Maps would be too difficult for their students. Finally, 3% expressed concern that the level of technical support at their school was lacking (Table 4.4).

Table 4.4 Obstacles to creating or using Story Maps in the classroom

Question	Identified Themes	Percent of Total Responses
Additional thoughts about obstacles that would limit your ability to create or use Story Maps in your classroom?	Lack of technology at school	30%
	Need more training	24%
	Lack of time	19%
	School filters	16%
	Too difficult for students	8%
	Level of tech support at school	3%

The identification of obstacles is reinforced by participant responses to two related items concerning the use of pre-made Story maps and the development of custom Story Maps for use in the classroom. Eighty-eight percent of the participants chose Agree or Strongly Agree in response to the item "I would use *pre-made* Story Maps in my classroom" (n=40), while only 78% of the participants chose Agree or Strongly Agree in response to the item "I would *create my own* Story Maps for use in my classroom" (n=40). When analyzed by Technology Profile (Enthusiast n=4; Pragmatist n=29; Laggard n=7), it becomes clear that the Laggard and Pragmatist groups slightly favor using pre-made Story Maps as opposed to creating their own. Eighty-six percent of the Laggard group and 90% of the Pragmatist group chose Agree or Strongly Agree for using pre-made Story Maps, while only 71% of Laggards and 79% of Pragmatists chose Agree or Strongly Agree for creating their own Story Maps. Comparatively, 25% of the Enthusiast group chose Strongly Agree for using pre-made and 75% chose Strongly Agree for creating their own (Figs. 4.3 and 4.4).

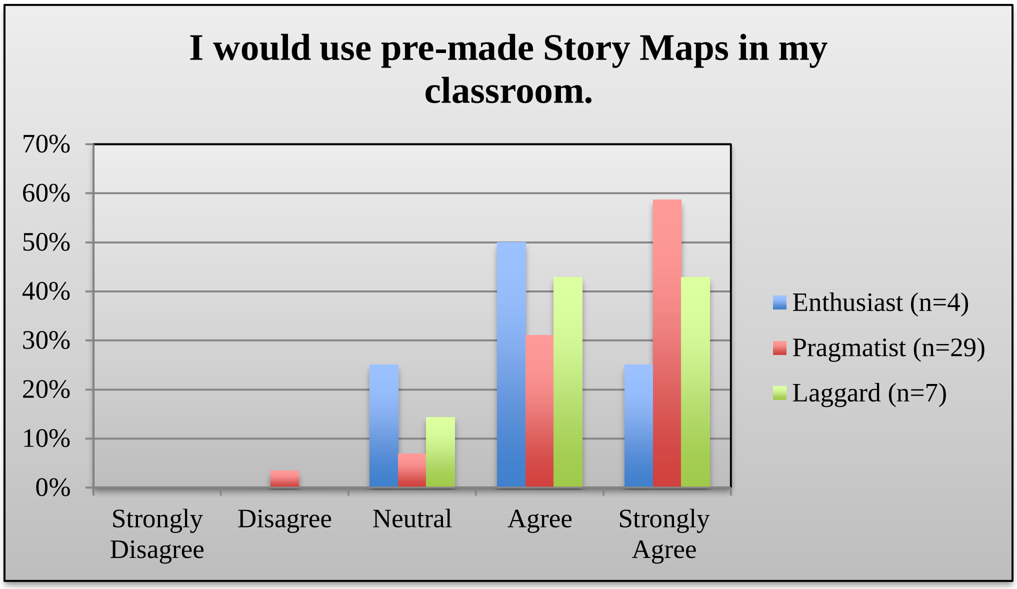

Figure 4.3 Technology Profile survey responses to "I would use *pre-made* Story Maps in my classroom."

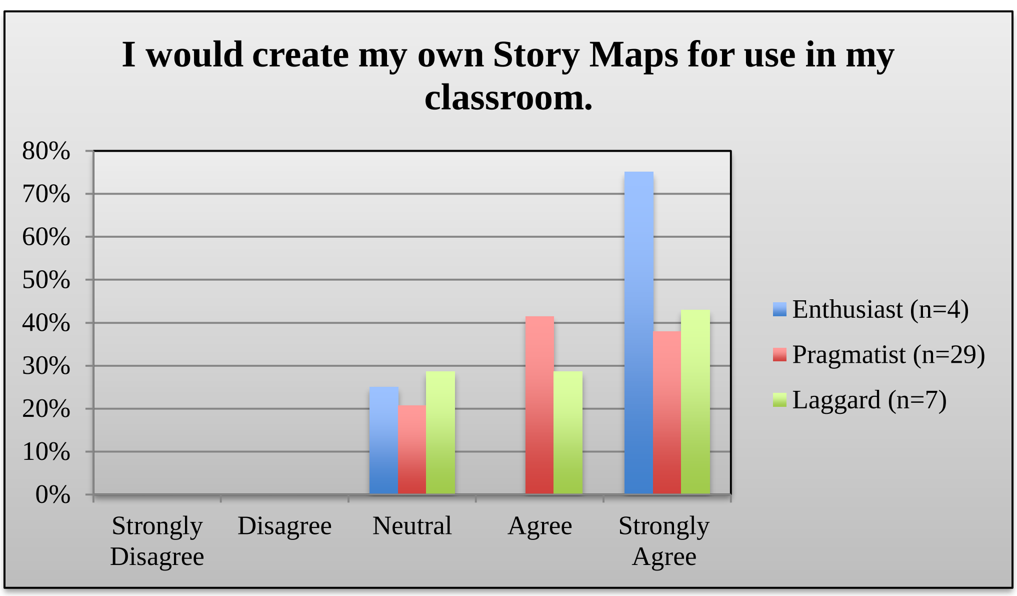

Figure 4.4 Technology Profile survey responses to "I would *create my own* Story Maps for use in my classroom."

The Age Analysis (21-30 n=14; 31-50 n=16; 51+ n=10) revealed similar findings. The 51 and older age group exhibited a preference for using pre-made Story Maps over creating their own. One hundred percent of the 51 older age group chose Agree or Strongly Agree for using pre-made, while only 70% chose Agree or Strongly Agree for creating their own. Comparatively, minimal difference was found in the other two groups. Ninety-three percent of the 21-30 age group and 75% of the 31-50 age group chose Agree or Strongly Agree for using pre-made, and 93% of the 21-30 and 69% of the 31-50 age groups chose Agree or Strongly Agree for creating their own (Figs. 4.5 and 4.6).

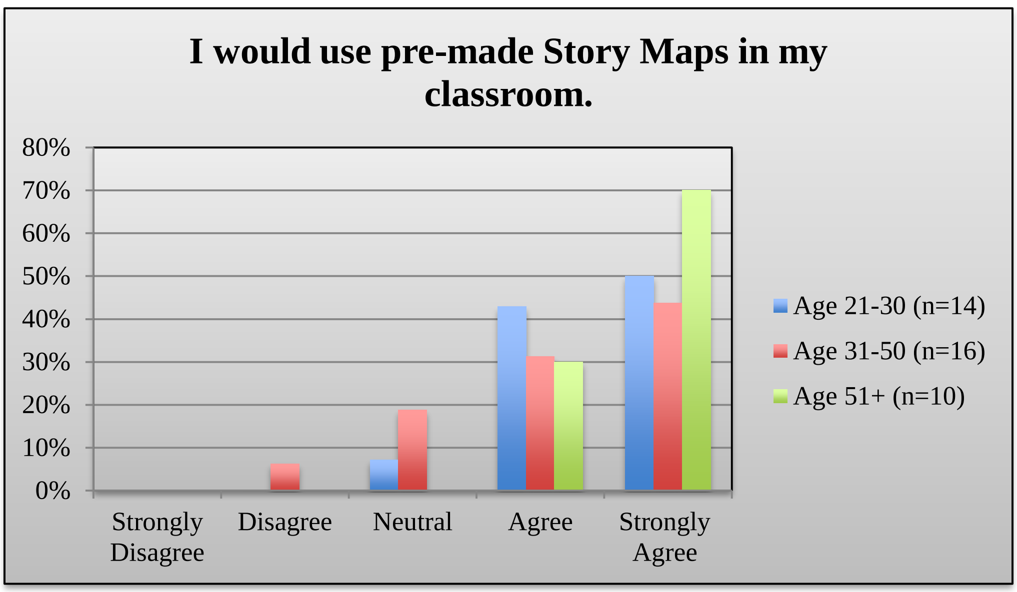

Figure 4.5 Age Profile survey responses to "I would use *pre-made* Story Maps in my classroom."

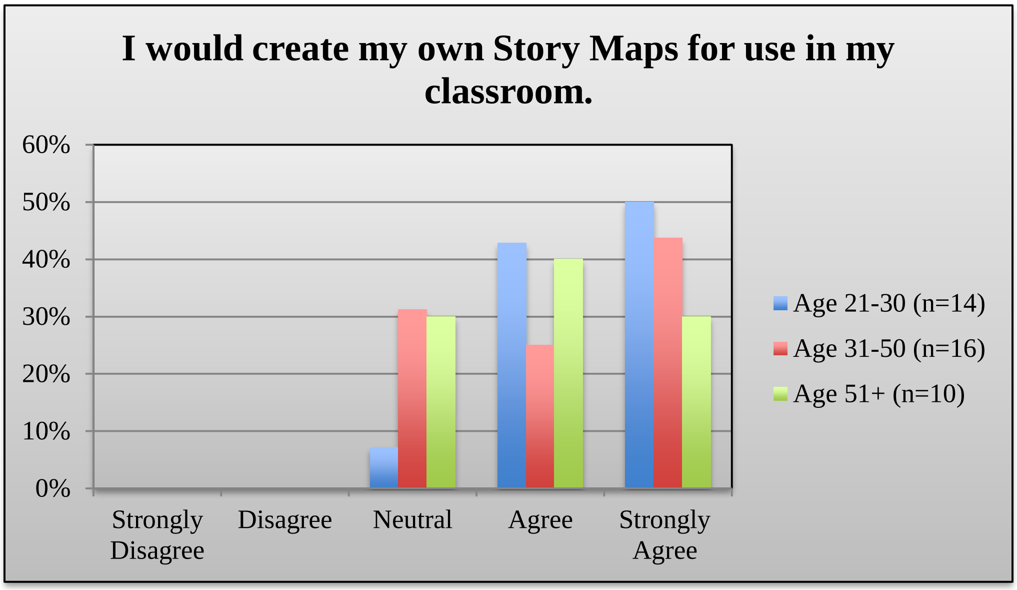

Figure 4.6 Age Profile survey responses to "I would *create my own* Story Maps for use in my classroom."

When analyzed by Education Type (Formal n=25; Informal n=15), it appears that formal educators prefer using pre-made Story Maps, while informal educators prefer creating their own. Ninety-six percent of the Formal group and 73% of the Informal group chose Agree or Strongly Agree for using pre-made Story Maps, while 68% of the Formal group and 93% of the Informal group made the same selections for creating their own (Figs. 4.7 and 4.8).

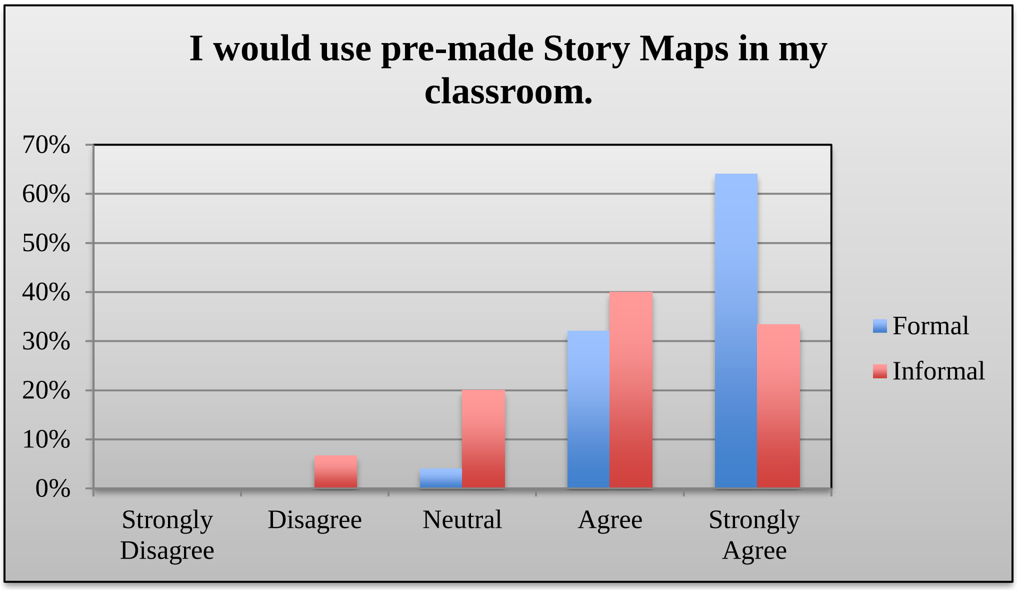

Figure 4.7 Education Type survey responses to "I would use *pre-made* Story Maps in my classroom."

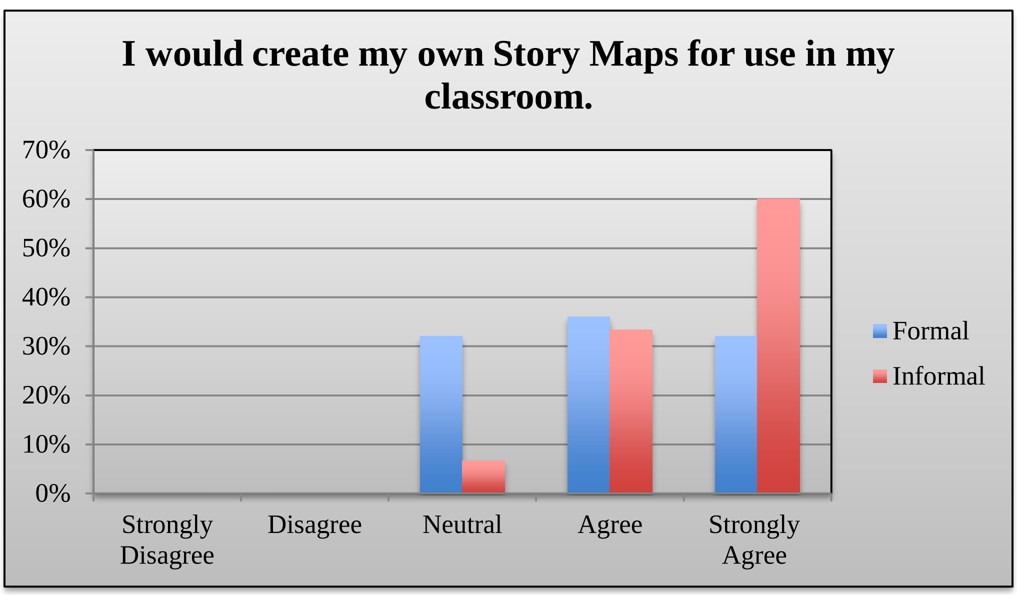

Figure 4.8 Education Type survey responses to "I would *create my own* Story Maps for use in my classroom."

Most participants expressed a preference for using pre-made Story Maps as creating your own Story Maps takes time and technical knowledge. For almost all participants, the workshop was their first exposure to this new web application. However, 57% of the participants chose Agree or Strongly Agree in response to the item "I would be more likely to use Story Maps in the classroom if an additional professional development workshop was offered" (n=37). Thirty-five percent remained neutral, and 8% selected Disagree or Strongly Disagree. When analyzed by Technology Profile (Enthusiast n=4; Pragmatist n=27; Laggard n=6), the Pragmatist and Laggard groups responded most favorably to the idea of additional professional development. Fifty-six percent of the Pragmatist group and 83% of the Laggard group chose Agree or Strongly Agree, while only 25% of the Enthusiast group made similar selections. Fifty percent of the Enthusiast group chose Disagree or Strongly Disagree (Figure 4.9)

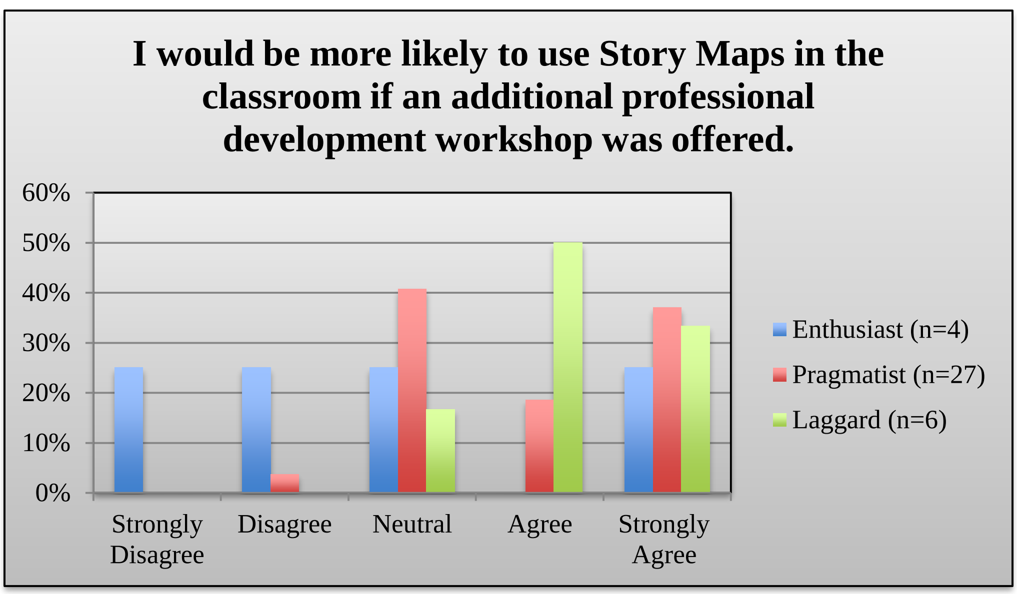

Figure 4.9 Technology Profile survey responses to "I would be more likely to use Story Maps in the classroom if an additional professional development workshop was offered."

When analyzed by Age (21-30 n=14; 31-50 n=13; 51+ n=10), the 51 and older age group expressed a strong desire for additional professional development. Ninety percent of the 51 and older age group chose Agree or Strongly Agree, while only 43% of the 21-30 age group and 46% of the 31-50 age group made similar selections. Only 10% of the 51 and older age group remained Neutral, while 50% of the 21-30 age group and 38% of the 31-50 age group chose Neutral (Figure 4.10).

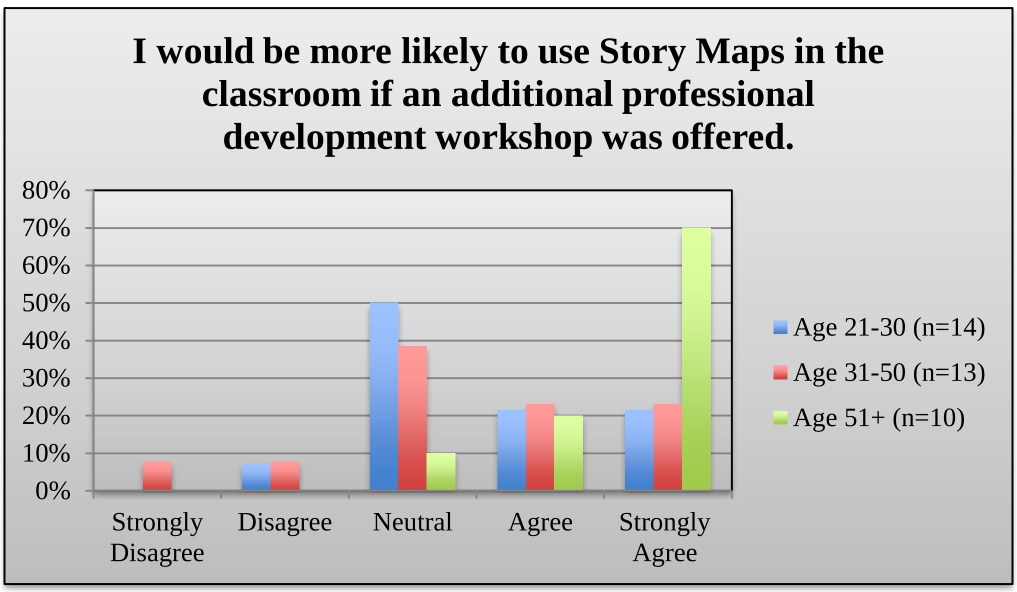

Figure 4.10 Age Profile survey responses to "I would be more likely to use Story Maps in the classroom if an additional professional development workshop was offered."

When analyzed by Education Type (Formal n=23; Informal n=14), it appears that formal educators would be more likely to use Story Maps in their classrooms following an additional professional development workshop. Sixty-five percent of the Formal group chose Agree or Strongly Agree, while only 43% of the Informal group made the same selections. Fifty percent of the Informal group and only 26% of the Formal group chose Neutral (Figure 4.11).

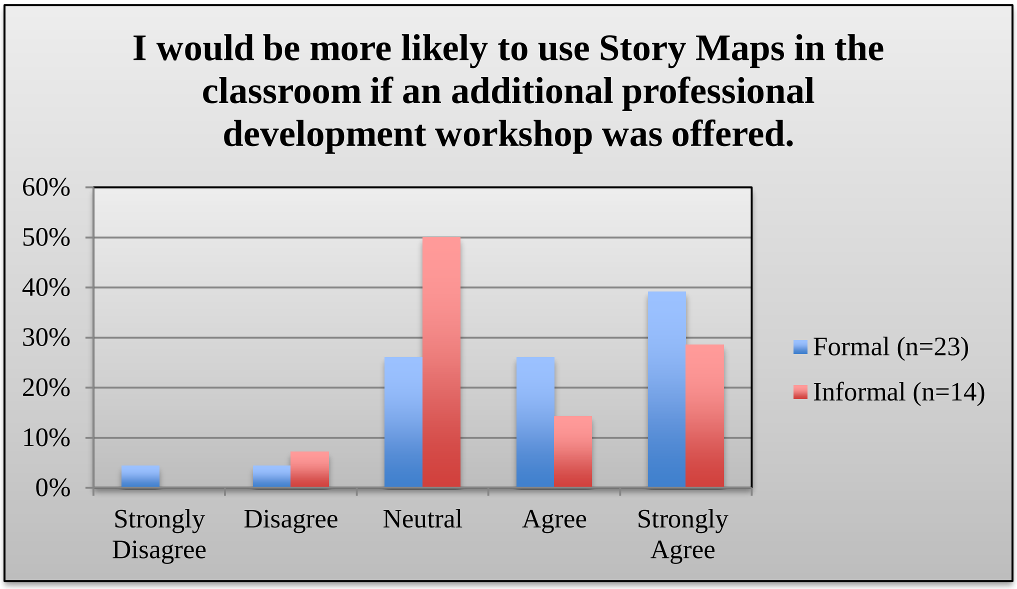

Figure 4.11 Education Type survey responses to "I would be more likely to use Story Maps in the classroom if an additional professional development workshop was offered."

Overall, the participants identified a number of obstacles that could serve as potential problems when using Story Maps in their classrooms. A lack of computer access at school, a need for additional training, and a lack of time constituted the most often cited challenges. Because of these potential hindrances, some groups of participants expressed a preference for using pre-made Story Maps as opposed to creating their own. Despite this initial preference and hesitancies concerning the identified obstacles, some groups of participants reported that they would be more likely to use Story Maps in their classrooms if an additional professional development workshop was offered. Being open to a challenge and expressing a willingness to overcome obstacles, both personal and circumstantial, is very encouraging.

4.3.3 Research Question 2c

Although a number of obstacles could pose problems for classroom implementation, the participants responded positively to the idea of their *students* creating Story Maps. Seventy-nine percent of the participants selected Agree or Strongly Agree in response to the item "My students could create a Story Map using the interactive builder" (n=34). When analyzed by Education Type (Formal n=24; Informal n=10), 83% of the Formal group and 70% of the Informal group chose Agree or Strongly Agree. This demonstrates that informal educators, in addition to formal educators, see the potential for students to create Story Maps even though informal educators may not necessarily have a consistent classroom of students. In addition, 25% of the total responses to the open-ended question regarding participants' plans for using Story Maps in the classroom (n=55) indicated potential use for student-centered projects. The grade level at which this would be appropriate varies based on a variety of factors, but it is safe to assume that the older the students are, the more applicable it is to explore Story Map development. The participants attending the workshop taught various grades, but the majority worked with middle to high school students. Given this population and their favorable views on students creating Story Maps, it can be inferred from this particular study that Story Map development is most appropriate for middle and high school students.

4.3.4 Overall Findings for Research Question 2

Analysis of the survey feedback and open-ended question responses revealed a number of challenges associated with creating and using a Story Map in a K-12 classroom. Despite fairly favorable responses concerning the ease, intuitiveness, and enjoyment of ArcGIS Online and the associated web maps, participants identified a number of obstacles when developing Story Maps, including a lack of technology at school, a need for training, and a lack of time. Although the Enthusiast and Informal groups preferred to create their own Story Maps, many participants, particularly those with greater concerns regarding the availability of technology, training, and time, expressed a preference for using pre-made Story Maps. However, many participants indicated that they would be more likely to use Story Maps in their classroom if an additional professional development workshop was offered. Furthermore, despite the obstacles, the majority of participants supported the idea of their students creating Story Maps. Given the population studied, Story Map development would be most suitable for middle and high school students.

CHAPTER 5

DISCUSSION

5.1 SUMMARY OF RESEARCH PROBLEM AND STUDY DESIGN

The goal of this research was to establish an understanding of teachers' perceptions of Esri Story Maps as effective teaching tools. Story Maps are a fairly recent web application developed for use within Esri's web-based GIS platform, ArcGIS Online, that combine digitized, dynamic maps with other story elements (i.e., title, text, legend, popups, and other visuals) to help the creator effectively convey a message. The novelty of the product means that few other studies from the fields of GIS or educational technology have attempted to examine Story Maps and their potential as an innovative educational technology.

Multiple workshops were conducted for South Carolina educators in the spring of 2014. Participants were first introduced to the concept of a Story Map and then encouraged to browse a gallery of pre-made web applications. The bulk of the workshop was spent engaging in a hands-on demonstration concerning the process of creating a Story Map within ArcGIS Online. Surveys were administered at the conclusion of the workshop and pertained to participants' perceived ease of use, usefulness, and barriers relating to the use of Story Maps in informal and formal K-12 classrooms. Likert item survey data were analyzed and graphed based on a general descriptive analysis as well as Technology Profile, Age, and Education Type analyses. Content analysis of open-ended survey questions provided for additional understanding of participants' perceptions of Story Maps.

5.2 Major Findings

5.2.1 Perceived Ease of Use

Within his Technology Acceptance Model, Davis (1989) identifies two key variables that influence an individual's intention to use a technology: perceived ease of use and perceived usefulness. Perceived ease of use is defined as "the degree to which a person believes that using a particular system would be free of effort" (1989, 320). Similarly, in the UTAUT, Venkatesh et al. (2003) cite effort expectancy as one of four key constructs that directly determine user acceptance and behavior and define it as "the degree of ease associated with the use of the system" (2003, 450). In this study of teachers' perceptions of Esri Story Maps, an overwhelming majority of the participants felt that Story Maps were user-friendly, interactive, and engaging. This is supported by the findings of Battersby and Remington (2013) in an informal study of student use of Story Maps at the university level. In addition, multiple pieces of feedback from the open-ended question concerning likes and dislikes about using Story Maps pertained to their interactive nature and ease of use. For example, one participant commented that Story Maps were "Highly interactive and easy to use; relevant to any profession or teaching application (2-14)." Another participant noted specifically that Story Maps were "Much more user friendly than some of the other GIS software I've seen (1-4)." These findings are very encouraging as the complexity of GIS software was often cited as a major barrier to adoption and implementation by K-12 educators (Baker 2005; Meyer et al. 1999; Kerski 2003).

With respect to actually creating a Story Map using web maps and ArcGIS Online, participants expressed slightly more neutral sentiments. When asked about their likes and dislikes concerning the process of creating Story Maps, for example, one participant said, “Like with anything similar to this, time is needed to play around and learn. Not hard to do, just foreign. Also, sitting down, planning data, finding it, remembering how everything works takes time (1-1).” Another participant noted, “We had really good step-by-step instruction, but I would have been daunted by prospect of creating on my own (2-1).” These findings are not discouraging, though, as the workshop was the first exposure to Story Maps for most participants. In terms of Rogers’ Diffusion of Innovations Theory (2003), the participants were still in the first stage of adoption which is characterized by an initial exposure to the innovation that sparks an interest and encourages potential adopters to begin gathering information. This is demonstrated by participants reporting that they still enjoyed the process of building a Story Map with the interactive builder on ArcGIS Online. Nevertheless, these findings underscore the importance for explicit instructions and organized training. If participants had received no training or step-by-step instructions, it is likely that they would have expressed less positive perceptions of using Story Maps.

Participants also expressed that their students would enjoy using Story Maps. This coincides with multiple studies naming enhanced student engagement and attitudes as one of the many benefits of incorporating GIS into a K-12 classroom (Audet and Paris 1997; Shin 2006; Keiper 1999; Kerski 2003). Even informal educators, who do not necessarily operate within a traditional classroom and may not teach on a regular basis, felt strongly that students would enjoy using Story Maps. The Technology Profile

Analysis, however, revealed that the Laggard group, in comparison with the Enthusiast and Pragmatists groups, was more likely to express neutral feelings regarding the potential for their students to enjoy using Story Maps. The Laggard group was composed of participants who scored relatively low on the technology profile statements concerning their comfort level teaching with technology, the level of technical support available at their school, and their level of experience with geospatial technologies. The average response values to the technology profile statements shed light on the strengths and weaknesses of each group and therefore help explain differences in survey responses. The Laggard group, for example, had the lowest average score of all three groups for experience with geospatial technologies. Within the Laggard group, experience with geospatial technologies was also the lowest average score when compared to scores for teaching with technology and level of technical support. Mumtaz (2000) and Ball and Levy (2008) found that a lack of teaching experience with technology was one of many factors that negatively influenced teachers' use of technology. A low level of technical support, identified as a facilitating condition by Venkatesh et al. (2003) and as a structural constraint by Buchanan et al. (2013), can also impede technology adoption. Similarly, multiple GIS studies have found that a lack of training in geospatial technologies can inhibit the adoption and implementation of GIS by K-12 educators (Baker 2005; Kerski 2003). Given their comparatively low scores regarding teaching with technology and experience with geospatial technologies, it is possible that the Laggard group struggled more than the Enthusiasts and Pragmatists during the workshops. This struggle, in addition to a relatively low level of technical support, could negatively influence their perceptions of the technology and therefore make it more difficult to envision their students enjoying Story Maps.

Perceived ease of use was also examined via participants' responses to survey items regarding the use of pre-made Story Maps and creating original Story Maps. Overall, participants expressed a preference for using pre-made Story Maps over creating their own Story Maps. Although web-based GIS platforms require less time, commitment, and energy to master than desktop GIS (Baker 2005; Henry and Semple 2012), this finding was anticipated because the creation of Story Maps clearly requires more knowledge, skill, and time than simply accessing a pre-made Story Map. When analyzed by Technology Profile, Laggards and Pragmatists expressed a slight preference for using pre-made Story Maps, while Enthusiasts seemed to favor creating their own. Again, lower technology profile statement scores characterize Laggards and Pragmatists. Enthusiasts, on the other hand, reported very high scores for the three technology profile statements. Enthusiasts, although a small part of the sample, most likely found the workshop and innovative technology less intimidating than did Laggards and Pragmatists. Their comfort with teaching with technology coupled with a high level of technical support and experience with geospatial technologies led Enthusiasts to express a higher interest in creating original Story Maps for use in the classroom.

The Age analysis revealed similar findings. The 51 and older age group expressed a more noticeable preference for using pre-made Story Maps, while the 21-30 and 31-50 age groups displayed very minimal preference. This finding is supported by multiple technology adoption studies which concluded that technology adoption and use decreases as age and teaching experience increases (Waugh 2004; Smerdon et al. 2000;

Russell et al. 2007). The 51 and older age group were most likely least comfortable with learning an innovative educational technology and therefore prefer using pre-made Story Maps. The younger participants, on the other hand, were more experienced technology users in general and probably did not view the creation of Story Maps as such a daunting task.

When analyzed by Education Type, it is clear that formal educators preferred using pre-made Story Maps, while informal educators preferred creating their own. This finding was also anticipated, as pre-made Story Maps would most likely fail to fit the needs of informal educators. These educators, who work at local environmental organizations and government conservation departments, often work on very specific tasks and projects and would therefore require a customized Story Map to showcase their work to K-12 and adult learners. Formal educators, however, teach across a multitude of topics throughout the academic year and would have a better chance of finding pre-made Story Maps that fit their curricula. The formal educators realized that it could be a potential waste of valuable resources (e.g., time and effort) to create original Story Maps when a gallery full of pre-made Story Maps is available on ArcGIS Online.

Finally, teachers' perceptions of the ease of use of Story Maps were demonstrated with their positive responses to the idea of their students creating Story Maps. Again, despite their lack of consistent interaction with students in a traditional classroom, even the informal educators saw the potential for students to create Story Maps. This finding could speak to the participants' positive experience during the workshop, their confidence in the abilities of their students, or a combination of both factors. Given the literature on GIS in education and the fact that the majority of the workshop participants taught middle or high school students, it might be inferred that the participants responded positively to the idea of Story Map creation by their middle or high school students. Including GIS and other educational technologies in primary classrooms is still very important, but creating Story Maps is probably unsuitable for younger students who lack technology skills and other required experience. Easy, ready-to-use GIS products, like simplified Story Maps, are more appropriate for primary classrooms and would support multiple, interactive learning styles (Shin 2006; Keiper 1999; Forzani and Leu 2012).

Overall, participants perceived Story Maps as relatively engaging, easy to use, and enjoyable for students, but expressed more neutral feelings toward navigating ArcGIS Online and using web maps. Relatedly, a preference for using pre-made Story Maps was especially apparent in older and less technologically experienced participants. On the other hand, a preference for creating original Story Maps was expressed by informal educators as well as more technologically experienced participants. Furthermore, participants supported the idea of their students developing Story Maps. While perceived ease of use is a critical factor in determining educational technology adoption, the perceived usefulness of the technology is also a major influence (Buchanan, Sainter, and Saunders 2013; Davis 1989).

5.2.2 Perceived Usefulness

Perceived usefulness is defined as "the degree to which a person believes that using a particular system would enhance his or her job performance" (Davis 1989, 320). Additional educational technology studies have also referred to this concept as utility and performance expectancy (Badia, Meneses, and Sigalés 2013; Venkatesh et al. 2003). Davis et al. found that perceived usefulness was actually a stronger influence than perceived ease of use on users' intentions to accept a technology and stated that "Users may be willing to tolerate a difficult interface in order to access functionality that is very important, while no amount of ease of use will be able to compensate for a system that doesn't do a useful task" (1989, 1000). This is echoed by Badia et al., who concluded, "In their decision-making, teachers value first, the extent to which technology acts as a lever to improve their students' quality of learning, and to what extent its use fits in with the teaching methods and curricular skills they want to develop" (2013, 801). While participants generally found Story Maps to be user-friendly, engaging, and enjoyable, participants' perceived utility of Story Maps may be more indicative of the likelihood of adoption and implementation.

Under the provisions of No Child Left Behind, classrooms are increasingly dominated by high-stakes testing, and teachers are under immense pressure to meet academic standards. McClurg and Buss emphasize that, during professional development events where teachers are introduced to innovative educational technologies like GIS or Story Maps, "it is imperative that explicit connections are made to these standards" (2007, 82). In a study of teachers who owned a desktop GIS package, only one teacher decided to use GIS because of its ability to meet academic standards (Kerski 2003). In contrast, participants in the current study enthusiastically agreed that Story Maps could help them to better present material that meets academic standards. This may indicate that teachers see Story Maps serving a stronger role in classrooms as opposed to a desktop GIS because of their ability to meet academic standards.

Similarly, participants perceived Story Maps as a useful educational tool for presenting material from a variety of subjects. This creates a strong case for GIS and geography as inherently interdisciplinary subjects that could be incorporated into many types of classrooms (Baker et al. 2012; Hagevik 2011; Mitchell, Cantrill, and Kearse 2012). In addition, the interdisciplinary potential of Story Maps is supported by an existing study where middle school teachers claimed that "GIS has become the hub of the wheel that ties together all areas of the curriculum" (Audet and Paris 1997, 296). Again, in today's standards-dominated classrooms, teachers place value on cross-curricular teaching methods that meet multiple standards and provide a more engaging and real-world education for students as concepts and processes are linked across subjects (Jacobs 1989; Savage 2011; Brand and Triplett 2012). Participants' views of Story Maps as valuable, interdisciplinary tools may indicate a higher likelihood of classroom adoption and implementation.

Participants also responded very positively to the idea of collaborating with fellow teachers to use Story Maps as interdisciplinary teaching tools. According to the literature, cooperation between and collaboration amongst peers regarding new teaching tools and methods can lead to a more successful integration of innovative educational technologies (Sadik 2008). Park and Ertmer (2008), for example, studied the development of technology-enhanced, problem-based learning in classrooms and found that the difference between expert and typical teachers was the degree of collaboration with other teachers. Similarly, An and Reigeluth (2012) suggested that the establishment of communities of practice and social networks would encourage teachers to explore new education methods together and provide continuous support in-between professional development events. When analyzed by Technology Profile, the current study found Enthusiasts displayed a stronger propensity for collaboration compared to the Laggards and Pragmatists. Again, Enthusiast group members were most comfortable teaching with technology, had the highest level of technical support, and were most experienced with geospatial technologies. Their strong desire to collaborate with peers may reflect the ease with which they learned how to use and create Story Maps and the relatively high level of existing technical support at their schools. Enthusiasts may be the leaders in the adoption of Story Maps and could potentially serve as mentors for their less technologically literate colleagues as they progress from technology skills to pedagogical implementation (Abuhmaid 2014). Using colleagues as a training source may increase technology adoption (Kotrlik and Redmann 2009), so participants' positive approach toward collaborating with peers is encouraging and could mean the difference between the adoption and rejection of Story Maps in classrooms.

Finally, perceived usefulness was indicated by participants' responses to an open-ended question asking how they would plan to use Story Maps in the classroom. The highest percentage of responses indicated plans to use Story Maps in conjunction with existing lectures and presentations, as exhibited by one participant's comment: "I can see adding them as part of powerpoint lectures much like video downloads (1-10)." While this demonstrates that participants were still viewing the educational value of Story Maps as part of traditional instruction methods, using Story Maps as a supplement to existing lessons could still be very beneficial. López-Pérez et al. (2013), for example, found that online learning activities are best suited as an enhancement to the traditional learning process. Similarly, the use of social media in high school classrooms as a complement to typical classroom instruction allowed for more engaging and enjoyable lessons (Bull and Adams 2012; Haygood and Bull 2012). The second highest percentage of responses indicated plans to have students create Story Maps as part of assigned projects. Participants had already reported on the survey that their students would enjoy using and have the ability to create Story Maps, so it was promising to see participants communicate this as a short response as well. Story Maps used in projects would encourage students to think critically, use real-world data, and analyze issues in their local communities. According to Kearsley and Sniderman's (1998) engagement theory, which posits that learning activities should be collaborative, project-based, and authentically focused, student projects could support successful Story Map integration. Furthermore, participants indicated that they planned to use Story Maps as part of outreach efforts via web content. Most of these responses originated from informal educators who work at local environmental organizations and government conservation departments. Publishing original Story Maps pertaining to specific projects and outreach concerns would be the best course of action as these educators reach many of their learners through organizational web pages.

Overall, participants perceived Story Maps to be useful in a variety of contexts. They were viewed, most importantly, as a tool to better present material that meets academic standards. In addition, participants were willing to collaborate with peers to develop interdisciplinary Story Maps that could be used as cross-curricular teaching tools. Short responses indicated that participants planned to use Story Maps as supplements to existing lectures or presentations, as part of student projects, and for web outreach. Participants clearly perceived Story Maps as easy to use and applicable to educational environments. A number of obstacles, however, could hinder the successful integration of Story Maps in classrooms.

5.2.3 Obstacles

Several conditions can inhibit the implementation of an educational technology like Esri Story Maps. Barriers can be classified in two distinct categories: first- and second-order barriers (Ertmer 1999). First-order barriers are extrinsic to teachers and usually refer to missing or inadequate resource provision (e.g., time, support, training, equipment). These have also been called structural constraints or facilitating conditions (Buchanan, Sainter, and Saunders 2013; Venkatesh et al. 2003). Second-order barriers are intrinsic to teachers and refer to teachers' attitudes, beliefs, knowledge, and skill regarding technology use. These could also include the concepts of self-efficacy, computer anxiety, and experience with the use of technology (Bandura 1977; Ball and Levy 2008). First-order barriers are easier to quantify and can often be remedied with better allocation of time and money, while second-order barriers are more difficult to measure and overcome as they are deeply-rooted personal beliefs. The type of barriers facing an educator may moderate the extent to which they are capable of implementing a new educational technology. Whether first- or second-order barriers, Audet and Paris noted, "Even when the benefits of an innovative practice are recognized, the motivation to change may dwindle if a teacher encounters major difficulties during implementation" (1997, 294).

Participants in the current study identified multiple obstacles that would be problematic for implementing Story Maps in their classrooms. The highest percentage of responses cited a lack of technology at school. This echoes multiple GIS in education studies citing a paucity of hardware as a major obstacle (Kerski 2003; Alibrandi 1998; Baker 2005; Bednarz and Ludwig 1997; Meyer et al. 1999). There is a tendency to assume that, in the year 2014, schools are now furnished with adequate technology to meet the needs of teachers and students. The current study reveals, however, that a lack of technology still poses a major barrier to teachers wishing to implement GIS in their classrooms. The second highest percentage of responses communicated a need for additional training. Regarding innovative educational technologies, this is not a new barrier and will continue to inhibit teachers' abilities to effectively use GIS unless adequate resources are dedicated to effective training (Audet and Paris 1997; Baker 2005; Kerski 2003). Participants also cited a lack of time as an obstacle that would limit their ability to create or use Story Maps in their classrooms. Increasing demands placed on teachers have consistently limited the amount of time they may devote to learning and integrating new educational technologies and teaching methods, and this may be one of the most difficult barriers to overcome. School filters were also noted as a potential barrier as the creation of Story Maps within a public ArcGIS Online account requires access to photo-sharing sites that are often blocked by district regulated school filters.

Despite the numerous obstacles cited as problematic for the implementation of Story Maps in classrooms, over half of the participants expressed that they would be more likely to use Story Maps if an additional professional development workshop was offered. The Technology Profile analysis revealed that Laggards and Pragmatists responded more favorably to the idea than did Enthusiasts. It may be inferred that Laggards and Pragmatists, given their lower level of technology experience and technical support, would find an additional professional development workshop very beneficial, while Enthusiasts already feel well equipped to use Story Maps after just the initial exposure. Similarly, the 51 and older age group expressed a stronger desire for additional professional development opportunities when compared to the 21-30 and 31-50 age groups. As an increase in age and teaching experience often correlates with a decrease in technology adoption (Smerdon et al. 2000; Waugh 2004; Russell et al. 2007), the 51 and older group would likely benefit more from developing their technical skills at a professional development workshop. The younger groups expressed more neutral feelings, possibly indicating that they are already confident in their abilities to use Story Maps and do not see a definitive need for further help. Furthermore, formal educators conveyed a stronger need for additional professional development, while informal educators remained more neutral on the topic. The formal educators regularly encounter new educational technologies and therefore would require additional training to truly feel comfortable with Story Maps. Informal educators, on the other hand, seemed to grasp Story Maps more quickly and thus did not express a strong desire for additional training.

Participants identified multiple factors, including a lack of technology, need for training, lack of time, and school filters, which could serve as obstacles to the successful implementation of Story Maps in classrooms. However, multiple groups expressed a higher likelihood of using Story Maps pending an additional professional development workshop. Although encouraging, these results point to a number of factors that must be addressed in order to lay the foundation for the adoption of Story Maps as teaching tools.

5.3 DISCUSSION

This study found that teachers perceived Story Maps to be very user-friendly, interactive, and engaging. Participants felt that their students would enjoy using and be capable of creating Story Maps in educational settings. As this was participants' first exposure to the educational technology, many expressed more neutral feelings pertaining to the ease with which they created web maps and navigated ArcGIS Online. Accordingly, most participants expressed a slight preference for using pre-made Story Maps over creating their own Story Maps. Participants' overall positive reactions to ease of use were complimented with their perceptions of the utility of Story Maps. They believed that Story Maps could be used to present materials that meet academic standards and are well suited to serve as interdisciplinary teaching tools. Participants even conveyed a willingness to collaborate with colleagues to develop cross-curricular Story Maps.

The ease of use and usefulness of Story Maps as communicated by participants is a very promising finding and may indicate a greater probability of successful classroom integration when compared to traditional desktop GIS. Desktop GIS is a much more complex software that requires extensive training and dedicated information technology (IT) support for successful implementation. Story Maps, however, operate within a web-based GIS platform called ArcGIS Online and do not require complex software installations and updates. The use and creation of Story Maps, as demonstrated in this study, also demand substantially less technological knowledge and skill. The use of traditional GIS in classrooms has not significantly increased since its inception due to multiple obstacles, but Story Maps as an extension of web-based GIS have the potential to alleviate some of the concerns and serve as easy-to-use, effective teaching tools that promote spatial thinking and geographic knowledge.

Despite the relative ease of use and utility of Story Maps, participants identified multiple obstacles to successful classroom implementation, including inadequate technology at schools, a need for additional training, a lack of time, and district imposed internet filters. These barriers are largely extrinsic to teachers and, although relatively easy to quantify, require school districts to make considerable modifications in the allocation of time, money, and other resources. Even though participants enthusiastically supported the idea of using and creating Story Maps in their classrooms, these extrinsic barriers are largely out of the control of teachers and are likely to inhibit implementation of Story Maps much like they have hindered classroom adoption of desktop GIS.

Although numerous barriers may slow implementation, teachers' overwhelmingly positive perceptions of Story Maps as effective teaching and learning tools should urge involved stakeholders to take certain steps that would allow teachers and students to access, use, and create Story Maps as effectively and as efficiently as possible. Firstly, Story Maps, and the associated web-based GIS platform, are a very specific technology that was not originally developed for use in the classroom. The successful integration of interactive white boards (IWB), for example, may be attributed to their pointed development as teaching and learning tools (Lee and Winzenried 2009). GIS-related products, on the other hand, are initially developed with professional users in mind, and then the technology is adapted and framed for use in classrooms. Unless educators were exposed to GIS in their preservice programs, specifically to teach the subject of geography, or have attended a geography related professional development event, it is unlikely that they have been exposed to Story Maps and web-based GIS as effective teaching tools. This may soon change, however, as Esri has just announced that every classroom and school across the country will now have free access to ArcGIS Online (Esri Press 2014). This $1 billion pledge is a response to the ConnectEd initiative, President Barack Obama's urge for businesses to assist schools in creating innovative

STEM opportunities for students through the use of educational technologies. This monumental donation has the potential to significantly affect the rate at which teachers and schools adopt GIS.

Educators will now be able to easily view and create Story Maps for classroom use, but free access to ArcGIS Online does not guarantee successful integration. As demonstrated by the average response values to the technology profile statements, teachers are most lacking in geospatial technology experience. Without the necessary experience, teachers may find it difficult to adjust to this new educational technology. For long-term success, GIS and Story Maps should be used in preservice programs. During a study of preservice teachers, Nadelson et al. reported that "experience learning with technology is highly influential on the technologies preservice teachers perceive they will use for instruction" (2013, 87). Aside from mainstream technologies that dominate preservice education, Nadelson et al. conclude that "if we want teachers to use new technologies for instruction they will likely need to explicitly experience learning and teaching with the technology, which may need to be an integral part of their preparation programs…" (2013, 87). To become a staple in educational settings, GIS and Story Maps should play central roles in teacher preparation programs.

Ideally, teachers will be exposed to Story Maps in their preservice programs. For inservice educators, however, professional development is needed to develop the knowledge and skills necessary for effective use. In addition to introducing Story Maps and the process of creating them, these professional development events should clearly demonstrate their curriculum relevance and educational use (McClurg and Buss 2007). Analysis of the current study showed that older and less technologically literate participants, although willing to partake in additional professional development events, struggled the most during the Story Map workshop. If resources like time and money are severely limited, it is recommended that efforts should focus on introducing Story Maps to younger and more technologically savvy educators who have kept current with evolving technologies. These educators have mastered basic technology skills and would more easily comprehend specific educational technologies like GIS and Story Maps. This group could then serve as mentors in their schools and support other educators in learning and implementing the new technology. Various studies have found this type of collaboration and mentorship as beneficial as it provides support outside of professional development events and encourages educators to progress from technology skills to pedagogical implementation (Park and Ertmer 2008; An and Reigeluth 2012; Abuhmaid 2014).

Furthermore, it is suggested that outside parties could play a critical role in assisting educators who wish to use GIS and Story Maps in their classrooms. Although schools usually have IT staff, it is unlikely that these personnel are knowledgeable in GIS technologies. Therefore, GIS users from local government departments, businesses, and universities could serve as mentors for schools and teachers using GIS and provide sustained technical support. Rather than hitting a roadblock and having to halt classroom implementation, schools and teachers could take advantage of their liaisons' extensive GIS experience. This ongoing technical support could be the difference between educational technology adoption or rejection (Abuhmaid 2014). Esri, the creator of ArcGIS Online and Story Maps, and National Geographic have voiced their support for this type of initiative by creating the GeoMentor Program (Esri EdCommunity 2014).

The GeoMentor Program encourages volunteers to “adopt” a school, class, or club and provide technical support and mentorship for educators using geography and geospatial technologies to empower and inspire young learners.

Finally, it is recommended that Esri as well as related parties pay particular attention to the needs of educators and take actions that would allow for more efficient and effective adoption of Story Maps in classrooms. Formal educators, for example, expressed a desire to use pre-made Story Maps. As limited computer access in schools could hinder teachers’ abilities to create Story Maps with their students, teachers need off-the-shelf Story Maps and accompanying lesson plans that have been clearly aligned to academic standards. State geographic alliances, for example, could play a critical role by providing teachers access to an online library of completed Story Maps that have been created specifically to support state academic standards. Furthermore, these teachers need very simple documentation with explicit, step-by-step instructions to encourage the creation of very basic Story Maps within the classroom. Conversely, informal educators will almost exclusively use original Story Maps that meet their specific needs. They require simple to moderate documentation that perhaps delves more deeply into customization options. Although pre-made Story Maps would not fit their needs, well-crafted Story Maps relating to informal education disciplines could play an integral part in marketing campaigns; they would serve as examples for informal educators that demonstrate the potential for Story Maps as effective outreach and educational tools.

Participants communicated that Story Maps were easy to use and have the potential to function as effective teaching and learning tools. Multiple obstacles could hinder the adoption and implementation of Story Maps in educational settings, but certain actions could help to overcome these barriers. Esri's recent donation will allow students and teachers across the country to access ArcGIS Online and Story Maps more efficiently, but successful integration in the classroom starts with explicit use in preservice teacher preparation programs. Similarly, inservice educators require meaningful professional development events that, in addition to teaching technology skills, effectively illustrate the curriculum relevance and pedagogical implementation of GIS and Story Maps. Furthermore, distinctive groups of educators have different needs that must be addressed. Formal educators, for example, desire pre-made, standards-aligned Story Maps for use in their classrooms, while informal educators need explicit documentation and effective examples that inspire them to create their own Story Maps. The future of Story Maps in education looks very bright, but successful implementation requires that resources be devoted to meet these needs.

CHAPTER 6

CONCLUSION

6.1 OVERVIEW OF FINDINGS

This study aimed to establish an understanding of teachers' perceptions of Esri Story Maps as effective teaching tools. Story Maps combine digitized, dynamic maps with other story elements (i.e., title, text, legend, popups, and other visuals) to help the creator effectively convey a message. They couple the benefits of a GIS with an easy-to-use, non-technical interface that could be accessible to both teachers and students.

Before collecting data, a sample Story Map illustrating the Congaree National Park Boardwalk Tour was created and aligned to state academic standards and literacy skills. This Story Map served as an example of a final, polished product that participants could examine at the beginning of the workshop. A detailed tutorial was also created outlining the specific steps to create a Story Map. Step-by-step instructions and corresponding screenshots helped the participants to follow along during the workshop and also provided them with the documentation necessary to practice in the future. A survey unique to this study was designed to assess participants' perceptions with a variety of Likert statements and open-ended questions. Data collection took place in the spring of 2014 in Columbia, SC at multiple professional development events for educators. During each workshop, participants first explored sample Story Maps, including the

Congaree National Park Boardwalk Tour, and then worked toward creating their own Story Map. Surveys were administered at the conclusion of the workshops.

Forty-two educators participated in the study. Participants ranged from preservice to inservice K-12 educators as well as informal educators working for local government organizations and conservation groups. Survey data collected from the participants were analyzed and graphed in multiple manners, including analyses based on a Technology Profile, Age, and Education Type in addition to content analyses of the open-ended questions. Analysis of the survey data revealed that participants perceived Story Maps to be user-friendly, interactive, and engaging. Furthermore, participants communicated that their students would enjoy using and have the ability to create their own Story Maps. After just this initial exposure to the technology, participants expressed more neutral sentiments concerning the ease with which they created web maps and navigated ArcGIS Online. Consequently, they expressed a preference for using pre-made Story Maps over creating their own Story Maps. Participants also felt that Story Maps could be used to present materials that meet academic standards. Additionally, they conveyed enthusiasm for collaborating with fellow teachers to create interdisciplinary Story Maps to be used at teaching tools.

Despite the ease of use and utility of Story Maps, participants noted several obstacles to classroom implementation, including a lack of technology at their schools, a need for additional training, a lack of time, and internet filters that could restrict access to pertinent websites. Although some obstacles are extrinsic to teachers and difficult to address without substantial investments of time and money, certain steps should be taken by involved stakeholders to encourage the use of Story Maps in educational settings and positively affect the current state of geographic literacy. As teachers' use of educational technologies is often related to the technologies they use in their preservice programs, increased emphasis should be placed on using GIS and Story Maps as both teaching and learning tools within teacher preparation programs. Furthermore, professional development events should be provided for inservice educators to provide them with the knowledge and skills necessary to effectively use and create Story Maps. These events, in addition to teaching technology skills, should focus on the pedagogical applications of Story Maps and their ability to support standards-based education. Given the results of the current study, initial professional development efforts should focus on developing younger, more technologically savvy educators who could then serve as leaders and mentors to their less experienced colleagues. Mentorship for educators using Story Maps and GIS in their classrooms should also come from outside parties. Professional GIS users from the local community could function as sustained technical support providers and use their extensive GIS knowledge to mentor classes, schools, and clubs.

It is also recommended that involved parties, such as Esri, state geographic alliances, and GIS education consultants, pay particular attention to the varying needs of educators. For example, this study revealed that formal educators desire pre-made Story Maps that are aligned to academic standards and ready for immediate use in the classroom. Educators wishing to create Story Maps for or with their students will require simplified documentation with explicit directions designed for educational settings. Informal educators, on the other hand, have little need for pre-made Story Maps and therefore require sufficient documentation on creating their own Story Maps. They would also benefit from seeing a variety of successful Story Maps created by informal educational institutions which could serve as examples for their own projects.

6.2 LIMITATIONS

The findings of this study provided ample data to answer the research questions. Several limitations, however, should be considered when interpreting the results and discussion.

First, the sample size of this study was rather small as only forty-two educators were surveyed. Furthermore, the sampling technique was not extensive and only reached a limited number of educators attending professional development workshops in South Carolina. The small sample size and narrow sampling technique were due to the limited nature of the research. Future research of Story Maps could include a larger and more comprehensive sample of educators.

The limited period of time allotted to the hands-on demonstration and survey during the professional development events was also a significant limitation. Participants' levels of technology expertise varied, so much of the allotted time was devoted to solving simple technical errors. The workshops occasionally felt rushed for time, which may have negatively influenced teachers' perceptions of Story Maps.

The survey instrument was created specifically for this research and, although reviewed by a geography education expert, has not been proven to be reliable or valid. Additionally, some participants left survey items blank, which could mean that the final results do not truly reflect the sample population. Also, the organization of the survey was not clear enough as some participants seemed to answer questions concerning the use of Story Maps with their opinions about creating Story Maps and vice versa. A more explicit, tested survey may yield more reliable results in future studies.

Finally, this study focused solely on teachers' perceptions of Story Maps as effective teaching tools. As evidenced by the literature on educational technology, perceptions do not directly indicate adoption and implementation. Although teachers found Story Maps to be user-friendly and applicable to their classrooms, the rate of adoption and extent of successful implementation is moderated by many other factors including the extrinsic obstacles identified by participants. Further research is necessary to examine the factors beyond perception that affect Story Map use in educational settings.

6.3 IMPLICATIONS FOR FUTURE RESEARCH

Given the novelty of the technology, limited research has studied Esri Story Maps or their applicability to classrooms. Although this study establishes a basic understanding of teachers' perceptions of Story Maps as effective teaching tools, further research is necessary to explore how teachers may or may not apply Story Maps to their classrooms, the obstacles they face, and the resources they need.

Methodological limitations of this study present opportunities for future research to examine teachers' perceptions of Story Maps at a larger scale. A larger and more representative sample population may unveil that perceptions are further moderated by age, experience, gender, and school circumstances. For example, it would be useful to explore how teachers' perceptions may or may not differ based on their experience with educational technologies in preservice programs or their level of professional development attendance during inservice years. Furthermore, new obstacles may be uncovered by research that considers both teachers in well-equipped, technologically advanced schools and teachers in poorly provisioned schools.

Future research should also study how students' test scores, behavior, spatial thinking skills, and geographic knowledge are affected by the use of Story Maps as an educational technology. Teachers will invest their time and energy in learning a new educational technology if it is proven to be superior instructional method that increases student learning outcomes (Guskey 1986). If it were shown that students' learning outcomes and level of engagement were improved by using or creating Story Maps, teachers may be much more likely to adopt the technology in their own classrooms.

Furthermore, additional studies should be conducted to assess the benefits and challenges associated with using a web-based GIS like ArcGIS Online. Esri's recent donation of ArcGIS Online organizational accounts to every classroom may forever alter the role of GIS in education. Although web-based GIS platforms like ArcGIS Online may lessen certain instructional and IT concerns, Battersby and Remington (2013) discovered that the administration of an organizational account and the current credit expenditure system posed challenges to the efficient use of Story Maps in educational settings. Moreover, the ArcGIS Online interface can change slightly with new releases and updated functionality, as is common with online software. The current study focused only on teachers' perceptions of the web application, so future research should explore teachers' perceived challenges of working within ArcGIS Online and managing the recently donated organizational accounts, as well as how a changing interface affects teachers' level of comfort with using the product. Additionally, Story Maps compose just a small amount of the functionality available within ArcGIS Online, so future research should examine how teachers and students perceive and use the more extensive analytical functions of ArcGIS Online.

In sum, Story Maps have the potential to play a large role in encouraging spatial thinking skills and geographic knowledge in K-12 and informal classrooms. Although several obstacles may impede their implementation, the overwhelmingly positive perceptions expressed by educators imply a budding future for Story Maps as a successful and effective educational technology.

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Appendix A: Story Map Tutorial

Creating an Esri Story Map

In today's workshop, we will create a 'Map Tour' Story Map using data and pictures from the Boardwalk Tour at Congaree National Park.

***Task 1*: Upload photos to a photo-sharing site (i.e., Flickr, Picasa Web/Google+, Facebook).**

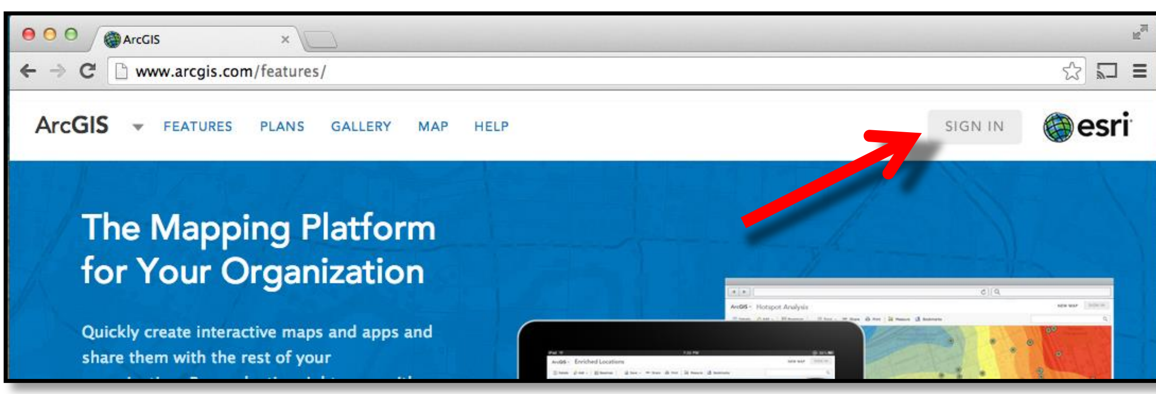
-With an ArcGIS Online Public account, pictures for your Story Map must be hosted on a photo-sharing site. Make sure the privacy settings for your photos are set to public.

-To save time, sample pictures for this Story Map tutorial have already been uploaded to a Flickr account.

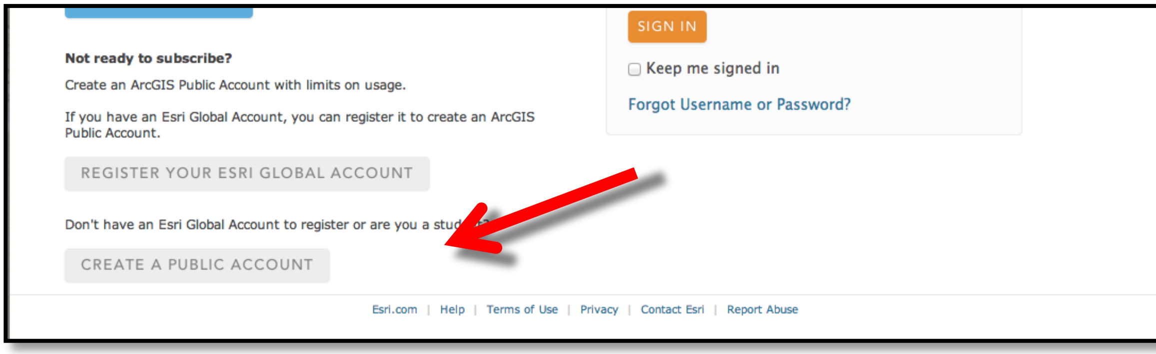
(User name: USC Caitlin ; Album: Story Map tutorial)

***Task 2*: Create a FREE public account on ArcGIS Online.**

1. Open an internet browser (e.g., Google Chrome, Firefox) and navigate to www.arcgis.com. Select **"Sign In"** in the top right-hand corner.

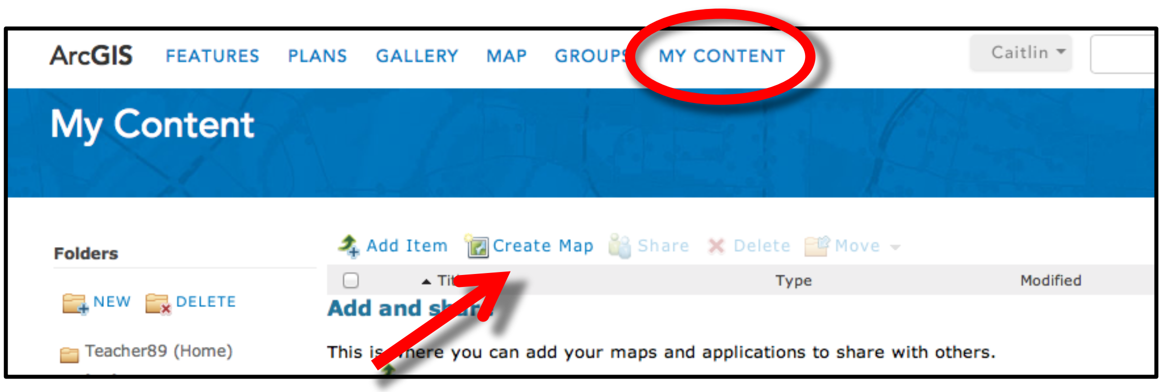


2. Select **"Create a Public Account"** in the lower left-hand corner. Create a username and password that you can easily remember. You will be able to use this FREE account later on in your classroom!



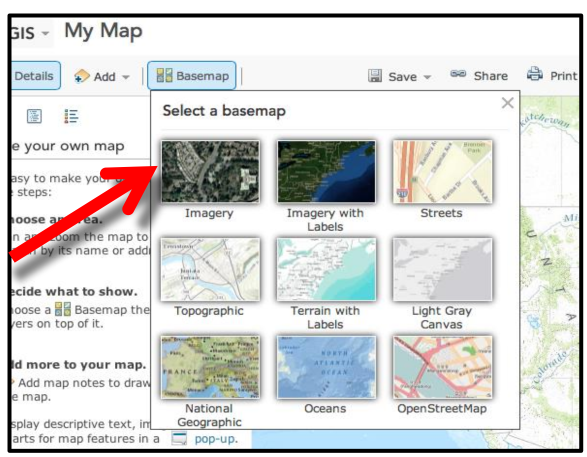
***Task 3*: Create a new web map with the appropriate basemap and data to support your story.**

1. Once you have created your account, select **"My Content"** at the top of the page. Then select **"Create a Map"**.



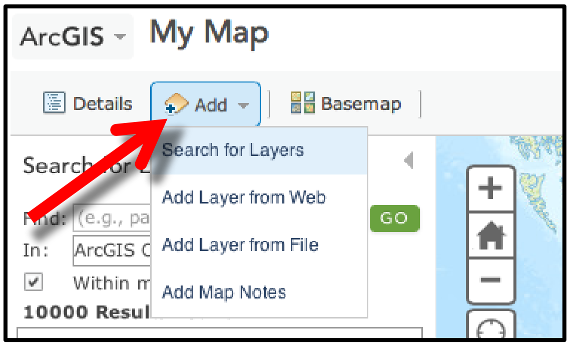
2. Choose an appropriate basemap that will support, not overpower, your story.

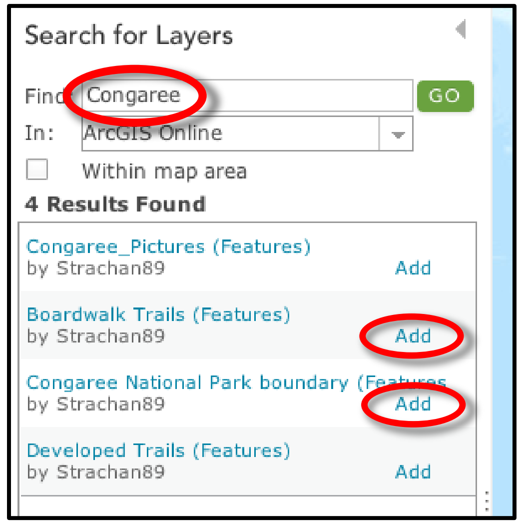
   For this Story Map, the **imagery basemap** would be a good choice. Zoom into the South Carolina area. We will supplement the imagery with a few data layers in the next step.



3. You can add data (map layers) to your web map in a variety of ways. One of the easiest ways is to search for data hosted within ArcGIS Online. For this Story Map, select **“Add”** and **“Search for layers”**. Type the word Congaree in the **“Find”** bar. You will see a few options for map layers that have already been created and are hosted within ArcGIS Online. Add the **“Boardwalk Trails”** and **“Congaree National Park boundary”** layers to your web map.

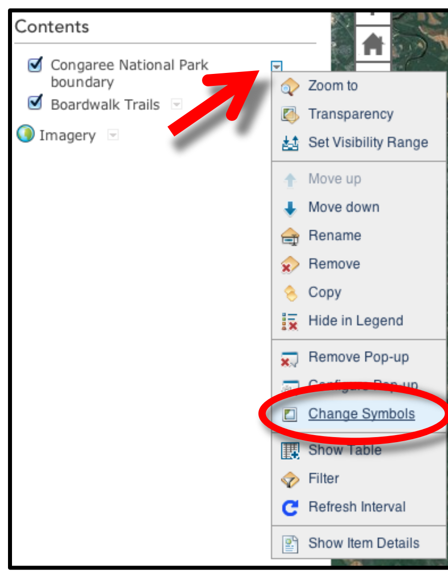
   Click **“Done adding layers”**.

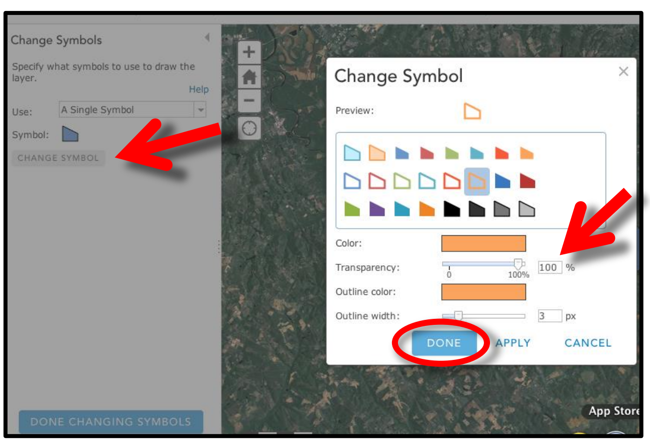




   You can easily change the look of each data layer by selecting the small dropdown arrow next to the layer and then choosing **“Change Symbols”**.

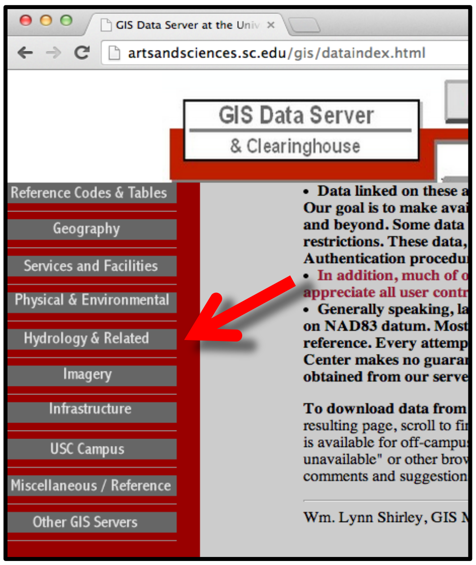
   Choose **“Change symbol”**. For the Congaree National Park boundary layer, you may want to choose a bright, solid outline with interior transparency set to 100%.

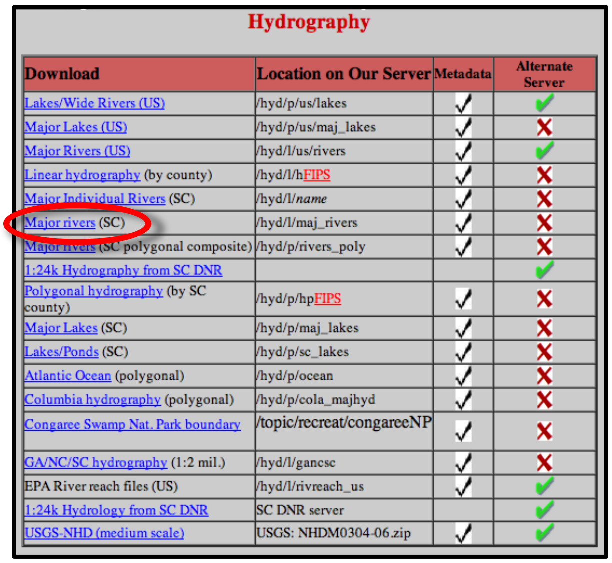




4. Although there is an increasing amount of content created and hosted within ArcGIS Online, oftentimes the data you need to support your story has not yet been uploaded to ArcGIS Online. Let's practice adding data that we have found outside of ArcGIS Online by going to one of many websites that give you access to free geospatial data.

   Open a <u>new</u> browser tab and navigate to http://artsandsciences.sc.edu/gis/dataindex.html. This is USC's Data Server & Clearinghouse, managed by the Department of Geography. Choose the **"Hydrology & Related"** tab, and then select **"Major rivers (SC)"**. One click will download a zipped file of geospatial data and save it in the Downloads folder on your computer.

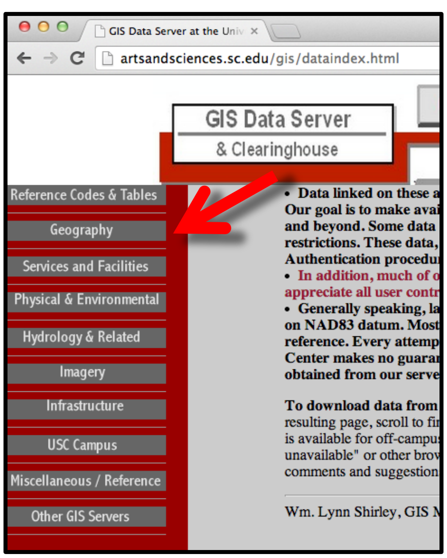


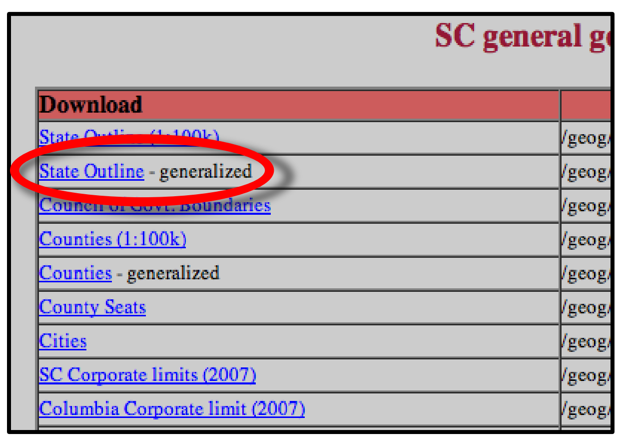


Hydrography

Download	Location on Our Server	Metadata	Alternate Server
Lakes/Wide Rivers (US)	/hyd/p/us/lakes	✓	✓
Major Lakes (US)	/hyd/p/us/maj_lakes	✓	✗
Major Rivers (US)	/hyd/l/us/rivers	✓	✓
Linear hydrography (by county)	/hyd/l/hFIPS	✓	✗
Major Individual Rivers (SC)	/hyd/l/*name*	✓	✗
Major rivers (SC)	/hyd/l/maj_rivers	✓	✗
Major rivers (SC polygonal composite)	/hyd/p/rivers_poly	✓	✗
1:24k Hydrography from SC DNR			✓
Polygonal hydrography (by SC county)	/hyd/p/hpFIPS	✓	✗
Major Lakes (SC)	/hyd/p/maj_lakes	✓	✗
Lakes/Ponds (SC)	/hyd/p/sc_lakes	✓	✗
Atlantic Ocean (polygonal)	/hyd/p/ocean	✓	✗
Columbia hydrography (polygonal)	/hyd/p/cola_majhyd	✓	✗
Congaree Swamp Nat. Park boundary	/topic/recreat/congareeNP	✓	✗
GA/NC/SC hydrography (1:2 mil.)	/hyd/l/gancsc	✓	✗
EPA River reach files (US)	/hyd/l/rivreach_us	✓	✓
1:24k Hydrology from SC DNR	SC DNR server		✓
USGS-NHD (medium scale)	USGS: NHDM0304-06.zip	✓	✓

   Let's also download a state outline to support our story. Choose the **"Geography"** tab, and then select **"State outline-generalized"**.

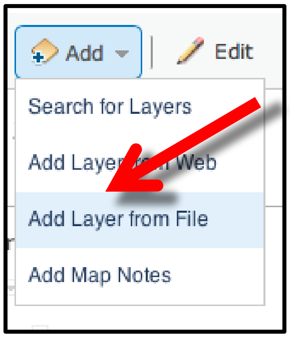


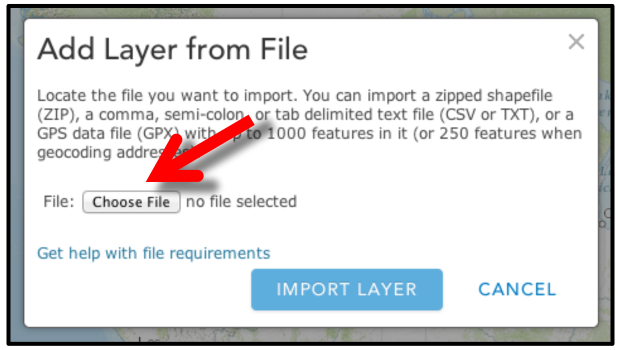


SC general g

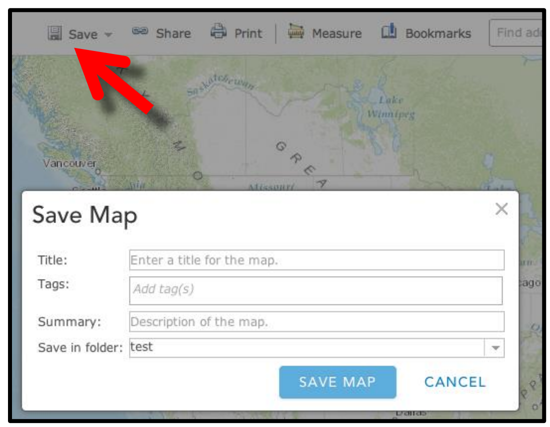
Download	
State Outline (1:100k)	/geog
State Outline - generalized	/geog
Council of Govt. Boundaries	/geog
Counties (1:100k)	/geog
Counties - generalized	/geog
County Seats	/geog
Cities	/geog
SC Corporate limits (2007)	/geog
Columbia Corporate limit (2007)	/geog

Return to your web map tab. To add these newly downloaded files to your web map, select **"Add"** and **"Add layer from File"**. Click **"Choose File"** and navigate to the Downloads folder on your computer. Select the **"maj_rivers.zip"** file, leave the default preferences (generalize features), and click **"Import layer"**. Repeat this process and import the **"scoutgen.zip"** file. Click **"Done adding layers"**.





Feel free to customize the look of each data layer to fit your style. Keep in mind that we will be building a Story Map along the Boardwalk Trail on top of this web map.



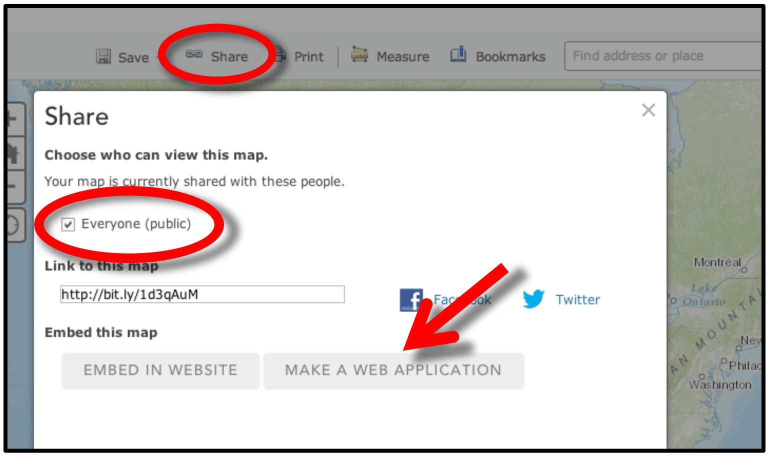
5. Zoom out to a scale where you can view the entire park boundary. The extent at which you save your web map will serve as the default extent of your Story Map.

6. Save your web map. Create an appropriate title and add a few "tags". These tags will help you and other users search for specific content in the future. You may leave the "Summary" blank for now, but it is good practice to create thorough metadata about each of your products.

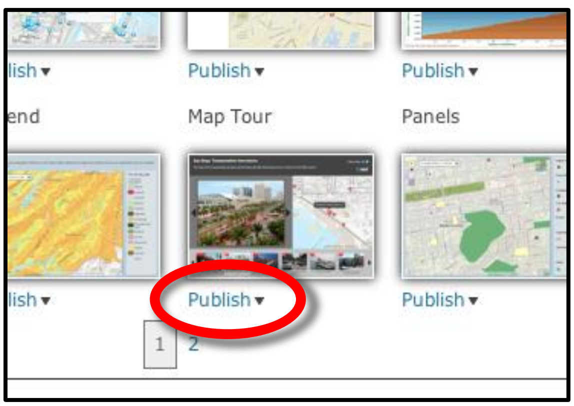
This web map will now be located under "My Content".

***Task 4**: Share your web map as a Map Tour Story Map.*

1. After you have saved your map, select **"Share"**. Check the box next to **"Everyone (public)"**. This indicates that your Story Map will be shared publicly.

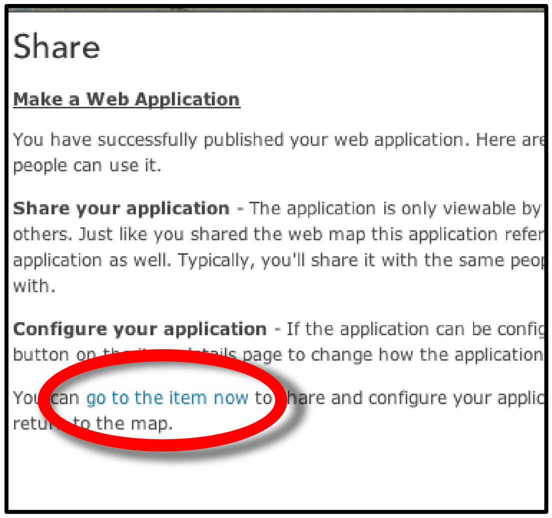


2. Select **"Make a Web Application"**. Choose **"publish"** under the Map Tour.

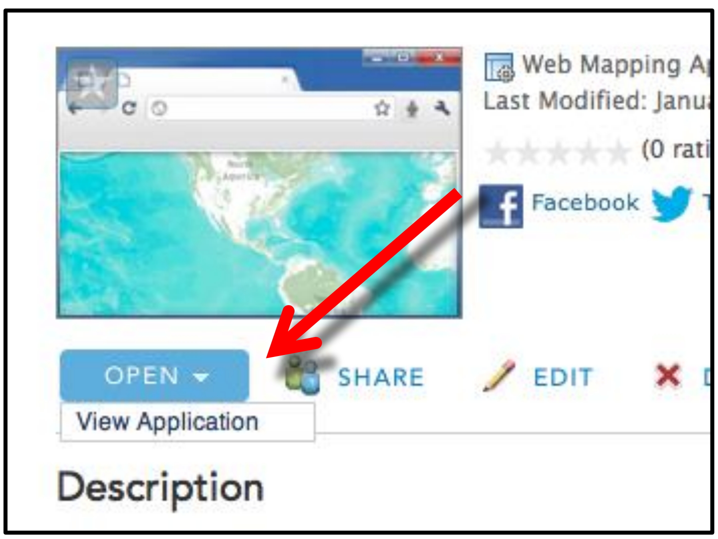


3. Give your Map Tour Story Map an appropriate title, related tags, and a short summary. This information can be the same as that provided for the web map, but you may want to indicate in the title that this is a Story Map.

4. Select **"Save and Publish"**. To start building your Map Tour Story Map, choose **"go the item now"**.



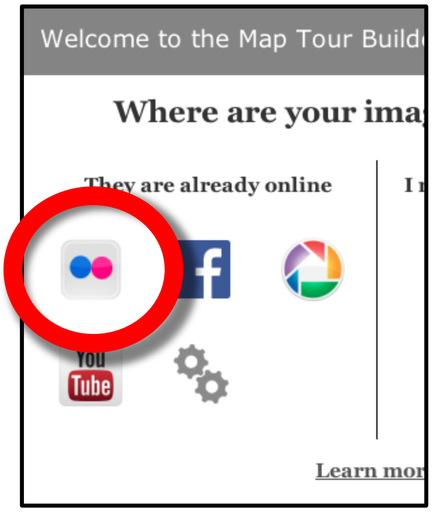
5. On the following screen, select the large map thumbnail to go to the web application (Story Map). You could also select **"Open"** and **"View Application"**.

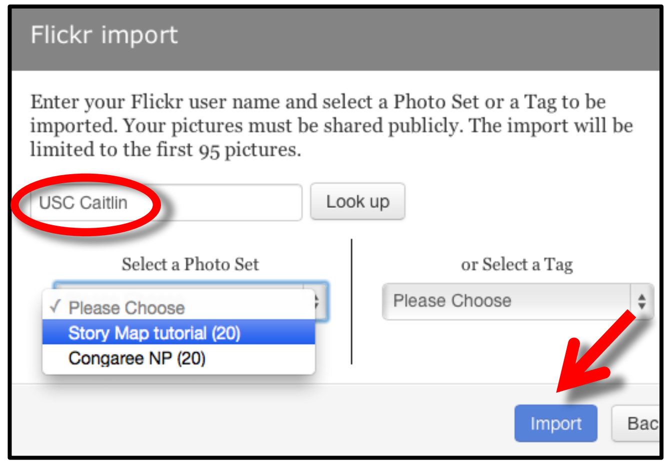


***Task 5**: Use the interactive builder mode to integrate photos and text to your map.*

1. This Story Map needs to know where to go to find your photos. When prompted with the question "Where are your images or videos?", select the icon for Flickr in the top left-hand corner.

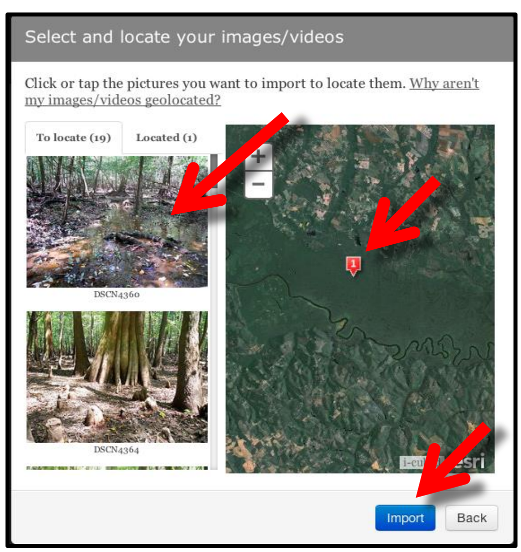
2. On the next screen, type **"USC Caitlin"** as the Flickr user name and click **"Look up"**. This will search for a specific Flickr account and show you the available photo sets (those that have been shared publicly). Under **"Select a Photo Set**", choose the set called **"Story Map tutorial (20)"**. Now click **"Import"**.





3. You now need to tell the Story Map where to locate the photos on the map. Click once on the first picture, and then click once on the imagery basemap in the general area where the picture should be (somewhere near central South Carolina). A small, numbered red pinpoint should appear on the map. Do not worry about the specific location; you can adjust the location of each pinpoint in the next steps.

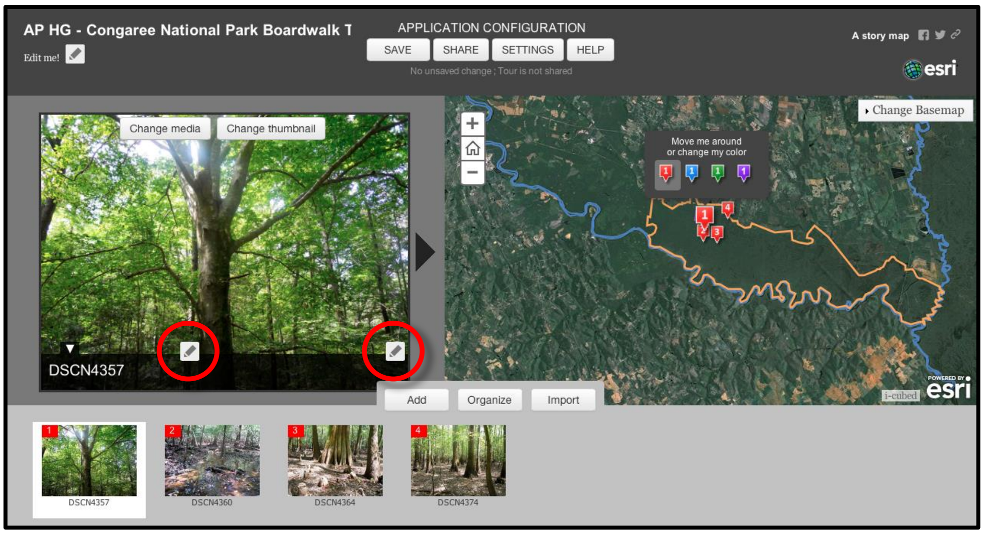
   Select and locate 3-4 pictures. Once you have done this, click **"Import"**. This will import the selected photos from Flickr to your Story Map.



4. Your screen should now look like a Story Map. Let's turn this into a real story by relocating each pinpoint to an appropriate location along the Boardwalk and adding titles and captions to each picture.

   To adjust the location of your points, click once on the numbered red flag and then drag it to a new location. You may also change the color of each point.

   Click the leftmost **pencil icon** at the bottom of the picture. This will let you rename the title of the picture. Similarly, the **pencil icon** to the right will let you type a caption for that picture.

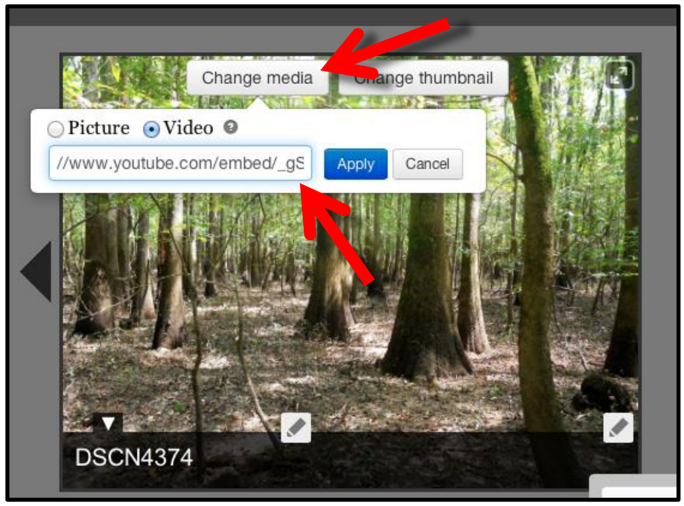


   The first picture is of an American beech tree located at Point 1 on the Congaree National Park Boardwalk Tour. An example of a title and caption could be…

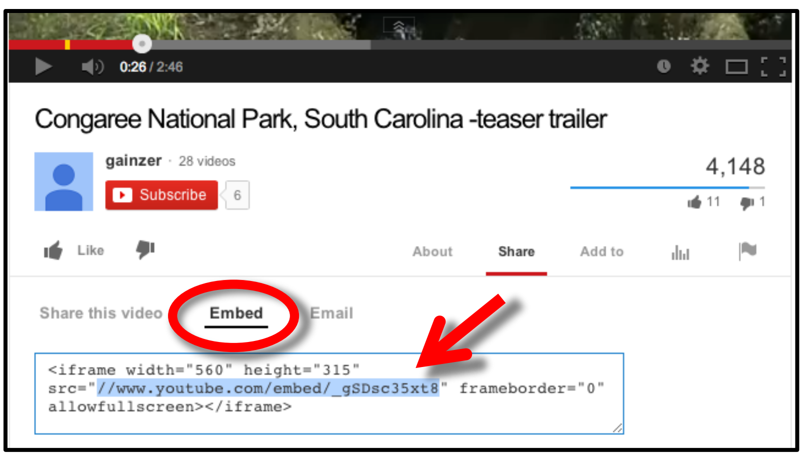
   Title: American beech

   Caption: This American beech tree, identified by its smooth gray bark, is likely over 100 years old; this species was an important source of food in the floodplain for American Indians and early settlers. Beech nuts were collected and ground into flour for bread and meal cakes.

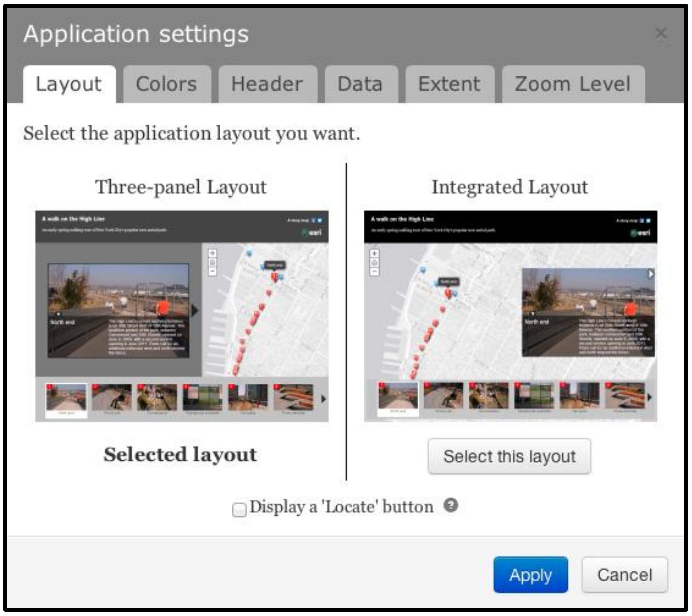
5. Now let's add a video to our Story Map. Click on the last picture in the carousel and select **"Change media"** above the large picture. With **"Video"** selected, add the following URL into the blank box: //www.youtube.com/embed/_gSDsc35xt8
Click **"Apply"**.



This video URL comes from the embed code which can be found under the "Embed" option on the video's YouTube page. If you would like to try this yourself, visit www.youtube.com and search 'Congaree National Park'. Select the video you want for your Story Map. Find the video URL between the quotation marks in the embed code, and copy & paste this into the "Change Media" tab on your Story Map.



6. If you have time leftover, visit the **"Settings"** tab at the top of the page to customize your Story Map. You can change things like the layout, colors, and zoom level (how far the map zooms in for each point in your story). When you are satisfied with your changes, click **"Apply"**.



7. Save your Story Map. Now exit that browser tab.

<u>Task 6</u>: Populate metadata.

1. Revisit the *information* page for your Story Map (If you have closed this tab, simply go to My Content and click on the name of your Story Map).

2. In this information page, choose **"Edit"**. Provide a brief description of your Story Map, and make sure to add relevant tags. Save your changes.

<u>Task 7</u>: View your Story Map!

1. Click on the large map thumbnail or select **"Open"** and **"View Application"** to go to your Story Map!

APPENDIX B: STORY MAP PERCEPTION SURVEY

The purpose of this research is to record teachers' perceptions of Esri Story Maps. You are asked to complete this survey as a teacher participating in a Story Maps workshop. The results of this research will be used to direct future Story Maps development for use in K-12 education. This survey will take approximately 10 minutes. Survey participation is voluntary and responses will remain anonymous. Study questions should be directed to strachan@email.sc.edu.

I. ABOUT YOU

Age ___________ # Years Teaching ___________ Current Grade Level Teaching ___________

Current Subject(s) Teaching ____________________ ____________________ ____________________

Circle the choice that best describes you:

My comfort level teaching with technology (PowerPoint, Mobile devices, Tablets)	Low	Medium	High
The level of technical support available at my school (IT support, internet access)	Low	Medium	High
My level of experience with geospatial technologies (GIS, GPS, Google Earth)	Low	Medium	High

II. USING STORY MAPS

These questions relate to *using* Story Maps. *Circle* the choice that best describes your belief:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
Story Maps are user-friendly.	1	2	3	4	5
Story Maps are interactive and engaging.	1	2	3	4	5
My students would enjoy using Story Maps.	1	2	3	4	5

Story Maps can help me better present material that meets academic standards.	1	2	3	4	5
Story Maps could be used to be present material from a variety of subjects (i.e., interdisciplinary).	1	2	3	4	5
I would collaborate with fellow teachers to use Story Maps as a teaching tool.	1	2	3	4	5

Additional thoughts about what you did or did not like about *using* Story Maps?

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How would you plan to use Story Maps in *your* classroom? (i.e.: specific topic, subject, lesson, student projects)

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___

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III. CREATING STORY MAPS

These questions relate to *creating* Story Maps. *Circle* the choice that best describes your belief:

	Strongly disagree	Disagree	Neutral	Agree	Strongly Agree
ArcGIS Online is intuitive and easy to navigate.	1	2	3	4	5
It was easy to create a web map.	1	2	3	4	5
I enjoyed building a Story Map with the interactive builder.	1	2	3	4	5
I would use *pre-made* Story Maps in my classroom.	1	2	3	4	5
I would *create my own* Story Maps for use in my classroom.	1	2	3	4	5
My students could create a Story Map using the interactive builder.	1	2	3	4	5

I would be more likely to use Story Maps in the classroom if an additional professional development workshop was offered.	1	2	3	4	5

Additional thoughts about what you did or did not like about *creating* Story Maps?

Additional thoughts about obstacles that would limit your ability to create or use Story Maps in your classroom?