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Educational Technology and Innovation Capacity in Arkansas Public Schools

Allie Nicole Taylor
University of Arkansas, Fayetteville

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Allie Taylor
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Dr. Ron Warren
Thesis Director

Dr. Robert Wicks
Committee Member

Dr. Dennis Beck
Committee Member

Abstract

We all have high hopes for our educational system. As they stress the need for 21st century learning, governments recognize the importance of innovation and creativity in schools and invest resources to develop learning environments that foster these qualities. This thesis adapts Crosling, Nair, and Vaithilingam's (2015) model to provide a framework for studying factors that contribute to a creative learning ecosystem (*intellectual capital development*, *21st century literacies*, *climate for innovation*, and *integrity of the system*), the quality of the educational system, and the system's innovation capacity. A survey of 126 Arkansas high school teachers, indicates that two variables, student's global literacy skills and *integrity of the system,* are seen as positive influences on Arkansas public schools *innovation capacity* and that the quality of the educational system moderates those relationships.

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Table of Contents

Introduction

The demands our society puts on education are at a unique historical disjuncture. This new century, to many, requires new ways of learning and thinking (Gardner, 2008; Pink, 2005). The issue of what our students need to know has received a great deal of attention recently, mostly under the umbrella term "21st century learning." But what is 21st century learning? According to Kereluik, Mishra, Fahnoe, and Terry (2013) "It is bold. It breaks the mold. It is flexible, creative, challenging, and complex" (p. 127). In the same breath they assert that statements such as this one are common these days. Ultimately, the authors and groups that criticize public education agree that current schooling practices are designed to prepare students to become citizens of the industrial age, not the new millennium. Jacobs (2014) believes the best way of stepping into the 21st century is through infusing three literacies (digital literacy, media literacy, and global literacy) into our schools.

Yet it is all too often that schools, proud of their reputation for excellence, feel the need to state that they have a "firm grip on innovation" (Hall, 2016). This claim suggests many things the school is, such as technologically advanced and ahead in current pedagogy and practice, as well as what they are not, which is "antiquated and dated." The reality is that most schools proclaim their belief in innovation, but few have successfully navigated the "innovation challenge."

After reviewing 21st century literacies (digital literacy, media literacy, and global literacy), this study explores different learning environment factors that could potentially impact the innovation capacity of Arkansas public high schools. Hall (2016) asserts that the right way to innovate is to start identifying the right questions to ask schools. To start managing innovation successfully in Arkansas public schools, this study hopes to start finding some of these questions.

Literature Review

Common Core

According to the Common Core State Standards Initiative (*About the Standards*, 2015), the Common Core is "a set of high-quality academic standards in mathematics and English languages arts/literacy." The standards were created to ensure that all students graduate from high school with skills and knowledge that are considered necessary to succeed in college, career, and life. These standards establish what students need to learn, but do not dictate how teachers should teach. Instead, schools and teachers decided how to best help their students reach these standards.

Media literacy education is incorporated in Common Core Standards, specifically in the English Language Arts (ELA). The National Association for Media Literacy Education (NAMLE, 2014) defines the connections between media literacy education and Common Core. The five broad connections made are: exploring the relationship between authors and audiences; expanding the concept of literacy; research with information, news, and current events; empowering students as critical thinkers through media production and analysis; and reflection, ethics, and understanding multiple points of view. These standards fall under the content areas of reading literature and/or information, writing, language, and speaking/listening. Common core also mandates digital literacy standards for 11th and 12th graders, namely the ability to "demonstrate command of technology, including the Internet, to produce, publish, and update work in response to ongoing feedback, including fresh arguments or new information" (Avila & Moore, 2012, p. 28).

Common Core State Standards maintain a strong focus on disciplinary knowledge, but also understand the importance of critical thinking. Although many argue that Common Core

State Standards structure divides it from 21st century skills, there exists a meaningful alignment. For example, critical thinking, problem solving, creativity, innovation, communication, and collaboration are represented throughout the standards (Kereluik, Mishra, Fahnoe, & Terry, 2013). While this alignment may exist, Price-Dennis, Holmes, and Smith (2015) urge for a stronger focus on 21st century literacy frameworks:

> If the notion that public schools should prepare children to be proficient consumers, producers, and disseminators of a variety of print-based and digital texts is taken seriously, then all students, particularly those receiving special services, should have access to pedagogies that promote fluency with tenets of the 21-st century literacies framework" (p. 196).

Digital Literacy

The term "digital" is the latest descriptive term used to label activities of new information and media. Its predecessors include "computer" (-based, -assisted, -mediated), "online", "networked", "web-based", and "e-." It is worthy to note this evolution of terms because it highlights a transition from resource-oriented ("computer-based") to "digital," which now rhetorically relates to a whole institution ("the digital universe") (Goodfellow, 2011). Gilster (1997) first made the world aware of the concept of digital literacy in the 1990s. He defined the term as the ability to recognize the fundamental but revolutionary uniqueness of the Internet. He identified the digitally literate student as having specific information skills that can be applied to texts and multimedia information. The literature presents multiple definitions of digital literacy, but despite the evolutionary change of terminology, it is commonly understood that technology has forever changed literacy practices (Malani, 2013).

The concept of digital literacy captures a wide range of interdisciplinary research and applications. Early approaches emphasized individuals' skills and competencies as they related to "technical stuff." While this emphasis persists in the literature, it is accompanied by

perspectives that stress the multimodal aspects of new technologies (Bhatt, 2012; Meyers, Erickson, & Small, 2013). More recent definitions of digital literacy emphasize skills beyond technical fluency. In 2014a, MediaSmarts, the Digital and Media Literacy Center of Canada, made it clear that although the ability to use the technology is foundational, digital literacy is built upon strong critical thinking skills and comprehension of online rights and responsibilities.

MediaSmarts (2014b) condensed digital literacy into three main principles: use, understand, and create. "Use" represents the technical fluency with the devices/Internet. An example would be the ability to copy and paste from one document to another. "Understand" is the critical component and focuses on comprehension and critical thinking skills (for example, the ability to analyze information and its sources). The last component, "Create," is the ability to produce content and effectively communicate. This principle gives great opportunity for innovative and creative projects that afford students an opportunity to produce media content. Figure 1 illustrates the many interrelated elements that fall under digital literacy.

The American Library Association (2013) task force on digital literacy concluded that "(it) is the ability to use information and communication technologies to find, understand, evaluate, create, and communicate digital information, an ability that requires both cognitive and technical skills." One important skill of a digitally literate individual is the ability to interpret information and effectively judge its quality. These skills transcend into lifelong learning and understanding personal privacy in the digital world. These skills allow individuals to communicate, collaborate, and to understand how to actively participate in a civic community.

The good news is that digital literacy is now being understood as essential to overall literacy (Kirkland, 2014; MediaSmarts, 2014a). The International Society for Technology (2014) and Education and British Columbia's Digital Literacy Framework (n.d.) provide a concise and

comprehensive curriculum of six major competencies for digital literacy. For a full list of digital literacy skills refer to Table 1.

It is important to understand that, within dramatic pedagogical and curriculum shifts, there will be a requirement for new social practices, skills, and strategies for digital tool use both by teacher and student. In the case of digital literacy, four significant contrasts between traditional literacy and digital literacy exist: digital text are interactive and are able to be manipulated, comprehension may be encouraged by guided reading, structure and layout are far different, and digital literacy includes multimedia presentations and/or various icons. Unlike the traditional left to right, "first to last word" approach of traditional literacy, digital texts require strategic, nonlinear movement from point to point. There is also an integration of information presented in multimedia, such as hyperlinks, to connect new information (Reinking, 1994).

Media Literacy

Since the initiative for media literacy began in 1982, it has been considered in an international context. From the beginning, media literacy has been considered a very important skillset for citizenship in today's information-fueled society (Tanriverdi & Apak, 2010). Media literacy education extends the traditional skills and competencies of print reading and writing to all forms of text (e.g., video, audio, pictures). Commonly, media literacy is defined as the ability to access, analyze, evaluate, and communicate information in all forms (Aufderheide, 1993; Hobbs, 2010).

Media literacy contains three significant aspects: media access and content (a critical approach), the ability to decipher messages (awareness of media functions), and the creative component (communication skills). Within the critical approach, it is important for the media literate individual to acquire the capacity to discern and make critical selection of media content.

Along with this decision comes the ability to view and critique the content and production of messages- social, political, and economic. Finally, media literacy involves the capability to produce texts and significant content. Media literacy refers to all media. This would include radio, TV, movies, Internet, and other digital communication technologies (Marghescu, 2010).

There are three common philosophies that shape media literacy practices. The first is usually associated with the goal of inoculating youth with cognitive defenses against media messages and sources. This protectionist viewpoint emphasizes the potentially negative effects of media content. The second approach seeks to develop students' critical thinking skills with a healthy dose of skepticism. This approach is from an empowerment perspective. This perspective places more emphases on skill rather than defense. The third is the development of student appreciation. This approach asserts that if children consume media entertainment/technologies outside of school, they might be more motivated to learn if classes integrated more media. Unfortunately, there is limited scholarship on practice or philosophical standpoints of how to incorporate media literacy practices into the classroom (Redmond, 2012).

There are a number of reasons for teaching media literacy. One reason, as mentioned above, is to motivate reluctant learners. Considine, Horton, and Mooreman (2009) assert that engaging curricula involving media help connect students to content. This notion supports the idea that education must be relevant to students' cultural experiences (including mass media and popular culture) (Hobbs & Jenson, 2009). Furthermore, Hobbs (2010) notes good media literacy education can support the acquisition of traditional literacies. Concepts such as audience analysis, comprehension, and point of view must be applied to both digital and printed texts.

Teaching media literacy, like digital literacy, would require a major paradigm shift because it falls under a more sociological model of education rather than the current

psychological model. More emphasis would need to be placed on social and cultural texts. This drives efforts towards a critical media literacy perspective. This progressive approach encourages empathy and openness (Share, 2010). The New Media Literacy (NML) perspective envisions individuals as active members in the new digital environment. This role does not only account for their consumption of media, but also their creation of media as well. According to Literat (2014) NMLs are "social and cultural competencies that go beyond access to technology…rather they are conceived as critical skill sets that are bred and enhanced by one's digital involvement in a participatory culture" (p. 16).

NML studies focus on media use and production within the context of a community of participants. This means that media literacy education should be viewed as enabling students to analyze and understand the usefulness and limitations of media. Robinson (2010) states that the principle of learning in a participatory context is that it moves the conversation away from media tools and texts and towards spaces, places, and communities. Jenkins, Purushotma, Weigel, Clinton, and Robison (2006) identify twelve skills within this NML perspective (see Table 2), including experimenting with surroundings as a form of problem-solving, ability to remix and sample media content, evaluate the reliability and creditability of different sources, etc.

New Media Literacy skills have been linked to increase engagement with Web 2.0 platforms, as well as higher levels of creative production and distribution of multimedia texts. Also, Literate (2014) concluded that new media literacy skills and civic engagement were strongly correlated. Respondents that scored high in NML skills showed much higher degrees of civic engagement. As education moves to incorporate digitally mediated technologies and contexts, it must be understood that global connectivity is not as simple as linking teachers, classrooms, and students

with new technologies. This new relationship must include literacies of individuals' local communities, cultures, and broad ideological systems (Stornauiuolo & Leblanc, 2014).

Global Literacy

Farmer (2015) asserts that "global literacy" is a term that can be surprisingly difficult to define. On one hand, the term can refer to the concept of universal literacy. On the other, global literacy can often be interchanged with the concept of global citizenship. This conceptualization of global literacy emphasizes civic responsibility and cultural competency. In 2009, the Oregon Department of Education defined global literacy as the ability to "demonstrate knowledge of diverse cultures, linguistic, and artistic expression, and apply a global perspective to analyze contemporary and historical issues" (King & Thrope, p. 127).

In the twenty-first century, the global connectedness of people, as Zang, Hsu, and Wang (2010) mention, has grown because of technology advancements, rise in media sources, and the rapid popularization of communication networks. Within the professional realm, there are shifts in communication toward open, participatory, and networked cultures. This means there is a need to understand how to connect and communicate across diverse, cultural contexts and to manage communication and information networks. Employers need individuals that can collaborate effectively and ethically in a global network (Starke-Meyerring, 2005).

This call means to promote global awareness and global literacy among students. Global literacy is about "fostering students' understanding of the intersection between their lives and global issues, and their sense of responsibility as a local and global citizen" (Nair, Norman, Tucker & Burkert, 2012, p. 56). Through the nineteenth and twentieth century it was appropriate to frame education in national terms, but with increasing levels of global connectedness brought about by digital communication, the challenge of 21st century education will be unfolding

education on a global stage (Bennett, Cornwell, Al-Lail & Schenck, 2012). Indeed, one of the main tasks of literacy education now is to teach students how to engage in dialogue with others in a digitally mediated context (Stornaiuolo & Leblanc, 2014).

The Council of Chief State School Officers (CCSSO) (2011) set forth a field-tested framework called the Global Competence Matrix, which offers six content areas matrices with objectives to achieve global competence. Global competence is defined as "the knowledge, skills and disposition to understand and act creatively on issues of global significance" (p. 1). Under this matrix there are four sets of skill-based objectives: (1) investigating the world, (2) recognizing perspectives, (3) communicating ideas, and (4) taking action. The first set ("investigating the world") emphasizes generating researchable questions with a local, regional, or global focus. This would include using language and sources relevant to the particular questions and analyzing the evidence to construct a significant response/argument that contains multiple perspectives. Recognizing perspectives is to express individual perspectives and understanding influences on these perspectives. Also, it is important under this objective to examine the perspectives of other people or groups and explain cultural influences on situations.

To communicate ideas would involve recognizing and expressing how diverse audiences interpret messages differently. This would include listening and communicating effectively with appropriate behavior and language, using appropriate technology, and reflecting on how communication affects the world. Naturally, taking action follows this reflection by assessing options and plans for the potential impact of the communication. This impact should be creative and ethical to contribute to local, regional, or global scale issues. Finally, individuals should, once again, take time to reflect on their capacity to advocate and make contribution (Council of

Chief State School Officers' EdSteps Project, 2011). Table 3 contains a full list of global literacy skills.

Jacobs (2014) urges educators to shift and upgrade curriculum, assessment, and instruction with contemporary educational approaches through integrating new literacies (digital, media, and global). She argues that it is essential to understand how to approach these new literacies and capitalize on their intersections, which she believes will provide opportunities for higher levels of teaching and learning (Figure 2).

DMG Model

Because both digital and media literacy are fairly new concepts, there is debate among experts and academics about how they should be defined. It is generally agreed upon though that they are closely related to each other. Figure 3 illustrates how digital literacy and media literacy connect and intersect with each other. MediaSmarts' (2014b) model (Figure 3) provides a full range of competencies for 21st century life. This model acknowledges the term "multi-literacies" that is often used to describe the requisite aptitudes and abilities to *use, understand,* and *create* digital media. A wide range of interrelated skills falls under digital literacy, media literacy, technology literacy, information literacy, visual literacy, communication literacy, and social literacy. Media literacy generally focuses on teaching to be critically engaged media consumers, while digital literacy emphasizes digital media participation in a safe and ethical manner.

Due to the intersection of technology and globalization, there is more interaction across societies. Because information, meaning, and impact are culturally specific, though, shared knowledge and meaning can be hard to achieve (Farmer, 2015). Journell (2009) asserts that people not only need to be critical users of technology, but they should also evaluate the information they consume and produce. Thus, digital citizenship education is needed so users of information can act

civically (Ribble, 2004). Technology and information literacy have never been so important, but alone they do not suffice (Farmer, 2015).

21st Century Skills and Innovation

According to the Partnership for 21st Century Skills (P21) (2007), unless the gap between how students live and how they learn is bridged, today's educational system will become irrelevant. While every educated individual should have core skills in literacy and numeracy, to succeed in the 21st century they must also have skills that enable them to think logically and solve problems (Kivunja, 2015). Fundamental changes in the skill requirements of the US economic system are reflected in the shift from the industrial era to the knowledge economy (Carnevale & Smith, 2013). Kereluik, Mishra, Fahnoe, and Terry's (2013) framework for 21st century learning includes three key categories: foundational knowledge, meta-knowledge, and humanistic knowledge (see figure 4). Foundational knowledge includes core content knowledge, such as English and mathematics, digital and information literacies, and cross-disciplinary knowledge. Under digital and information literacy it is important to be able to evaluate, navigate, and construct information using digital technologies. Cross-disciplinary knowledge requires synthesis of information, especially considering the vast amount of information available due to digital media.

The category of meta-knowledge includes the subcategories of problem solving and critical thinking, communication and collaboration, and creativity and innovation. Critical thinking is the ability to interpret information and make informed decisions, and problem solving uses critical thinking skills toward effective resolutions. Communication involves articulation of ideas. Collaboration builds on communication, but also includes individual contributions, flexibility, and participation in a group. Creativity was one of the skills most cited for success in

the 21st century. Creativity and innovation apply knowledge and skills toward generating novel and worthwhile products/solutions. The last category, humanistic knowledge, refers to an individual's broader social and global context, and includes subcategories of life skills, job skills, leadership, cultural competence, and emotional/ethical awareness. The need for cultural competence and ethical awareness has risen from the increased cultural diversity that accompanied globalization. Eisner (2010) reported that more than 990 employers ranked critical thinking/problem solving, information technology, and creativity/innovation in the top four of twenty separate desired work skills.

The introduction of digital technologies has changed the methods and techniques for acquiring, representing, and manipulating knowledge (Mishra, Terry, Henriksen, & The Deep-Play Research Group, 2013). Problem solving and critical thinking are not unique to 21st century learning; however, they are transformed by technology. Technology allows for large-scale communication and collaboration and serves as a bridge toward cultural competency (Kereluik, Mishra, Fahnoe, & Terry, 2013).

Regarding meta-knowledge, specifically creativity and innovation, Martins and Terblanche (2003) note that concepts of creativity and innovation are often used interchangeably. Ultimately they are steps in the same process. Creativity is the process of generating new ideas, whereas innovation turns those ideas into reality. Encouraging the development of creativity and innovation foregrounds the promotion of creative, critical thinking and social responsibility. Creativity and innovation cannot be taught, but in an appropriate environment, curiosity and innovation can be awakened, enabling problem solving (Likar, Cankar, & Zupan, 2015).

Scott and Bruce (1994) assert innovation as a multistep process. The process begins with problem recognition and generation of ideas, either novel or adapted (creativity). The next step

involves the individual to seek support for ideas from other individuals (communication and collaboration). Finally, the individual produces a product or solution (creation and innovation). While the literature on creativity and innovation is quite broad (Hoelscher & Schubert, 2015), the study of innovation and creativity is one of the most important emerging trends in social sciences and humanities (European Commission, 2009).

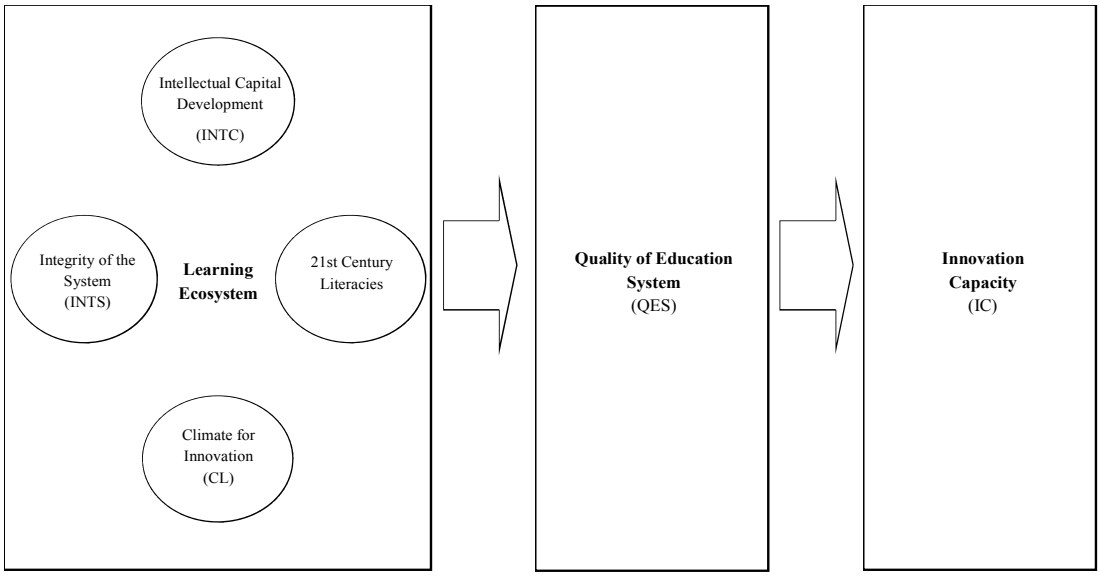

Figure 5. Innovation Capacity Model. This figure illustrates the regression model to test innovation capacity.

Innovation Capacity Model

Due to the rapid technological advancements over the last few decades, inherently, the way we share information and the way individuals learn has changed. In this world of rapid change, several studies have shown that nations require a workforce that has the capacity for critical thinking, creativity, and innovative solutions (Lucas 1988; Hagopian and Lee, 2012). Romer (1990) asserts that the current lack of creative talent is due to weak educational systems

that hinder innovation capacity. Countries that can increase the supply of creative talent for the workforce can also improve the their nation's economic wealth and competiveness.

But while a country's educational system plays a vital role in the development of creative, critical thinking, the educational system is underpinned by numerous resources and constraints (Hodgson, 2006). This paper provides a framework adapted from Nair's (2007) Innovation Helix model to study the factors contributing to the learning ecosystem, quality of the educational system, and the system's innovation capacity (see Figure 5).

A learning ecosystem is "an integrated, interrelated, evolving, potentially fragile, and ultimately a success-driven system" (The LEARNING Ecosystem, 2013, p. 44). The ecosystem components within this framework are intellectual capital development (INTC), 21st century literacie*s*, climate for innovation (IC), and integrity of the system (INTS). Intellectual capital development is a resource measure oriented around training and development and technology capital (Crosling, Nair, & Vaithilingam, 2015). Intellectual capital allows individuals to keep up to date with information, which in turn creates capacity for higher order thinking skills. Nair and Shariffadeen (2009) stress that skills dealing with information communication technologies and information literacy are a key feature of higher-order thinking. These features enable collaborative teaching and new learning approaches that are premised on higher order thinking skills. 21st century literacies focus on the inclusion of literacy objectives and student skills with digital, media, and global literacy objectives. Climate for innovation views individual innovative behavior as the outcome of four factors: (1) support for creativity, (2) tolerance for differences, (3) preference for the status quo, and (4) resources (Scott & Bruce, 1994). Finally, the integrity of the system is a resource that involves the standards of operations. Sound integrity systems encourage transparency in decision-making and operations. Learning ecosystem factors

contribute to overall quality of the education system (QES), a general assessment of students' skill set with the three literacies and their skills for success in the future, and the system's innovation capacity (IC) (Crosling, Nair, & Vaithilingam, 2015). While exploring the innovation capacity model above, the following research questions and hypotheses will be addressed:

RQ1: Which 21st century literacy objectives do teachers believe are included in Arkansas public high schools' curricula?

RQ2: How do Arkansas public high school teachers rate their students' 21st century literacy skills?

RQ3: Are there collective barriers to including 21st century literacy objectives in Arkansas public high school teachers' classrooms?

RQ4: To what extent do Arkansas teachers believe digital literacy, media literacy, and global literacy should be included in curriculum?

H1: Intellectual Capital Development will be positively related to innovation capacity (Crosling, Nair, & Vaithilingam, 2015).

H2: Integrity of the System will be positively related to innovation capacity (Crosling, Nair, & Vaithilingam, 2015).

RQ5: How are the other learning ecosystem variables (21st century literacies and climate for innovation) related to innovation capacity?

RQ6: Does Quality of the Education System (QES) moderate any of these relationships?

Method

When determining what population would provide the most rounded view of the learning ecosystem and innovation capacity within schools, the classroom would seem to be the main focus. Price-Dennis, Holmes, and Smith (2015) assert that if children are to be capable of consuming, producing, and distributing a variety of text both print and digital, then students should have access to pedagogies that "promote fluency with tenets of the 21st-century literacies framework" (p. 196). This notion heavily relies on the essence of inclusivity and equity-based pedagogies. The transfer of skills and knowledge relies on teachers' ability to integrate concepts into curriculum in a relevant way, especially those regarding technology (Willis, 2015).

Procedure

This study surveyed a sample of Arkansas secondary teachers. Principals from Arkansas public high schools were mailed and emailed a brief of the study and asked to forward the brief, including a URL for the survey, to their school's teachers (see Appendix A). The survey was administered using the survey software Qualtrics. Respondents were informed that the findings will be sent to the Arkansas Department of Education, which will use the report to determine how they can better provide for their students' and teachers' learning environments. A follow-up email was sent one and two week later to ask the principals to remind teachers of the survey.

Sample

Sixty-four schools were selected using a stratified random sampling procedure. The stratification variable was school size, based on enrollment figures from the Arkansas Activities Association (which classifies schools as 1A through 7A based on student enrollment in grades 9 through 12). For this study, schools were split into three categories: 1A – 3A schools (up to 300 students), 4A – 6A schools (up to 1150 students), and 7A schools (over 1200 students). This

resulted in a sample of 126 teachers. Respondents ranged in age from 20-34 (27%), 35-44 (34%), 45-54 (33%), and 55+ (32%). Of the sample, 62.7% of the respondents were female. Other demographic information collected included the number of years taught, with 40% of the sample teaching 21 or more years. Of the subjects represented in the sample there was a fairly equal representation with 35.7% being arts, humanities and social studies, 32.5% math and science, and 31.8% falling into all others. A majority of the teachers identify as teaching a college-bound student population (54.8%), followed by non-college bound population (31%). The grade primarily taught was 9th grade (29.4%), followed by 11th grade (27.8%), 10th grade (26.2%), and 12th grade (16.7%).

Measures

Intellectual Capital Development. Five separate variables are included in the concept of Intellectual Capital Development (INTC). One item measured *Internet Access* with teachers rating the level of Internet access in their school on a five- point scale ranging from extremely bad (1) to extremely good (5) (M = 1.85, SD = .87). To measure *technology resources* within the schools, one question asked teachers on a five-point scale ranging from widely unavailable (1) to widely available (5) to rate the extent that high-quality computers are available to their students (M = 2.99, SD = .86). Three items were summed to compute the *training and development* scale, which measured the investment in training and employee development from the school district, and the state, as well as the availability of technology teacher training in the district. One item was dropped from the scale (How much assistance does your school district get from your state for employee and training development?) to gain acceptable reliability. Teachers answered on a five-point scale ranging from none at all (1) to a great deal (5) (M = 7.26, SD = 1.88, $\propto = .78$). One item measured the amount of *technology-based, in-service teacher training* teachers had

attended this year (M = 8.10, SD = 6.48). To measure *brain drain*, teachers were asked to rate teachers in their school on their technological competency. For this question, teachers answered along a five-point scale ranging from very limited (1) to very extensive (5) (M = 3.25, SD = .83).

21st Century Literacies. The survey included items about three types of literacy (media literacy, digital literacy, and global literacy). It measured teachers' beliefs about the extent of students' skills in these literacies, the extent to which these literacies are already included in their school's curriculum, and how important those objectives are to their school's curriculum.

Student Literacy Skills. Items were summed to form scale scores for literacy skills variables. Six-items asked teachers to rate their students' abilities on specific *digital literacy* objectives. Teachers answered on a five-point scale ranging from terrible (1) to excellent (5) (M = 19.25, SD = 5.02, $\propto = .92$). The objectives for digital literacy were pulled from Hoechsmann and DeWaard (2015). Teachers were asked in an eleven-item scale to rate their students' ability on listed *media literacy* objectives. They rated students' abilities on a five-point scale ranging from terrible (1) to excellent (5) (M = 33.56, SD = 9.43, $\propto = .95$). Objectives for this literacy were obtained from Literat (2014). Teachers were asked in a sixteen-item scale to rate their students' abilities on listed *global literacy* objectives. They rated students' abilities on a five-point scale ranging from terrible (1) to excellent (5) (M = 46.20, SD = 15.77, $\propto = .98$). These objectives were obtained from the field-tested framework from the Council of Chief State School Officers' EdSteps Project (2011).

Included Objectives. Items were summed to form scale scores for the included objectives variables. For this variable teachers were asked to indicate to what extent each of the same *digital literacy* objectives were included into their school's curriculum. Teachers answered along a five-point scale ranging from none at all (1) to a great deal (5) (M = 18.30, SD = 4.47, $\propto =$

.94). Eleven-items asked teachers to indicate to what extent each of the *media literacy* objectives were already being included in their school's curriculum. Teachers answered along a five-point scale ranging from none at all (1) to a great deal (5) (M = 30.83, SD = 8.13, $\propto =$ .96). For *global literacy*, teachers were asked in sixteen-item scale to indicate to what extent each of the global literacy objectives were already being included into their schools' curriculum. Teachers answered along a five-point scale ranging from none at all (1) to a great deal (5) (M = 43.25, SD = 13.15, α = .99).

Objective Importance. For the variable objective importance one question asked teachers if they believed the objectives should be included in curriculum. For *digital literacy,* teachers answered along a five-point scale ranging from never (1) to always (5) (M = 3.89, SD = 1.07). The same question was asked to teachers pertaining to *media literacy* objectives. Teachers answered along a five-point scale ranging from never (1) to always (5) if they believed the media literacy objectives should be included in curriculum (M = 3.83, SD = 1.07). For the objective importance variable concerning *global literacy* objectives, the same question asked teachers if they believed the global literacy objectives should be included in curriculum. Teachers answered using a five-point scale ranging from never (1) to always (5) (M = 3.66, SD = 1.19).

Challenges to Incorporate Objectives. Items were summed to compute scales for the challenges to incorporate objectives variable. In a six-item scale taken from Purcell et al's (2012) PEW report on research in the digital world, teachers were asked to identify if the following: general resistance by colleagues and administrators, time constraints, pressure to teach to assessments, lack of resources and/or access to digital technologies among students, your own lack of comfort knowledge, or training with digital technologies, and lack of technical support were either major, minor, or not challenges for them to incorporate *digital literacy* objectives

into their classroom pedagogy. Teachers answered along a three-point scale (major challenge, minor challenge, or not a challenge). One item was deleted (Your own lack of comfort, knowledge, or training with digital technologies) to obtain acceptable reliability ($M = 9.98$, $SD = 2.46$, $\propto = .71$). The same six-item scale was used for *media literacy* objectives. Teachers answered that the listed barriers were either major, minor, or not a challenge for incorporating more of the media literacy objectives into their classroom pedagogy ($M = 12.46$, $SD = 2.81$, $\propto = .75$). The same six-item scale was used for *global literacy* objectives. Teacher answered that the listed barriers were either major, minor, or not a challenge for incorporating more of the global literacy objectives into their classroom pedagogy ($M = 12.40$, $SD = 2.84$, $\propto = .76$).

Climate for Innovation. To assess teachers' perceptions of each school's climate for innovation, participants answered a modified twenty-six-item scale used by Scott and Bruce (1994). This scale was a modification and extension of the innovative climate measure developed by Siegal and Kaemmerer (1978). Items were summed to compute scales for the climate for innovation variable. These items were submitted to an exploratory factor analysis using varimax rotation (Table 4). That analysis showed that seventeen items adequately loaded onto four factors. Eight items loaded onto a factor measuring the school's *support for creativity* ($M = 27.90, SD = 5.77, \alpha = .87$). These items included questions pertaining to creativity being encouraged by curriculum, openness to solving problems in different ways, adequate time to pursue creative ideas, etc. Four items loaded onto the factor labeled *tolerance for differences* ($M = 9.83, SD = 3.72, \alpha = .85$). This scale included items associated with flexibility for students being different, how problems are solved, groupthink, etc. Three items loaded onto a factor labeled *preference for the status quo* ($M = 8.53, SD = 2.76, \alpha = .78$). The items that loaded onto this scale include school personnel sticking to tried and true ways, concern for the

status quo, and the reward system benefiting those who do not rock the boat. Finally, two items loaded onto a factor labeled *innovation resource* ($M = 6.52, SD = 2.02, \alpha = .68$). These two items were associated with personnel shortages and lack of funding.

---Insert Table 4 here---

Integrity of the System. Another variable adapted from Crosling, Nair, and Vaithilingam (2015) measures teachers' perceptions of transparency in decision-making and operations at a district and state level. Integrity systems that are sound allow flow of capital, talent, and resources. They also encourage transparency. Teachers indicated their level of agreement on a five-point scale ranging from strongly disagree (1) to strongly agree (5) (M = 30.30, SD = 6.73, $\propto = .87$). Examples of statements include involvement of teachers on achieving state learning standards, effect of policy and regulations from the state, openness of decision making at the district and state level, etc. (see Appendix B for a list of all items).

Quality of the Education System. Two variables comprise the concept of quality of the education system (QES). To measure *future success* (adapted from Crosling, Nair, & Vaithilingam, 2015), teachers were asked to rate on a five-point scale ranging from strongly disagree (1) to strongly agree (5) how they felt about the following statement: Students graduating from my school are equipped with skills and knowledge that will foster success in their futures (M = 3.69, SD = 1.02). To investigate the perceived quality of the educational system, participants were asked to give a *general assessment of their school and students*. Items were summed to form scales for the variable general assessment. A three-item scale asked teachers to assess their students' abilities on digital literacy, media literacy, and global literacy along a five-point scale ranging from terrible (1) to excellent (5) (M = 9.28, SD = 2.80, $\propto = .92$).

Capacity for Innovation. One question measured teachers' opinions of their school's ability to foster innovative ideas, projects, and/or products in their students on a five-point scale ranging from terrible (1) to excellent (5) the schools' (M = 3.46, SD = 1.02).

Results

The data were analyzed using the statistical package SPSS. Responses that were not fully complete were discarded (one case of a school counselor who did not select a grade taught was retained for analysis). Data addressing the first three research questions were compared according to three teacher demographics: school size (small: 1A-3A, medium: 4A-6A, and large: 7A), years of experience (5 years or fewer; 6-10 years; 11-15 years; 16-20 years; 21+ years), and the teacher's subject area (arts, humanities, and social studies; math and sciences; all others).

Research Question One

The first research question assessed teachers' perceptions of whether 21st century literacies are included in Arkansas high school curricula. Regarding digital literacy objectives, a one-way ANOVA (Table 5) revealed statistically significant mean scores by the teachers' school size, ($F = 3.08$, $df = 2, 123$, $p < .05$). A post hoc Tukey HSD test indicated that teachers in the smallest schools ($M = 17.15$, $SD = 4.23$) felt the objectives were less included in existing curricula than did teachers in medium-sized schools ($M = 19.47$, $SD = 4.34$). There was no statistically significant difference by school size in teachers' opinions about the inclusion of media literacy objectives, ($F = 2.03$, $df = 2, 123$, $p = .12$). For global literacy objectives, the one-way ANOVA revealed no statistical significance among teachers from different school sizes ($F = 2.99$, $df = 2, 123$, $p = .06$).

----Insert Table 5 here----

To test a relationship between teachers' opinions about the inclusion of 21st century literacy objectives in existing curricula and teachers' years of experience, a Pearson Product-Moment Correlation test was conducted. This test did not reveal a significant correlation between teaching experience and opinions about the extent to which digital literacy objectives are

included in existing curricula (r = -.07, n = 126, p = .43). The correlation between years teaching and the inclusion of media literacy objectives included was not significant (r = -.03, n = 126, p = .72). Also, the correlation between years teaching and the inclusion of global literacy objectives included was not significant (r = -.01, n = 126, p = .89).

Finally, teachers' opinions on the inclusion of 21st century literacy objectives in existing curricula were compared by their primary subject area (Table 6). A one-way ANOVA for digital literacy was statistically significant, (F = 8.76, df = 2, 123, p < .05). A post hoc Tukey HSD test showed that arts, humanities, and social studies teachers (M = 20.38, SD = 4.05) had significantly higher scores than did teachers in other subjects (M = 17.50, SD = 4.43) and math and science teachers (M = 16.81, SD = 4.18). The one-way ANOVA test for media literacy objectives did reveal significant differences among subject areas (F = 4.09, df = 2, 123, p < .05). A post hoc Tukey HSD test showed that teachers in the arts, humanities, and social studies (M = 32.64, SD = 7.50) had significantly higher scores than those in all other subjects (M = 31.78, SD = 8.91) and math and science teachers (M = 28.00, SD = 7.30). For the inclusion of global literacy objectives, a one-way ANOVA proved to be significant, (F = 4.93, df = 2, 123, p < .05). A post hoc Tukey HSD test again showed that arts, humanities, and social studies teachers (M = 46.40, SD = 12.58) reported a higher mean score than those in all other subjects (M = 44.90, SD = 12.21) and math and science teachers (M = 38.20, SD = 13.45).

----Insert Table 6 here----

Research Question Two

The second research question was concerned with how teachers ranked their students' 21st century literacy skills compared by school size, years of experience of the teacher, and by the teacher's primary subject area. Regarding digital literacy skills, a one-way ANOVA revealed

no statistical difference by how teachers ranked their students' digital literacy skills and school size ($F = 2.50$, $df = 2,\ 123$, $p = .09$. As for media literacy skills, the one-way ANOVA also proved no statistical significance ($F = .84$, $df = 2,\ 123$, $p = .43$). Finally, for global literacy skills no statistical significance was revealed ($F = 1.82$, $df = 2,\ 123$, $p = .17$).

----Insert Table 7 here----

To explored teachers' opinion of students' skills with 21st century literacies and teachers' years of experience, a Pearson Product-Moment Correlation was conducted. The negative correlation between years teaching and teachers' opinion of student digital literacy skills was significant ($r = -.01$, $n = 126$, $p = .92$). Also, there was significance for years teaching and teachers' opinion of global literacy skills ($r = .01,\ n = 126,\ p = .93$), There was no significance for opinions on student's media literacy skills and years teaching ($r = -.09$, $n = 126,\ p = .31$).

Finally, teachers' opinion of students' 21st century literacy skills were compared by teacher's primary subject area (Table 8). A one-way ANOVA for digital literacy was statistically significant ($F = 3.73$, $df = 2,\ 123$, $p < .05$). A post hoc Tukey HSD test showed that teachers in the arts, humanities, and social studies ($M = 20.31$, $SD = 4.56$) had significantly higher scores than teachers in all other subjects ($M = 19.80,\ SD = 5.06$), and math and science ($M = 17.56$, $SD = 5.13$). The one-way ANOVA for media literacy skills was statistically significant ($F = 5.04$, $df = 2,\ 123$, $p < .05$). A post hoc Tukey HSD test showed that teachers in the arts, humanities, and social studies ($M = 35.56$, $SD = 8.64$) scored significantly higher than teachers in all other subjects ($M = 35.13$, $SD = 9.87$) and math and science ($M = 29.85$, $SD = 8.91$). The one-way ANOVA for global literacy skills did not reveal significant differences among these groups, ($F = .69$, $df = 2,\ 123$, $p = .51$.

----Insert Table 8 here----

Research Question Three

The third research question asked how the following barriers, collectively, present challenges for including 21st century literacy objectives in teachers' classrooms (general resistance by colleagues and administrators, time constraints, pressure to teach to assessments, lack of resources and/or access to digital technologies among your students, your own lack of comfort, knowledge, or training with digital technologies, and lack of technical support to use digital technologies consistently) compared by school size, teacher experience, and teacher's subject area. A one-way ANOVA for challenges to include digital literacy objectives compared by school size revealed no significance, ($F = 1.74$, $df = 2, 123$, $p = .18$). For challenges of including media literacy objectives by school size, the one-way ANOVA resulted in no significance, ($F = 2.46$, $df = 2, 123$, $p = .09$). For global literacy objectives the one-way ANOVA also result in no significance, ($F = 1.05$, $df = 2, 123$, $p = .35$).

----Insert Table 9 here----

A one-way ANOVA for challenges to include digital literacy objectives compared by teacher's years of experience resulted in no significance ($F = .18$, $df = 4, 121$, $p = .95$). A one-way ANOVA for challenges to include media literacy objectives compared by teacher's years of experience resulted in no significance ($F = .67$, $df = 4, 121$, $p = .61$). A one-way ANOVA for challenges to include global literacy objectives compared by teacher's years of experience resulted in no significance ($F = .25$, $df = 4, 121$, $p = .91$).

To explore the challenges for including 21st century literacies compared by teachers' primary subject area a one-way ANOVA was conducted. To determine the challenges for including digital literacy objectives compared by subject area, a one-way ANOVA resulted in significance ($F = 4.10$, $df = 2, 123$, $p < .05$). A post hoc Tukey HSD test showed that teachers in

math and sciences (M = 12.56, SD = 2.68) scored significantly higher than teachers in all other subjects (M = 11.48, SD = 2.18), and arts, humanities, and social studies (M = 10.98, SD = 2.86). For challenges including media literacy objectives compared by subject a one-way ANOVA resulted in significance, (F = 5.27, df = 2, 123, $p < .05$). A post hoc Tukey HSD test revealed that teachers in math and sciences (M = 12.61, SD = 2.83) scored significantly higher than teachers in all other subjects (M = 11.35, SD = 2.41), and arts, humanities, and social studies (M = 10.73, SD = 2.86). For global literacy a one-way ANOVA resulted in significance, (F = 5.38, df = 2, 123, $p < .05$). A post hoc Tukey HSD test showed teachers in math and science (M = 12.71, SD = 2.78) scored significantly higher than teachers in all other subjects (M = 11.38, SD = 2.45), and arts, humanities, and social studies teachers (M = 10.80, SD = 2.96).

----Insert Table 10 here----

Research Question Four

The fourth research question was concerned with the variable objective importance and asked teachers to indicate if they believed these three literacies should be included in Arkansas high schools' curricula. The sample's mean score for the inclusion of digital literacy objectives was 3.89 (SD = 1.07). Nearly two-thirds (65.8%) of the respondents indicated that digital literacy objectives should be included always or most of the time. The overall mean score for media literacy objectives was 3.83 (SD = 1.07), and again about two-thirds (69.1%) of the respondents suggested media literacy objectives be included in curriculum always or most of the time. For global literacy, the mean score was 3.66 (SD = 1.19). Over half (59.5%) of respondents indicated that global literacy objectives should be included always or most of the time.

In a secondary analysis, objective importance was compared by school size, years teaching, and by teacher's primary subject area. A one-way ANOVA revealed no statistically

significant differences when compared by school size or years of teaching experience (Table 11). The one-way ANOVA did prove to be statistically significant when compared by teacher's primary subject area. Mean scores for the importance of digital literacy objectives were significant ($F = 10.29$, $df = 2, 123$, $p < .05$). A post hoc Tukey HSD test showed that teachers in math and science teachers ($M = 3.32$, $SD = 1.01$) had significantly lower importance ratings than did arts, humanities, and social sciences teachers ($M = 4.09$, $SD = .95$) and those in all other subjects ($M = 4.25$, $SD = 1.03$). The ANOVA test for the importance of media literacy objective importance was also significant ($F = 7.64$, $df = 2, 123$, $p < .05$). Here, a post hoc Tukey HSD test again indicated that math and science teachers ($M = 3.32$, $SD = 1.13$) had significantly lower importance ratings than did teachers in arts, humanities, and social studies ($M = 4.02$, $SD = .87$) and those in all other subjects ($M = 4.13$, $SD = 1.07$). Finally, mean scores for the importance of global literacy objectives also proved to be significant ($F = 8.25$, $df = 2, 123$, $p < .05$). As with the other literacies, a post hoc Tukey HSD test showed that math and science teachers ($M = 3.07$, $SD = 1.17$) had significantly lower importance ratings than did teachers in the arts, humanities, and social studies ($M = 3.93$, $SD = 1.03$) and those in all other subjects ($M = 3.95$, $SD = 1.18$).

----Insert Table11 here----

Regression Analysis (H1, H2, RQ5, RQ6)

A hierarchical regression analysis was performed to test the relationships between the dependent variable (innovation capacity) and the independent variables intellectual capital development (which includes training and development, Internet access, in-service training, and brain drain variables), 21st century literacies (which includes ratings students' digital, media, and global literacy skills and ratings of those literacies' inclusion in current curricula), climate for innovation, and integrity of the system. The independent variables were entered into four blocks

in a stepwise fashion. The first step in the regression model included demographic control variables (gender, majority of the teachers' student population, and primary grade level taught). The second step included the teacher-grouping variables tested in the first three research questions (years of teaching experience, primary subject area, and the school size). In the third step, learning ecosystem variables were included in the regression (intellectual capital development, 21st century literacies, climate for innovation, and integrity of the system).

In step one of the model, only about 2% of the variance was accounted for by the first round of demographic variables ($R^2 = .02$). None of which were a significant predictor of innovation capacity. Step two added another 4% of variance explained ($R^2 = .04$). Again, none of the second round of demographic variables significantly predicted innovation capacity. The third step of the model proved to be significant (F (12, 107) = 6.05) and explained around 50% of the variance ($R^2 = .50$). In terms of individual variable relationships, intellectual capital development included training and development ($\beta = .16$, p = .08), Internet access ($\beta = -.05$, p = .59), in-service training ($\beta = -.01$, p = .90), and brain drain variables ($\beta = .01$, p = .92). None of which significantly predicted innovation capacity, thus hypothesis 1 was not supported. Integrity of the system, also in step three of the model, proved to be a significant predictor of innovation capacity ($\beta = .18$, p = .04). Thus, hypothesis two was supported.

The fifth research question explored the influence of 21st century literacies and innovation climate, also in step three of the model, on innovation capacity. Here, digital literacy skills ($\beta = .14$, p = .28), digital literacy objectives included ($\beta = .24$, p = .08), media literacy skills ($\beta = -.04$, p = .76), media literacy objectives included ($\beta = -.15$, p = .29), and global literacy objectives included ($\beta = .10$, p = .41) were not significant predictors. However, global

literacy skills ($\beta = .27, p = .01$) did significantly predict innovation capacity. Climate for innovation ($\beta = .10, p = .17$) was not significant.

----Insert Table 12 here----

In the regression model's fourth step, quality of the education system was added to determine if it moderated any of the previously stated relationships (RQ 6). This step explained an additional four percent of the variance ($F(2, 105) = 6.232$). Further, the significant predictors in the first two steps were no longer statistically significant. Step three still explained around 50% of the variance. (Table 13). Twenty-first century literacies variables digital literacy skills, digital literacy included objectives, media literacy skills, media literacy objectives included, global literacy objectives included, and climate for innovation once again were not statistical significant. However, once QES was added in the fourth step of the model integrity of the system ($\beta = .15, p = .07$) and global literacy skills ($\beta = .20, p = .06$) were no longer significant predictors of innovation capacity. Thus, QES proved to be moderator to those relationships.

----Insert Table 13 here----

Discussion

The purpose of this study was to explore teachers' perceptions of Arkansas public high schools' capacity for innovation regarding tenets of 21st century literacy skills. The International Society for Technology in Education (ISTE) and the State Educational Technology Directors Association (SETDA) embrace a new vision of learning in which the focus of education is teaching students to become critical thinkers, problem solvers, innovators, effective communicators, collaborators, and intrinsically motivated learners (Vockley, 2007). These organizations stress the need for globally aware citizens who are civically engaged and fluent in information, media, and technology skills.

This study indicates that two teacher demographics influence teachers' opinions of students' skills. First, there is a significant correlation between the teacher's years of experience and their opinions on their students' digital and global literacy skills. For digital literacy skills the correlation is negative; therefore, the more years of experience a teacher has the less likely they are to rank their students positively on their digital literacy skills. Regarding global literacy skills, the relationship between teachers' opinion and skill assessment is positive; thus the more experience the teacher has the more likely they are to positively rate their students' global literacy skills. There could be many explanations for this relationship. First, younger teachers are more likely to be digital natives, thus have stronger digital skills themselves (New Media, 2005) and potentially be more capable of accurately assessing students' skills. Alternatively, younger teachers might be over assessing their students' literacy skills and more experienced teachers might be more capable of accurate student skill assessments. A number of studies have been conducted that conclude the relationship between years of teaching and student achievement is not simple (Clotfelter, Ladd & Vidgor, 2007; Croninger, Rice, Rathbun, & Nishio, 2007; Rowan,

Correnti, & Miller, 2002; Sandoval-Hernandez & Jaschinski, 2015). In many educational systems the students of more experienced teachers achieved better than students of less experienced teachers, and in some cases the opposite was found. Further exploration into how Arkansas teachers are making student assessments would need to be conducted.

Teachers' opinions of students' 21st century literacy skills also differed by the subject area taught. For both digital literacy and media literacy skills, teachers in arts, humanities, and social studies reported highest mean scores for their students' literacy skills, while the lowest mean scores were reported from teachers in math and science. This conclusion is expected, especially for media literacy, as these literacy objectives are already incorporated into Common Core State Standards for Language Arts and History/Social Studies (National Association for Media Literacy Education, 2014). Renee Hobbs (2005) notes that subject areas including health education, social studies, English language arts, communication arts, and fine and performing arts are those most frequently referenced to media literacy in state curriculum documents. Media literacy is not emerging because of state or school district initiatives, but because of individual teachers who value media, technology, and popular cultures influence on interactions with students. Teachers in the arts, humanities, and social sciences are obviously finding the importance of including these literacies within the curriculum. However, as most of the frameworks for 21st century competencies advocate, it is important to integrate these literacies across subject areas (Voogt, Erstad, Dede, & Mishra, 2013).

In addition to gauging students' skills with these technologies, this study explored perceptions of these objectives' place within current curricula. Here, school size seemed to influence teachers' perceptions on included objectives. For digital literacy objectives alone, school size influenced teachers' perceptions that digital literacy objectives are included in current

curricula. The smallest schools perceived digital literacy objectives to be less included into their schools' existing curriculum compared to medium-sized schools, which reported the highest mean scores for included objectives. Reinking (1994) mentions that dramatic and pedagogical shifts would be needed for digital literacy to be implemented into the curriculum. It could be that these smaller schools' limited resources make these shifts difficult in their curriculum. Another potential explanation is that these smaller schools have less digitally oriented class options, such as online, distance learning class, broadcasting, multimedia classes, etc.

While school size was related to the inclusion of digital literacy objectives, teachers reported that there were no barriers to including them in their classrooms. It could be that the barriers tested for this study do not tap into the reason why the smallest schools would report lower levels of included digital literacy objectives. The barriers mostly cover challenges within the school, such as general resistance by colleagues and administrators, time constraints, lack of resources, lack of technical support, etc. So it could be that these barriers originate outside the school at the level of district administration or state education departments. The New Media Consortium (2005) listed many barriers that could be hindering the understanding and utility of 21st century literacies. Some of these pertain to policy changes at the national, state, and local-level; systematic barriers such as lack of incentive for institutional change and resistance to change; and the lack of a critical process around teaching and evaluating new forms of literacy. Often when organizations implement policy changes that are linked to high-stake outcomes, in this case curriculum shifts, the individuals within the system are unaware of unintended consequences (Baert, 1991). In this case, policy changes could affect the inclusion of literacy objectives at the local level. The lack of a critical process could be the result of digital and media

literacies being fairly new concepts (MediaSmarts, 2014c). Hence, there is little consensus on why or how to bring these literacies to public schools (Hobbs, 2005).

Teachers' subject area also influenced perceptions of whether or not these objectives are included in existing curricula. The data indicated that subject area influenced perceptions of the inclusion of digital, media, and global literacy objectives within curricula. Arkansas high school teachers had strong beliefs that these objectives were already included in their school's curriculum. The highest mean scores for these literacies were for arts, humanities, and social studies teachers, while the lowest mean scores were reported for math and science teachers. Regarding digital and media literacy, this finding supports why teachers from arts, humanities, and social studies would report higher skill sets of their students. These teachers believe they are already providing instruction on these skills. As for collective barriers to include these literacy objectives, teachers in math and science reported the highest level of barriers for including digital, media, and global literacy objectives into their classrooms. Arts, humanities, and social studies teachers reported the lowest amount of collective barriers for including these objectives. This goes back to the alignment of literacy objectives and content area. Arts, humanities, and social studies are some of the classes most frequently cited for media literacy objectives (Hobbs, 2005).

It is not surprising to find that math and science courses are those that struggle most to include digital, media, and global literacies into their curriculum due to content alignment. However, as Vockley (2007) argues, it is important to understand that most work within organizations (outside of education) is not neatly categorized into "math problems" or "science issues" (p. 9). Barnett (2011) highlights the overarching issue: "The fact is, throughout this century, we will be faced with a productive paradox: how we can consistently fulfill the

traditional side of our mission and adapt to changing conditions?" (p. 36) This suggests that 21st century literacies should not be confined to obvious subject alignments. As most of the 21st century frameworks advocate, it is important to integrate these literacies across subjects and to emphasize the acquisition of key literacy competencies (Voogt, Erstad, Dede, & Mishra, 2013).

It is not a question if these objectives are important. This study's findings indicate that the majority of teachers believe that the objectives for digital, media, and global literacies should be included in curricula. Teaching these literacies is not a predictor of innovation capacity, so the regression sought to gain a better understanding of variables that potentially predict innovation capacity in Arkansas public high schools.

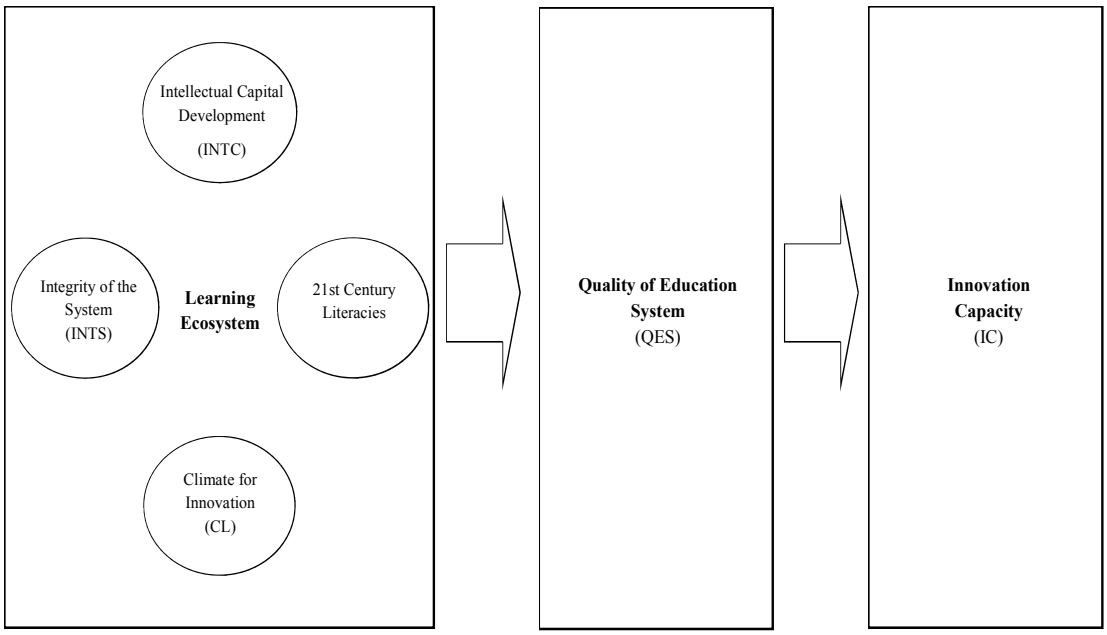

Figure 5. Innovation Capacity Model. This figure illustrates the regression model to test innovation capacity.

With regards to the Innovation Capacity Model, this study offers a few interesting findings. First, the variable, quality of the education system, did moderate the learning ecosystem

factors and innovation capacity. Whenever QES was added to the model, all other variables that were once significant drop out of the model. The factors of the learning ecosystem, intellectual capital development, 21st century literacies, climate for innovation, and integrity of the system outline resources that are intended to work together, underpin the development of a quality education system, which would then foster creative thinking and lead to innovation (Crosling, Nair & Vaithlingam, 2015). Whereas in the original study (Crosling, Nair & Vaithlingam, 2015) intellectual capital development influences overall innovation capacity, this study indicates that it was not significantly related to the innovation capacity of Arkansas public high school systems. Of the variables that comprised intellectual capital development, one should be singled out for further investigation. The variable associated with training and development approached significance. It is possible that with a larger, more diverse sample we could see training and development of teachers regarding technology-based teacher training have more influence on innovation capacity than noted in this study.

Teacher training and development programs are an obvious place to start introducing technology, but evidence suggest that they programs have not been successful at preparing new teachers to use technology effectively (Moursund& Bieefeldt, 1999; US Department of Educational, 2000; Yildirim, 2000) A reason could be that numerous education programs have made efforts to implement technology, but the strategies to do so are complex and diverse. To date there is no agreement on how to effectively introduce technology to preservice teachers (Kay, 2006). However, Spector (2016) states that technologies and workplace training can help "maintain and highly skilled and adaptive workforce" (p. 147).

If training and development is a predictor of innovation capacity, then it is important to reason through the complex issues of development programs mentioned above. Moursund and

Bielefeldt (1999) had three recommendations on how to improve the effectiveness of how teacher education programs integrate technology that might be helpful: (1) instructional technology should be integrated through all teacher education courses; (2) faculty members should model technology-integrated teaching and learning; and (3) encourage field experiences with mentor teachers to support and encourage pre-service student teachers as they practice teaching with technology. By integrating technology into all teacher education courses it ensures that undergraduate students are gaining experience on how to integrate instructional technologies into all aspects of their educational training. The second and third recommendations go hand-in-hand. More experienced teachers should be models for less experienced teachers to follow and help when integrating technology into less experienced teachers' lessons and activities.

In this study, integrity of the system focused on academic learning standards at the district and at the state levels. Sound systems encourage transparency in decision-making and day-to-day operations, as well as organizational adherence to best practices (Nair & Vaithilingam, 2013). In this study, the integrity of the system was a strong predictor of innovation capacity. Vockley (2007) notes that in order for the U.S. educational system to foster innovative teaching and learning, there must be robust educational support systems. This includes standards and assessments, curriculum and instruction, and administration. Arkansas public high school teachers reported positive beliefs about the transparency of their school's decision-making and operations. To continue fostering innovation, the state and individual school districts can use technology to update standards more frequently, compare state and school district standards and curriculum, and work collaboratively to infuse them with 21st century learning objectives.

Teachers' perceptions of students' global literacy skills also significantly influence innovation capacity. An explanation for this could be that 40% of the teachers in this sample had over 21 years of teaching experience. The data indicated that more experienced teachers rated their student's global literacy skills more favorably. Given the significant relationship between global literacy skills and innovation capacity, one could argue that Arkansas public high schools are on the right track in regards to their students' global literacy skills. This is a positive finding, considering that the majority of respondents in this study reported teaching primarily college-bound students. Nair, Norman, Tucker & Burkert (2012) state that faculty members in higher education often suggest that the most significant learning experience for their students is their interaction among different worldviews. So perhaps this means Arkansas public high schools are setting up their students for success in higher education.

Teachers' perceptions of digital literacy's inclusion in existing curricula approached significance as a predictor of innovation capacity. Despite this, future research should test this relationship with a larger, more diverse sample. While there are objectives currently under the Library Media Curriculum Framework for the state of Arkansas that include some digital literacy objectives (Arkansas Department of Education, 2013), it is possible that smaller schools are confronting challenges not tested in this study. For smaller schools to produce innovative students, more inquiry on these barriers is necessary.

Finally, this study found that the quality of the education system was a moderating variable between the learning ecosystem factors and innovation capacity. Whenever QES was added to the regression model all factors that were once significant to innovation capacity (integrity of the system and global literacy skills) drop out of the model. This suggest that the influence that integrity of the system and global literacy skills are changed by the variable QES.

One possible explanation is that Arkansas public high school teachers have more of a macro perspective on assessment. The QES variable asks for a more general assessment on literacy sills and student's future preparedness, whereas a majority of the other variables are on individual assessment. Further suggesting that future research should study how teachers are making assessment of their students and their school system.

An obvious limitation to this study is the size and diversity of the sample. Arkansas schools are unique, just as every state has unique educational systems. A national, diverse sample would better determine the validity of the model and determinants of innovation capacity. As Boyle and Schmierbach (2015) state, the degree that a study's results are applicable to a larger population refers to the validity. A large, diverse sample aids in the generalizability of a study.

The idea behind creating a 21st century education system is about making sure that all students are prepared to succeed in this highly competitive world. To do so, it is important that educational systems strive to utilize technology for the development of 21st century skills, support innovation in teaching and learning, and create educational system factors that are vigorous and impactful. Sustained, directed effort can work toward creating an educational system that will help educators, policy makers, and the community bring 21st century literacies to the forefront of the conversation.

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Tables and Figures

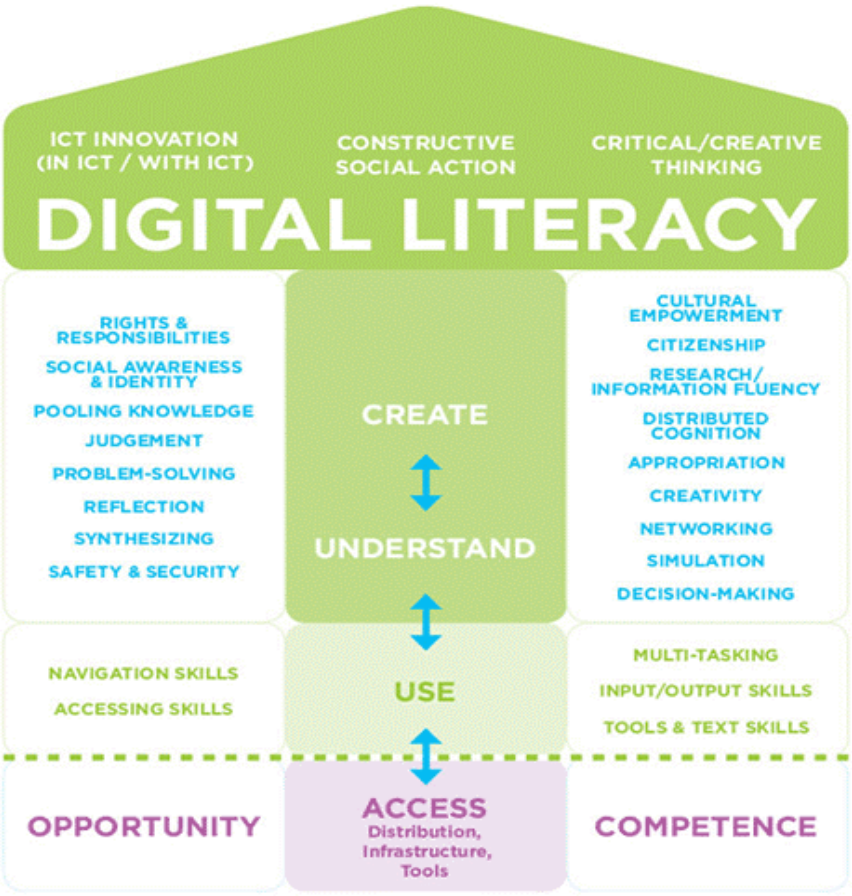

Figure 1. Digital Literacy. This figure illustrates skills under digital literacy. MediaSmarts. (2014b) *Digital Literacy Model.* Retrieved from http://mediasmarts.ca/digital media-literacy-fundamentals/digital-literacy-fundamentals

Table 1: Digital Literacy Skills

1.	The ability to apply digital tools to gather, evaluate, and use information
2.	The ability to use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources
3.	Demonstrate creative thinking, construct knowledge, and develop innovative products and processing using technology
4.	Understand human, cultural, and societal issues related to technology and practice legal and ethical behavior
5.	The ability to use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others
6.	Demonstrate a sound understanding of technology concepts, systems, and operations

Table 2: New Media Literacy Skills

1.	The capacity to experiment with one's surroundings as a form of problem-solving
2.	The ability to adopt alternative identities for the purpose of improvisation and discovery
3.	The ability to interpret and construct dynamic models of real-world processes
4.	The ability to meaningfully sample and remix media content
5.	The ability to scan one's environment and shift focus as needed to salient details
6.	The ability to interact meaningfully with tools that expand mental capacities
7.	The ability to pool knowledge and compare notes with others towards a common goal
8.	The ability to evaluate the reliability and credibility of different information sources
9.	The ability to follow the flow of stories and information across multiple modalities
10.	The ability to search for, synthesize, and disseminate information
11.	The ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms
12.	The ability to create and understand visual representations of information

Table 3: Global Literacy Skills

1.	The ability to identify an issue, generate a question, explain the significance of locally, regionally, or globally focused researchable questions
2.	The ability to use a variety of languages and domestic and international sources and media to identify and weigh relevant evidence to address a globally significant researchable question
3.	The ability to analyze, integrate, and synthesize evidence collected to construct coherent responses to globally significant researchable questions
4.	Develop an argument based on compelling evidence that considers multiple perspectives
5.	The ability to recognize and express their own perspectives on situations, events, issues, or phenomena and identify the influence on that perspective
6.	Examine perspectives of other people, groups, or schools of thought and identify the influence on those perspectives
7.	Explain how cultural interactions influence situations, events, issues, or phenomena, including the development of knowledge
8.	The ability to articulate how differential access to knowledge, technology, and resources affects quality of life and perspective
9.	Recognize and express how diverse audiences may perceive difference meaning form the same information and how that affects communication
10.	The ability to listen to and communicate effectively with diverse people, using appropriate verbal and nonverbal behavior, languages, and strategies
11.	The ability to select and use appropriate technology and media to communicate with diverse audiences
12.	The ability to reflect on how effective communication affects understanding and collaboration in an independent world
13.	The ability to identify and create opportunities for personal or collaborative action to address situations, events, issues, or phenomena in ways that improve conditions
14.	Assess options and plan action based on evidence and the potential for impact, taking into account previous approaches, varied perspectives, and potential consequences
15.	The ability to act, personally or collaboratively, in creative and ethical ways to contribute to improvement locally, regionally, or globally and assess the impact of actions taken
16.	The ability to reflect on their capacity to advocate for and contribute to improvements locally, regionally, or globally

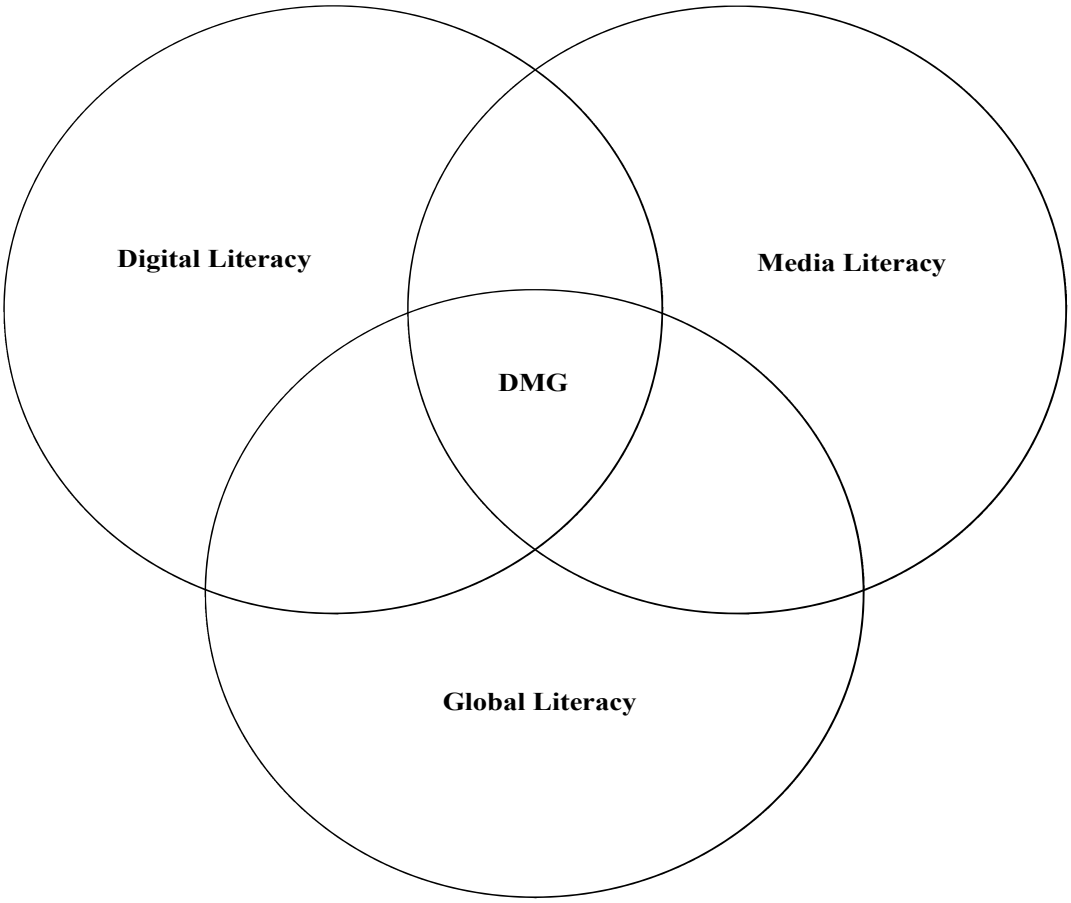

Figure 2. DMG Model. This figure illustrates the intersection of the three literacies digital, media, and global.

Jacobs, H. (2014). Digital-Media-Global literacies & learning. *Independent School,* 60-68.

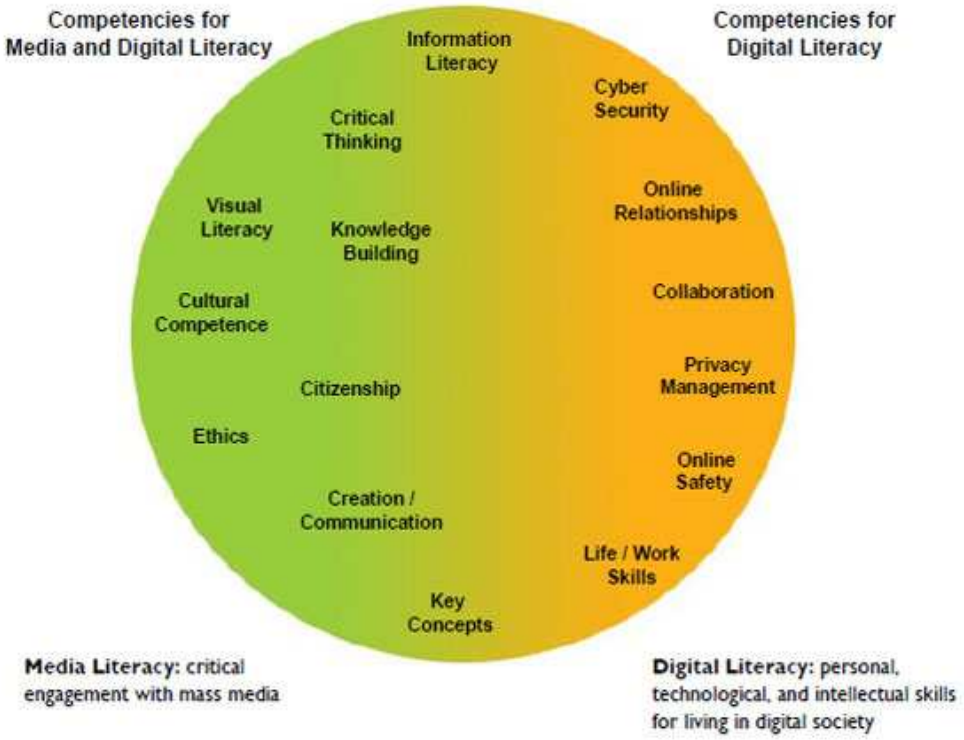

Figure 3. Intersection of digital and media literacy. This figure illustrates the intersection of digital literacy and media literacy.

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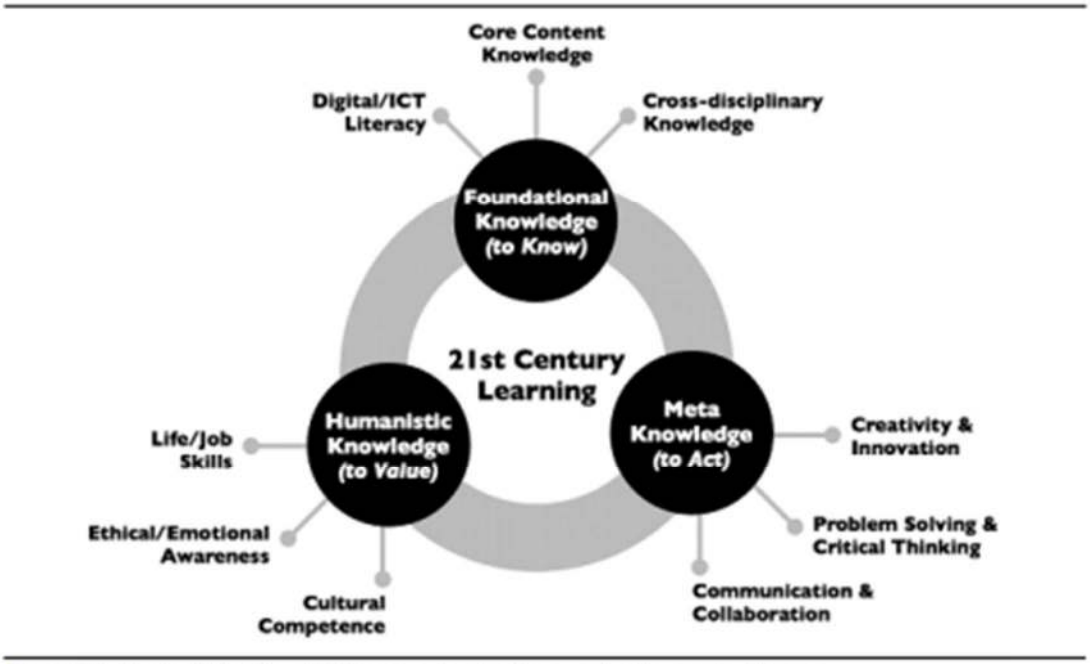

Figure 1. Synthesis of 15 different 21st century learning frameworks into one visual image.

Figure 4. 21st Century Learning. This figure illustrates knowledge and skills for 21st century learning.

Kereluik, K., Mishra, P., Fahnoe, C., & Terry, L. (2013). *21st century learning framework.*

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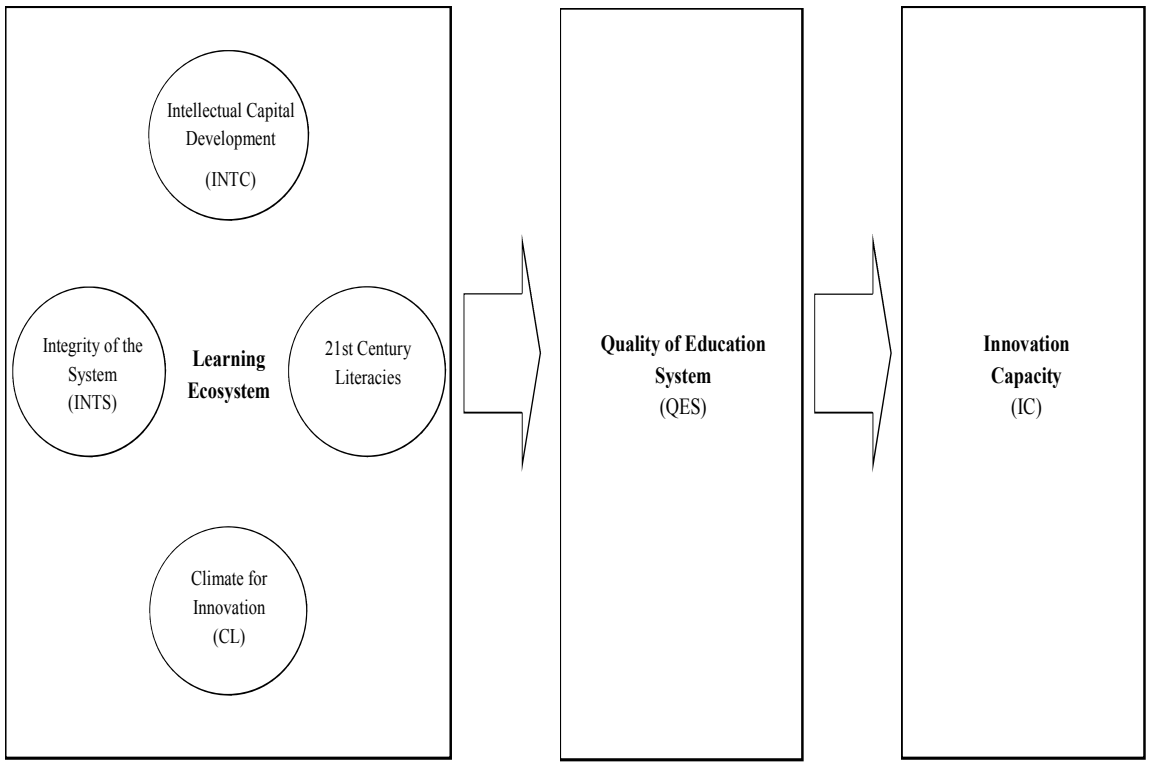

Figure 5. Innovation Capacity Model. This figure illustrates the regression model to test innovation capacity.

Table 4: *Climate for Innovation Factor Analysis*

	Factor 1	Factor 2	Factor 3	Factor 4
	Support for Creativity	Tolerance for Differences	Preference for Status Quo	Resources
Creativity is encouraged by our curriculum.	**.81**	-.14	-.16	-.01
The ability to function creatively is encouraged by our school's curriculum.	**.86**	-.13	-.13	-.03
Around here, students are allowed to try and solve the same problem in difference ways.	**.78**	-.22	-.09	-.04
There is adequate time available for students to pursue creative ideas.	**.68**	.09	-.07	-.18
Students that think creatively are respected by other students.	**.64**	-.13	.15	-.14
Our school is open and responsive to change.	**.59**	-.39	-.36	-.08
Out school publicly recognizes those who are innovative	**.57**	-.07	-.42	-.14
Our school can be described as flexible and continually adapting to change.	**.53**	-.21	-.43	.01
In our school, a student can get in a lot of trouble by being different.	-.01	**.82**	.07	.14
Students in our school are expected to deal with problems in the same way.	-.23	**.80**	.21	-.02
The best way to get along in our school is to think the way the rest of the group does.	-.22	**.74**	.35	.13
A student can't do things that are too different in our school without provoking anger.	-.15	**.70**	.32	.27
In our school, we tend to stick to tried and true ways.	.02	.12	**.84**	.11
Our school seems to be more concerned with the status quo than with change.	-.21	.35	**.71**	.02
The reward system in our school benefits mainly those who don't rock the boat.	-.19	.32	**.68**	.06
Personnel shortages inhibit innovation in our school.	-.20	.10	.03	**.84**
Lack of funding to investigate creative ideas is a problem in our school.	-.07	.20	.13	**.82**
Eigenvalues	6.42	2.22	1.38	1.08
Variance Explained	38.12	13.08	8.13	6.33
Cronbach's Alpha	.87	.85	.78	.68

Table 5: ANOVA for Literacy Objectives Included in Curriculum by School Size

	M	SD	F	df
Digital Literacy				
Group 1	17.15*	4.23	3.09	2,123
Group 2	19.47*	4.34		2,123
Group 3	18.58	4.65		2,123
Media Literacy				
Group 1	29.02	7.23	2.03	2,123
Group 2	31.90	6.79		2,123
Group 3	32.08	9.84		2,123
Global Literacy				
Group 1	39.69	12.38	2.99	2,123
Group 2	45.90	12.51		2,123
Group 3	45.03	13.99		2,123

Note. * Denotes means with statistically significant differences ($p < .05$)

Table 6: ANOVA for Literacy Objectives Included in Curriculum by Subject

	M	SD	F	df
Digital Literacy				
Arts, humanities, social studies	20.38*	4.05	8.76	2,123
Math and science	16.80*	4.18		2,123
All others	17.50	4.43		2,123
Media Literacy				
Arts, humanities, social studies	32.64*	7.50	4.09	2,123
Math and science	28.00*	7.30		2,123
All others	31.78	8.91		2,123
Global Literacy				
Arts, humanities, social studies	46.40*	12.58	4.93	2,123
Math and science	38.20*	13.45		2,123
All others	44.90	12.21		2,123

Note. * Denotes means with statistically significant differences ($p < .05$).

Table 7: ANOVA for Student Literacy Skills by School Size

	M	SD	F	df
Digital Literacy				
Small	18.02	5.07	2.50	2,123
Medium	20.26	5.73		2,123
Large	19.78	3.92		2,123
Media Literacy				
Small	32.21	8.817	.84	2,123
Medium	34.08	10.25		2,123
Large	34.70	9.35		2,123
Global Literacy				
Small	42.92	13.92	1.82	2,123
Medium	48.24	16.96		2,123
Large	48.53	16.29		2,123

Note. * Denotes means with statistically significant differences ($p < .05$).

Table 8: ANOVA for Student Literacy Skills by Subject

	M	SD	F	df
Digital Literacy				
Arts, humanities, social studies	20.31*	4.56	3.73	2,123
Math and science	17.56*	5.13		2,123
All others	19.80	5.06		2,123
Media Literacy				
Arts, humanities, social studies	35.56*	8.64	5.04	2,123
Math and science	29.85*	8.91		2,123
All others	35.13	9.87		2,123
Global Literacy				
Arts, humanities, social studies	47.44	12.26	.69	2,123
Math and science	43.93	18.79		2,123
All others	47.45	15.94		2,123

Note. * Denotes means with statistically significant differences ($p < .05$).

Table 9: ANOVA for Challenges to Included Objectives by School Size

	M	SD	F	df
Digital Literacy				
Small	12.17	2.24	1.74	2,123
Medium	11.11	3.22		2,123
Large	11.55	2.51		2,123
Media Literacy				
Small	12.13	2.17	2.46	2,123
Medium	10.79	3.27		2,123
Large	11.55	2.90		2,123
Global Literacy				
Small	12.00	2.53	1.05	2,123
Medium	11.11	3.19		2,123
Large	11.60	2.85		2,123

Note. * Denotes means with statistically significant differences ($p < .05$).

Table 10: ANOVA for Challenges to Included Objectives by Subject

	M	SD	F	df
Digital Literacy				
Arts, humanities, social studies	10.98*	2.86	4.10	2,123
Math and science	12.56*	2.68		2,123
All others	11.48	2.18		2,123
Media Literacy				
Arts, humanities, social studies	10.73*	2.86	5.27	2,123
Math and science	12.61*	2.83		2,123
All others	11.35	2.41		2,123
Global Literacy				
Arts, humanities, social studies	10.80*	2.96	5.38	2,123
Math and science	12.71*	2.78		2,123
All others	11.38	2.45		2,123

Note. * Denotes means with statistically significant differences ($p < .05$).

Table 11: ANOVA for Objective Importance by Subject

	M	SD	F	df
Digital Literacy				
Arts, humanities, social studies	4.09^{α}	.95	10.29	2,123
Math and science	$3.32^{\alpha\beta}$	1.01		2,123
All others	3.89^{β}	1.03		2,123
Media Literacy				
Arts, humanities, social studies	4.02^{α}	.87	7.64	2,123
Math and science	$3.32^{\alpha\beta}$	1.13		2,123
All others	4.13^{β}	1.07		2,123
Global Literacy				
Arts, humanities, social studies	3.93^{α}	1.03	7.64	2,123
Math and science	$3.07^{\alpha\beta}$	1.17		2,123
All others	3.95^{β}	1.18		2,123

Note. Superscripts denote means with statistically significant differences ($p < .05$).

Table 12: Linear Regression Predicting Innovation Capacity without QES

	B	SE B	β	t	Sig.
Step 1 Demographics					
Student population	.10	.06	.13	1.66	.10
Gender	.02	.16	.01	.14	.89
Grade level	-.01	.07	-.01	-.12	.90
Adj. $R^2 = -.01$					
F (3, 122) = .80, $p < .05$					
Step 2 Other Demographics					
Years Teaching	.05	.05	.07	.86	.39
Subject	.06	.10	.05	.59	.56
School Size	-.04	.10	-.03	-.43	.67
Adj. $R^2 = -.01$					
F (3, 119) = .87, $p < .05$					
Step 3 Ecosystem Variables					
Training and Development	.09	.05	.16	1.77	.08
Internet Access	-.05	.10	-.05	-.55	.59
In-service Training	-.00	.01	-.01	-.13	.90
Brain Drain	.01	.11	.01	.10	.92
Digital Literacy Skills	.03	.03	.14	1.09	.28
Digital Literacy Objectives Included	.06	.03	.24	1.79	.08
Media Literacy Skills	-.01	.02	-.04	-.31	.76
Media Literacy Objectives Included	-.02	.02	-.15	-1.07	.29
Global Literacy Skills	.02	.01	.27	2.72	.01**
Global Literacy Objectives Included	.01	.01	.10	.82	.41
Climate for Innovation	.02	.01	.10	1.38	.17
Integrity of the System	.03	.01	.18	2.12	.04*
Adj. $R^2 = .42$					
F (12, 107) = 6.05, $p < .05$					

* $p < .05$,** $p < .01$,*** $p < .001$.

Table 13: Linear Regression Predicting Innovation Capacity with QES

	B	SE B	β	t	Sig.
Step 1 Demographics					
Student population	.11	.06	.14	1.83	.07
Gender	.08	.16	.04	.47	.64
Grade level	.04	.07	.05	.61	.54
Adj. $R^2 = -.01$					
F (3,122) = .80, $p < .05$					
Step 2 Other Demographics					
Years Teaching	.01	.05	.02	.23	.82
Subject	.05	.10	.04	.55	.58
School Size	-.09	.10	-.08	-.97	.58
Adj. $R^2 = -.01$					
F (2, 119) = .87					
Step 3 Ecoystem Variables					
Training and Development	.08	.05	.14	1.62	.11
Internet Access	-.11	.10	-.10	-1.19	.24
In-service Training	-.00	.01	-.03	-.35	.73
Brain Drain	-.01	.11	-.01	-.12	.91
Digital Literacy Skills	.02	.03	.08	.68	.50
Digital Literacy Objectives Included	.03	.03	.15	1.11	.27
Media Literacy Skills	-.01	.02	-.13	-.97	.34
Media Literacy Objectives Included	-.01	.02	-.11	-.77	.45
Global Literacy Skills	.01	.01	.20	1.92	.06
Global Literacy Objectives Included	.01	.01	.10	.86	.39
Climate for Innovation	.02	.01	.11	1.48	.14
Integrity of the System	.02	.01	.15	1.82	.07
Adj. $R^2 = .42$					
F (12, 107) = 6.05, $p < .05$					
Step 4 QES					
Future Success	.02	.08	.02	.18	.86
General Literacy Assessment	.12	.04	.32	2.86	.01**
Adj. $R^2 = .46$					
F (2, 105) = 6.23, $p < .05$					

* $p < .05$,** $p < .01$,*** $p < .001$.

Appendix A

Hello,

My name is Allie Taylor and I am a current Graduate Student at the University of Arkansas, Fayetteville. I am currently working on my Master's Thesis and am contacting you in a request that you participate in my current research project: Educational Technology and Innovation Capacity in Arkansas Public Schools.

Your participation in this study will require that you complete a short survey that shouldn't take more than 15 minutes. At the completion of this project a research report will be sent to the **Arkansas Department of Education.** This project will give the department information on how to better provide for the students, teachers, and schools of the state in regards to educational technology.

The purpose of this study is to test a model for Innovation Capacity within Arkansas Public High Schools. This model revolves around the inclusion of 21st century literacies: digital literacy, media literacy, and global literacy. Within Common Core, media literacy is incorporated, but objectives fall mainly under the English Language Arts (ELA). As society moves towards a more technology saturated environment, and employers demand skills of innovation, creativity, and critical thinking it is important to understand where our educational standards are aiding or hindering the preparedness of our future generation. You are being asked to participate in this study because you, as an Arkansas Public High School teacher, have great insight into the operations of your school, curriculum, and student's achievements.

There are no anticipated risks associated with your participation in this study. There will be no cost for your participation. While your contribution is greatly appreciated, you will receive no compensation for your participation.

Please select the following link to begin the survey:

https://waltonuark.az1.qualtrics.com/SE/?SID=SV_3WWsukJUn4h6kJf

IRB Protocol # 16-01-460

Thank you for your time and participation,

Allie Taylor

Appendix B

Survey Instrument

To begin, we are interested in your experience with digital technologies. There is no right or wrong answer; we are just interested in your truthful opinion.

1. Overall, how confident are you in your ability to learn how to use new digital technologies? 1=Very confident; 4=Not at all confident

Next, we are interested in the intellectual capital development of your school.
Intellectual Capital Development (INTC)

2. How would you rate the level of access to the Internet in your school? 1=Extremely good; 5=Extremely bad
3. To what extent are high-quality computers available to students in your school? 1=Widely Unavailable; 4= widely available
4. To what extent does your school district invest in training and employee development? 1=none at all; 5=a great deal; 6=do not know
5. How much assistance does your school district get from your state for employee training and development? 1=none at all; 5=a great deal; 6=do not know
6. How much technologically based teacher training is available to teachers in your school district? 1=none at all; 5=A great deal; 6=do not know
7. About many hours (if any, outside of set requirements) of tech-based, in-service teacher training did you attend this year?
    a. _____
8. How would you rate teachers' technological competency in your school? 1=very limited; 5=very extensive; 6=do not know

Now we would like you to answer a few questions about digital literacy objectives. Digital literacy is the ability to use, understand, and create with digital technologies.

Please answer each question in full. It does not matter your direct experience with the objectives, your honest answer is our concern.

Digital Literacy (DL)

9. Overall, how would you rate your students' abilities on each of the following digital literacy objectives? 1=terrible; 5=excellent, 6=do not know
    a. "Apply digital tools to gather, evaluate and use information."
    b. "Use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources."
    c. "Demonstrate creative thinking, construct knowledge, and develop innovative products and processing using technology."
    d. "Understand human, cultural, and societal issues related to technology and practice legal and ethical behavior."
    e. "Use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others."
    f. "Demonstrate a sound understanding of technology concepts, systems, and operations."
10. To what extent is each of these objectives **already included** in your school?
    a. "Apply digital tools to gather, evaluate and use information." 1=None at all; 5=A great deal
    b. "Use critical thinking skills to plan and conduct research, manage projects, solve problems, and make informed decisions using appropriate digital tools and resources." 1=not at all; 7= to a great extent; 9= don't know
    c. "Demonstrate creative thinking, construct knowledge, and develop innovative products and processing using technology."
    d. "Understand human, cultural, and societal issues related to technology and practice legal and ethical behavior."
    e. "Use digital media and environments to communicate and work collaboratively, including at a distance, to support individual learning and contribute to the learning of others."

f. “Demonstrate a sound understanding of technology concepts, systems, and operations.”

11. Do you believe these objectives **<u>should be included</u>**? 1=Never; 5=Always; 6= Do not know

12. Is each of the following a **MAJOR** challenge, **MINOR** challenge, or **NOT** a challenge at all for you, personally, in incorporating more of these objectives into your classroom pedagogy?
    a. General resistance by colleagues and administrators
    b. Time constraints
    c. Pressure to teach to assessments
    d. Lack of resources and/or access to digital technologies among your students
    e. Your own lack of comfort, knowledge, or training with digital technologies
    f. Lack of technical support (such as repair, troubleshooting, set-up) to use digital technologies consistently

Next we would like you to answer a few questions about media literacy objectives. Media literacy is defined as the ability to access, analyze, evaluate, and communicate information.

Please answer each question in full. It does not matter your direct experience with the objectives, your honest answer is our concern.

Media literacy (ML)

13. Overall, how would you rate your students’ abilities on each of the following media literacy objectives? 1=terrible ; 5=excellent; 6=do not know
    a. “Capacity to experiment with one’s surroundings (with technology) as a form of problem-solving.”
    b. “Ability to adopt alternative identities for the purpose of improvisation and discovery.”
    c. “Ability to interpret and construct dynamic models of real-world processes.”
    d. “Ability to meaningfully sample and remix media content.”

e. “Ability to scan one’s environment and shift focus as needed to salient details.”
f. “Ability to interact meaningfully with tools that expand mental capacities.”
g. “Ability to pool knowledge and compare notes with others towards a common goal.”
h. “Ability to evaluate the reliability and credibility of different information sources.”
i. “Ability to follow the flow of stories and information across multiple modalities.”
j. “Ability to search for, synthesize, and disseminate information.”
k. “Ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms.”

14. To what extent is each of these objectives **already included** in your school?
    a. “Capacity to experiment with one’s surroundings (with technology) as a form of problem-solving.” 1=none at all; 5= A great deal
    b. “Ability to adopt alternative identities for the purpose of improvisation and discovery.”
    c. “Ability to interpret and construct dynamic models of real-world processes.”
    d. “Ability to meaningfully sample and remix media content.”
    e. “Ability to scan one’s environment and shift focus as needed to salient details.”
    f. “Ability to interact meaningfully with tools that expand mental capacities.”
    g. “Ability to pool knowledge and compare notes with others towards a common goal.”
    h. “Ability to evaluate the reliability and credibility of different information sources.”
    i. “Ability to follow the flow of stories and information across multiple modalities.”
    j. “Ability to search for, synthesize, and disseminate information.”
    k. “Ability to travel across diverse communities, discerning and respecting multiple perspectives, and grasping and following alternative norms.”

15. Do you believe these objectives **should be** included? 1=Never; 5=Always; 6= do not know

16. Is each of the following a **MAJOR** challenge, **MINOR** challenge, or **NOT** a challenge at all for you, personally, in incorporating more of these objectives into your classroom pedagogy?
    a. General resistance by colleagues and administrators
    b. Time constraints
    c. Pressure to teach to assessments
    d. Lack of resources and/or access to digital technologies among your students
    e. Your own lack of comfort, knowledge, or training with digital technologies
    f. Lack of technical support (such as repair, troubleshooting, set-up) to use digital technologies consistently

Now we would like you to answer a few questions about global literacy objectives. Global literacy is the ability to demonstrate knowledge of diverse cultures including the ability to apply global perspectives to analyze contemporary and historical issues.

Please answer each question in full. It does not matter your direct experience with the objectives, your honest answer is our concern.

Global Literacy (GL)

17. Overall, how would you rate your students' abilities on each of the following global literacy objectives? 1=Terrible; 5=excellent; 6= Do not know

    a. "Identify an issue, generate a question, explain the significance of locally, regionally, or globally focused researchable questions."
    b. "Use a variety of languages and domestic and international sources and media to identify and weight relevant evidence to address a globally significant researchable questions."
    c. "Analyze, integrate, and synthesize evidence collected to construct coherent responses to globally significant researchable questions."

d. “Develop an argument based on compelling evidence that considers multiple perspectives.”
e. “Recognize and express their own perspectives on situations, events, issues, or phenomena and identify the influence on that perspective.”
f. “Examine perspective of other people, groups, or schools of thought and identify the influence on those perspectives.”
g. “Explain how cultural interactions influence situations, events, issues, or phenomena, including the development of knowledge.”
h. “Articulate how differential access to knowledge, technology, and resources affects quality of life and perspectives.”
i. “Recognize and express how diverse audiences may perceive different meaning from the same information and how that affects communication.”
j. “Listen to and communicate effectively with diverse people, using appropriate verbal and nonverbal behavior, languages, and strategies.”
k. “Select and use appropriate technology and media to communicate with diverse audiences.”
l. “Reflect on how effective communication affects understanding and collaboration in an independent world.”
m. “Identify and create opportunities for personal or collaborative action to address situations, events, issues, or phenomena in ways that improve conditions.”
n. “Assess options and plan actions based on evidence and the potential for impact, taking into account previous approaches, varied perspectives, and potential consequences.”
o. “Act, personally or collaboratively, in creative and ethical ways to contribute to improvement locally, regionally, or globally and assess the impact of actions taken.”
p. “Reflect on their capacity to advocate for and contribute to improvement locally, regionally, or globally.”

18. To what extent is each of these objectives **already included** in your school?
    a. "Identify an issue, generate a question, explain the significance of locally, regionally, or globally focused researchable questions."1= none at all; 5= A great deal
    b. "Use a variety of languages and domestic and international sources and media to identify and weight relevant evidence to address a globally significant researchable questions."
    c. "Analyze, integrate, and synthesize evidence collected to construct coherent responses to globally significant researchable questions."
    d. "Develop an argument based on compelling evidence that considers multiple perspectives."
    e. "Recognize and express their own perspectives on situations, events, issues, or phenomena and identify the influence on that perspective."
    f. "Examine perspective of other people, groups, or schools of thought and identify the influence on those perspectives."
    g. "Explain how cultural interactions influence situations, events, issues, or phenomena, including the development of knowledge."
    h. "Articulate how differential access to knowledge, technology, and resources affects quality of life and perspectives."
    i. "Recognize and express how diverse audiences may perceive different meaning from the same information and how that affects communication."
    j. "Listen to and communicate effectively with diverse people, using appropriate verbal and nonverbal behavior, languages, and strategies."
    k. "Select and use appropriate technology and media to communicate with diverse audiences."
    l. "Reflect on how effective communication affects understanding and collaboration in an independent world."
    m. "Identify and create opportunities for personal or collaborative action to address situations, events, issues, or phenomena in ways that improve conditions."

n. "Assess options and plan actions based on evidence and the potential for impact, taking into account previous approaches, varied perspectives, and potential consequences."
o. "Act, personally or collaboratively, in creative and ethical ways to contribute to improvement locally, regionally, or globally and assess the impact of actions taken."
p. "Reflect on their capacity to advocate for and contribute to improvement locally, regionally, or globally."

19. Do you believe these objectives **should be** included? 1=Never; 5=Always; 6= Do not know

20. Is each of the following a **MAJOR** challenge, **MINOR** challenge, or **NOT** a challenge at all for you, personally, in incorporating more of these objectives into your classroom pedagogy?
    a. General resistance by colleagues and administrators
    b. Time constraints
    c. Pressure to teach to assessments
    d. Lack of resources and/or access to digital technologies among your students
    e. Your own lack of comfort, knowledge, or training with digital technologies
    f. Lack of technical support (such as repair, troubleshooting, set-up) to use digital technologies consistently

The next set of questions pertains to the learning environment in your school.

21. Innovative Behavior (IB): The statements below all focus on the learning environment in your school. For each statement, check the answer that indicates how strongly you agree or disagree. 1=strongly disagree; 5=strongly agree

    Creativity is encouraged by our school's curriculum

    The ability to function creatively is encouraged by our school's curriculum.

    Students that think creatively are respected by other students.

Around here, students are allowed to try and solve the same problems in different ways.

The main function of our students is to follow directions of the teachers and staff.

In our school, a student can get in a lot of trouble by being different.

Our school can be described as flexible and continually adapting to change.

A student can't do things that are too different in our school without provoking anger.

The best way to get along in our school is to think the way the rest of the group does.

Students in our school are expected to deal with problems in the same way.

Our school is open and responsive to change.

The people in charge in our school usually get credit for others' ideas.

In our school, we tend to stick to tried and true ways.

Our school seems to be more concerned with the status quo than with change.

Assistance in developing new ideas is readily available.

There is adequate time available to pursue creative ideas here.

Lack of funding to investigate creative ideas is a problem in our school.

Personnel shortages inhibit innovation in our school.

There is adequate time available for students to pursue creative ideas.

The reward system in our school encourages innovation.

Our school publicly recognizes those who are innovative.

The reward system in our school benefits mainly those who don't rock the boat.

22. Integrity of the System (INTS): The next set of statements focuses on the academic learning standards in your state and school district. For each statement, check the answer that indicates how strongly you agree or disagree. 1=strongly disagree; 5=strongly agree; 6=Do not know

    My school involves teachers in decision making on how to achieve state learning standards.

    I can easily get information about government policy and regulations that affect my school.

    Policy and decision-making at the state level strongly affect my schools' academic operations.

Decision-making about academic standards in my local school district is open and transparent.

Decision-making about academic standards in my state is open and transparent.

My district makes information regarding academic standards readily available to the public.

My district makes information readily available regarding our district's instructional practices.

My district makes information about how our school standards compare to state standards readily available.

Quality of the Education System (QES): These last few questions ask for your general assessment of your school and its students.

23. Do you believe students graduating for your schools are equipped with skills and knowledge that will foster success in their futures? 1=Strongly disagree; 5=Strongly agree

24. How would you assess, overall, your students' abilities to critically select media content, examine the content, and produce significant media text? 1=Terrible; 5=Excellent; 6=Do not know

24. How would you assess, overall, your students' ability to use information and communication technologies to find, understand, evaluate, create, and communicate digital information? 1=Terrible; 5=Excellent; 6=Do not know

24. How would you assess, overall, your students' ability to apply a global perspective to analyze contemporary and historical issues? 1=Terrible; 5=Excellent; 6=Do not know

Lastly, we are interested to know:

Innovation Capacity (IC)

21. How would you assess your schools ability to foster innovative idea/projects/products in students? 1=Terrible; 5=Excellent; 6=Do not know

In finishing, we would like to end with a few demographic questions.

22. What is your age?
    a. 20-34
    b. 35-44
    c. 45-54
    d. 55+
23. What is your gender?
    a. Male
    b. Female
    c. Other (please specify)
24. How many years have you been teaching?
    a. 5 or fewer
    b. 6 to 10
    c. 11 to 15
    d. 16 to 20
    e. 21 to more
25. What subject is a majority of your teaching schedule?
    a. Fine Arts (Arts/Music/Drama /Film)
    b. Foreign Language
    c. History/Social Studies (ex. American History, Cultural studies, Psychology, Geography, etc.)
    d. Language Arts (English, Reading/Composition)
    e. Mathematics
    f. Natural Science (Biology, Chemistry, Physics, Environmental Science, etc.)
    g. Vocational/Technical (Automotive Services, Criminal Justice, Culinary Arts, Welding, etc.)
    h. Computer/Technology Education (coding, computer skills, etc.)
    i. Health Education or Physical Education
    j. Other: _____

26. Which student population makes up the majority of students you teach this year?
    a. College-bound
    b. Non College-bound
    c. ESL
    d. Remedial
    e. Special Education

27. Which grade level makes up the majority of students you teach this year?
    a. 9
    b. 10
    c. 11
    d. 12
28. What percentage of students in your school receives free and reduced lunches?
    a. Under 25%
    b. 25%-49%
    c. 50%-74%
    d. 75% and over
29. Check below what school you work for…

THANK YOU SO MUCH for your input in this questionnaire. Your responses will greatly contribute to further understand the current state of 21st century literacies and innovation capacity of Arkansas Public High Schools.

Appendix C

UNIVERSITY OF ARKANSAS

Office of Research Compliance
Institutional Review Board

January 29, 2016

MEMORANDUM

TO:	Allie Taylor Ron Warren
FROM:	Ro Windwalker IRB Coordinator
RE:	New Protocol Approval
IRB Protocol #:	16-01-460
Protocol Title:	*Educational Technology and Innovation Capacity in Arkansas Public Schools*
Review Type:	☒ EXEMPT ☐ EXPEDITED ☐ FULL IRB
Approved Project Period:	Start Date: 01/28/2016 Expiration Date: 01/27/2017

Your protocol has been approved by the IRB. Protocols are approved for a maximum period of one year. If you wish to continue the project past the approved project period (see above), you must submit a request, using the form *Continuing Review for IRB Approved Projects*, prior to the expiration date. This form is available from the IRB Coordinator or on the Research Compliance website (https://vpred.uark.edu/units/rscp/index.php). As a courtesy, you will be sent a reminder two months in advance of that date. However, failure to receive a reminder does not negate your obligation to make the request in sufficient time for review and approval. Federal regulations prohibit retroactive approval of continuation. Failure to receive approval to continue the project prior to the expiration date will result in Termination of the protocol approval. The IRB Coordinator can give you guidance on submission times.

This protocol has been approved for 800 participants. If you wish to make *any* modifications in the approved protocol, including enrolling more than this number, you must seek approval *prior to* implementing those changes. All modifications should be requested in writing (email is acceptable) and must provide sufficient detail to assess the impact of the change.

If you have questions or need any assistance from the IRB, please contact me at 109 MLKG Building, 5-2208, or irb@uark.edu.

Educational Technology and Innovation Capacity in Arkansas Public Schools
Consent to Participate in a Research Study
Principal Researcher: Allie Taylor
Faculty Advisor: Ron Warren

INVITATION TO PARTICIPATE
You are invited to participate in a research study about 21st century literacies presence in Arkansas Public Schools and the schools ability to be innovative. You are being asked to participate in this study because you, as an Arkansas public high school teacher, have great insight into the operations of your school and curriculum.

WHAT YOU SHOULD KNOW ABOUT THE RESEARCH STUDY

Who is the Principal Researcher?
Allie Taylor
417 Kimpel Hall, Fayetteville, AR 72701
Email: ant002@uark.edu
Office Phone: (479)-575-5955
[redacted]

Who is the Faculty Advisor?
Ron Warren, Associate Professor
417 Kimpel Hall, Fayetteville, AR 72701
Email: ronw@uark.edu
Office Phone: (479)-575-5957

What is the purpose of this research study?
The purpose of this study is to test a model that aims to gauge the innovation capacity of high schools regarding their incorporation of 21st century literacies (digital literacy, media literacy, and global literacy). This model will inform us of the innovation capacity of schools, as well as factors that can contribute to the innovative capabilities. This study will also inform us of whether students are meeting or if schools even include objectives defined by these 21st century literacies, and what factors could be hindering this process.

Who will participate in this study?
The expected participants of this study are 700 Arkansas public high school teachers.

What am I being asked to do?
Your participation in this study will require that you complete a short survey that shouldn't take more than 15 minutes. At the completion of this project results will be sent to the Arkansas Department of Education.

What are the possible risks or discomforts?
There are no anticipated risks associated with participating in this study.

What are the possible benefits of this study?
Besides the knowledge gained, there are no anticipated benefits for the participants of this study.

How long will the study last?
As a participant, you will be asked to complete a one-time, 15-mintue survey online.

Will I receive compensation for my time and inconvenience if I choose to participate in this study?
If you choose to participate in this study, while your contribution is much appreciated, you will receive no compensation for your participation.

Will I have to pay for anything?
There will be no cost for your participation.

IRB #16-01-460
Approved: 01/28/2016
Expires: 01/27/2017

What are the options if I do not want to be in the study?
If you do not want to be in this study, you may refuse to participate. Also, you may refuse to participate at any time during the study. Your job will not be affected in any way if you refuse to participate.

How will my confidentiality be protected?
All information will be kept confidential to the extent allowed by applicable university policy, State law, and Federal law. We will not be gathering personally identifiable information from you.

Will I know the results of the study?
At the conclusion of the study you will have the right to request feedback about the results. You may contact the faculty advisor, Ron Warren by email (ronw@uark.edu) or phone (479-575-5957) or Principal Researcher, Allie Taylor by email (ant002@uark.edu) or phone (479-575-5955). You will receive a copy of this form for your files.

What do I do if I have questions about the research study?
You have the right to contact the Principal Researcher or Faculty Advisor as listed below for any concerns that you may have.

Allie Taylor
417 Kimpel Hall, Fayetteville, AR 72701
Email: ant002@uark.edu
Office Phone: (479)-575-5955
[redacted]

Ron Warren, Associate Professor
417 Kimpel Hall, Fayetteville, AR 72701
Email: ronw@uark.edu
Office Phone: (479)-575-5957

You may also contact the University of Arkansas Research Compliance office listed below if you have questions about your rights as a participant, or to discuss any concerns about, or problems with the research.

Ro Windwalker, CIP
Institutional Review Board Coordinator
Research Compliance
University of Arkansas
109 MLKG Building
Fayetteville, AR 72701-1201
479-575-2208
irb@uark.edu

By clicking the "continue" button below, you agree to the follow:

I have read the above statement and have been able to ask questions and express concerns, which have been satisfactorily responded to by the investigator. I understand the purpose of the study as well as the potential benefits and risks that are involved. I understand that participation is voluntary. I understand that significant new findings developed during this research will be shared with the participant. I understand that no rights have been waived by signing the consent form. I have been given a copy of the consent form.