Spring 5-1-2017

21st Century Teaching and Learning: Teachers' Perceptions and Practices in Four High Schools of One District

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21ST CENTURY TEACHING AND LEARNING: TEACHERS' PERCEPTIONS AND PRACTICES IN FOUR HIGH SCHOOLS OF ONE DISTRICT

A Dissertation Proposal Submitted
to the Graduate College
Arkansas Tech University

in partial fulfillment of requirements
for the degree of

DOCTOR OF EDUCATION
in School Leadership

in the Department of Center Leadership and Learning
of the College of Education

May 2017

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Title: 21ST CENTURY TEACHING AND LEARNING: TEACHERS' PERCEPTIONS AND PRACTICES IN FOUR HIGH SCHOOLS OF ONE ARKANSAS DISTRICT

Program: School Leadership

Degree: Doctor of Education

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Abstract

Education needs have shifted from a focus on static skills to the ability to continuously learn in a dynamic environment as information technology rapidly transforms the workplace and classrooms. High schools are searching for instructional practices that will close the achievement gap as well as meet the challenge of ensuring that students are college and career ready upon graduation. Over 50% of jobs by 2020 will be computer oriented yet a small percent of students seek education to qualify for those jobs. Twenty first century skills are essential to prepare students for those jobs (Carnevale & Smith, 2012). The purpose of this research was to identify consensus on what constitutes 21st Century skills, measure teachers' perceptions of their ability to lead students in acquisition of 21st Century skills and identify teaching practices that enable learning of academic content integrated with appropriate technology. This was a mixed methods study. A perceptual survey accompanied by open-ended questions deepened analysis and understanding. Though perceptual surveys are qualitative in nature, rigorous statistical analysis of survey results lends a quantitative touch. Analysis included parametric and non-parametric statistical analysis. Finally, open-ended question responses were coded, categorized, and analyzed using constant comparison method.

Dedication

I dedicate this paper to my mother, Darlene Roper and my husband, Dennis Rice. Darlene was *the* teacher that modeled construction of knowledge through play. Her 43-year career as a volunteer teacher of pre-school children ignited curiosity. Always focused on the student, she planned experiential opportunities for investigation immersed in a love of life and learning. She fully understood the whole child, mind, body, and spirit, leading children to explore God's creations.

To my husband Dennis, the encourager, the rock, and the love of my life, thank you for wings that propel me in pursuit of the love of learning.

Acknowledgments

Thank you to the Center for Leadership and Learning, Arkansas Tech University, for encouragement and guidance to promote professional growth in Arkansas educators. Dr. Gunter, thank you for visionary leadership. Dr. Shopfner, thank you for challenging thought in pursuit of the best learning for the child. Dr. Endel, thank you for your reflective practice. Dr. Chadwick-Scott, thank you for encouraging and challenging educators to reach their full potential. Dr. Freeman and Dr. Trombly, thank you for your patience and push in support of this educator.

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I. Introduction

A broad review of literature acknowledges that traditional high schools have *not* made the shift to 21st Century (21C) skills implementation and have remained tied to 20th Century instructional models (Darling-Hammond, 2012). Lee and Hung (2012) reported that explicit knowledge was taught, tested, and transmitted through systematic teacher-centered content instruction. Freire (1970), who considered such practices as oppressive, referred to this type of instruction as the "banking model," because, while the teacher deposits knowledge, it is of little interest to students due to the lack of engagement or investigation. Conversely, Science, Technology, Engineering, and Mathematics (STEM) schools, such as those in the New Tech Network (2016) that was piloted in Arkansas in 2012 and 2013, serve as inquiry-driven 21st Century instructional model incubators. Carnevale and Smith (2012) reported that by 2020, 51% of all jobs in Arkansas require post-secondary education; these jobs require 21C skills.

This mixed methods study sought to determine teachers' perceptions of their ability to teach 21C skills across four schools: an alternative education program, a STEM school of choice, and two comprehensive high schools with diverse populations. The Twenty First Century Teaching and Learning Survey (Hixson, Ravitz, & Whisman, 2012) was employed in this study, as was open-ended questions that were added to that instrument to allow for the depth of analysis that characterize qualitative research design.

Background of the Study

The recent focus on the implementation of (to say nothing of the political disputes about) the Common Core State Standards (2016) has largely overshadowed the imperative for 21C skills instruction. Since the passage of the No Child Left Behind

legislation in 2001, assessment regimes have caused educators to focus their efforts almost exclusively on reading, writing, and computational math. National consortiums such as Partnership for Assessment of Readiness for College and Careers (PARCC) and Smarter Balanced Assessment Consortium (SBAC) were charged in 2010 with developing assessments that would measure college and career readiness. During 2016, Arkansas educators and political leaders selected the American College Test (ACT) for all Grade 11 students and the ACT Aspire assessment for students in Grade 3 through Grade 10. The ACT is a literacy and computational math test to measure college and career readiness. American College Test (2016) offered this caveat in its description of the academic areas assessed by its instrument: "A holistic model of education and workplace success must be anchored in core academic content areas. While these skills are necessary for success, they do not account for the full range of knowledge and skills that one needs for success." (American College Test, 2016. para. 6) A refocus on the comprehensive nature of 21C skills prepares students to be 21C career ready and successful in obtaining certifications or college degrees. Many high-paying, high-skill careers available to 21C students are largely dependent on more than reading, writing, and computational math. These careers require critical thinking and problem solving, as well as collaboration, communication, and creativity all integrated with technology (Partnership for 21 Century Learning (P21) Framework for 21st Century Learning, 2016).

Problem Statement

High schools are searching for instructional practices that will close the achievement gap as well as meet the challenge of ensuring that students are college and career ready upon graduation. In 2015, Arkansas Governor Asa Hutchinson launched the

Computer Science and Technology in Public School Task Force (CSTF). The CSTF (2015) reported,

> According to Code.org, 67% of new STEM jobs are in computing, but only 8% of STEM graduates are in computer science. There are currently over 1,750 open computing jobs in Arkansas at an average salary of $68,933.00, yet there were only 250 computer science graduates in 2015. Therefore, funding computer science education provides Arkansas with the opportunity for a very high job market return on investment. (p. 4)

High-skill, high-wage careers require development of the full range of 21C skills. This study sought to determine teachers' perceptions of their ability to teach 21st Century skills and to identify the relationship between those perceptions and student achievement in four schools.

Purpose of the Study

Mixed methods research design provided a comprehensive analysis of data – in this case, teachers' perceptions – that neither a qualitative nor a quantitative design alone could provide (Creswell, 2008). Sieber (1973, as reported in Creswell, 2008) integrated multiple research techniques in a single study. The research employed for this study was a mixed methods design that utilized a survey instrument used by teachers to rank their perceptions and supplemented with qualitative open-ended survey questions, as well as a review of archival data. The survey provided insights into many teachers' perceptions in teaching 21C skills. Patterns and themes emerged between the four schools selected for this study (Huberman & Miles, 1984, p. 14-15; Patton, 2002, p. 432-437). The purpose of this study was to analyze consistency across four high schools among teachers in the

perceptions of their abilities to lead 21C skills acquisition. Common characteristics expressed by teachers of their ability to lead students in their acquisition of 21C skills were sought to determine where instructional support was needed to close learning gaps between students.

Research Questions

1. How consistent, across four school types, are teachers' perceptions of their ability to lead students in the acquisition of 21st Century skills?
2. To what do teachers attribute their ability to lead students in the acquisition of 21st Century skills?

Conceptual Foundation

The lens that was employed throughout this investigation was 21C learning, as identified by Partnership for 21st Century Learning Our History (P21) (2016). Established in 2002, P21 – a consortium of representatives from education, government, and business - sought consensus on what students need to know and be able to do to survive and thrive in the 21C workplace. Three categories of skills identified by P21 as necessary were life skills, learning skills, and Information Communication Technology (ICT) literacy.

Life skills included "flexibility and adaptability, initiative and self-direction, social and cross-cultural skills, productivity and accountability, and leadership and responsibility" (P21 Framework for 21st Century Learning, 2016, p. 1). Learning skills and ICT were the focus of this study. Learning skills included the four "Cs" of critical thinking and problem solving, creativity and innovation, collaboration, and

communication. ICT was the tool used for research, knowledge building, and communication embedded in learning.

This investigative study was a mixed methods design (Creswell, 2008). The goal in today's educational landscape is to prepare students for jobs that have not yet been designed (Darling-Hammond & Bransford, 2005, p. 76-78). This study sought to understand teachers' instructional needs in reaching that goal.

Nature of the Study

Mixed methods design was selected to produce a comprehensive view of teachers' perceptions. A perceptual survey enabled participants to rank their perceptions and reflect on their professional needs associated with leading students in 21st Century skill development. The dependent variable in the study was teachers' perceptions; ranked on a scale of one to five followed by five open-ended questions. The instrument employed in this investigation was adapted from the Innovative Teaching Research Center 2010 study of 650 schools in eight countries (Shear, Novais, Means, Gallagher, & Langley, 2010). The addition of open-ended questions adds to the investigator's understanding of teachers' perceptions. Arkansas School Report Card data for each of the four schools involved in this investigation were also considered.

Definitions

Throughout this investigation, the following definitions will be employed:

Comprehensive high schools offer both academic or college bound curricula (e.g., mother tongue language, math, science, arts) and vocational or career focused curricula, as well as student choice to move freely between career programs of study (Wraga, 2000).

Professional development defined as activities that provide educators with knowledge and skills to meet students' needs that are sustained, collaborative, job-embedded, data-driven, and focused on student learning (Hirsh, 2016, para. 4).

21st-century skills. The use of the terms 21st Century competencies and 21st Century skills varies from one geographic location to the next. Voogt and Roblin (2012) explained that, while the term 'competencies' is preferred in much of the world, the terms '21st Century skills' and '21st Century learning' are more likely to be heard in the United States, as they link the needs of the knowledge-based economies with education. For the purpose of this study, the term 21st Century skills (21C) will be used. Further, the definitions of eight specific skills will be employed. These definitions are taken from Jason Ravitz's (2014) design of the 21st Century Teaching and Learning Survey.

> *Critical thinking skills* (CT) refers to students being able to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning.
>
> *Collaboration skills* (CO) refers to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task.
>
> *Communication skills* (CM) refers to students being able to organize their thoughts, data, and findings; and share these effectively through a variety of media, as well as orally and in writing.

Creativity and innovation skills (CR) refers to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis, and then combining or presenting what they have learned in new and original ways.

Self-direction skills (S) refers to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback.

Global connections (G) refers to students being able to understand global, geopolitical issues including awareness of geography, culture, language, history, and literature from other countries.

Local connections (L) refers to students being to apply what they have learned to local contexts and community issues.

Using technology as a tool for learning (U) refers to students being able to manage their learning and produce products using appropriate information and communication technologies (Hixson et al., 2012, p. 1-2; Ravitz, 2014).

Figure 1.1. Skill name and definition (Code)

Scope and Delimitations

This study focuses on four high schools, all grades 9-12. Pseudonyms are used to protect the confidentiality of participants. High School 1 is an alternative high school. High School 2 is a STEM school of choice. School 3 is a comprehensive high school. School 4 is also a comprehensive high school. Archival data was used to determine each

school's graduation rate, attendance rate, school improvement plan, professional development plan, and technology plan. These four schools were chosen because of accessibility and variety. Table 1.1 provides a comprehensive review of the schools' statistical data.

The high schools are located in a small city of approximately 60,000 (United States Census Bureau, 2016). Gender splits the population in half, with roughly 50% males and 50% females. About one-third of the population was under 18 years of age, and about 10% are over 65 years of age. Around 70% of the population was White; the remaining 30% are mostly Hispanic. Median home value is over $125,000; median income is around $50,000. Persons living in poverty make up about 13 % of the population. Primary employment comes from manufacturing, retail, and healthcare. High school graduates make up 80% of the population; about 25% have a Master's degree or above. This small city is located within a Statistical Metropolitan Area with an estimated population of 500,000.

Table 1.1.

Summary of School Demographics

School	High School 1	High School 2	High School 3	High School 4
Total Population	120	385	2015	2015
White	NA	60.8	51.0	50.7
Hispanic	NA	33.2	42.4	43.1
Other	NA	6.0	6.6	6.2
Limited English Proficiency	NA	15.0	28.0	25.0
Low Income	NA	49.0	61.0	49.0
Special Education	NA	9.0	13.0	9.0
Attendance Rate 2014	NA	98.3	95.3	93.6
Graduation Rate 2015	NA	NA	90.7	92.8

Note. NA = Not Applicable High School 1 statistics are reported in home school reports. (Arkansas Data Center, 2016. Attendance rate and graduation rate numbers are percentages. 2015, Demographics are percentages.)

Limitations

The researcher, who has a strong commitment to equitable 21C skill integration, is a participant observer. Although the Innovative Teaching and Learning Study (Shear et al., 2010) serves as its conceptual impetus, the study is much more limited in scale. Rather than involving 650 schools from across the globe, the present study examines four schools in one community.

Significance of the Study

Results from this analysis of teachers' perceptions about their ability to teach 21C skills may be used to guide decisions in designing equitable instructional support programs, especially since this investigation examines such different contexts as an alternative education program, a STEM school, and two comprehensive high schools. Local and international demands for highly skilled labor highlight the need for comprehensive 21C skills instruction (Kivunja, 2015; Voogt & Roblin, 2012). Results of

the study could be used to guide state assessment of 21C skill development, district professional development in strategies that foster 21C skill development, teachers' professional growth plans, equitable access to information technology, and a consistent understanding of 21C skills needed for 21C careers.

Gaps in research are narrowed as a result of the present study. Previous state accountability assessments focused on reading, writing, and computational math. Such assessments did not measure 21C skills acquisition. Studies completed prior to 2015 noted a research gap in 21C skill assessment (Atwell, 2014; Hixson et al., 2012). Assessments of 21st Century skills acquisition were under development at the time of the previous studies and administered for the first time in 2015. Full descriptions of these assessments as well as baseline data are reported in this study.

Summary

High schools need to close the achievement gap. Implementing consistent 21C skills instruction prepares students for college and careers. This study seeks to analyze common understanding and characteristics of teachers' efforts to implement 21C skills. The *Literature Review* in the next chapter is organized into four themes, consensus of understanding of definitions of 21C skills, assessments of 21C skills, instructional strategies that promote 21C skill development, and integrated ICT.

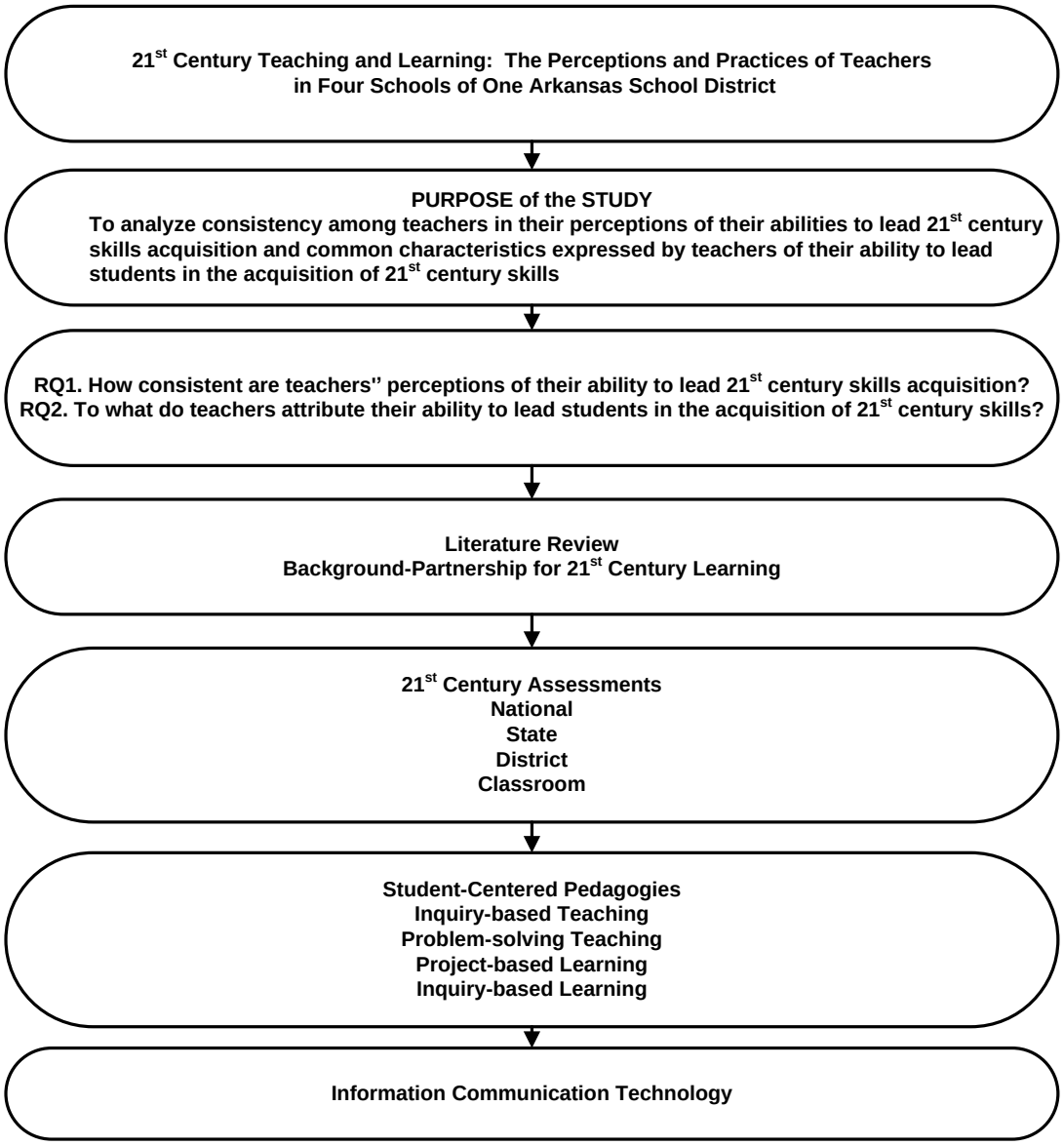

Figure 2.1. Literature Review Flow Chart

II. Literature Review

Friedman's (2005) concept of a *flat world* refers to a major shift in economies and education having global consequences because of technological advances in the 21st Century. Shifts from industrialized economies to knowledge-based economies launched an early exploration into what knowledge and skills workers would need to sustain a knowledge-based economy (Darling-Hammond & Bransford, 2005; Voogt & Roblin, 2012; P21, 2015).

Literature Search Strategy

A search of the ProQuest Educational Journals and ERIC Institute of Educational Sciences databases using the keywords "*21st Century skills*" yielded over 75,000 hits. Terms that were added to refine the number of hits were "*education*," "*teacher preparation*," "*professional development*," "*inquiry based learning*," "*equity*," "*21Century skills assessment*," "*student engagement*," and "*survey*". Searches were limited to sources that were published between 2006 and the present, that were available in full text, and that had been peer reviewed. A variety of Boolean search operators were used including 'or' and 'not'. Four studies were selected and their reference lists were checked for duplicate references or filtered for topics unrelated to the researcher's stated purpose. A fifth study was chosen from the reference lists of the studies. The five studies frame the background of this study.

Conceptual Framework

The workplace is both vastly different and somewhat the same as previous centuries. The printing press revolutionized the 15th century and globalized knowledge exchange and trade. Information communication technology (ICT) revolutionized the

21st century, transforming global economies into knowledge-based economies—"economies which are directly based on the production, distribution and use of knowledge and information" (Organisation for Economic Co-operation and Development, 1996). The transformation of global economies with ICT 20 years ago created a need for educational systems that produce more highly-skilled labor; thus, in 2002 the Partnership for 21st Century Skills (P21) in the United States was founded (Partnership for 21st Century Learning Our History, 2016). A consortium of industry, education, and government leaders sought to identify learning, knowledge, and skills needed for students entering the 21C workforce. Education needs have shifted from a focus on static skills to the ability to continuously learn in a dynamic environment as information technology rapidly transforms the workplace and classrooms. An indication of the constant change and adaption is that P21 changed its name and focus from Partnership for 21st Century Skills to Partnership for 21st Century Learning (2015).

Since its inception P21 is most often cited in literature as the authority on defining 21st Century skills in the United States (P21 Framework, 2016). P21 embraces three themes or skill sets identified as life skills, learning skills and Information Communication Technology (ITC) skills. The skills are student outcomes and are supported by four systems including standards and assessments, curriculum and instruction, professional development, and learning environments. The core set of learning skills identified by P21 (Framework, 2106) is the "4Cs, critical thinking and problem solving; creativity and innovation; communication and collaboration; and Information Communications Technology literacy."

Voogt and Roblin (2012) conducted a comparative analysis of learning, competencies, and skills frameworks for the 21st Century which spanned 32 international documents and found consistency in defining what students need to know or be able to do to become productive members of the workforce. Essential 21C skills identified in all 32 frameworks described by Voogt and Roblin (2012) were collaboration, communication, Information Communication Technology (ICT) literacy, and citizenship literacy. Additionally, most of the 32 frameworks included creativity, critical thinking, problem-solving, and using technology as a productivity tool. The "4Cs" and Information Communications Technology (ICT) literacy provide foundation to this study (P21, 2015; Shear et al., 2010; Voogt and Roblin, 2012).

Literature Review

Five studies frame the background for this study. Two international studies sought complementary goals. Voogt and Roblin (2012) comparatively analyzed 32 international documents from eight frameworks identifying and defining 21C skills including P21. The analysis was systematic, concurrence was found in definitions of 21C skills, and many countries were found to have adopted 21C skills as "a major national goal" (Voogt & Roblin, 2012, p. 315). While, in the United States, the terms 21C skills and 21C learning are used, the term 21C competencies is employed outside the U.S. (Voogt & Roblin, 2012).

Shear et al. (2010) performed an investigative international research study in association with the Gates Foundation and William and Flora Hewlett Foundation to discover innovative teachers' practices that aligned with student centered pedagogies, extension of learning outside the classroom, and Information Communication

Technology (ICT) integrated in teaching and learning. The mixed methods study utilized a quantitative survey across eight countries to garner teachers' perceptions of 21st Century skills and investigate innovative teaching practices. The Shear et al. (2010) study provided the conceptual framework for the survey instrument - the "Twenty First Century Teaching and Learning Survey" (Hixson et al., 2012; Ravitz, 2014) – as is being employed in the present study. The qualitative study included three levels of interviews (national, school, and teacher); classroom observations; reviews of student work; student focus groups; and achievement data. The strengths of this research are its scope, 650 schools across eight countries; and its use of both qualitative and quantitative methods to gather information across multiple levels of education (national, school leaders, teachers, and students). A weakness was that the study was conducted for only two years. Longitudinal study of student outcomes warrants further study. The William and Flora Hewlett Foundation launched the Deeper Learning Network (2013) to investigate innovative teaching and learning models, an outcome of their study indicated teaching practices that spark curiosity and inquiry designs showed promise.

Two separate state level studies investigated education for 21C skills in Arkansas (Atwell, 2014) and West Virginia (Hixson et al., 2012). The West Virginia Education Department (WVED) implemented a three-year professional development program that included project-based learning and technology integration for implementation and support of 21C skills. Twenty-first Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) was used in this study to measure teachers' perceptions of their ability to lead students in acquisition of 21C skills related to project-based learning. Findings included significant difference in 24 matched pairs of teachers. Teachers

supported with extensive three-year professional development perceived that they were better able to lead students in 21C skill acquisition compared to those teachers who were not afforded such high quality professional development experiences. There was, however, no significant difference in the achievement of the students taught by those two different groups of teachers. Findings indicated a research gap in assessment of 21C skills. Assessments used by states for accountability purposes assessed basic literacy skills and computation math skills. Arkansas educators took a different approach, utilizing the New Tech Network. New Tech Network (NTN), based in Napa, California, replicated the three-year professional development plan in developing a culture of student agency, project-based learning and one computer to one student ratio access to technology. NTN currently supports 15 Arkansas high schools. Atwell (2014) replicated the Hixson et al. (2012) study in Arkansas comparing the 10 Arkansas schools that then participated in NTN to 10 traditional Arkansas schools that were not included in that network. As Hixson et al. (2012) had found in West Virginia, Atwell (2014) identified a significant difference in the perceived ability to lead student acquisition of 21C skills between those teachers that had three years of professional development in project-based learning and one computer to one student (1:1) access and those teachers without such focused intensive support. A research gap identified was lack of assessments of 21C skills.

Finally, Gunn and Hollingsworth (2013) conducted a longitudinal study of a single school district. The study involved three-years of focused professional development in formative assessment, differentiation, and technology integration. Annually, teachers participated in a perceptual survey. The perceptual survey asked

teachers to rate themselves on their ability to lead students in the acquisition of 21C skills. While the findings indicated that teachers with focused professional development perceived themselves able to lead students in the acquisition of 21C skills, the numbers of teachers participating in the professional development dwindled by year three due to attrition or retirement. Student achievement was not included in the study.

Where early adopters like West Virginia, select schools in Arkansas, and Lethbridge School District led with vision, employed one to one computer to student access, and provided intensive professional development, limited access to technology and lack of adult skill in use of instructional technology hampered traditional schools (Gunn & Hollingsworth, 2013). A review of literature associated with these five studies revealed that innovative practices were isolated, and that traditional high schools have not made the shift to 21st Century skills implementation, which remained tied to 20th Century instructional models (Darling-Hammond, 2012; Zhao, 2015). Lee and Hung (2012) reported that explicit knowledge is taught, tested, and transmitted through systematic teacher-centered content instruction.

Four themes emerged from the five studies. Assessments designed to measure students' demonstration of 21C skills were an identified gap in research (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson et al., 2012). Student-centered pedagogies including inquiry based instructional models engage students in learning and acquisition of 21C skills. Integrated Information Communications Technology (ICT) is an instructional tool for both teaching and learning. Access to instructional technology as well as student centered pedagogy, tech support, and intensive professional development

are necessary for success at teaching 21C skills (Gunn & Hollingsworth, 2013; Hixson et al., 2012; Shear et al., 2010; Voogt & Roblin, 2012).

All five studies consistently defined 21st Century skills, and all integrated ICT as a learning tool. Four of the five studies found that teachers' perceptions of their ability to teach 21C skills largely depends on the availability of support through ongoing focused professional development (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson et al., 2012; Shear et al., 2010). The studies described several different instructional approaches through which 21C skill acquisition was promoted and Information Communications Technology was integrated.

The authors of the studies examined student-centered pedagogies including project-based learning, differentiation, formative assessment, and inquiry-based learning. Project-based learning was the focus of two studies (Atwell, 2014; Hixson et al., 2012). Shear et al. (2010) purposely omitted project-based learning from their survey to find other innovative practices that enable teachers to promote 21C skill acquisition. Gunn and Hollingsworth (2013) and Hixson et al. (2012) focused on formative assessment strategies along with technology integration for the purpose of implementing 21C skills instruction. Additionally, Gunn and Hollingsworth (2013) focused on differentiation. Thus, the strengths of the studies include clear and consistent definition of 21C skills, recognition that teacher self-efficacy impacts teachers' ability to teach 21C skills, and identification of multiple instructional methods that result in students' acquisition of 21C skills.

Focused professional development makes a significant difference in teachers' perceptions of their ability to instill 21C skills through student centered pedagogies and

ICT integration (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson et al., 2012; Shear et al., 2010). Three years of focused professional development for teachers should produce measureable effects on their students' achievement. The study of the Lethbridge School District did not use a statistically standardized instrument, and omitted student achievement data (Gunn & Hollingsworth, 2013). Hixson et al. (2012) reported neutral impact on student achievement in West Virginia. Atwell (2014) reported neutral impact on student achievement after the second year of implementation when comparing schools in Arkansas that were part of the NTN with those that were not. While the use of student centered pedagogies showed no short-term gain in student achievement, neither did they have a negative impact on student achievement. Assessments designed to measure 21C skills were first employed in 2015, only after these studies were performed. Longitudinal student achievement over three years with assessments intended to measure 21C skills and achievement should be considered when investigating the degree to which teachers are able to promote 21C skill acquisition. Student engagement was mentioned as a positive impact of student-centered pedagogies, but no literature concerning student engagement theory was reviewed or reported.

Assessment of 21st Century Skills

Assessments of students' demonstration of 21st Century (21C) skills were absent from the existing research (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson, et al., 2012). This researcher identified, however, that, since those studies were conducted and published, a new generation of assessments have been created to measure critical thinking skills and problem solving skills (Voogt & Roblin, 2012). Darling-Hammond (2012) wrote that "while some countries test recall, a growing number of assessments

from many countries are using analytical items that require students to apply knowledge and demonstrate skill in performance tasks" (pp. 301-302). Schwartz, Bransford, and Sears (2005) stated that, "New technologies make it possible to conduct large-scale assessments of people's abilities to learn to solve new problems (dynamic assessments) rather than simply assess what they can do given SPS [sequestered-problem solving] tests" (pp. 43-44).

National Assessments

The National Assessment of Educational Progress Technology and Engineering Literacy Assessment (NAEPTEL) administered for the first time in 2014 to Grade 8 students across the United States of America measured students' technology use and engineering design skills. Results of the 2014 assessment showed females to outscore males by three points. An achievement gap still persists, though, as students not eligible for the National School Lunch Program outperformed by 28 points those students who are eligible. Fifty percent of students reported using a computer at least once a month to create, edit or organize digital media, and 87% reported trying to fix something that does not work outside of school" (National Assessment of Educational Progress Technology and Engineering Assessment [NAEPTEL], 2016).

State Sponsored Assessments

Additional new generation standardized assessments administered in 2015 included those created by the Smarter Balance Assessment Consortium (SBAC) (2015), the Partnership for Assessment of Readiness for College and Careers (PARCC) (2015), and the ACT Aspire (2015). The call for 21st Century assessments resulted in the development of SBAC and PARCC (P21 Skills Assessment, 2015). New generation

assessments were designed to measure student growth in their acquisition of rigorous Common Core State Standards (2016) inclusive of critical thinking skills and problem-solving skills.

SBAC (2015), PARCC (2015), and ACT Aspire (2015) assessments were administered via computer, using technology as a tool in 2015. New technology item types were featured including drag and drop, multiple select, highlighter, on-screen calculator, and performance tasks such as word processing box to construct responses. Thus technology as a tool was embedded within 21st Century assessments designed to measure student growth on a rigorous set of performance standards. The technology enhanced tools enabled students to apply knowledge and demonstrate analytical skill. Arkansas participated in the 2015 PARCC assessment.

District Assessments

Districts across the nation designed curriculum and instruction to meet standards in preparation for state sponsored assessments. District technology departments were equally involved in ramping up technology infrastructure to support new generation technology enhanced standardized assessments. In addition to the technical preparation, some district technology departments were responsible for training teachers in instructional technology use. District leaders used surveys, rubrics, and classroom walkthroughs to record technology use as a teaching and learning tool at the classroom level (Porter, 2004). Using Porter's (2004) Classroom Walkthrough Observation (2004) protocol, observers ranked student technology use at three levels: technology literacy, whose sole focus was for students to learn to use technology; adaptive technology use, which was described as writing with pen and paper equal to typing in a word processing

document; and transformational use was described as student-centered, designed from a constructivist approach, innovative, and a task that could not have been accomplished without the technology.

Classroom Level Assessments

Besides standardized tests and district self-assessments, a greater emphasis was placed on formative assessments at the classroom level to inform day to day student-centered instructional decisions (Brookhart, 2010; Gunn & Hollingsworth, 2013; Tomlinson & Moon, 2013). Common to formative assessments were defined learning targets or goals from rigorous standards, criteria for attaining stated goals, and feedback on progress from self, peers, and teacher (Brookhart, 2010; Danielson, 2007, 86-89; Pollock, 2012; Tomlinson & Moon, 2013.)

Student-Centered Pedagogies

Dweck (2006) found that "mindsets" make the difference in student achievement and closing the achievement gap. The "growth mindset" propels students to persevere until new learning takes place, where a "fixed mindset" causes students to shrink in fear of failure. Student-centered pedagogies are cloaked in the "belief that it's impossible to foresee what can be accomplished with years of passion, toil, and training" (p. 8). Dweck (2006) detailed how surveys and observation of people with a *growth mindset* were "oriented toward learning" and were able to accurately assess their abilities (p. 11). An accurate assessment of ability enabled students to set goals and map a terrain toward success. Long-term goals and effort toward them were foundational to student-centered pedagogies.

In addition to defining and assessing 21C skills, student-centered pedagogies were found to have had the potential to advance 21C skills in traditional high schools. Students engaged in learning production were found at the core of student-centered pedagogies. Student choice, agency, self-direction, self-regulation, and personalization were terms used to communicate that the students' learning goals and interests were identified through various means (Hixson et al., 2012; New Tech Network, 2016; Shear et al., 2010). Shear et al. (2010) stated that goals were both short range, single course, and long range, from high school through advanced learning, into the workforce. Teachers provided feedback and assisted in designing student goal-oriented learning plans. Students and parents monitored progression through interactive learning management systems.

Contrast student-centered learning with teacher-centered, one size fits all instruction in which the teacher as the depositor of knowledge determined how and when students engaged with content. Student centered learning did not eliminate the teachers' role as expert in the classroom; most often, teachers craft investigations in goal oriented, standards focused content instruction by engaging students in inquiry, using research and integrated technology to learn and communicate learning. Hattie (2009), in a meta-analysis of instructional strategies, described this teaching practice as the Direct Instruction system of planning instruction. The Direct Instruction model consisted of seven steps for formulating performance events. The teacher identifies what students should know and be able to do through the instruction. A series of connected steps communicate the goal and success criteria, plan for student engagement, model a lesson, provide exemplars, guide practice, close the lesson, and extend the learning through

independent practice (Ryder, Burton, & Silberg, 2006; Yeh, 2009). The Direct Instruction model closely resembles Pollock, Ford, and Blacks' (2012) instructional plan featuring a stated learning goal, accessing prior knowledge, opportunities to learn new information integrated with one of thirteen thinking skills, application of the learning, and revisiting the goal.

There are pockets of successful implementation of student-centered teaching practices and ICT integration that lead students in acquisition of 21C skills (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson et al., 2012; Voogt & Roblin, 2012) but they are isolated (Shear et al., 2010). Despite national goals that support the implementation of instructional practices that promote 21st Century skill acquisition, "at the school level most teaching practices do not yet foster the learning of 21st Century competences" (Voogt & Roblin, 2012, p. 315).

Inquiry is an integral part of instruction. Danielson (2007) promoted "Using Questioning and Discussion Techniques" when she declared "a teacher's skill in leading discussions served purposes of exploring new concepts, providing evidence of student understanding, and promoting student engagement" (p. 79-82). However, lines are blurred between inquiry-based teaching, what the teacher must do, to produce desired student outcomes, inquiry-based learning**.**

Inquiry-based teaching. Described by Hattie (2009), inquiry-based teaching focuses on the learning process, the result of teacher developed open-ended inquiry where students observed an event, posed an explanation, conducted experiments, collected and analyzed data, and produced a product showing the results of the inquiry. Such an inquiry would occur generally in science classrooms where the teacher designed

units of instruction that engaged students to investigate, observe, and question in open-ended inquiries.

Problem-solving teaching. Most often associated with math, problem-solving teaching involves carefully designed lessons that are student-centered, include cooperative small group work, teacher as facilitator, an authentic problem presented in the beginning, and student selected tools and investigation into new learning to solve the problem. Outcomes of project-based learning and problem-based learning approaches are neutral on student achievement, no reported student achievement gain was found but student outcomes were greater for the process of learning (Loyens & Gijbels, 2008; Loyens, Rikers, & Schmidt, 2008).

Project-based learning. Project-based learning encompasses an investigation initiated by a complex question, problem, or challenge. Elements involved in planning are standards-based content learning goal and identified skills, critical thinking and problem solving, challenging questions, sustained inquiry, an authentic real-world situation, student choice and voice, critique, revision, and public presentation beyond the classroom (Atwell, 2014; Buck Institute for Education 21st Century Skills Framework, 2015; Hixson et al., 2012; Holm, 2011; New Tech Network, 2016).

Inquiry-based learning. Inquiry-based learning involves students engaged in the process of observing more than finding one right answer. Most frequently, the strategy was used in science classrooms. Studies indicated greater learning effects in the process of inquiry science than learning science content. Where science teachers were properly trained, students out-performed students of teachers that were traditionally trained (Hattie, 2009). A contributor to the success of inquiry-based learning was careful

planning utilizing the direct instruction method. Seven steps directed inquiries including that they were planned, linked to standards, identified success criteria, included a hook, provided modeling, and practice in a group setting and individually (Hattie, 2009; Musawi, Asan, Abdelraheem & Osman 2012; Song & Looi, 2012).

Many instructional models make up inquiry teaching and learning. Inquiry teaching focuses on what the teacher must do in planning so that students learn deeply. Securing consensus on definitions of 21C skills and identifying instructional methods through inquiry that prepare students for their future, along with equitable access to learning is contemplated by the researcher.

Information Communication Technology

National goals established a need for 21C skills embedded in content instruction as a result of rapid development of information communication technology and the shift to knowledge based economies (Voogt & Roblin, 2012). One of the 21C skills is ICT use as a tool for research, for communication, and as a tool that facilitates collaboration (Shear et al., 2010). The International Society for Technology in Education (ISTE) formerly the National Standards for Technology in Education demonstrates the shift of ICT in learning with the launch of revised student standards in 2016. Standards for ICT use in learning integrate 21C skills and student-centered pedagogies. ISTE Standards for Students (2016) reported that in 1998, at the beginning of the technological revolution, the focus was to use technology tools with no mention of learning content; that in effect, learning how to use the tool was the content. By 2007, the ISTE Standards' focus shifted to how the tool applied to learning, an adaptive state. The ISTE Standards for Students in 2016 fully integrate 21C skills learning facilitated by ICT as a tool.

The ISTE Standards for Students are labeled "Empowered Learner, Digital Citizen, Knowledge Constructor, Innovative Designer, Computational Thinker, Creative Communicator, and Global Collaborator" (ISTE, 2016, p.1). As stated by ISTE (2016), the empowered learner is a student that practices agency, sets learning goals and uses technology to gather feedback. The digital citizen acts responsibly and legally in technology oriented learning environments. The knowledge constructor conducts research to learn. The innovative designer uses a variety of technologies and the design process to solve problems. The computational thinker uses technology assisted data analysis. The creative communicator uses a variety of technology tools to communicate clearly. The global collaborator uses digital tools to broaden their perspectives by collaborating with others locally and globally. The revised ISTE Standards (2016) reflected the 21C workplace. ICT is a productive tool that facilitates work. Students practice 21C skills when high school classrooms employ student centered pedagogies and ICT integration (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson et al., 2012; Voogt & Roblin, 2012).

Summary

The breadth of the literature review examined five research studies: two international studies, two state studies and a school district study. The reviewed literature consistently defined 21C skills, addressed the longstanding lack of 21C skill assessments, and examined student-centered pedagogies including Information Communications Technology use as a tool in teaching and learning.

The purpose of the present study is to investigate teachers' perceptions of 21C skills acquisition in four diverse high schools in one Arkansas school district. Identifying

significant differences will enable the district to investigate and implement a plan to close any 21C skills gaps through innovative practices unique to each school setting, focused professional development, and equitable access to Information Communication Technologies.

Chapter 3 will articulate the methods design to be used in the study, including a survey intended to measure teachers' perception of their ability to lead 21C skill acquisition.

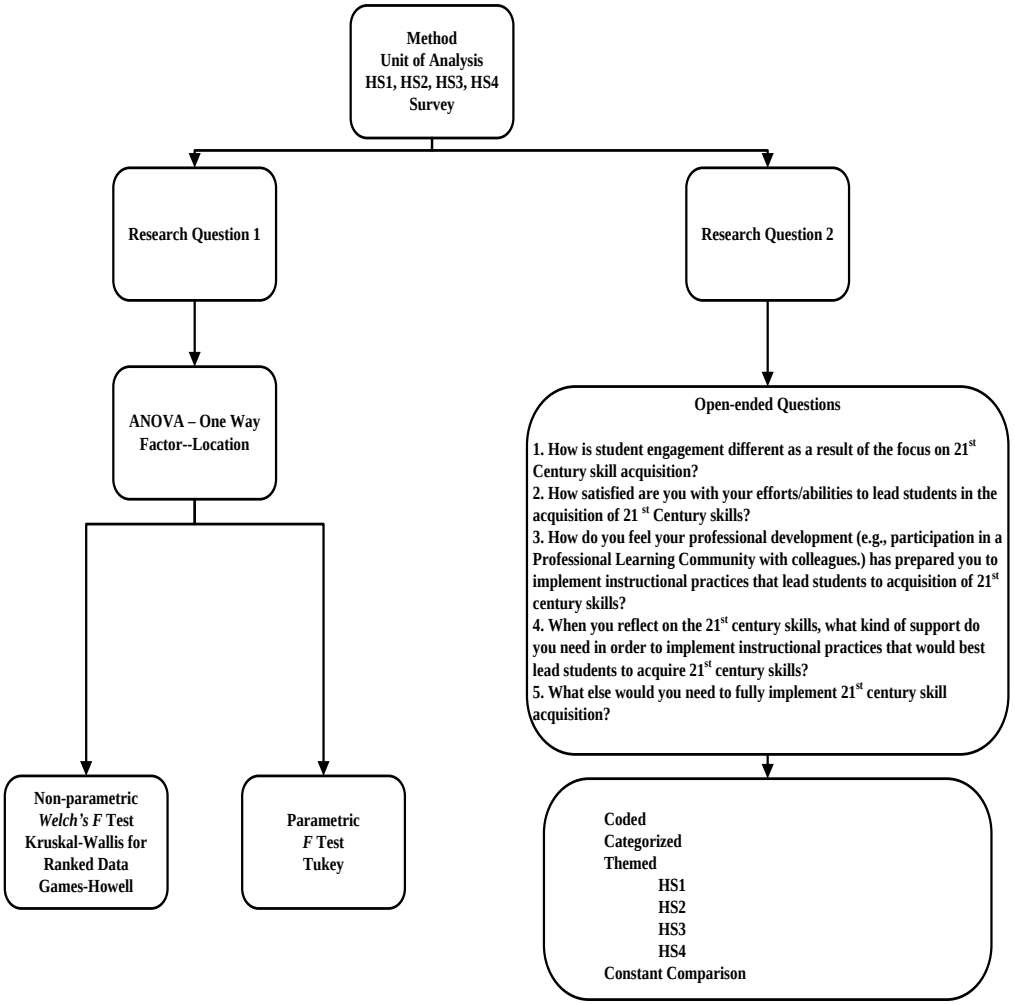

Figure 3.1 Methodology Flow Chart

III. Methodology

The purpose of this study was to investigate how teachers in four different high schools perceive themselves to promote their students' acquisition of 21C skills. The Twenty-first Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) was employed to reveal how consistent teachers' perceptions are of their ability to teach 21C skills. A mixed methods design was involved in this study because numbers – while very helpful – tell only part of the story. This research study sought to analyze common themes among teachers' perceptions of their ability to implement instructional practices that yield students' implementation of 21C skills in four high schools. A perceptual survey was conducted at each of four high schools to measure teachers' perceptions of their ability to lead 21C skills development. Five open-ended questions added depth of understanding to and a qualitative element to the study. Responses to open-ended questions were coded, categorized, and trends analyzed using the constant comparative method (Creswell, 2008; Patton, 2002).

State wide achievement data was a resource constraint. State achievement exams changed in 2015 from measuring reading, writing, and computational math to merge critical thinking, problem solving, and technology use through performance based assessments that measure 21C skills acquisition. Different states used different assessments. For example, Arkansas participated in the Partnership for Assessment of Readiness for College and Careers, while Missouri participated in Smarter Balance Assessment Consortium. Some states shifted assessments again in 2016. Arkansas shifted to ACT for Grade 11 and ACT Aspire for Grade 3 through 10. For these reasons, graduation rate, and attendance rate will be used as student achievement measures.

Instrumentation

Mixed methods design was the choice for this study. The perceptual survey was utilized for analyzing the degree to which participating teachers perceive that they can teach 21 century skills. The Twenty-first Century Teaching and Learning Survey, which was used previously by the West Virginia Department of Education and which has been tested for reliability "std. alpha > .90, inter-item correlations > .58" (Hixson et al., 2012 p. 1; Ravitz, 2014, p. 1) and validity, was employed, with permission by Ravitz (2016) its developer. Participants were also asked to provide demographic information for purposes of analysis, as well as several open-ended questions designed to elicit participants' thinking about how their promotion of students' 21C skill development might be enhanced. The Twenty-First Century Teaching and Learning Survey employed a Likert Scale: (1) not really; (2) to a minor extent; (3) to a moderate extent; (4) to a great extent or (5) to a very great extent.

The open-ended questions to which participants were asked to write narrative responses included:

1. How is student engagement different as a result of acquisition of 21st C skills?
2. Which of these 21C skills are you most comfortable implementing?
3. How satisfied are you with your efforts/abilities to lead students in acquisition of 21st C skills?
4. How do you feel your professional development such as participation in a Professional Learning Community with colleagues has prepared you to implement instructional practices that lead students to acquisition of 21C skills?

[PROFESSIONAL DEVELOPMENT defined as “activities that—are an integral part of school … strategies for providing educators with the knowledge and skills necessary to enable students to succeed in a well-rounded education and to meet the challenging State academic standards; and are sustained (not stand-alone, 1-day, or short term workshops), intensive, collaborative, job-embedded, data-driven, and classroom-focused, and may include activities that—improve and increase teachers'—knowledge of the academic subjects the teachers teach; understanding of how students learn; and ability to analyze student work and achievement from multiple sources, including how to adjust instructional strategies, assessments, and materials based on such analysis….” (Hirsh, 2016, p.1)]

5. When you reflect on 21C skills, what kind of support do you need to implement instructional practices that would lead students in acquisition of 21C skills?

A link to the survey, administered using an online survey tool, was delivered via email to teachers of each school participating in the study. Written approval was obtained from district superintendent before any teachers were contacted. Participating teachers provided consent via the instruction page prior to entering the survey. Confidentiality was provided to participants. The survey was distributed by email, December 9, 2016 and remained open until January 9, 2017. Responses to the survey were included in the data analysis only if participant both clicked ‘Start’ to acknowledge their consent and if they identified in which of the four schools they served as teachers.

Population

Pseudonyms were used to protect confidentiality of participants. High school 1 is an alternative high school. High school 2 is a STEM school of choice. High schools 3 and 4 are comprehensive high schools.

Sampling and Sampling Procedures

The qualitative perceptual survey and open-ended questions were administered to all faculty members in each of the four participating schools. Diverse school settings were sought for this study to reflect the fact that the nation's schools are organized in a variety of ways and serve diverse populations.

Procedures for Recruitment, Participation, and Data Collection (Primary Data)

The district's assistant superintendent for secondary instruction along with the principals of the four schools were contacted and invited to participate in the study. All accepted. The superintendent provided permission to access faculty to administer the survey.

The link to the Survey Monkey instrument was distributed via teachers' school email accounts in late Fall 2016. Confidentiality was maintained, and teachers were allowed to discontinue participation at any time without penalty. Each section of the survey provided a definition of a 21st Century skill accompanied by a list of five to eight related practices. Participants selected from a bank of responses to indicate the frequency with which they engage students in certain practices: 1 'Almost never'; 2 'A few times a semester'; 3 '1-3 times per month'; 4 '1-3 times per week'; 5 'Almost daily' (Hixson et al., 2012; Ravitz, 2014). In addition to the frequency of different practices, the survey asked how much teachers perceived having taught and assessed each skill. One series of

items asks about collaboration: (a) I have tried to develop students' collaborative skills; (b) Most students have learned collaborative skills while in my class; and (c) I have been able to effectively assess students' collaborative skills. Response choices for this series of items were as follows: 1 'Not really'; 2 'To a minor extent'; 3 'To a moderate extent'; 4 'To a great extent'; 5 'To a very great extent' (Hixson et al., 2012; Ravitz, 2014). Qualitative open-ended questions were coded and categorized using the constant comparative method (Dye, Schatz, Rosenberg, & Coleman, 2000).

State reported archival data from school report cards was collected, including population, race, graduation rate, and attendance rate. All information was reported anonymously.

Instrumentation and Operationalization of Constructs

The instrument used for the survey is Twenty-first Century Teaching and Learning Survey constructed by Jason Ravitz (2014) for use by the West Virginia Department of Education (Hixson et al., 2012) conceptualized from the Innovative Teaching and Learning Study (Shear et al., 2010). The survey is presented in Appendix A, Twenty-first Century Teaching and Learning Survey, and was appropriate for this study as well because of their focus on 21C skills. Permission was granted by Ravitz on July 22, 2016 as shown in Appendix B. Demographic items and qualitative questions were added for the purpose of this study. Reliability and validity "std. alpha > .90, inter-item correlations > .58" (Hixson et al., 2012, p. 1; Ravitz, 2014) values from West Virginia are included. The survey was used in a 2011 program evaluation of a three-year longitudinal study measuring statewide professional development in project based learning, formative assessment, and technology integration. Additionally, Atwell (2014)

used the survey in Arkansas to measure the effects of project based learning professional development between 10 Arkansas high schools that had not provided its faculties with professional development in project based learning and 10 Arkansas highs schools that were part of the NTN, and which therefore provided such professional development.

Data Analysis Plan

Microsoft Mini Tab was utilized for analysis of perceptual survey data. Data analysis included ANOVA one-way parametric test, post hoc Tukey, pairwise comparison assumption of equal variances, and Kruskal-Wallis non-parametric test and post hoc Games-Howell no assumption of variances (Field, 2010).

Constant comparison was used to analyze responses to open-ended survey questions. Additionally, those responses were coded and categorized. Cross-case analysis was utilized between schools.

Validity

Confidence in the Twenty-first Teaching and Learning Survey (Ravitz, 2014) is rooted in the number of times the survey has been used in previous research (Atwell, 2014; Hixon et al., 2012; Shear et al., 2010). Asking teachers to respond to open-ended questions diminishes participant observer influences or interpretations. The survey instrument employed in this study was based on a review of P21 skills, the William and Flora Hewlett Foundation Deeper Learning Framework (2010), and the Innovative Teaching and Learning Study (Shear et al., 2010) as shown in Appendix C. Ordinal scales are used for respondents' self-reports of the frequency with which they demonstrate certain practices, and the extent to which they perceive themselves to lead students to acquire 21C skills.

Ethical Procedure

Agreements were obtained from each institution involved in the study prior to Institutional Review Board (IRB) approval. No data was collected prior to IRB approval. No treatment was administered to individuals participating in this research study. Pseudonyms were used for individuals and each school to protect identity. Participants were excused from participation at any time and for any reason. Data is stored on an external hard drive in a secure place. The researcher has access to the data. Data will be destroyed July 1, 2018.

Researcher Positionality

The researcher is a participant observer employed by the district. Perceptual surveys are qualitative in nature but rigorous statistical analysis was performed to validate my analyses of the qualitative data.

Summary

This study is a comprehensive look at four high schools in a single school district in Arkansas concerning perceptual understanding of 21C skills, teachers' perceptions of their ability to teach 21C skills. The study is mixed in design, utilizing the 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) and constant comparison analysis to determine patterns, themes, and generalizations. IV. Results is an analysis of the collected data.

IV. Results

The purpose of this study was to analyze the perceptions of teachers from four different schools in one Arkansas school district about their abilities to lead 21C skills acquisition. The 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) was utilized to engage teachers' in self-reporting their perceptions and understanding of 21C skills and associated practices. Five open-ended questions enabled teachers to reflect on practice and express their attributes associated with leading 21C skills acquisition.

Research Questions

1. How consistent are teachers' perceptions of their ability to lead 21st Century skills acquisition?
2. To what do teachers attribute their ability to lead students in the acquisition of 21st Century skills?

Data Collection

The 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) was opened to the faculties of the four schools on December 9, 2016 and remained open until January 9, 2017. Four email reminders were sent between the opening and closing of the survey. The link to the Survey Monkey online survey instrument was emailed to 232 teachers, grades 9 - 12 in four high schools in the same school district. The response rate was 42%, 97 teachers. Teachers in content/departments were represented: 15 Math, 18 English Language Arts, 18 Social Studies, 5 Physical Education, 4 Art, 7 Foreign Language, 11 Career Technical Education, 14 Science, and 17 Special Education. Table 4.2 summarizes background information including

disbursement of responses and descriptions of respondents. The small sample size of HS1 should be noted in reviewing the data presented in this chapter.

Table 4.2.

Demographics of Sample

Participating High Schools (HS)	Population N	Sample Size, Response Rate %	Respondents/Years of Experience	Education Level Bachelor/Master
1	13	3, 23	2/Over 15 years	3/0
2	33	12, 36	4/0-3 Years 4/Over 15 years	6/4
3	105	39, 37	11/8-15 Years 20/Over 15 Years	16/19
4	106	43, 41	11/8-15 Years 25/Over 15 Years	18/23

Note: Respondents and Education Level include top two responses.

Study Results

The study results were analyzed in two parts, each part addressing a research question. Research question one (RQ1) was: How consistent are teachers' perceptions of their ability to lead 21st Century skills acquisition? The 21st Century Teaching and Learning Survey (Hixon et al., 2012; Ravitz, 2014) asked teachers to rank their perception on each of the eight 21C skills and associated five to eight practices and the extent to which the teacher effectively lead students to acquire the skills, the extent to which students learned each skill, and extent to which the teacher effectively assessed each skill. The unit of analysis was the school. The four high schools in this investigation were HS1 alternative, HS2 STEM a NTN school of choice, HS3 comprehensive, and HS4 comprehensive. The data was tested for normality using the

Chi-Square Goodness-of-Fit test. Analysis of Variance (ANOVA) One-way parametric, equal variances assumed for the analysis and post hoc Tukey were performed for each of the eight 21C skills and supporting practices. Kruskal-Wallis non-parametric, hypotheses test, including *Welch's F* and Games-Howell post hoc were performed with no assumption of equal variances. Mean, standard deviation, and confidence intervals were reported in tables as appropriate in Appendix F.

Research question two (RQ2) was: To what do teachers attribute their ability to lead students in the acquisition of 21st Century (21C) skills? Responses to five open-ended questions allowed teachers to reflect on practice and 21C skills. Sixty-three teachers responded. Constant comparison analysis was used. Teachers' responses were coded, then categorized to identify themes within each school. Finally, theme comparisons were made between the four high schools.

Research Question 1

Research Question 1 *How consistent were teachers' perceptions of their ability to lead 21st Century skills acquisition?* results from the survey are reported in a pattern. ANOVA One-way results including the eight 21C skills, associated practices, the means, standard deviations, and 95% confidence intervals are reported in tables in Appendix F. Kruskal-Wallis results for the eight skills and associated practices are reported in the text where significant difference resulted. The practice descriptor and response descriptor from the survey are identified by underline followed the Kruskal-Wallis hypothesis test statistic. Statistical abbreviations are italicized as appropriate.

Post hoc Games-Howell results are indicated by groups. Where significant difference was found, schools would be identified by different groups named Group A or

Group B. When a school was identified by Group AB then the school had data points that overlapped with Group A and or Group B. An example is HS 1 in Group A compared to HS 2 in Group B were found significantly different with no matching data points. HS 3 and HS4 were frequently identified by Group AB, indicating that data points overlapped with Group A and or Group B.

Critical thinking skills. Analysis of the six practices of critical thinking skills found differences in the means of responses but differences were not significant, i.e. practice a. compare information *Welch's F* = 2.01, *p* =.178; practice b. draw conclusions *Welch's F* = 1.53, *p* = .274; practice c. summarize *F* = 0.84, *p* = .473; practice d. analyze arguments *Welch's F* = 1.79, *p* = .213; practice e. develop an argument *Welch's F* = .62, *p* = .621; and practice f. solve complex problems *Welch's F* = 2.01, *p* = .182. Therefore, RQ1 teachers' perceptions based on frequency of practices that lead students in acquisition of critical thinking skills are consistent across the four high schools. Statistical significance $\alpha = .05$ was found when teachers reported the extent to which they tried to lead students in acquisition of critical thinking skills *F* = 4.86, *p* = .003, most students have learned critical thinking skills, *Welch's F* = 6.85, *p* =.010, and teacher effectively assessed critical thinking skills *Welch's F* = 6.68, *p* = .010.

Table 4.3 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis. Teacher efforts in leading acquisition of critical thinking skills found statistically significant difference (<p = .01) between the four high schools, *H*(3) = 15.67, *p* = .001 adjusted for ties. HS1 Median(*Mdn)* equal to three showed moderate confidence in the teachers' ability to lead students in the acquisition of critical thinking skills. HS2 (*Mdn* = 5) responses were to a very great extent indicating confidence in the teachers'

ability to lead students in critical thinking skills. HS3 (*Mdn* = 4) and HS4 (*Mdn* = 4) reported to a great extent in their ability to lead students in acquisition of critical thinking skills. Post hoc analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size, and multiple groups of varying sizes) confirmed the findings of significant difference between the four schools, therefore RQ1 teachers' perceptions of their efforts to lead students to acquire critical thinking skills are inconsistent from one high school to another.

The perceptions of teachers among the four high schools regarding student learning of critical thinking skills between the four high schools differed significantly, $H(3) = 10.00$, $P = .019$. HS1 (*Mdn* = 2) showed little confidence in student learning of critical thinking skills, responding to a minor extent. HS2 (*Mdn* = 4) responses were to a great extent indicating confidence in student learning critical thinking skills. HS3 (*Mdn* = 3) and HS4 (*Mdn* = 3) reported to a moderate extent in student learning of critical thinking skills. Follow up analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size and multiple groups of varying sizes) confirmed the findings into the two reporting groups, therefore RQ1 teachers' perceptions of student learning critical thinking skills are inconsistent between the four high schools.

Table 4.3.

Kruskal-Wallis Hypothesis Test Summary Critical Thinking Skills

Practices	H(df) H(df) Adj. for ties	Sig. p p Adj. for ties
a. Compare information from different sources before completing a task or assignment?	4.20(3) 4.61(3)	.240 .203
b. Draw their own conclusions based on analysis of numbers, facts, or relevant information?	5.42(3) 5.90(3)	.144 .116
c. Summarize or create their own interpretation of what they have read or been taught?	3.65(3) 4.10(3)	.301 .251
d. Analyze competing arguments, perspectives or solutions to a problem?	2.41(3) 2.60(3)	.492 .458
e. Develop a persuasive argument based on supporting evidence or reasoning?	2.00(3) 2.16(3)	.573 .540
f. Try to solve complex problems or answer questions that have no single correct solution or answer?	4.88(3) 5.15(3)	.180 .161
a. I have tried to develop students' critical thinking skills	13.04(3) 15.67(3)	.005** .001**
b. Most students have learned critical thinking skills while in my class	8.89(3) 10.00(3)	.031* .019*
c. I have been able to effectively assess students' critical thinking skills	8.61(3) 9.73(3)	.035* .021*

Note. *p<.05; **p<.01; H = Test Statistic; df = degrees of freedom; N = 232; High School 1 n = 3; High School 2 n = 12; High School 3 n = 39; High School 4 n = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Teachers significantly differed in regards to assessing critical thinking skills, $H(3) = 9.73$, $P = .021$. HS1 ($Mdn = 2$) showed little confidence in their ability to assess critical thinking skills, responding to a minor extent. HS2 ($Mdn = 3$), HS3 ($Mdn = 3$), and HS4 ($Mdn = 3$) responded to a moderate extent. Post hoc analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size and multiple groups of varying sizes) confirmed the findings into the two groups; therefore RQ1

teachers' perceptions of their ability to assess critical thinking skills are inconsistent from one high school to another.

Collaboration skills. Analysis of the six practices of collaboration skills at significance level $\alpha = 0.05$ found significant differences in the means of responses and statistically significant differences ($p = <.01$) in most practices, i.e. practice a. work in pairs, *Welch's F* = 2.76, p =.105; practice b. set goals and plan, *Welch's F* = 12.29, p = .001; practice c. create joint products, *Welch's F* = 6.46, P =.010; practice d. present group work, *Welch's F* = 8.77, p =.004; practice e. work as a team to incorporate; *Welch's F* = 6.98, p = .007; and practice f. give feedback to peers, *Welch's F* = 5.86, p = .013. Therefore, RQ1 teachers' perceptions based on frequency of practices that lead students in acquisition of collaboration skills are not consistent between the four high schools. Kruskal-Wallis pairwise comparison follow up analysis was performed. Table 4.4 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis at the significance level $\alpha = .05$. Statistically significant difference was found in frequencies of teacher practice b. Work with other students to set goals and create a plan for their team, $H(3) = 15.67$, $p = .001$ adjusted for ties, HS1 (*Mdn* = 3) one to three times per month, HS2 (*Mdn* = 5) almost daily, HS3 (*Mdn* = 4) and HS4 (*Mdn* = 4) one to three times per week. Games-Howell pairwise comparison post hoc analysis placed HS2 in Group A and HS1, HS3, and HS4 in Group B. Therefore, RQ1 teachers' perceptions of leading collaboration skills are inconsistent across the four high schools.

Significant difference was found in frequencies of teacher practice c. Create joint products using contributions from each student, $H(3) = 11.21$, $p = .011$ adjusted for ties, HS1 (*Mdn* = 2) a few times a semester, HS2 (*Mdn* = 4) one to three times per week,

HS3 (*Mdn* = 3) and HS4 (*Mdn* = 3) one to three times per month. Games-Howell pairwise comparison post hoc analysis placed HS1 in Group A, HS2 in Group B, and HS3 and HS4 in Group AB. Therefore, RQ1 teachers' perceptions of leading collaboration skills are inconsistent across the four high schools.

Statistically significant difference was found in frequencies of teacher practice d. Present their group work to the class, teacher or others, $H(3) = 13.60$, $p = .004$ adjusted for ties, HS1 (*Mdn* = 1) almost never, HS2 (*Mdn* = 3.5) one to three times per week, HS3 (*Mdn* = 3) and HS4 (*Mdn* = 3) one to three times per month. Games-Howell pairwise comparison post hoc analysis placed HS2 in Group A, HS1 and HS3 in Group B and HS4 in Group AB. Therefore, RQ1 teachers' perceptions of leading collaboration skills are inconsistent across the four high schools.

Significant difference was found in frequencies of teacher practice e. Work as a team to incorporate feedback on group tasks or products, $H(3) = 10.67$, $p = .018$ adjusted for ties, HS1 (*Mdn* = 1) almost never, HS2 (*Mdn* = 3) one to three times per month, HS3 (*Mdn* = 2) and HS4 (*Mdn* = 2) a few times a semester. Games-Howell pairwise comparison post hoc analysis placed HS2 in Group A, HS1 and HS3 in Group B, and HS4 in Group AB. Therefore, RQ1 teachers' perceptions of leading collaboration skills are inconsistent across the four high schools.

Significant difference was found in frequencies of teacher practice f. Give feedback to peers or assess other students' work, $H(3) = 9.62$, $p = .022$ adjusted for ties, HS1 (*Mdn* = 2) and HS3 (*Mdn* = 2) a few times a semester, HS2 (*Mdn* = 3) and HS4 (*Mdn* = 3) one to three times per month. Games-Howell pairwise comparison post hoc analysis placed HS1 in Group B, HS2 in Group A, and HS3 and HS4 in Group AB.

Therefore, RQ1 teachers' perceptions of leading collaboration skills are inconsistent across the four high schools.

Assessing collaboration skills found significant difference across the four schools, $H(3) = 8.02$, $p = .046$ adjusted for ties. HS1 ($Mdn = 2$) found confidence to a minor extent in their ability to assess collaboration skills. HS2 ($Mdn = 4$) responded to a great extent, HS3 ($Mdn = 3$), and HS4 ($Mdn = 3$) responded to a moderate extent. Post hoc analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size and multiple groups of varying sizes) confirmed the findings into the two groups; therefore RQ1 teachers' perceptions of their ability to assess collaboration skills are inconsistent across the four high schools.

Table 4.4.

Kruskal-Wallis Hypothesis Test Summary Collaboration skills

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Work in pairs or small groups to complete a task together?	11.28(3) 12.94(3)	.010* .005**
b. Work with other students to set goals and create a plan for their team?	18.82(3) 19.84(3)	.000** .000**
c. Create joint products using contributions from each student?	10.46(3) 11.21(3)	.015* .011*
d. Present their group work to the class, teacher or others?	12.42(3) 13.60(3)	.006** .004**
e. Work as a team to incorporate feedback on group tasks or products?	10.05(3) 4.35(3)	.018* .014*
f. Give feedback to peers or assess other students' work	8.91(3) 9.62(3)	.031* .022*
a. I have tried to develop students' collaboration skills	5.53(3) 6.15(3)	.137 .105
b. Most students have learned collaboration skills while in my class	6.35(3) 7.01(3)	.096 .072
c. I have been able to effectively assess students' collaboration skills	7.15(3) 8.02(3)	.067 .046*

Note. 95 cases used; *p<.05; **p<.01; H = Test Statistic; df = degrees of freedom; N = 232; High School 1 n = 3; High School 2 n = 12; High School 3 n = 37; High School 4 n = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Communication skills. Analysis of the five practices of communication skills found consistency in practice a. Structure data for use in written products or oral presentations (e.g., creating charts, tables, or graphs), *Welch's F* = 1.68, p =.234; d. Answer questions in front of an audience, *Welch's F* = 1.09, p = .394; and e. Decide how they will present their work or demonstrate their learning, *Welch's F* = 1.23, p = .354. Table 4.5 presents the results of Kruskal-Wallis pairwise comparison for ranked data

analysis at the significance level α = .05. Statistically significant difference (<p = .01) was found in frequencies of teacher practice b. Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc,), *Welch's F* = 2.29, p = .001, $H(3)$ = 15.86, p = .001 adjusted for ties, HS1 (*Mdn* = 2), HS3 (*Mdn* = 2.5), and HS4 (*Mdn* = 2) one to three times per semester, HS2 (*Mdn* = 3.5) one to three times per month. Games-Howell Pairwise Comparison follow up analysis confirmed two groupings, HS2 in Group A and HS1, HS3, HS4 in Group B. Therefore, RQ1 teachers' perceptions of leading communication skills are inconsistent across the four high schools.

Significant difference was found in practice c. Prepare and deliver an oral presentation to the teacher or others, *Welch's F* = 6.46, p = .010, $H(3)$ = 9.00, p = .029 adjusted for ties, HS1 (*Mdn* = 1) almost never, HS2 (*Mdn* = 3) one to three times per month, HS3 (*Mdn* = 2) and HS4 (*Mdn* = 2) a few times per semester. Games-Howell pairwise comparison post hoc analysis confirmed multiple groupings HS1 and HS4 in Group AB, HS2 in Group A, and HS3 in Group B. Therefore, RQ1 teachers' perceptions based on frequency of two practices of communication skills are inconsistent across the four high schools.

Table 4.5.

Kruskal-Wallis Hypothesis Test Summary Communication Skills

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	2.49(3) 2.77(3)	.476 .428
b. Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	14.71(3) 15.86(3)	.002** .001**
c. Prepare and deliver an oral presentation to the teacher or others?	8.31(3) 9.00(3)	.040* .029*
d. Answer questions in front of an audience?	1.33(3) 1.40(3)	.722 .706
e. Decide how they will present their work or demonstrate their learning?	3.99(3) 4.35(3)	.262 .226
a. I have tried to develop students' communication skills	4.44(3) 4.8(03)	.218 .187
b. Most students have learned communication skills while in my class	4.41(3) 4.69(3)	.220 .196
c. I have been able to effectively assess students' communication skills	4.24(3) 4.52(3)	.237 .210

Note. 93 cases used; *p<.05; **p<.01; *H* = Test Statistic; *df* = degrees of freedom; *N* = 232; High School 1 *n* = 3; High School 2 *n* = 12; High School 3 *n* = 37; High School 4 *n* = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Creativity and innovation skills. Analysis of the five practices of creativity and innovation skills found consistency in practice a. Use idea creation techniques, *Welch's F* = 1.88, *p* = .195; d. Invent a solution to a complex, *Welch's F* = 1.85, *p* = .201; and e. Create an original, *Welch's F* = 1.30, *p* = .334.

Table 4.6 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis at the significance level $\alpha = .05$. Statistically significant difference was found in frequencies of teacher practice b. Generate their own ideas about how to

confront a problem or question, *Welch's F* = 13.62, *p* = .001, *H*(3) = 18.31, *p* = .001 adjusted for ties, HS1 (*Mdn* = 2) a few times per semester, HS3 (*Mdn* = 3), and HS4 (*Mdn* = 3) one to three times per month, HS2 (*Mdn* = 4) one to three times per week. Games-Howell pairwise comparison post hoc analysis confirmed two groupings, HS2 in Group A and HS1, HS3, HS4 in Group B. Therefore, RQ1 teachers' perceptions of leading communication skills are inconsistent across the four high schools.

Significant difference was found in practice c. Test out different ideas and work to improve them, *Welch's F* = 3.27, *p* = .072, *H*(3) = 8.78, *p* = .032 adjusted for ties, HS1 (*Mdn* = 2) a few times a semester, HS2 (*Mdn* = 4) one to three times per week, HS3 (*Mdn* = 3) and HS4 (*Mdn* = 2.5) one to three times per month. Games-Howell Pairwise Comparison follow up analysis confirmed three groupings HS1 and HS4 in Group AB, HS2 in Group A, and HS3 in Group B. Therefore, RQ1 teachers' perceptions based on frequency of practices of communication skills are inconsistent across the four high schools.

Table 4.6.

Kruskal-Wallis Hypothesis Test Summary Creativity and Innovation Skills

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Use idea creation techniques such as brainstorming or concept mapping?	4.55(3) 4.84(3)	.208 .184
b. Generate their own ideas about how to confront a problem or question?	16.92(3) 18.31(3)	.041* .032*
c. Test out different ideas and work to improve them?	8.28(3) 8.78(3)	.015* .011*
d. Invent a solution to a complex, open-ended question or problem?	2.87(3) 3.06(3)	.413 .383
e. Create an original product or performance to express their ideas?	3.96(3) 4.25(3)	.266 .235
a. I have tried to develop students' creativity and innovation skills	5.56(3) 5.96(3)	.135 .114
b. Most students have learned creativity and innovation skills while in my class	6.44(3) 6.96(3)	.092 .073
c. I have been able to effectively assess students' creativity and innovation skills	6.70(3) 7.25(3)	.082 .064

Note. 93 cases used; *$p<.05$; **$p<.01$; *H* = Test Statistic; *df* = degrees of freedom; *N* = 232; High School 1 *n* = 3; High School 2 *n* = 12; High School 3 *n* = 37; High School 4 *n* = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Self-direction. Analysis of the six practices of self-direction skills found consistency in practice b. Choose their own topics of learning or questions to pursue, $F = 0.84$, $p = .474$; d. Choose for themselves what examples to study or resources to use, $F = 1.59$, $p = .260$; e. Monitor their own progress towards completion of a complex task, *Welch's* $F = 1.40$, $p = .308$, and f. Use specific criteria to assess the quality of their work, *Welch's* $F = 6.34$, $p = .011$.

Additionally, teachers' perceptions in regards to student learning between the four high schools related to self-directed learning, found no significant differences in means,

H(3) = 1.62, *P* = .654 adjusted for ties. HS1, HS2, HS3, and HS4 (*Mdn* = 2) showed little confidence in student learning of self-directed learning skills, responding to a minor extent. Post hoc analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size and multiple groups of varying sizes) confirmed the findings of one group, therefore RQ1 teachers' perceptions of student learning self-directed learning skills are consistent across the four high schools.

Table 4.7 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis at the significance level $\alpha = .05$. Significant difference was found in frequencies of teacher practice a. Take initiative when confronted with a difficult, *Welch's F* = 3.88, *p* = .051, *H*(3) = 9.90, *p* = .019 adjusted for ties, HS1 (*Mdn* = 2) a few times per semester, HS3 (*Mdn* = 3), and HS4 (*Mdn* = 3) one to three times per month, HS2 (*Mdn* = 4) one to three times per week. Games-Howell pairwise comparison post hoc analysis confirmed grouping of the means of each school, HS2 in Group A and HS1 overlaps Group A and B, HS3 and HS4 in Group B. Therefore, RQ1 teachers' perceptions of leading self-direction skills are inconsistent across the four high schools.

Statistically significant difference was found in practice c. Plan the steps they will take to accomplish a complex task, *F* = 16.12, *p* = .000, *H*(3) = 16.96, *p* = .001 adjusted for ties, HS1 (*Mdn* = 1) a few times a semester, HS2 (*Mdn* = 4) one to three times per week, HS3 (*Mdn* = 3) and HS4 (*Mdn* = 3) one to three times per month. Games-Howell Pairwise Comparison post hoc analysis confirmed two groupings HS2 in Group A, HS1, HS3, and HS4 in Group B. Therefore, teachers' perceptions based on frequency of practices of self-direction skills are inconsistent across the four high schools.

Statistically significant difference was found in practice g. Use peer, teacher or expert feedback to revise their work, $F = 11.72$, $p = .001$, $H(3) = 12.92$, $p = .005$ adjusted for ties, HS1 ($Mdn = 2$) and a few times a semester, HS2 ($Mdn = 4$) and HS3 ($Mdn = 4$) one to three times per week, and HS4 ($Mdn = 3$) one to three times per month. Games-Howell pairwise comparison post hoc analysis confirmed two groupings HS2 in Group A and HS2, HS3, and HS4 in Group B, therefore RQ1 teachers' perceptions based on frequency of practices of self-direction skills are inconsistent across the four high schools.

Teacher efforts in leading acquisition of self-direction skills were significantly different between the four high schools, $H(3) = 6.33$, $p = .011$ adjusted for ties. HS1 ($Mdn = 2$) showed minor confidence in their ability to lead students in acquisition of CTS. HS2 ($Mdn = 4$) responses were to a great extent indicating confidence in their ability to lead students in self-direction skills. HS3 ($Mdn = 3$) and HS4 ($Mdn = 3.5$) reported to a moderate extent in their ability to lead students in acquisition of self-direction skills. Post hoc analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size, and multiple groups of varying sizes) confirmed the findings of the multiple groups therefore RQ1 teachers' perceptions of their efforts to lead students to acquire self-direction skills are inconsistent across the four high schools.

Table 4.7.

Kruskal-Wallis Hypothesis Test Summary Self-Direction Skills

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Take initiative when confronted with a difficult problem or question?	9.10(3) 9.90(3)	.028* .019*
b. Choose their own topics of learning or questions to pursue?	2.37(3) 2.55(3)	.499 .466
c. Plan the steps they will take to accomplish a complex task?	16.03(3) 16.96(3)	.001** .001**
d. Choose for themselves what examples to study or resources to use?	4.79(3) 5.18(3)	.188 .159
e. Monitor their own progress towards completion of a complex task and modify their work accordingly?	4.35(3) 4.56(3)	.227 .207
f. Use specific criteria to assess the quality of their work before it is completed?	8.09(3) 8.67(3)	.044 .034
g. Use peer, teacher or expert feedback to revise their work?	12.113) 12.92(3)	.007** .005**
a. I have tried to develop students' self-direction skills	8.80(3) 9.57(3)	.032* .023*
b. Most students have learned self-direction skills while in my class	9.29(3) 10.11(3)	.026* .018*
c. I have been able to effectively assess students' self-direction skills	6.98(3) 7.55(3)	.073 .056

Note. 90 cases used; *p<.05; **p<.01; H = Test Statistic; df = degrees of freedom; N = 232; High School 1 n = 3; High School 2 n = 12; High School 3 n = 37; High School 4 n = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Global connections. Analysis of the six practices of making global connections skills found consistency in five of six practices, a. Study other countries or cultures, *Welch's F* = 0.53, p = .675; c. Discuss issues related to global interdependency, *Welch's F* = 0.75, p = .547; d. Understand life experiences of other cultures, F = 0.41, p = .747; e. Study geography, *Welch's F* = 0.75, p = .547; and f. Reflect on own experiences

connected to global issues, *Welch's F* = 0.15, *p* = .927. Significant difference was found in b. Use information from people in other countries, *Welch's F* = 3.80, *p* = .043.

The extent to which teachers have tried to teach, *Welch's F* = 0.42, *p* = .739 the extent to which students learned, *Welch's F* = 1.38, *p* = .303, and the extent to which teachers were able to assess skills in making global connections, *Welch's F* = 1.12, *p* = .384 were consistent among groups. Table 4.8 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis at the significance level $\alpha = .05$. Consistency was found in all practices. However, Games-Howell Pairwise Comparison post hoc analysis confirmed significant difference in b. Use information or ideas that come from people in other countries, *Welch's F* = 3.80, *p* = .043. HS1, a few times a semester, and HS2, one to three times per week were grouped differently. Therefore, RQ1 teachers' perceptions of leading making global connections are inconsistent across the four high schools.

Table 4.8.

Kruskal-Wallis Hypothesis Test Summary Global Connections

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Study information about other countries or cultures?	1.40(3) 1.49(3)	.706 .685
b. Use information or ideas that come from people in other countries or cultures?	4.32(3) 4.58(3)	.229 .205
c. Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	0.96(3) 1.03(3)	.812 .794
d. Understand the life experiences of people in cultures besides their own?	0.91(3) 0.97(3)	.822 .807
e. Study the geography of distant countries?	0.58(3) 0.68(3)	.902 .878
f. Reflect on how their own experiences and local issues are connected to global issues?	0.35(3) 0.37(3)	.951 .946
a. I have tried to develop students' skills in making global connections	0.52(3) 0.56(3)	.915 .907
b. Most students have learned to make global connections while in my class	1.52(3) 1.62(3)	.678 .654
c. I have been able to effectively assess students' skills in making global connections	1.17(3) 1.26(3)	.760 .740

Note. 91 cases used; **p*<.05; ***p*<.01; *H* = Test Statistic; *df* = degrees of freedom; *N* = 232; High School 1 *n* = 3; High School 2 *n* = 12; High School 3 *n* = 37; High School 4 *n* = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Local connections. Analysis of the five making local connections practices found consistency in five practices, a. Investigate topics relevant to family or community, *Welch's F* = 0.68, *p* = .565; b. Apply learning to local situations, *Welch's F* = 4.69, *p* = .026; c. Talk to community members, *F* = 0.71, *p* = .566; d. Analyze how community member views a problem, *F* = 0.94, *p* = .425; and e. Respond to task that weighs concerns of different community members *F* = 1.48, *p* = .225.

Table 4.9 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis at the significance level $\alpha = .05$. Consistency was found in all practices. Games-Howell pairwise comparison as well as Tukey post hoc analysis confirmed consistency in all practices; therefore RQ1 teachers' perceptions of leading making local connections are consistent across the four high schools.

Table 4.9.

Kruskal-Wallis Hypothesis Test Summary Local Connections

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Investigate topics or issues that are relevant to their family or community?	2.46(3) 2.63(3)	.483 .453
b. Apply what they are learning to local situations, issues or problems?	4.75(3) 5.05(3)	.191 .168
c. Talk to one or more members of the community about a class project or activity?	1.14(3) 1.34(3)	.768 .719
d. Analyze how different stakeholder groups or community members view an issue?	3.15(3) 3.69(3)	.369 .297
e. Respond to a question or task in a way that weighs the concerns of different community members or groups?	4.84(3) 5.41(3)	.184 .144
a. I have tried to develop students' skills in making local connections	4.55(3) 4.85(03)	.208 .183
b. Most students have learned to make local connections while in my class	6.31(3) 6.79(3)	.097 .079
c. I have been able to effectively assess students' skills in making local connections	4.46(3) 4.87(3)	.216 .182

Note. 90 cases used; **p*<.05; ***p*<.01; *H* = Test Statistic; *df* = degrees of freedom; *N* = 232; High School 1 *n* = 3; High School 2 *n* = 12; High School 3 *n* = 37; High School 4 *n* = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Use technology as a tool. Analysis of the practices found consistency in most practices including a. use technology for self-instruction, $F = 1.90$, $p = .135$; b. Select

appropriate technology tools, $F = 1.76$, $p = .0228$; d. Use technology to analyze information, $F = 1.76$, $p = .228$; and e. Use technology to share information, $F = 2.54$, $p = .123$.

Significant difference was identified in practice c. Evaluate the credibility of online sources, $F = 2.75$, $p = .047$, however Kruskal-Wallis did not confirm the difference as significant $H(3) = 7.22$, $p = .065$ adjusted for ties. Significant difference was found in practice f. Use technology to support teamwork or collaboration, $F = 4.17$, $p = .008$, Kruskal-Wallace confirms the significance $H(3) = 10.43$, $p = .015$, HS1 ($Mdn = 2.00$) and HS3 ($Mdn = 2.00$) a few times a semester, HS2 ($Mdn = 5$) and almost daily, and HS4 ($Mdn = 3.00$) one to three times per month. Games-Howell pairwise comparison post hoc analysis confirmed multiple groupings HS1 overlaps Group A and B, HS2 in Group A and HS3, and HS4 in Group B. Therefore, RQ1 teachers' perceptions based on frequency of practices of use of technology as a tool are inconsistent across the four high schools.

Significant difference was found in practice g. Use technology to interact with experts $F = 2.92$, $p = .038$, Kruskal-Wallace confirms the significance $H(3) = 6.25$, $p = .049$ adjusted for ties, HS1 ($Mdn = 1.00$), HS3 ($Mdn = 1.00$), and HS4 ($Mdn = 1.00$) almost never, and HS2 ($Mdn = 2$) few times a semester. Games-Howell pairwise comparison post hoc analysis confirmed multiple groupings HS2 in Group A and HS1 and HS3 are in Group B. HS4 overlaps Group A and B. Therefore, RQ1 teachers' perceptions based on frequency of practices of use of technology as a tool are inconsistent across the four high schools.

Significant difference was found in practice h. Use technology to keep track … of assignments *Welch's F* = 6.09, *p* = .010. Kruskal-Wallace confirms the significance *H*(3) = 9.85, *p* = .020 adjusted for ties, HS1 (*Mdn* = 2.00) and HS3 (*Mdn* = 2.00) one to three times monthly, and HS4 (*Mdn* = 3.00) one to three times per week, and HS2 (*Mdn* = 5) almost daily. Games-Howell pairwise comparison post hoc analysis confirmed multiple groupings HS2 in Group A and HS1 and HS3 are in Group B, and HS4 overlaps Group A and B, therefore RQ1 teachers' perceptions based on frequency of practices of use of technology as a tool are inconsistent across the four high schools.

Table 4.10 presents the results of Kruskal-Wallis pairwise comparison for ranked data analysis at the significance level $\alpha = .05$. Teacher efforts in leading use of technology as a tool were significantly different between the four high schools, *H*(3) = 12.17, *p* = .007 adjusted for ties. HS1 (*Mdn* = 2) found minor confidence in their ability to lead students in use of technology as a tool. HS2 (*Mdn* = 5) responses were to a very great extent indicating maximum confidence in their ability to lead students in using technology as a tool. HS3 (*Mdn* = 3) and HS4 (*Mdn* = 3.5) reported to a moderate extent in their ability to lead students in use of technology as a tool. Post hoc analysis using the Games-Howell and Tukey pairwise comparison, confirmed the findings of the multiple groups therefore RQ1 teachers' perceptions of their efforts to lead students to use technology as a tool are inconsistent across the four high schools.

Table 4.10.

Kruskal-Wallis Hypothesis Test Summary Use Technology as a Tool

Practices	H(*df*) H(*df*) Adj. for ties	Sig. *p* *p* Adj. for ties
a. Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	5.47(3) 5.57(3)	.141 .123
b. Select appropriate technology tools or resources for completing a task?	5.87(3) 6.27(3)	.118 .099
c. Evaluate the credibility and relevance of online resources?	6.85(3) 7.22(3)	.077 .065
d. Use technology to analyze information (e.g., databases, spreadsheets, graphic programs, etc.)?	6.29(3) 6.60(3)	.098 .086
e. Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?	6.37(3) 6.65(3)	.095 .084
f. Use technology to support team work or collaboration (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?	9.97(3) 10.43(3)	.019* .015*
g. Use technology to interact directly with experts or members of local/global communities?	6.25(3) 7.87(3)	.100 .049*
h. Use technology to keep track of their work on extended tasks or assignments?	9.42(3) 9.85(3)	.024* .020*
a. I have tried to develop students' skills in using technology as a tool for learning	11.46(3) 12.17(3)	.009* .007*
b. Most students have learned to use technology as a tool for learning while in my class	14.26(3) 15.02(3)	.003** .002**
c. I have been able to effectively assess students' skills in using technology for learning	9.48(3) 9.95(3)	.024* .019*

Note. 91 cases used; *p<.05; **p<.01; H = Test Statistic; df = degrees of freedom; N = 232; High School 1 n = 3; High School 2 n = 12; High School 3 n = 37; High School 4 n = 43; 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014)

Statistically significant difference (<p = .01) between the four high schools was found in response to b. Most students have learned to use technology as a tool for learning while in my class, $H(3) = 15.02$, $p = .002$ adjusted for ties. HS1 ($Mdn = 2$)

found to a minor extent that students learned the use of technology as a tool in class. HS2 (*Mdn* = 4) responses were to a great extent students learned use of technology as a tool in class. HS3 (*Mdn* = 3) and HS4 (*Mdn* = 3) reported to a moderate extent students learned use of technology in class. Post hoc analysis using the Games-Howell pairwise comparison (when variances are unequal, small group size, and multiple groups of varying sizes) confirmed the findings of multiple groups, HS2 was placed in Group A, HS1, HS3, and HS4 were placed in group B, therefore RQ1 teachers' perceptions of their efforts to use technology as a tool are inconsistent across the four high schools.

Table 4.11 summarizes the findings of statistical significance of 21C skills and associated practices. Trends identified as being significantly different between the four schools included collaboration skills, self-direction skills, and using technology as a tool.

Table 4.11.

Summary of Statistical Tests

Skills	Practices								Extent		
	A	b	c	d	e	f	g	h	a	b	c
Critical thinking									*Sig.*	*Sig.*	*Sig.*
Collaboration	*Sig.*	*Sig.*	*Sig.*	*Sig.*	*Sig.*	*KW*				*Sig. Nc*	*Sig.*
Communication		*Sig.*	*Sig.*								
Creativity and innovation		*Sig.*	*Sig.*								
Self-direction	*Sig.*		*Sig.*			*Sig.*	*Sig.*		*Sig.*	*Sig.*	*Sig.*
Global connections											
Local connections											
Use technology as a tool			*Sig. Nc*			*Sig.*	*Sig.*	*Sig.*	*Sig.*	*Sig.*	*Sig.*

Note. Sig. = Significant difference, *Nc* = Not confirmed, Shaded cells indicates no practice, KW = Kruskal-Wallis non-parametric

Table 4.12 displays the range of medians associated with significant differences. Patterns that emerged were HS1 is repeatedly the lowest in the range with fewer opportunities than the other three high schools to develop 21C skills. HS2 is repeatedly in the highest range with the most opportunities of all four high schools. HS3 and HS4 typically fall in the same range with equal opportunities more than HS1 but less than HS2.

Table 4.12.

Summary of Range of Median

	Practices								Extent		
Skills	a	b	c	d	e	f	g	h	a	b	c
Critical Thinking									3-5	2-4	2-3.5
Collaboration	3-5	2-4	2-4	1-3	1-3	2-3			3-4	2-4	2-4
Communication		2-3.5	1-3								
Creativity & Innovation		2-3.5	1-3								
Self-Direction	2-4		1-4			2-4	2-4		2-4	2-4	2-4
Tech as tool			2-4			2-5	1-2	2-5	2-5	2-4	2-4

Note. Practices a-h 1 = Almost never, 2 = A few times a semester, 3 = 1-3 times per month, 4 = 1-3 times per week, 5 = almost daily. Extent *a - c* , 2 = minor extent, 3 = moderate extent, 4 = great extent, 5 = very great extent, Blank = not statistically significant

Research Question 2

Teachers were given the opportunity to reflect and respond to five open-ended questions regarding 21C skills in response to Research Question 2 *How consistent were teachers' perceptions of their ability to lead 21st Century skills acquisition?* The results to the open-ended questions were reported in the following pattern, by question one to five then by school, HS1 alternative, HS2 STEM, HS3 comprehensive high school, and HS4 comprehensive high school. The total number of respondents was recorded followed by the number of responses on a given duplicated code, i.e. 24 teachers responded, two of which indicated increased engagement, two no change, seven indicated

student-centered. The duplicated responses do not equal the total number of respondents. Teachers were not required to respond to every question in the survey. Teachers' written responses follow the statistical summary and were quoted directly from the survey. The survey instrument did not auto-correct spelling, abbreviations, or grammar. In the pages that follow, the responses have been edited only for punctuation and spelling for the convenience of the reader.

Question 1. How is student engagement different as a result of the focus on 21C skill acquisition? Two teachers responded from HS1. Eight teachers responded from HS2. Fifteen teachers from HS3 responded. Twenty-nine teachers responded from HS4.

HS1 Teacher A responded that, "students are hard pressed to acquire these skills." Teacher B wrote that there was limited access to technology.

HS 2, four of eight respondents stated an increase in engagement. Descriptors used by respondents to communicate engagement were "better problem solvers, better communicators," "more responsible," "value choice," and "focus on teamwork." One respondent stated, "You have to engage them emotionally and make a connection with the students."

HS3 had 24 responses to Q1, five answered more or increased engagement; three communicated students were distracted by personal devices; two reported no change, seven acknowledged student-centered, and three recognized increased collaboration. Teachers noted students engaged "in hands on real life," "information gathering," and "It seems to be more student-led and student-focused, giving young people options and control over the learning process, while also developing real connections to themselves and their families."

HS4 had 28 respondents which included five recorded more or increased engagement, three replied collaboration, two replied decreased, two reported no change, three associated phones as a distraction, and one acknowledged student centered. Teachers wrote:

- "Mixed results--students are distracted by technology (cellphones) and have diminishing independent focus/initiative. But, these skills should be useful in helping students navigate a more global, more technology-infused future."
- "Students are more engaged when they can choose the direction of their learning and incorporate technology into their learning."
- "Not much different in the field of CTE. The rest of the academics have just caught up with us."
- "I believe student engagement is more related to teacher - student relationship than the differentiation of task."

Question 2. How satisfied are you with your efforts/abilities to lead students in the acquisition of 21st C skills?

HS1 had two responses, one commented "basic level" and one responded, "slightly".

HS 2 had eight responses, four responded satisfied, one reported very satisfied, one stated, "not," and one outlier, "What is 21C skills?" Teachers stated:

- "I think they are doing well, we struggle to increase rigor."
- "Although there is always room to grow and improve my craft, I feel like I'm on the right track in helping students acquire 21C Skills."

HS3 had 26 responses, 10 need more, one needs access, one needs one to one computer to student access, two "not," six were satisfied, five were very satisfied, and one was overwhelmed. Teachers stated:

- "I can definitely add more technology use and student-monitoring/peer feedback into weekly classes."
- "The most difficult issue I have dealt with is giving student more control. I still don't believe this is as important as we are told it is. There is a reason why I am the professional and why my knowledge is needed to set goals and curriculum. I am not comfortable giving student control over selecting goals and methods. I also struggle with giving student an opportunity to practice communication skills."
- "I feel that I could use more support since I am teaching a self-contained special education class."

HS4 had 29 responses, 11 were satisfied, 14 needed more, one was very satisfied, three were not satisfied, and one outlier stated, "I do not know what this is".

- "Not very satisfied. I need to work more on self-direction of student learning."
- "I feel inadequate in regards to the use of technology."
- "Reasonably satisfied. I use technology such as Google Classroom and online textbooks (using Chromebooks) rather than traditional paper textbooks. Students work collaboratively a large amount of time in my class to conduct scientific investigation."

Question 3. How do you feel your professional development (e.g., participation in a Professional Learning Community with colleagues) has prepared you to implement instructional practices that lead students to acquisition of 21C skills?

HS1 had two respondents. One respondent acknowledged building personal knowledge base but not yet always transferable to classroom. One respondent acknowledged, improving academic success.

HS2 had six responses, one was growing, two were satisfied, one was not satisfied, and two were very satisfied. Teachers reported:

- "My building level professional development both in formal PD and through PLCs is very helpful in our preparation to implement instructions practices that lead to 21st Century Skill acquisition. District wide PD and PLCs are far less effective and often clash with or stand in the way of 21st Century Skill instruction practices."
- "Really well, our environment is very conducive to 21C skills."

HS3 had 25 responses, four were satisfied, three were not helpful, one was not interested, seven needed improvement including support, skills, assessments, time and sequence, and local and international communication. Teachers recorded:

- "Collaborating with other educators have enhanced the teaching and learning in my class."
- "I think we need more help with connecting with local and international resources and communication"
- "It's help with introducing a lot of new ways, but I'd like more help in implementing them."

HS4 had 27 responses, three were satisfied, seven were helped, four were not helped, one was not a PLC, one preferred self-directed, two needed improvement, one reported moving in the PLC direction. Teachers responded:

- "Professional development as a whole is very hit and miss. Many times it is not applicable or "that would be nice to use but... where is the time?"
- "Our PLC is not a true PLC but I wish that it would evolve to be."
- "Has been a tremendous help."

Question 4. When you reflect on the 21C skills, what kind of support do you need in order to implement instructional practices that would best lead students to acquire 21C skills?

HS1 had two respondents, one stated mobile devices and the other was unsure.

HS2 had seven respondents. One teacher responded, "Ways to assess these skills." Two reported more time and collaboration and one stated, "well prepared". Teachers wrote:

- "Critical Friends opportunities with building level professionals. More digital resources for instructional strategies.

HS3 had 26 respondents. Ten teachers responded "time" for a variety of reasons which included training, planning, and resource gathering. Six reported access, two of which stated one computer to one student access. Two recorded support for 1:1 integration and support for special education. Teachers wrote:

- "What I need more anything is time. It takes time to create intentional and effective lessons that are centered on technology use and student-centered learning/instruction."

- "…there is a misconception that the student is a master of technology. This is a lie. Students know how to text, snapchat, and play the latest games on their phones. They have no clue how to utilize this technology into a research or academic tool…"
- "PLC's and more technology classroom laptops for each student."

HS4 had 26 responses, two stated none, three indicated training, four reported resources, one replied need example, one indicated trust, four reported support and access. Teachers wrote:

- "Structured peer review and reflection"
- "The biggest challenge is time. If I spent more time designing lessons around online/computer interfaces (khan academy, excel...) I know my class would be better. Best would be having a list of skills, lessons, websites... that go along with a specific skill."

Question 5. What else would you need to fully implement 21C skill acquisition?

HS1 had two responses, "more parental support for these skills" and "mobile devices for Kahoot! [an online quiz tool.]"

HS2 had 7 responses including time, training, resources, modeling, and funding. Teachers wrote:

- "More training in Global resources, other cultures, and community for more problem based learning in math"
- "More access to technology that works in the gym, heart rate monitors with computerized assessment for my students progress"

HS3 had 22 responses, six recorded access, eight needed training included observing peers or examples, three needed time, two reported collaboration. Teachers wrote:

- "More training and more opportunity to implement new ideas/tech on a trial basis"
- "More education on them myself. Peer collaboration. Specific direction from an expert"

HS4 had 22 responses, four needed time, two desired community contacts, three needed access and training. Teachers wrote:

- "Time, resource list, computers, guidance (goes with time, time to collaborate with others in my content areas.)"
- "Opportunities to consult with leaders in the community."

Summary

Results of the 21st Century Teaching and Learning Survey indicated that teachers' perceptions of their ability to lead acquisition of 21C skills are consistent in Global Connections and Local Connections. Teachers' perceptions were mostly consistent in Communication and Creativity and Innovation. Teachers' perceptions of Critical Thinking practices are consistent, but not the extent to which teachers' perceive they are able to teach, students able to learn, or ability to assess critical thinking. Teachers' perceptions are significantly different in Collaboration, Self-direction, and Use of Technology as a Tool. Caution must be taken when examining the results of High School 1 because of the small sample size.

Results of the open-ended questions revealed patterns. High School 1 teachers indicated that "students are hard pressed to acquire 21C skills." Teachers were able to lead acquisition at the "basic" and "slightly" level. Teachers were able to build their own skills, but find it difficult to "transfer these skills" due to the "academic needs" of their students. Needs to implement 21C skills are "mobile devices" and "parental support for these skills."

High School 2 teachers stated that students are "more engaged," "better problem solvers," and teachers are on the "right track" for leading students in skill acquisition and concerned about lessons with "rigor." Teachers report that time, training, resources, modeling and connections with global and community resources are needed.

High School 3 teachers wrote students are more engaged and "distracted by their own personal devices." Teachers acknowledged they need to do more to lead skill acquisition and five were very satisfied with their ability. Teachers are satisfied with professional development but need more time, resources, training, tech support, and strategies to implement 21C skills. One teacher wrote that "students need to learn to use technology for research and an academic tool." Six teachers reported needing access to technology.

High School 4 teachers reported students are more engaged and distracted by their phones. Teachers report being satisfied with professional development though it is not a PLC. Teachers need more time, resources, training, collaboration, access, support, community connections and collaboration with like content colleagues.

Common themes emerged from the data. Themes are analyzed and interpreted in the next chapter as well as recommendations for the four high schools studied as well as for future studies.

V. Conclusions

Educators continue to seek out instructional practices that close the learning gap and meet the challenge of ensuring that students are college and career ready. The Arkansas Computer Science and Technology in Public School Task Force (CSTF), launched in 2015, set out to connect students to the demand for computer science careers. In 2015, the demand for computer jobs was 67% according to CSTF. The demand for computer science careers rose to 71% in 2017 (code.org, 2017). High-wage, high skill careers require practice in the full range of 21C skills. This study sought to analyze teachers' perceptions of their ability to lead students in the acquisition of 21C skills in four high schools in one school district. Data collection was facilitated by the 21st Century Teaching and Learning Survey, (Hixson et al., 2012; Ravitz, 2014). Summary of data collection and its findings are presented.

Summary of the Findings

This study surveyed 232 teachers in one school district of four high schools to determine teachers' needs in leading acquisition of 21C skills. Of the 232 teachers who were given the opportunity to complete the survey, 97 responded. HS1 is an alternative school with a population of 120 students, 3 teachers responded. HS2 is a STEM, a participant in the New Tech Network and a school of choice serving 385 students, 13 teachers responded. HS3 is a comprehensive high school serving 2015 students, 39 teachers responded. HS4 is a comprehensive high school serving 2015 students, 43 teachers responded. The researcher is a participant observer employed in the school district.

Analysis of survey data using rigorous statistical tests found that teachers' perceptions from the four high schools were significantly different in the 21C skills of collaboration, self-direction, and use of technology as a tool. Differences were found in teachers' perceptions in formatively assessing 21C skills including assessing critical thinking skills, assessing collaboration skills, assessing self-direction skills and use of technology as a tool. Post hoc analysis further identified how the differences impacted the four high schools. HS1, the alternative school, teachers consistently ranked the least, to a minor extent, or not really in response to how frequently the skill was taught, students learned the skill, or teachers assessed the skill. HS2, the STEM school affiliated with NTN, consistently ranked the highest or most frequently taught the skills, students learned the skills, or teachers assessed the skills, i.e. to a great extent. HS3 and HS4 were consistently in the middle, to a moderate extent.

Open-ended questions required teachers to reflect on what was needed to support them in their attempts to lead acquisition of 21C skills. Three themes that emerged from the constant comparison analysis found that teachers reported needs included resources, collaboration, and access to technology. Access to technology was a concern of teachers in HS1, HS3, and HS4.

Teachers in HS1 serve students who have been identified as requiring an alternative learning environment. Teachers' responses reflected the challenges with which their students present. Teachers' responses also seem to indicate lack in confidence to get students where they need to be. One teacher's comment that "students would be hard pressed to acquire 21C skills," conveyed the inherent difficulty of engaging underprepared and frequently absent students in a setting in which online credit

recovery is prioritized and the professional development in which they engage is not tailored to their particular population. Teachers in HS1 identified resources, access to technology, time, and training as the supports that they would need to lead students in acquisition of 21C skills.

HS2 teachers were confident in their ability to lead students in 21C skills acquisition as reflected in the statement, "our environment is very conducive to to 21C skills." This is expected given the school's affiliation with the New Tech Network, through which they receive professional development in project-based learning, operate in a culture of risk-taking, and employ one to one technology integration. Even with these advantages, teachers in HS2 reflected that they need "more" — technology, training, strategies, and connections to community.

Teachers in HS3, one of two comprehensive high schools, were confident in their ability to foster 21C skill acquisition. They recognized the shift that needs to be made to student-centered classrooms, and are ready to learn more about cultivating 21C skills. The resources needed, according to HS3 teachers, include time; access to technology; training, both in pedagogies and in use of technology; assessment tools; guidance in making global and local connections; and more opportunities to collaborate purposefully with their peers. (The faculty of this school have made the most gains in implementing authentic professional learning communities. Their comments seem to indicate that they recognize the importance of this work.)

Teachers in HS4, the second of two comprehensive high schools, were likewise confident in their ability to promote 21C skills. When asked about student engagement, one teacher indicated that they are having "Mixed results" as "students are distracted by

technology (cellphones) and have diminishing independent focus/initiative. But, these skills should be useful in helping students navigate a more global, more technology-infused future." Resources needed by HS4 teachers include time, access to technology, training, connections to the community, and collaboration with peers. (Teachers' identification of a desire to collaborate with peers indicates a willingness to explore authentic professional learning communities. Teachers specifically expressed an interest in collaborating with peers who teach in the same subject areas.)

Interpretation of Findings

A pattern developed in teachers' responses to survey items. A representative example is the result of assessing critical thinking skills. HS1 teachers' responses consistently fell on the low end of the Likert Scale, indicating that they engage in practices that promote 21C skills only infrequently. HS2 teachers' responses, by contrast, tended to fall at the high end of that same scale, revealing the frequency with which they engage students in 21C skill development. Teachers in HS3 and HS4 revealed through their responses that they employ these practices more frequently than their colleagues in HS1, but not as often as their colleagues in HS2.

Teachers across the four schools acknowledged the shift from teacher-centered to student-centered practices. "The traditional role of the teacher has changed drastically. No longer are we living in a teacher centered classroom. Instead we are seeing education evolve to a student centered environment in which the student is responsible for the learning and goals. Student engagement is no longer a series of lectures and classroom notes. Instead the teacher must include multi-media, group collaboration, and technology into the classroom. Students born in the last 20 years have been conditioned to live with

technology which has created a short attention span. Therefore, education must adapt and be willing to change to meet the needs of next generation," wrote one teacher. Another educator recorded, "My students are more independent, relying less on me to lay out the concrete steps in solving problems."

It was clear from a couple of responses that some faculty members remain unconvinced of the need for instructional practices geared toward the development of 21C skills. "I do not believe a lot of the 21C skills mentioned apply to instruction in mathematics," offered one teacher. Another educator admitted, "The most difficult issue I have dealt with is giving students more control. I still don't believe this is as important as we are told it is. There is a reason why I am the professional and why my knowledge is needed to set goals and curriculum. I am not comfortable giving students control over selecting goals and methods. I also struggle with giving students an opportunity to practice communication skills." It is evident that professional development needs to be delivered in such a way as to honor faculty members' content area expertise, and to help teachers to discern between abdicating professional responsibility and gradually releasing control for learning to the learners themselves. Student-centered pedagogies require teachers with a high degree of expertise to design inquiry that leads students to be independent, goal oriented learners.

In a similar vein, there is a clear need for teachers to grow accustomed to the use of technology as a tool for learning. At present, many teachers think of technology only as a distraction, particularly to the off-task learner. Teachers in both HS3 and HS4 regularly wrote comments that revealed their frustration with students' cell phone use. Teachers in all four schools expressed a need for *more* technology. Teachers in HS1,

HS3, and HS4 are essentially asking for one computer to one student access to technology. Teachers in HS2, where one to one is already in place are asking for upgrades to software and equipment. Teachers in all four schools expressed their desire and need for professional development in the use of instructional technology as well as in assessment practices related to technology

Recommendations

Recommendations are presented for four levels including student, teacher, school, and district.

Students

Student voice is an important characteristic of student-centered pedagogies. Administering the 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) to students from all four high schools grade 9-12 would contribute to a shared vision of college and career readiness. Student voice would illuminate learning gaps so that focused instruction could meet the needs of students.

A shared vision of 21C learning and a common language is imperative to leading change in organizations (Fullan, 2006). Administering the 21st Century Teaching and Learning Survey to administrators and district support personnel could facilitate community connections, and would complement the data that have already been collected from teachers, as well as the valuable input that should be collected from students.

Teachers

Focused professional development in four areas previously identified in the research literature (Atwell, 2014; Gunn & Hollingsworth, 2013; Hixson et al., 2012; Voogt & Roblin, 2012) would equip the teachers of both comprehensive high schools and

the alternative high school to close the learning gap between themselves and their colleagues at HS2 who have had the benefit of professional development through the NTN. Several focus areas for professional development that emerged from participants' responses to the survey items included collaboration, self-direction, use of technology as a learning tool, and assessment of 21C skills. All four of these identified needs are encapsulate in the student centered pedagogies of project-based and problem-based teaching (Hattie, 2009).

Connections to local and global entities can be achieved by partnerships in the community. Although the survey data did not identify local and global connections as significant, teachers listed it frequently in response to questions. Grant funding could provide externships for teachers to job shadow local organizations, some with global connections, for five days during the summer or spring break. An avenue through which teachers could practice collaboration within authentic professional learning communities might include round table discussions between teachers and representatives of community agencies and local organizations to investigate potential partnerships.

Schools

This Arkansas school district is fortunate to include amongst its high schools, a school that is affiliated with the NTN. The lessons that the faculty of that school have learned through the period of that affiliation, and as a result of a significant investment by the district, should be shared with the faculties of the other three high schools. This cross fertilization should begin with the faculty of HS1, both because its small size will allow for this to occur pretty readily, but also – and more importantly – because the students who attend HS1 have the greatest needs and the least time to waste.

District

Given the successes of HS2, the district should be mindful of hiring personnel with 21C skills. The district should coordinate, recruit, train, as well as design targeted professional development in formative assessment, differentiation, project-based and problem-based learning including collaboration, self-directedness, and use of technology as a learning tool. Implementation of Professional Learning Communities should speed support for the process. Equitable access to technology via devices, training, and tech support were repeatedly mentioned by teachers at HS1, HS3, and HS4. Pursuit of equitable access for all so that all succeed in the 21C workforce is a must.

Conclusions

There are indeed differences between the teachers of the four schools in leading students to acquire 21C skills. As the faculty of one of the schools have benefited from a multi-year partnership with an organization that promotes 21st Century learning, it is advised that the faculties of the other three schools share in that benefit. This is an equity issue as the students in all four schools are deserving of instruction that helps them to succeed in their post-secondary life and learning experiences. Respondents from all four schools acknowledged the shift that is being made from teacher-centered to student-centered instruction, and they all expressed the need and the willingness to learn how to make that shift. Even a teacher from the school that has had the most exposure and experience wrote, "I have completed the survey, it was very informative and helped me reflect on the work that I still need to do in problem based learning…to incorporate these 21st skills more."

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Appendix A

21st Century Teaching and Learning Survey

21st Century Teaching and Learning Survey

Thank you for agreeing to participate in the 21st Century Teaching and Learning Survey. Your response will help me complete the qualitative method design of my dissertation topic 21st Century skills; and understand teachers' instructional practices as they relate to 21st Century teaching and learning. This study is being completed through Arkansas Tech University, Advanced Leadership Studies. The title of the research is: Twenty-first Century Teaching and Learning: Teachers' Perceptions and Practices in Four High Schools of One School District

I will use the data to analyze the consistency of teachers' perception of 21st Century skills in my dissertation. If you agree to take part in this study, the survey should take 20 minutes to complete. The benefits of participating in this study could be for guiding professional development to meet identified desires or needs related to 21st Century skills acquisition.

Please be frank in your responses. There is no right or wrong response. I will keep your response confidential. No individual data will be collected. Reponses will be recorded by school. Survey results will be stored in Arkansas Tech University's Advanced Studies Survey Monkey account. Analysis will be stored by the researcher in a safe place until July 1, 2018. No individual teacher's names will be collected. Pseudonyms will be used to protect the identities of the schools. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this research study is voluntary. No costs are associated to any participant of the study. No monetary compensation is provided for participation in the study. There is no research funding for this research study. If you choose to take part in this research, your major responsibilities will include responses to the survey items included in the survey link. You do not have to participate in this research. If you choose to take part, you have the right to stop at any time. If you decide not to participate or if you decide to stop taking part in the research at a later date, there will be no penalty or loss of benefits to which you are otherwise entitled.

Should you have any questions about this survey or regarding your rights as a research participant, please contact me at crice6@atu.edu or 417 438 8752. I look forward to your participation in this survey. For more information about participation in a research study and about the Institutional Review Board (IRB), a group of people who review the research to protect your rights, please visit Arkansas Tech University's IRB web site at https://www.atu.edu/research/human_subject.php Included on this web site, under the heading "Participant Info", you can access federal regulations and information about the protection of human research participants. If you do not have access to the internet, copies

of these federal regulations are available by calling the Arkansas Tech University at 479 968 0319.

By clicking on the link, I voluntarily agree to participate in the 21st Century Teaching and Learning study.

Demographics

School
Years of experiece, 0-3 years, 4-7 years, 8-15 years, over 15 years
Level of Education, Bachelor's, Masters, Specialist, Doctoral
Department/Content Expertise current position, Science, Social Studies, Math, English, Arts, Physical Education, Foreign Language, Career Technical Education, Special Education

Instructions

The rest of this survey asks about your teaching practices that might support students' learning of the following 21st Century skills. The definition of each is provided for you in the survey.

Critical Thinking
Collaboration
Communication
Creativity & Innovation
Self-Direction
Making Global Connections
Making Local Connections
Using Technology as a Tool for Learning

For each of the above you will be asked about your general teaching of these skills, and about a few specific practices you may have used.

There are no correct or incorrect answers and all responses will be kept confidential.

For the rest of this survey, pick a "Target Class". This is a class in which you think your teaching was most effective. If your teaching was equally effective, pick any of these classes in which you believe the most learning occurred.

Department/Course Period

Please refer to this target class for the rest of this survey.

CRITICAL THINKING SKILLS refer to students being able to analyze complex problems, investigate questions for which there are no clear-cut answers, evaluate different points of view or sources of information, and draw appropriate conclusions based on evidence and reasoning

1. Here are some examples of practices that may help students learn CRITICAL THINKING SKILLS.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Compare information from different sources before completing a task or assignment?	O	O	O	O	O
b. Draw their own conclusions based on analysis of numbers, facts, or relevant information?	O	O	O	O	O
c. Summarize or create their own interpretation of what they have read or been taught?	O	O	O	O	O
d. Analyze competing arguments, perspectives or solutions to a problem?	O	O	O	O	O
e. Develop a persuasive argument based on supporting evidence or reasoning?	O	O	O	O	O
f. Try to solve complex problems or answer questions that have no single correct solution or answer?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**a great extent**	**ery great extent**
a. I have tried to develop students' critical thinking skills	O	O	O	O	O
b. Most students have learned critical thinking skills while in my class	O	O	O	O	O
c. I have been able to effectively assess students' critical thinking skills	O	O	O	O	O

COLLABORATION SKILLS refer to students being able to work together to solve problems or answer questions, to work effectively and respectfully in teams to accomplish a common goal and to assume shared responsibility for completing a task.

1. Here are some examples of practices that may help students learn COLLABORATION SKILLS.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Work in pairs or small groups to complete a task together?	O	O	O	O	O
b. Work with other students to set goals and create a plan for their team?	O	O	O	O	O
c. Create joint products using contributions from each student?	O	O	O	O	O
d. Present their group work to the class, teacher or others?	O	O	O	O	O
e. Work as a team to incorporate feedback on group tasks or products?	O	O	O	O	O
f. Give feedback to peers or assess other students' work	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**a great extent**	**To a very at extent**
a. I have tried to develop students' collaboration skills	O	O	O	O	O
b. Most students have learned collaboration skills while in my class	O	O	O	O	O
c. I have been able to effectively assess students' collaboration skills	O	O	O	O	O

COMMUNICATION SKILLS refer to students being able to organize their thoughts, data and findings and share these effectively through a variety of media, as well as orally and in writing.

1. Here are some examples of practices that may help students learn COMMUNICATION SKILLS.

In your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	O	O	O	O	O
b. Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	O	O	O	O	O
c. Prepare and deliver an oral presentation to the teacher or others?	O	O	O	O	O
d. Answer questions in front of an audience?	O	O	O	O	O
e. Decide how they will present their work or demonstrate their learning?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**a great extent**	**ery great extent**
a. I have tried to develop students' communication skills	O	O	O	O	O
b. Most students have learned communication skills while in my class	O	O	O	O	O
c. I have been able to effectively assess students' communication skills	O	O	O	O	O

CREATIVITY AND INNOVATION SKILLS refer to students being able to generate and refine solutions to complex problems or tasks based on synthesis, analysis and then combining or presenting what they have learned in new and original ways.

1. Here are some examples of practices that may help students learn CREATIVITY AND INNOVATION SKILLS.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Use idea creation techniques such as brainstorming or concept mapping?	O	O	O	O	O
b. Generate their own ideas about how to confront a problem or question?	O	O	O	O	O
c. Test out different ideas and work to improve them?	O	O	O	O	O
d. Invent a solution to a complex, open-ended question or problem?	O	O	O	O	O
e. Create an original product or performance to express their ideas?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**To a great extent**	**To a very great extent**
a. I have tried to develop students' creativity and innovation skills	O	O	O	O	O
b. Most students have learned creativity and innovation skills while in my class	O	O	O	O	O
c. I have been able to effectively assess students' creativity and innovation skills	O	O	O	O	O

SELF-DIRECTION SKILLS refer to students being able to take responsibility for their learning by identifying topics to pursue and processes for their own learning, and being able to review their own work and respond to feedback.

1. Here are some examples of practices that may help students learn SELF-DIRECTION SKILLS.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Take initiative when confronted with a difficult problem or question?	O	O	O	O	O
b. Choose their own topics of learning or questions to pursue?	O	O	O	O	O
c. Plan the steps they will take to accomplish a complex task?	O	O	O	O	O
d. Choose for themselves what examples to study or resources to use?	O	O	O	O	O
e. Monitor their own progress towards completion of a complex task and modify their work accordingly?	O	O	O	O	O
f. Use specific criteria to assess the quality of their work before it is completed?	O	O	O	O	O
g. Use peer, teacher or expert feedback to revise their work?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**To a great extent**	**To a very great extent**
a. I have tried to develop students' self-direction skills	O	O	O	O	O
b. Most students have learned self-direction skills while in my class	O	O	O	O	O
c. I have been able to effectively assess students' self-direction skills	O	O	O	O	O

GLOBAL CONNECTIONS refers to students being able to understand global, geo-political issues including awareness of geography, culture, language, history, and literature from other countries.

1. Here are some examples of practices that may help students learn to make GLOBAL CONNECTIONS.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Study information about other countries or cultures?	O	O	O	O	O
b. Use information or ideas that come from people in other countries or cultures?	O	O	O	O	O
c. Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	O	O	O	O	O
d. Understand the life experiences of people in cultures besides their own?	O	O	O	O	O
e. Study the geography of distant countries?	O	O	O	O	O
f. Reflect on how their own experiences and local issues are connected to global issues?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**To a great extent**	**To a very great extent**
a. I have tried to develop students' skills in making global connections	O	O	O	O	O
b. Most students have learned to make global connections while in my class	O	O	O	O	O
c. I have been able to effectively assess students' skills in making global connections	O	O	O	O	O

LOCAL CONNECTIONS refers to students being able to apply what they have learned to local contexts and community issues.

1. Here are some examples of practices that may help students learn to make LOCAL CONNECTIONS.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Investigate topics or issues that are relevant to their family or community?	O	O	O	O	O
b. Apply what they are learning to local situations, issues or problems?	O	O	O	O	O
c. Talk to one or more members of the community about a class project or activity?	O	O	O	O	O
d. Analyze how different stakeholder groups or community members view an issue?	O	O	O	O	O
e. Respond to a question or task in a way that weighs the concerns of different community members or groups?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**eat**	**ry great**
a. I have tried to develop students' skills in making local connections	O	O	O	O	O
b. Most students have learned to make local connections while in my class	O	O	O	O	O
c. I have been able to effectively assess students' skills in making local connections	O	O	O	O	O

USING TECHNOLOGY AS A TOOL FOR LEARNING refers to students being able to manage their learning and produce products using appropriate information and communication technologies

1. Here are some examples of practices that may help students learn to USE TECHNOLOGY as a TOOL FOR LEARNING.

In your teaching of your TARGET CLASS, how often have you asked students to do the following	**Almost never**	**A few times a semester**	**1-3 times per month**	**1-3 times per week**	**Almost daily**
a. Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	O	O	O	O	O
b. Select appropriate technology tools or resources for completing a task?	O	O	O	O	O
c. Evaluate the credibility and relevance of online resources?	O	O	O	O	O
d. Use technology to analyze information (e.g., databases, spreadsheets, graphic programs, etc.)?	O	O	O	O	O
e. Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?	O	O	O	O	O
f. Use technology to support team work or collaboration (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?	O	O	O	O	O
g. Use technology to interact directly with experts or members of local/global communities?	O	O	O	O	O
h. Use technology to keep track of their work on extended tasks or assignments?	O	O	O	O	O

2. To what extent do you agree with these statements about your TARGET CLASS?	**Not really**	**To a minor extent**	**To a moderate extent**	**To a t extent**	**To a ery great extent**
a. I have tried to develop students' skills in using technology as a tool for learning	O	O	O	O	O
b. Most students have learned to use technology as a tool for learning while in my class	O	O	O	O	O
c. I have been able to effectively assess students' skills in using technology for	O	O	O	O	O

learning

Open-ended Questions

1. How is student engagement different as a result of acquisition of 21st C skills?

2. Which of these 21C skills are you most comfortable implementing?

3. How satisfied are you with your efforts/abilities to lead students in acquisition of 21st C skills?

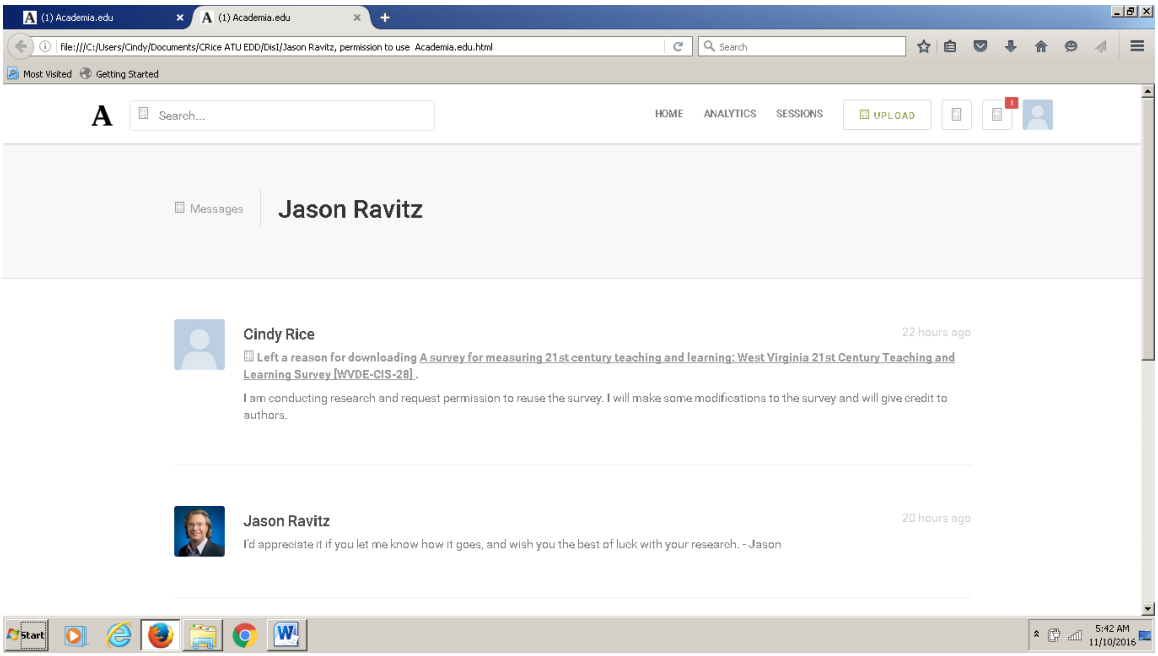
> **PROFESSIONAL DEVELOPMENT** defined as "activities that—are an integral part of school … strategies for providing educators with the knowledge and skills necessary to enable students to succeed in a well-rounded education and to meet the challenging State academic standards; and are sustained (not stand-alone, 1-day, or short term workshops), intensive, collaborative, job-embedded, data-driven, and classroom-focused, and may include activities that—improve and increase teachers'—knowledge of the academic subjects the teachers teach; understanding of how students learn; and ability to analyze student work and achievement from multiple sources, including how to adjust instructional strategies, assessments, and materials based on such analysis…." (Hirsh, 2016, ¶4).

4. How do you feel your professional development such as participation in a Professional Learning Community with colleagues has prepared you to implement instructional practices that lead students to acquisition of 21C skills?

5. When you reflect on 21C skills, what kind of support do you need to implement instructional practices that would lead students in acquisition of 21C skills?

Appendix B

Jason Ravitz permission to use 21st Century Teaching and Learning Survey



Appendix C

Framework for 21st Century Teaching and Learning Survey

The framework in the survey is the result of a careful review of the literature including the following key sources:

Students' 21st Century Skills - ITL/SRI version (Shear et al., 2010)

- Knowledge Building: Students move beyond the reproduction of information to construct knowledge that is new to them.
- Problem-Solving and Innovation: Students solve problems for which there is no previously learned solution, make choices in their approach, and implement their solutions in the real world.
- Skilled Communication: Students present their ideas in ways that are clear and compelling, and present sufficient relevant evidence on a topic or theme.
- Collaboration: Students work together in groups, take on roles, and produce a joint work product.
- Self-Regulation: Students plan and monitor their work, and make revisions based on feedback or self-assessment.
- Use of ICT for Learning: Students use ICT to construct knowledge; choose when, where, and how to use it; and evaluate the credibility and relevance of online re-sources.

The William and Flora Hewlett Foundation (2010) Deeper Learning initiative has focused on preparing students to:

- Master core academic content
- Think critically and solve complex problems
- Work collaboratively
- Communicate effectively
- Learn how to learn (e.g., self-directed learning)

Partnership for 21st Century Learning Framework (2015)

1. Content Knowledge and 21st Century Themes

Mastery of fundamental subjects and 21st century themes is essential for students in the 21st century. Disciplines include:

English, reading or language arts
World languages
Arts
Mathematics
Economics
Science
Geography
History
Government and Civics

In addition to these subjects, we believe schools must move beyond a focus on basic competency to promoting understanding of academic content at much higher levels by weaving 21st century interdisciplinary themes into curriculum:

Global awareness

Financial, economic, business and entrepreneurial literacy

Civic literacy

Health literacy

Environmental literacy

2. Learning and Innovation Skills: Learning and innovation skills increasingly are being recognized as the skills that separate students who are prepared for increasingly complex life and work environments in the 21st century, and those who are not. A focus on creativity, critical thinking, communication and collaboration is essential to prepare students for the future.

Creativity and Innovation

Critical Thinking and Problem Solving

Communication and Collaboration

3. Information, Media and Technology Skills: Today we live in a technology and media-suffused environment with: 1) access to an abundance of information, 2) rapid changes in technology tools, and 3) the ability to collaborate and make individual contributions on an unprecedented scale. To be effective in the 21st century, citizens and workers must be able to create, evaluate, and effectively utilize information, media, and technology.

Information Literacy

Media Literacy

ICT Literacy

4. Life and Career Skills: Today's students need to develop thinking skills, content knowledge, and social and emotional competencies to navigate complex life and work environments. P21's essential Life and Career Skills include::

Flexibility & Adaptability

Initiative & Self Direction

Social & Cross-Cultural Skills

Productivity & Accountability

Leadership & Responsibility" (Hixson et al., 2012)

Appendix D

Informed Consent to Participate

Thank you for agreeing to participate in the 21st Century Teaching and Learning Survey. Your response will help me complete the qualitative method design of my dissertation topic 21st Century skills; and understand teachers' instructional practices as they relate to 21st Century teaching and learning. This study is being completed through Arkansas Tech University, Advanced Leadership Studies. The title of the research is: Twenty-first Century Teaching and Learning: Teachers' Perceptions and Practices in Four High Schools of One Arkansas School District

I will use the data to analyze the consistency of teachers' perception of 21st Century skills in my dissertation. If you agree to take part in this study, the survey should take 20 minutes to complete. The benefits of participating in this study could be for guiding professional development to meet identified desires or needs related to 21st Century skills acquisition. Please be frank in your responses. There is no right or wrong response. I will keep your response confidential. No individual data will be collected. Reponses will be recorded by school. Survey results will be stored in Arkansas Tech University's Advanced Studies Survey Monkey account. Analysis will be stored by the researcher in a safe place until July 1, 2018. No individual teacher's names will be collected. Pseudonyms will be used to protect the identities of the schools. In the event of any publication or presentation resulting from the research, no personally identifiable information will be shared.

Taking part in this research study is voluntary. No costs are associated to any participant of the study. No monetary compensation is provided for participation in the study. There is no research funding for this research study. If you choose to take part in this research, your major responsibilities will include responses to the survey items included in the survey link. You do not have to participate in this research. If you choose to take part, you have the right to stop at any time. If you decide not to participate or if you decide to stop taking part in the research at a later date, there will be no penalty or loss of benefits to which you are otherwise entitled.

Should you have any questions about this survey or regarding your rights as a research participant, please contact me at crice6@atu.edu or 417 438 8752. I look forward to your participation in this survey. For more information about participation in a research study and about the Institutional Review Board (IRB), a group of people who review the research to protect your rights, please visit Arkansas Tech University's IRB web site at https://www.atu.edu/research/human_subject.php Included on this web site, under the heading "Participant Info", you can access federal regulations and information about the protection of human research participants. If you do not have access to the internet, copies of these federal regulations are available by calling the Arkansas Tech University at 479 968 0319.

By clicking on the link, I voluntarily agree to participate in the 21st Century Teaching and Learning study.

Appendix E

International Review Board Approval

ARKANSAS TECH UNIVERSITY

DISSERTATION PROPOSAL DEFENSE REPORT

This form should be completed and filed with the Graduate College after the dissertation proposal defense is completed.

STUDENT NAME: Cynthia L. Rice **T NUMBER:** T01007387

EMAIL ADDRESS: crice6@atu.edu **DATE:** 11-16-16

DISSERTATION TITLE:
21st Century Teaching and Learning: Teachers' Perceptions and Practices

RECEIVED FEB 1 REC'D 17 By SB

DATE OF DEFENSE: 11-16-16

- **DISSERTATION PROPOSAL DEFENSE:** ☑ PASSED ☐ FAILED

Please attach IRB Approval Forms when submitting this form to the Graduate College for approval.

SIGNATURES OF DISSERTATION COMMITTEE MEMBERS:

Christopher E. Trump		No Nov. '16	☑ PASSED ☐ FAILED	SB
CHAIR NAME (PRINT)	SIGNATURE	DATE		
Karen D. Endel	Karen D. Endel	11-16-16	☑ PASSED ☐ FAILED	SB
COMMITTEE MEMBER (PRINT)	SIGNATURE	DATE		
Rebecca Shopfner	Rebecca Shopfner	11-16-16	☑ PASSED ☐ FAILED	SB
COMMITTEE MEMBER (PRINT)	SIGNATURE	DATE		
John Freeman	John Freeman	11-16-16	☑ PASSED ☐ FAILED	SB
COMMITTEE MEMBER (PRINT)	SIGNATURE	DATE		
			☐ PASSED ☐ FAILED	
COMMITTEE MEMBER (PRINT)	SIGNATURE	DATE		

SIGNATURES OF APPROVAL:

John Freeman — Program Director — 11-16-16 — Date

Mary B. Deacon — Dean of the Graduate College — 2-8-17 — Date

ARKANSAS TECH UNIVERSITY

Academic Affairs
Administration Room 200
1509 North Boulder Avenue
Russellville, Arkansas 72801

Office: 479-968-0319
Fax: 479-968-0644
www.atu.edu/academics

1/3/2017

To Whom It May Concern:

Cynthia Rice's IRB application "21st Century Teaching" is approved through December 2, 2019. The approval code is Rice_120216.

Thank you,

Jack E. Tucci, Ph.D.

IRB Chair

Appendix F

Analysis of Variance (ANOVA) One-way Tables for eight 21C skills

- Critical Think
- Collaboration
- Communication
- Creativity and Innovation
- Self-directed
- Global Connections
- Local Connections
- Use of Technology as a Learning Tool

ANOVA One-way: Critical Thinking Skills

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 12** ***N* = 33**		**3** ***n* = 39** ***N* = 105**		**4** ***n* = 43** ***N* = 106**	
Practice	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**
a. Compare information from different sources	2.33 (.97)	[.90, 3.77]	3.33 (1.16)	[2.60, 4.07]	2.90 (.97)	[2.58, 3.21]	3.19 (1.03)	[2.87, 3.50]
b. Draw their own conclusions based on analysis …	2.33 (1.15)	[-0.53, 5.20]	3.92 (1.17)	[3.18, 4.65]	3.49 (1.07)	[3.14, 3.84]	3.70 (1.10)	[3.36, 4.04]
c. Summarize or create their own interpretation …	3.00 (0.00)	1.84, 4.16]	4.00 (.95)	[3.42, 4.58]	3.80 (1.03)	[3.47, 4.12]	3.89 (1.03)	[3.58, 4.19]
d. Analyze competing arguments, perspectives …	2.33 (0.58)	[0.90, 3.77]	3.25 (1.14)	[2.53, 3.97]	3.05 (1.19)	[2.67, 3.44]	3.21 (0.96)	[2.91, 3.51]
e. Develop a persuasive argument …	2.00 (1.00)	[-0.48, 4.48]	2.92 (1.24)	[2.13, 3.71]	2.62 (1.09)	[2.26, 2.97]	2.51 (0.99)	[2.21, 2.82]
f. Try to solve complex problems or answer questions	2.00 (1.00)	[-0.48, 4.48]	3.67 (1.16)	[2.93, 4.40]	2.97 (1.20)	[2.58, 3.36]	3.07 (1.32)	[2.67, 3.48]
a. I have tried to develop students' critical thinking skills	3.00 (0.00)	[2.18, 3.82]	4.50 (0.67)	[4.09, 4.91]	3.82 (0.60)	[3.59, 4.05]	4.07 (0.83)	[3.85, 4.29]
b. Most students have learned critical thinking skills while in my class	1.68 (0.58)	[0.23, 3.10]	3.58 (1.00)	[2.95, 4.22]	3.08 (0.77)	[2.83, 3.33]	3.30 (0.91)	[3.02, 3.58]
c. I have been able to effectively assess students' critical thinking skills	1.67 (0.58)	[0.23, 3.10]	3.42 (0.90)	[2.85, 3.99]	3.08 (0.81)	[2.82, 3.34]	3.33 (0.87)	[3.06, 3.52]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA One-way: Collaboration Skills

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 12** ***N* = 33**		**3** ***n* = 37** ***N* = 105**		**4** ***n* = 43** ***N* = 106**	
Practice	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**
a. Work in pairs or small groups to complete a task together?	3.00 (1.00)	[0.52, 5.48]	4.67 (0.89)	[4.10, 5.23]	3.97 (0.76)	[3.72, 4.23]	4.15 (0.88)	[3.85, 4.39]
b. Work with other students to set goals and create a plan for their team?	1.67 (0.58)	[0.23, 3.10]	4.17 (0.94)	[3.51, 4.76]	2.47 (1.15)	[2.11, 2.87]	3.09 (1.17)	[2.73, 3.45]
c. Create joint products using contributions from each student?	1.67 (0.58)	[0.23, 3.10]	3.83 (1.12)	[3.13, 4.54]	2.84 (1.04)	[2.49, 3.18]	2.83 (1.15)	[2.48, 3.19]
d. Present their group work to the class, teacher or others?	1.33 (0.58)	[-0.10, 2.77]	3.50 (0.80)	[2.99, 4.00]	2.62 (0.95)	[2.30, 2.94]	2.86 (1.04)	[2.54, 3.18]
e. Work as a team to incorporate feedback on group tasks or products?	1.33 (0.58)	[-0.10, 2.77]	3.42 (1.00)	[2.78, 4.05]	2.74 (1.16)	[1.99, 2.77]	2.67 (1.25)	[2.29, 3.06]
f. Give feedback to peers or assess other students' work	1.67 (0.58)	[0.23, 3.10]	3.42 (0.79)	[2.91, 3.92]	2.60 (1.21)	[2.19, 3.00]	2.83 (1.08)	[2.50, 3.17]
a. I have tried to develop students' collaboration skills	3.00 (1.00)	[0.52, 5.48]	4.25 (0.97)	[3.64, 4.87]	3.70 (0.78)	[3.44, 3.96]	3.89 (0.91)	[3.61, 4.16]
b. Most students have learned collaboration skills while in my class	2.00 (1.00)	[-0.48, 4.48]	3.75 (1.13)	[3.03, 4.47]	3.38 (0.83)	[3.10, 3.66]	3.58 (0.91)	[3.30, 3.86]
c. I have been able to effectively assess students' collaboration skills	1.67 (.58)	[.23, 3.10]	3.42 (.90)	[2.63, 4.21]	3.27 (.87)	[2.98, 3.56]	3.40 (0.90)	[3.12, 3.67]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA One-way: Communication Skills

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 12** ***N* = 33**		**3** ***n* = 36** ***N* = 105**		**4** ***n* = 42** ***N* = 106**	
Practice	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**
a. Structure data for use in written products or oral presentations (e.g., creating charts, tables or graphs)?	1.67 (0.58)	[0.23, 3.10]	2.67 (0.89)	[2.10, 3.23]	2.36 (1.13)	[1.98, 2.74]	2.31 (0.90)	[2.03, 2.60]
b. Convey their ideas using media other than a written paper (e.g., posters, video, blogs, etc.)	1.67 (0.58)	[0.23, 3.10]	3.67 (0.78)	[3.17, 4.16]	2.57 (1.01)	[2.16, 2.95]	2.38 (1.01)	[2.04, 2.67]
c. Prepare and deliver an oral presentation to the teacher or others?	1.67 (1.16)	[-1.20, 4.53]	3.25 (1.06)	[2.58, 3.92]	2.25 (1.05)	[1.89, 2.61]	2.31 (1.02)	[1.99, 2.63]
d. Answer questions in front of an audience?	2.33 (0.58)	[0.90, 3.77]	3.17 (1.19)	[2.41, 3.93]	2.86 (1.44)	[2.38, 3.35]	2.98 (1.14)	[2.62, 3.33]
e. Decide how they will present their work or demonstrate their learning?	2.00 (1.00)	[-0.48, 4.48]	3.17 (1.27)	[2.36, 3.97]	2.42 (1.16)	[2.03, 2.81]	2.50 (1.07)	[2.17, 2.83]
a. I have tried to develop students' communication skills	2.33 (0.58)	[0.90, 3.77]	3.83 (0.84)	[3.30, 4.36]	3.67 (1.17)	[3.27, 4.06]	3.79 (1.05)	[3.46, 4.11]
b. Most students have learned communication skills while in my class	2.00 (1.00)	[-0.48, 4.84]	3.42 (1.24)	[2.63, 4.21]	3.14 (1.15)	[2.75, 3.53]	3.43 (1.09)	[3.09, 3.77]
c. I have been able to effectively assess students' communication skills	2.00 (1.00)	[-0.48, 4.84]	3.33 (1.07)	[2.65, 4.02]	3.03 (1.23)	[2.61, 3.44]	3.33 (1.03)	[3.01, 3.65]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA One-way: Self-direction

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 11** ***N* = 33**		**3** ***n* = 35** ***N* = 105**		**4** ***n* = 41** ***N* = 106**	
Practice	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**
a. Take initiative when confronted with a difficult problem or question?	2.67 (1.16)	[-0.20, 5.54]	4.18 (0.87)	[3.60, 4.78]	3.14 (1.03)	[2.79, 3.49]	3.20 (0.95)	[2.84, 3.50]
b. Choose their own topics of learning or questions to pursue?	2.00 (0.00)	[0.58, 3.42]	3.00 (1.18)	[2.26, 3.74]	2.40 (1.24)	[1.87, 2.18]	2.51 (1.27)	[2.13, 2.90]
c. Plan the steps they will take to accomplish a complex task?	1.33 (0.58)	[-0.10, 2.77]	4.18 (0.75)	[3.68, 4.69]	2.74 (1.25)	[2.32, 3.17]	2.83 (1.14)	[2.47, 3.19]
d. Choose for themselves what examples to study or resources to use?	2.33 (1.53)	[0.93, 3.73]	3.55 (1.21)	[2.82, 4.28]	2.60 (1.17)	[2.19, 3.01]	2.73 (1.25)	[2.35, 3.10]
e. Monitor their own progress towards completion of a complex task and modify their work accordingly?	2.33 (1.53)	[-1.46, 6.13]	3.55 (1.21)	[2.73, 4.36]	2.60 (1.17)	[2.20, 3.00]	2.73 (1.25)	[2.34, 3.13]
f. Use specific criteria to assess the quality of their work before it is completed?	2.33 (1.53)	[-1.46, 6.13]	3.55 (1.29)	[2.68, 4.41]	2.89 (1.37)	[2.42, 3.36]	2.63 (1.20)	[2.26, 3.01]
g. Use peer, teacher or expert feedback to revise their work?	1.67 (0.58)	[0.23, 3.10]	3.73 (1.01)	[3.05, 4.41]	2.94 (1.11)	[2.56, 3.32]	3.02 (1.11)	[2.66, 3.37]
a. I have tried to develop students' self-direction skills	2.33 (0.58)	[0.90, 3.77]	4.18 (0.75)	[3.68, 4.69]	3.46 (0.92)	[3.14, 3.77]	3.43 (1.86)	[3.09, 3.77]
b. Most students have learned self-direction skills while in my class	1.67 (.58)	[0.23, 3.10]	3.64 (0.93)	[3.02, 4.26]	2.80 (0.90)	[2.49, 3.11]	2.88 (1.11)	[2.5, 3.23]
c. I have been able to effectively assess students' self-direction skills	1.67 (.58)	[0.23, 3.10]	3.55 (1.04)	[2.85, 4.24]	2.97 (1.15)	[2.58, 3.37]	2.91 (0.96)	[2.61, 3.20]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA *One-way: Creativity and Innovation Skills*

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 12** ***N* = 33**		**3** ***n* = 36** ***N* = 105**		**4** ***n* = 42** ***N* = 106**	
Practice	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**
a. Use idea creation techniques such as brainstorming or concept mapping?	2.33 (0.58)	[0.90, 3.77]	3.58 (1.31)	[2.75, 4.42]	2.81 (1.60)	[2.45, 3.17]	2.93 (1.16)	[2.45, 3.17]
b. Generate their own ideas about how to confront a problem or question?	1.67 (0.58)	[0.23, 3.10]	4.08 (0.67)	[3.66, 4.51]	2.89 (0.98)	[2.56, 3.22]	3.02 (1.00)	[2.71, 3.34]
c. Test out different ideas and work to improve them?	2.00 (1.00)	[-0.48, 4.48]	3.58 (1.00)	[2.95, 4.21]	2.86 (1.13)	[2.48, 3.24]	2.55 (1.21)	[2.17, 2.93]
d. Invent a solution to a complex, open-ended question or problem?	1.67 (0.58)	[0.23, 3.10]	2.92 (1.38)	[2.04, 3.79]	2.36 (1.29)	[1.92, 2.80]	2.38 (1.04)	[2.06, 2.70]
e. Create an original product or performance to express their ideas?	2.00 (1.00)	[-0.48, 4.48]	3.08 (1.24)	[2.30, 3.87]	2.42 (1.23)	[2.00, 2.83]	2.31 (1.00)	[2.00, 2.62]
a. I have tried to develop students' creativity and innovation skills	2.67 (1.16)	[1.54, 3.79]	4.18 (0.87)	[3.59, 4.78]	3.14 (1.03)	[2.81, 3.47]	3.20 (0.95)	[2.89, 3.50]
b. Most students have learned creativity and innovation skills while in my class	1.67 (0.58)	[0.23, 3.10]	3.42 (1.08)	[2.73, 4.11]	2.78 (1.17)	[2.38, 3.18]	2.81 (1.02)	[2.49, 3.13]
c. I have been able to effectively assess students' creativity and innovation skills	1.67 (0.58)	[0.23, 3.10]	3.42 (1.00)	[2.78, 4.05]	2.86 (1.31)	[2.48, 3.31]	2.77 (0.93)	[2.50, 3.07]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA One-way: Global Connections

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 11** ***N* = 33**		**3** ***n* = 35** ***N* = 105**		**4** ***n* = 42** ***N* = 106**	
Practice	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**
a. Study information about other countries or cultures?	2.00 (1.00)	[-0.48, 4.48]	2.55 (1.29)	[1.68, 3.41]	2.77 (1.33)	[2.31, 3.23]	2.52 (1.40)	[2.08, 2.96]
b. Use information or ideas that come from people in other countries or cultures?	1.67 (0.58)	[0.23, 3.10]	3.36 (1.29)	[2.50, 4.23]	2.86 (1.46)	[2.36, 3.36]	2.64 (1.34)	[2.23, 3.06]
c. Discuss issues related to global interdependency (for example, global environment trends, global market economy)?	1.67 (0.58)	[0.23, 3.10]	2.27 (1.10)	[1.53, 3.01]	2.40 (1.33)	[1.94, 2.86]	2.41 (1.17)	[2.04, 2.77]
d. Understand the life experiences of people in cultures besides their own?	2.00 (0.00)	[0.48, 3.52]	2.46 (1.29)	[1.66, 3.47]	2.74 (1.40)	[2.30, 3.19]	2.55 (1.29)	[2.14, 2.95]
e. Study the geography of distant countries?	1.33 (0.58)	[-0.10, 2.77]	1.91 (1.04)	[1.21, 2.61]	1.91 (1.22)	[1.50, 2.33]	1.88 (1.11)	[1.54, 2.23]
f. Reflect on how their own experiences and local issues are connected to global issues?	2.00 (0.00)	[0.63, 3.37]	2.46 (1.21)	[1.74, 3.17]	2.37 (1.24)	[1.97, 2.77]	2.45 (1.17)	[2.09, 2.82]
a. I have tried to develop students' skills in making global connections	2.33 (0.58)	[0.90, 3.77]	2.46 (1.13)	[1.70, 3.21]	2.69 (1.23)	[2.26, 3.11]	2.77 (1.27)	[2.34, 3.13]
b. Most students have learned to make global connections while in my class	1.67 (0.58)	[0.23, 3.10]	2.46 (1.21)	[1.64, 3.27]	2.47 (1.17)	[2.08, 2.89]	2.33 (1.18)	[1.97, 2.70]
c. I have been able to effectively assess students' skills in making global connections	1.67 (.58)	[0.23, 3.10]	2.18 (1.33)	[1.29, 3.07]	2.37 (1.22)	[1.95, 2.79]	2.36 (1.14)	[2.00, 2.71]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA One-way: Local Connections

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 11** ***N* = 33**		**3** ***n* = 36** ***N* = 105**		**4** ***n* = 41** ***N* = 106**	
Practice	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**	***M*** ***(SD)***	**95% CI**
a. Investigate topics or issues that are relevant to their family or community?	2.00 (0.00)	[0.67, 3.33]	2.55 (1.21)	[1.85, 3.24]	2.83 (1.18)	[2.44, 3.22]	2.85 (1.15)	[2.50, 3.21]
b. Apply what they are learning to local situations, issues or problems?	1.33 (0.58)	[-0.10, 2.77]	2.46 (1.37)	[1.54, 3.37]	2.74 (1.20)	[2.33, 3.15]	2.78 (1.17)	[2.41, 3.15]
c. Talk to one or more members of the community about a class project or activity?	1.33 (0.58)	[-0.10, 2.77]	2.00 (1.00)	[1.33, 2.67]	1.80 (1.08)	[1.43, 2.17]	1.83 (1.05)	[1.50, 2.16]
d. Analyze how different stakeholder groups or community members view an issue?	1.00 (0.00)	[-0.23, 2.23]	2.00 (1.18)	[1.36, 2.64]	1.77 (1.06)	[1.41, 2.13]	1.97 (1.08)	[1.64, 2.31]
e. Respond to a question or task in a way that weighs the concerns of different community members or groups?	1.00 (0.00)	[-0.20, 2.20]	2.36 (1.21)	[1.74, 2.99]	1.94 (1.03)	[1.59, 2.29]	2.10 (1.04)	[1.77, 2.42]
a. I have tried to develop students' skills in making local connections	1.33 (0.58)	[-0.04, 2.70]	2.55 (1.04)	[1.83, 3.26]	2.37 (1.26)	[1.97, 2.77]	2.68 (1.19)	[2.31, 3.05]
b. Most students have learned to make local connections while in my class	1.00 (0.00)	[-0.25, 2.25]	2.46 (1.13)	[1.80, 3.11]	2.11 (1.05)	[1.75, 2.48]	2.49 (1.14)	[2.15, 2.83]
c. I have been able to effectively assess students' skills in making local connections	1.00 (0.00)	[-0.26, 2.26]	2.27 (1.20)	[1.61, 2.93]	2.06 (1.14)	[1.69, 2.43]	2.27 (1.07)	[1.93, 2.61]

Note: 21st Century Teaching and Learning Survey (Hixson et al., 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.

ANOVA One-way: Use of Technology as a Tool

High School	**1** ***n* = 3** ***N* = 13**		**2** ***n* = 11** ***N* = 33**		**3** ***n* = 36** ***N* = 105**		**4** ***n* = 40** ***N* = 106**	
Practice	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**	***M* (*SD*)**	**95% CI**
a. Use technology or the Internet for self-instruction (e.g., Kahn Academy or other videos, tutorials, self-instructional websites, etc.)?	3.33 (2.08)	[-1.84, 8.50]	4.09 (0.94)	[3.46, 4.73]	3.11 (1.26)	[2.69, 3.54]	3.27 (1.14)	[2.91, 3.63]
b. Select appropriate technology tools or resources for completing a task?	2.33 (2.31)	[-3.40, 8.07]	4.18 (0.60)	[3.78, 4.59]	3.53 (1.06)	[3.71, 3.89]	3.37 (1.14)	[3.01, 3.72]
c. Evaluate the credibility and relevance of online resources?	2.67 (2.08)	[-2.50, 7.84]	3.73 (1.35)	[2.82, 4.63]	2.56 (1.21)	[2.15, 2.96]	2.84 (1.06)	[2.52, 3.19]
d. Use technology to analyze information (e.g., databases, spreadsheets, graphic programs, etc.)?	2.00 (1.73)	[-2.30, 6.30]	3.55 (1.29)	[2.68, 4.41]	2.47 (1.42)	[2.00, 2.95]	2.75 (1.13)	[2.39, 3.11]
e. Use technology to help them share information (e.g., multi-media presentations using sound or video, presentation software, blogs, podcasts, etc.)?	2.33 (1.53)	[-1.46, 6.13]	3.91 (1.22)	[3.90, 4.73]	2.72 (1.43)	[2.24, 3.21]	2.78 (1.44)	[2.31, 3.24]
f. Use technology to support team work or collaboration (e.g., shared work spaces, email exchanges, giving and receiving feedback, etc.)?	2.00 (1.00)	[-0.48, 4.48]	4.00 (1.34)	[3.10, 4.90]	2.53 (1.42)	[2.05, 3.01]	2.73 (1.14)	[2.37, 3.09]
g. Use technology to interact directly with experts or members of local/global communities?	1.00 (0.00)	[-0.36, 2.36]	2.64 (1.63)	[1.93, 3.35]	1.56 (1.00)	[1.16, 1.95]	1.93 (1.23)	[1.56, 2.30]
h. Use technology to keep track of their work on extended tasks or assignments?	1.67 (0.58)	[0.23, 3.10]	4.00 (1.41)	[3.05, 4.95]	2.53 (1.44)	[2.04, 3.02]	2.93 (1.44)	[2.47, 3.38]

a. I have tried to develop students' skills in using technology as a tool for learning	2.67 (1.16)	[-0.20, 5.34]	4.46 (0.69)	[3.99, 4.92]	3.28 (1.89)	[2.88, 3.68]	3.20 (1.17)	[2.83, 3.56]
b. Most students have learned to use technology as a tool for learning while in my class	1.67 (.58)	[0.23, 3.10]	4.27 (0.79)	[3.75, 4.80]	2.92 (1.25)	[2.49, 3.34]	2.98 (1.17)	[2.61, 3.35]
c. I have been able to effectively assess students' skills in using technology for learning	1.67 (.58)	[0.23, 3.10]	3.91 (1.14)	[3.15, 4.67]	2.78 (1.11)	[2.29, 3.26]	2.78 (1.11)	[2.43, 3.13]

Note: 21st Century Teaching and Learning Survey (Hixson *et al.*, 2012; Ravitz, 2014) *N* = Population, *n* = sample, *M* = Mean, *SD* = Standard Deviation, CI = Confidence Intervals.