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The Cost Effectiveness and Instructional Value of One-to-One Technology Investments Among Nebraska School Districts

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by

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The Cost Effectiveness and Instructional Value of One-to-One Technology Investments In Nebraska School Districts

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The purpose of this study compared 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts that do not expend funds for one-to-one technology. The study specifically examined Nebraska financial and achievement data from the following sources:

- Technology and staff development costs from Nebraska State expenditure codes 1100-400 (regular instruction technology) and 1100-300 (regular instruction staff development/training).
- Composite district achievement data from Nebraska State Assessment (NeSA) data in the areas of Math, Reading, Science and Writing; Four year graduation rates and American College Testing (ACT) composite scores.

The study used a quantitative data collection system of public K-12 Nebraska school districts, which allowed the researcher to create an overview of one-to-one instructional technology expenditures effect on core achievement, as well as other key components that measure school success. The K-12 districts studied were public school districts within the state of Nebraska. Overall, the study provided valuable information

for a variety of stakeholders in any school system which may be currently asking the question about the cost vs. outcomes of using learning technologies in their system. This type of information provides research to help justify decisions made in the strategic planning of budgets, specifically with implementation or continued support of one-to-one initiatives.

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Table of Contents

List of Tables

List of Figures

List of Appendices

Chapter One

Overview

Introduction and Rationale

Many leaders in K-12 districts today find themselves struggling with growing expenditures in technology, especially when it comes to providing equal access to all students. Educators maintain that access to the internet and on-line information must extend beyond the classroom door. To eliminate the access hurdle, a device for each student has been embraced by many districts as a means to facilitate a 21st century education for its students. To maintain competitiveness with counterparts in a global market, one-to-one access to devices during the entire school day in all classes is stressed. One-to-one access is defined as programs that provide all students in a school, district, or state with their own computing devices such as a laptop, net-book, tablet computer, or other mobile devices (Great Schools Partnership, 2013). In a world where every state and local dollar is scrutinized closely, the ability to find positive correlations with technology investments, specifically one-to-one technology purchases, is extremely important and significant for districts currently using one-to-one initiatives, or considering this initiative in their strategic plans for the future.

Prior studies have attempted to identify how technology increases academic achievement, but have fallen short in identifying if there is a true connection between investment and increased academic performance (Darling, 2014; Mann, 1999). Research on the question of whether there is a correlation between achievement gains with students and actual cost is very limited and not specific. The research provides no clear evidence

that actually demonstrates that the dollars invested in these devices, or a one-to-one initiative, actually contribute to the academic outcomes desired, which is why additional research in this area is needed.

Purpose Statement

The purpose of this study compared 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts that do not expend funds for one-to-one technology. The study specifically examined Nebraska financial and achievement data from the following sources:

- Technology and staff development costs from Nebraska State expenditure codes 1100-400 (regular instruction technology) and 1100-300 (regular instruction staff development/training).
- Composite district achievement data from Nebraska State Assessment (NeSA) data in the areas of Math, Reading, Science and Writing; Four year graduation rates and American College Testing (ACT) composite scores.

Research Questions

The researcher developed the following questions in order to support the purpose of this study as defined in the purpose statement section.

1. Does the use of one-to-one technology in grades 7-12 in Nebraska School Districts have a direct impact upon combined achievement scores, specifically in the areas measured by NeSA, Graduation Rates, and ACT?

2. Does spending on technology tools in Nebraska K-12 School Districts (State of Nebraska Expenditure Code 1100-400) correlate to higher achievement?
3. Are Nebraska School Districts with one-to-one initiatives in grades 7-12 spending more on staff development and training (State of Nebraska Expenditure Code 1100-300) than those districts who do not have one-to-one initiatives in grades 7-12?

Method Overview

In this quantitative study, the researcher used publically available archival data from the State of Nebraska to collect technology costs as well as specific comparable academic achievement measures in each district selected for the study. The researcher hoped to determine if trends, either in a positive or negative direction, existed for districts that invest in one-to-one devices. This was determined by, if a correlation existed between achievement in districts that have one-to-one devices, and dollars expended under codes 1100-400 and 1100-300, and those districts that do not have one-to-one devices, and the dollars expended under codes 1100-400 and 1100-300.

Assumptions, Delimitations and Limitations

As with any research, there are assumptions, delimitations, and limitations. Future expenditures on technology in a school system are projected to continue to rise. Thus, it is no surprise that calls for accountability regarding the impact of these efforts upon student achievement are common throughout the country. These discussions on student achievement, the social impact of educational technology, and overall cost-effectiveness

leads this researcher to question how effectively dollars are being spent on increasing achievement or improving the learning environment.

Assumptions. When specifically looking at the effects of one-to-one technologies upon student achievement, there are several assumptions the researcher identified.

1. Many district leaders and educators share the belief that by implementing one-to-one technology, their students achievement will increase, and thus the cost effectiveness of this expenditure is justified.
2. All districts define student achievement through similar quantitative outcomes. This can make supporting the belief, that by implementing one-to-one technology, students achievement will increase, and thus the cost effectiveness of this expenditure difficult for districts to justify. For this reason, the researcher has identified the areas of achievement to be studied as districts composite NeSA Math, Reading, Science and Writing; Four year graduation rate, and American College Testing (ACT) composite scores, in order to have an equal data analysis. Examples of the data gathered are included in Appendix A.
3. The school districts studied have accurately reported expenditures and student achievement scores.
4. Devices will be used consistently within the instructional environment. With the exception of attendance, and the quantity of time the device is used in class, the researcher was able to use financial data on technical support, and training provided in the districts identified with one-to-one initiatives.

5. The districts in the study with one-to-one initiatives had adequate infrastructure with on-site technical support. Technology is continually changing and evolving over time, but many teachers lack adequate troubleshooting skills, and time to fix equipment, especially if it breaks in the middle of a lesson.

By looking at achievement with the assumptions as described, the researcher was then able to accurately answer the question, "Does investment in technology correlate to increased academic achievement as measured by the State of Nebraska NeSA scores?"

Delimitations. In order to keep the research focused with districts that have common reporting systems for achievement, finances, and demographics there are some delimitations of the study.

1. The study is confined to public school districts located in the State of Nebraska.
2. The validity of this study will depend greatly on the data provided on each school district's state report card.
3. All school districts adhered to state recommended expenditure coding.

Limitation. Limitation of this study was looking at the impact that technology had on 7-12 achievement overall within the State of Nebraska. The study had a focus on districts that implement one-to-one initiatives 7-12 compared to those that do not have one-to-one initiatives 7-12. This limitation does offer the opportunity for possible additional research that may be done in the future to compliment the work from this study.

The Significance of the Study

As school districts consider moving to one-to-one computing, there are many factors to take into consideration. Teachers and administrators should carefully consider the outcomes that they would like to see and then design their implementation, training and assessment efforts accordingly. As one-to-one programs move from the experimental stage and become more ingrained in regular practice, adjustments will need to be made to achieve a higher level of use within individual instructor's lesson designs (Hanover Research, 2013; Herold, 2016) with many of the results from the new one-to-one programs being encouraging (Darling, 2014). This study provided some unique data to consider when determining if one-to-one initiatives, and the associated cost, are having a direct impact on achievement outcomes. This type of information is important because schools are becoming more and more accountable for expenditures of funds and levels of student achievement.

Summary

Publicly elected school leaders of today are being challenged more and more by their constituents to demonstrate high levels of fiscal accountability in a transparent manner. When school districts look at any major expenditure, the ability to demonstrate its effectiveness in student achievement is key for its continued support. This study compared 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts which do not expend funds for one-to-one technology. By examining the results of this study, the researcher was able to provide some thought provoking and

data driven discussions for school districts by demonstrating if a correlation exists between the two variables, thus providing supporting evidence and discussions on how technology dollars should be budgeted. These discussions will not necessarily be centered around the need to continue to fund technology in K-12 education, but how to be more definitive on what its intended purpose is in the educational environment. This study will help provide more meaningful discussions with the public and board of education members as they review budgets, priorities, and strategic goals when looking at the learning needs of their students, as well as what will be the best use of dollars for academics.

Chapter Two

Literature Review

Introduction

Over the past decade, large amounts of private and public sector funds have been spent on technology equipment and training infrastructure for the K-12 teaching/learning environments. Future expenditures are projected to rise and continue to be large fiscal items for school district budgets. Thus, it is no surprise that calls for accountability regarding the impact of these efforts upon student achievement continually echo throughout the country. These calls focus on student achievement in content areas, issues related to the social impact of educational technology, and overall cost-effectiveness. The primary questions this review of the literature addresses are as follows:

- Does the use of computer technologies have an impact upon 7-12 student achievement?
- How cost-effective are computer technologies in K-12 school districts?

To assist in answering these questions while also supporting the importance of this study, the review of literature is organized in the following manner:

- Technology and its overall impact on student achievement
- Technology and its overall impact specifically in one-to-one environments
- Cost effectiveness of technology when looking at student outcomes
- Overall summary of the literature reviewed

Literature on Technology Assisted Learning and Student Achievement

A report from the Alliance for Excellent Education and the Stanford Center for Opportunity Policy in Education (SCOPE) finds that technology - when implemented properly - can produce significant gains in student achievement as well as boost engagement, particularly among students most at risk (Darling, 2014). This research is another source which demonstrates districts must have a plan for how they will use technology before they make the purchase, if they desire growth in achievement. Eamonn O'Donovan wrote in *District Administration* that those planning a laptop program should observe the following 10 key steps to keep the program running efficiently:

1. Standardize a computer operating system/platform-Apple, Microsoft, or open source.
2. Decide upon a standard set of software tools that will be consistent across the school.
3. Identify research-based software that can support learning in math and reading.
4. Decide how much access students will have to the network.
5. Decide how to handle the inevitable upgrades to operating systems, as well as computers that use different versions of the operating systems.
6. Plan for obsolescence of software and hardware.
7. Develop a plan to repair and replace broken laptops, batteries and printers.
8. Provide other technology to supplement the laptop program, including presentation devices such as LCD projectors.
9. Plan for a robust network. Assume that all computers will be on the network at the same time.
10. Have on-site technical support. A lack of support will frustrate staff and students (O'Donovan, 2009).

Moreover, since hardware and software are constantly changing, schools and districts must revisit their technology plans on an ongoing basis and make revisions, as necessary, to take advantage of new opportunities and innovations (Sivin-Kachala & Bialo, 2000). Adequate access and proper technical support are key factors in successful

implementation of a technology program in schools. Even teachers who enjoy using computers will stop using technology if the equipment is unreliable or difficult to use without specific training. Longitudinal research examining teachers' use of technology suggest that the support teachers need changes as they become more proficient in integrating technology into instruction (Sandholtz, Ringstaff, & Dwyer, 1997).

The effective use of technology requires school districts to have a infrastructure for training and use of technology as well as on-site technical support. Once teachers have adequate access and technical support for technology, they must also understand how its use fits into the larger curricular and instructional framework set forth by the district and Board of Education. Researchers at Educational Testing Service (Coley, Cradler, & Engel, 1997) indicated that courseware should reflect curricular standards and should take into account research on how students learn.

According to researchers at the North Central Regional Educational Laboratory (Valdez et al., 1999), Computer Based Instruction, Computer Assisted Instruction, Intelligent Learning Systems and other forms of computerized tutoring were most likely to be effective when there was a match between the software, the objectives of instruction, the students' prerequisite knowledge and skills, and teachers' understanding of the needs of the learners. In the Apple Classrooms of Tomorrow study, student engagement remained highest when technology use was integrated into the larger curricular framework, rather than being an "add-on" to an already full curriculum (Sandholtz et al., 1997). When looking at if technology prepares students for tomorrow and the job skills that are needed some people will say that schools need to teach more

than keyboarding or word processing. Districts must also use technology as a tool to teach the curriculum. Research actually has suggested that when technology is integrated into the larger instructional framework, students will not only learn how to use the equipment and software, but will also gain content knowledge (Silverstein, Frechtling, & Miyoaka, 2000). Moreover, using technology within the curriculum framework can enhance important skills that will be valued in the workplace, such as locating and accessing information, organizing and displaying data, and creating persuasive arguments (Sandholtz et al., 1997). Other research that has shown the importance of bringing technology into the curricular framework would be West Virginia's Basic Skills/Computer Education program which integrated technology into instruction rather than isolating computer skills from content learning. This research showed how these characteristics of the program demonstrated a reason for its effectiveness (Mann, 1999). Research on the Middle School Mathematics through Application Project (MMAP) provided a great example of how technology can be used effectively if it is embedded in content-rich activities (Penuel, Golan, Means, & Korbak, 2000). MMAP was created to help students learn math as they designed solutions to real-world problems with the use of technology. At first, both students and teachers were engaged with the technology itself and little attention was given to the content learning. With some support from the project staff, math content became more of a focus and the use of technology became more transparent. Specifically, project staff helped structure problems, activities, and assessments to enhance the subject matter content. Eventually, a balance happened where students learned about using the technology while also reaching their instructional

objectives by meeting their math standards. Thus, technology became a tool for learning, and not separate from the learning itself. Overall, the literature reflects that having a technological learning tool for students is positive. Learning to use the tool appropriately is the challenge for educators today.

Literature on Learning with One-to-One Initiatives and Student Achievement

One-to-one technology is at its best in classrooms in which learning is driven by projects requiring research, collaboration, and production of a final product. In order for a one-to-one program to be successful academically, the focus needs to remain around content standards, and not drift away from that. An individual device can be an important tool which can help students meet these standards as well as meet additional goals such as innovation, creativity, and research (O'Donovan, 2009). When students can access the world around them, and when they do not have to wait to schedule time in a lab, the impact on achievement grows. This in turn helps engage a 21st century learner (Jackson, 2009). In 2010 a report from Project RED, cited in Hanover Research, found that "schools employing a 1:1 student-computer ratio . . . outperform other schools, and reveal significant opportunities for improving education return on investment by transforming teaching and learning"(cited in Hanover, 2013, p. 4). The study also reported that technology in high schools impacted college enrollment, AP course enrollment, plans for higher education, and graduation rates. Binbin Zheng, an assistant professor of counseling, educational psychology, and special education at Michigan State University states, "It's not like just providing a laptop to every student will automatically increase student achievement, but we find that it is the first step" (Herold, 2016, p. 1).

Research suggests that technology implementation, particularly a one-to-one initiative, should be implemented only after a planning stage where administrators and other district stakeholders develop clear objectives and goals if impacts on achievement are desired. An example of this is IBM's Reinventing Education program. Schools in this program allocated time and some other resources for planning on how to best use the technology for instructional improvement (Trotter, 2001). Andrew Marcinek the co-founder of Technology and EducatorU.org believes there are 5 important steps for schools districts to consider when implementing a successful one-to-one environment:

1. **Define the Goals of your 1:1 Program** / A 1:1 environment should be the goal of every learning institution; however, this is not about devices, it is about access.
2. **Define the Role of the Device in Your Classroom** / While selecting the right device is essential, making it the focal point is not the best way to deliver it.
3. **Model How to Harness the Device's Power** / Welcome the device and take time to understand it, model for students how to harness its power.
4. **Put it Away When Appropriate** / A 1:1 environment will not always have a device on display. There will be times when the best lesson is done in the absence of technology. Similarly, students should not become attached to the device, but understand when it should be accessed.
5. **Teach, Model and Support Information Literacy** / Students should understand that a device is an avenue for learning and discovery, it cannot replace their ability to think critically and question (Marcinek, 2015).

Even with both past and current literature supporting the idea of one-to-one initiatives being a factor in student achievement gains, there has been some recent information arguing the opposite. Faculty members at the U.S. Military Academy at West Point looked into the impact computers and tablets had on their students' grades. What they determined was when they took away students' computers and tablets in an introductory economics courses, their students' grades increased (Straumsheim, 2016). The Organization for Economic Cooperation and Development came to a similar

conclusion when looking at computer use among 15-year-olds across 31 nations and regions. They found that students who had more computer use at school showed decreases in reading and math scores (Hechinger Report, 2015). A paper was recently published by the Massachusetts Institute of Technology in which it was stated that students barred from using laptops or digital devices in lectures and seminars did better in their exams than those allowed to use computers and access the internet. The paper also suggested the removing of laptops and iPads from classes created a better quality of teaching (Adams, 2016). The Liverpool Central School District in New York decided to start phasing out laptops in the fall of 2007. "After seven years, there was literally no evidence it had any impact on student achievement," stated Mark Lawson, the school board president (Hu, 2007, p. 3).

Although computers in schools number well over 10 million, frequent student experiences with school computers generally occur outside of the core academic areas. The core areas are where one might imagine learning to be most impacted by technology, and thus impacting achievement and justifying increases in this expenditure area. The vast majority of the literature on this subject demonstrates that users are most comfortable with using technology within their classrooms outside of the core academic areas, and those in the core areas need additional training and support to feel comfortable with helping students use this tool beyond word processing and spreadsheets.

Literature on Cost Effectiveness of Technology

When discussing the cost, utility, and value of technology, several studies from 1996 to 2000 that discuss cost and effectiveness of technology in education support the

expenditure. In 2000, it was suggested that organizations should spend 30% of their budget on equipment and 70% on the "human infrastructure" to support ongoing training and technical assistance (Wahl, 2000). "Since many schools and districts prefer to spend their limited funds on hardware and software, it is not surprising that teacher training is a significant barrier to successful integration" (Mann & Shafer, 1997, p. 18). A 1994 survey for the Office of Technology Assessment reported that less than 10% of new teachers felt prepared to use multimedia and communication technologies in their teaching, and only about half felt that they were competent enough with tools such as word processing or spreadsheets to use them in the classroom (Statham & Torell, 1999). Research also suggested a lack of sufficient teacher training in technology use at the pre-service level (Willis & Mehlinger, 1996). As is the case with in-service professional development, the content of pre-service education related to technology is fundamental computer operation rather than preparation on how to use technology as a teaching tool and how to integrate it across the curriculum (Sandholtz, 2001).

The Hawkins study conducted in 1996 called for investments in all grades, but said that lower expenditures should be allocated to lower grades and higher amounts for the upper grades. The study argued for budgets to reflect coordinated improvements in technology and training with changes in the curriculum. This strategy better aligns technology and curriculum and thus reducing after-the-fact-spending. The study also discussed that many financing options are needed including corporate, nonprofit agencies, and low interest government loans. Additional grant monies also need be made

available to supplement loans and traditional revenue sources (Hawkins, Spielvogel, & Panush, 1996).

The Spielvogel study argued, that there is a need for more technology expenditures in education, especially in teacher and school leadership development. These expenditures focused not only on training for technological skills but on collaborative leadership and more constructivist ways of teaching. Thus, the argument is that K-12 spending needs to have more of a focus on training its people and not just purchasing the tools (Spielvogel et al., 2001). This is also supported by Wenglinsky in his 1998 study, where he recommends that there should be a targeting and prioritization first by doubling professional development in particular in the development of higher order thinking skills. He also suggested schools target implementation of more technology tools at the middle school age level (Wenglinsky, 1998). These sources emphasize the need for teacher training in the use of devices in order to provide a tool that enhances learning for students not just provide a supplement.

Mann in 1997, argued that schools spend less than industry spends on technology training. The logic is that if industry expects students to be prepared with high tech skills, then school spending must at least equal industry spending in order to keep pace with current market needs (Mann & Shafer, 1997, p. 18). Mann's research also demonstrated that teachers would be willing to forgo a raise if they could get more technology and that greater savings could be realized by increasing class size with more technology to support the increases.

Since 2000, studies looking at the cost and effectiveness of this type of expenditure especially in a one-to-one environment, tend to argue that the cost of computer technologies are not producing superior learning results. When measuring results in student achievement after large technology investments have been made, there are only small to modest improvements in overall academic achievement, which leads school district officials to believe there may be reason to re-evaluate the cost effectiveness of technology expenditures. Billions of dollars have been spent on technology over the past two decades in public school districts. The results consistently demonstrate small to moderate gains when comparing districts with large investments in technology to those with smaller investments. This emphasizes public school districts should curtail spending on computer technologies until more dramatic results can be demonstrated (Johnson, 2000).

More recently, there has been more information in support of what Johnson stated in 2000. Matoaca High School, just outside of Richmond, Virginia, eliminated its laptop program after a five year period. It was determined that students did not show academic gains compared to students in schools without laptops. Continuing to provide laptops would have cost an additional $1.5 million the first year alone to the school budget (Hu, 2007). The Kyrene School District in Arizona invested approximately $33 million for laptops and other technology items under a ballot initiative in 2005. By 2011, scores in reading and math stagnated, even though statewide scores rose in comparison (Richtel, 2011). In Texas, students in 22 schools received computers in a pilot program financed by the state with a cost of $14.5 million. The goal was to create higher achievement with

these students. At the end of four years, findings were inconsistent and did not provide evidence of academic improvement as a whole, even with a significant financial investment (Weston & Bain, 2010).

Summary

Educators and those involved in education must always do what is best for students as a diverse set of learners. Sometimes that means using alternative ways to reach students and complete learning activities. While it is possible to do all schoolwork on a device, it is not always the best way for all students. Thus, the overall conclusion for the review of the literature is that investing in technology and one-to-one devices can have a positive effect on academic achievement, when considering specific variables. These variables are:

- Teacher training,
- Academic areas that the training is focused on
- Grade levels that technology tools are used
- How devices are implemented in an educator's lesson design.

In 2009, a study specifically describes essentials for Districts to consider when looking at these variables.

1. Standardize a computer operating system/platform-Apple, Microsoft, or open source.
2. Decide upon a standard set of software tools that will be consistent across the school.
3. Identify research-based software that can support learning in math and reading.
4. Decide how much access students will have to the network.
5. Decide how you will handle the inevitable upgrades to operating systems, as well as computers that use different versions of the operating systems.
6. Plan for obsolescence of software and hardware.

7. Develop a plan to repair and replace broken laptops, batteries and printers.
8. Provide other technology to supplement the laptop program, including presentation devices such as LCD projectors.
9. Plan for a robust network. You must assume that all computers will be on the network at the same time.
10. Have on-site technical support. A lack of support will frustrate staff and students (O'Donovan, 2009).

These variables can be viewed differently based on the level of understanding of technology by district staff and the amount of training a district provides to its staff members on tool usage, but also its use as a curricular enhancer. This is where districts struggle when determining the cost effectiveness vs. instructional benefit with specific technology tools. This is why the researcher conducted this study with the specific purpose of comparing 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts that do not expend funds for one-to-one technology.

Chapter Three

Methodology

Purpose and Introduction

Currently, research has been varied and has not necessarily been specific to the topic of cost versus the benefit of K-12 technology tools, or one-to-one initiatives. The vast majority of data on this topic is more specific to illustrating expenditure growth in technology by reporting the level of disbursements from district budgets. The expenditures include everything from hardware and software to staff and facility cost. There are data and research sources citing specifically the cost districts have incurred with technology over the past several years, but nothing specific to cost vs. instructional value. Because of this gap, the researcher developed this study around the following purpose and questions.

The purpose of this study compared 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts that do not expend funds for one-to-one technology. The study will specifically examine Nebraska financial and achievement data from the following sources:

- Technology and staff development costs from Nebraska State expenditure codes 1100-400 (regular instruction technology) and 1100-300 (regular instruction staff development/training).

- Composite district achievement data from Nebraska State Assessment (NeSA) data in the areas of Math, Reading, Science and Writing; Four year graduation rates and American College Testing (ACT) composite scores.

The researcher developed the following questions in order to support the purpose of this study and to guide the method of research used to answer these questions.

1. Does the use of one-to-one technology in grades 7-12 in Nebraska School Districts have a direct impact upon combined achievement scores specifically in the areas measured by NeSA, Graduation Rates, and ACT?
2. Does spending on technology tools in Nebraska K-12 School Districts (State of Nebraska Expenditure Code 1100-400) correlate to higher achievement?
3. Are Nebraska School Districts with one-to-one initiatives in grades 7-12 spending more on staff development and training (State of Nebraska Expenditure Code 1100-300) than those districts who do not have one-to-one initiatives in grades 7-12?

Research Method

The researcher gathered both achievement and financial data from Nebraska districts used in the study. The achievement data used was the district composite results of the Nebraska State Assessment (NeSA) in Math, Reading, Science and Writing; Four year graduation rates, and American College Testing (ACT). The technology and staff development cost data used was State of Nebraska expenditure codes 1100-400 (regular instruction technology) and 1100-300 (regular instruction staff development/training) from 2012-2013 through 2015-2016 school years. The researcher submitted the data to

be collected with the Internal Review Board (IRB) to determine if specific permissions would be required. After review by the IRB, it was determined that because the data being compiled was all public record, IRB approval was not required.

In order to answer the specific research questions being asked, the researcher used a type of Quantitative Research known as Correlational Research Method. Correlational studies are used to look for relationships between two or more variables using statistical or quantitative data. The control or independent variable in this study is the use of one-to-one devices and their associated expenditures within expenditure codes 1100-400 and 1100-300 correlated with the dependent variables of the combined district results in NeSA Math, Reading, Science and Writing, Four year graduation rate and American College Testing (ACT) composite scores. After gathering all the financial and achievement data, the researcher was then be able to correlate two main variables to determine if trends, either in a positive or negative direction, existed for districts that invest in one-to-one devices. Is there actually a correlation between achievement in districts that have one-to-one devices and the amount of dollars expended under codes 1100-400 and 1100-300 and those districts that do not have one-to-one devices and the amount of dollars expended under codes 1100-400 and 1100-300?

In determining the Nebraska districts used in the study, the researcher compiled data from 16 different school districts from across the state over a four year period from 2012-2013 through 2015-2016 school years. Eight of these school districts had one-to-one initiatives in grades 7-12 during this time period and eight districts did not have one-to-one initiatives in grades 7-12 during this time period. The researcher developed a pool

of potential Nebraska districts for this study by surveying districts business managers across Nebraska and asking if their districts had one-to-one initiatives grades 7-12 during this time period. Two hundred eighty-six districts were contacted electronically by e-mail with this question, seventy eight districts responded with either a "yes or no" answer. If a district responded "yes", then that district was placed into the one-to-one initiative group. If a district responded "no", then that district was placed into the non one-to-one initiative group. In order to ensure comparability between the one-to-one and non one-to-one groups the following demographic information was gathered for each district:

- K-12 enrollment
- Number of enrolled students needing special education services
- Number of students who qualify for free and reduced lunch
- Number of English language learner students
- Number of learners with high abilities.

This data was gathered to provide the researcher assurances that the one-to-one districts and the non one-to-one districts had common demographics before doing the correlations. This added stronger validity to the study. After gathering all the demographic data for the districts in each group, the researcher created sub groups within the one-to-one group and sub groups within the non-one-to-one group. These sub groups were urban, suburban, and rural with similar demographics. By random selection, the researcher determined two different groups. The first group included, one urban, three suburban, and four rural districts for a total of eight, that had one-to-one initiatives grades 7-12.

The second group included, one urban, three suburban and four rural districts for a total of eight, that did not have one-to-one initiatives grades 7-12. The demographic data from these districts is reported to provide stronger validity to the correlations being conducted by demonstrating the study of districts with common student demographics.

By correlating the data from these identified variables there were three possible results:

1. Positive Correlation: Both variables increase or decrease at the same time. Within this study an increase in technology expenditures correlates evenly to increases in the identified measured areas of achievement.
2. Negative Correlation: Indicates that as the amount of one variable increases, the other decreases (and vice versa). Within this study when expenditures increased, achievement decreased or stayed the same.
3. No Correlation: Indicates no relationship between the two variables. In this study increases in spending on technology in a one-to-one district does not correlate to increases in areas of achievement.

While correlational studies can suggest that there is a relationship between two variables, they cannot prove that one variable causes a change in another variable. In other words, correlation does not equal causation. For example, this study determined if there was a relationship between increasing spending on technology in K-12 systems with one-to-one devices and increases in achievement in those same districts. The study cannot show if achievement decreases then technology expenditures also decrease, as other variables might play a role, including lesson designs, hours of use, instructor's capabilities

with technology, and many other possible factors. Other limitations of the study occur when looking at the impact technology has on K-12 achievement within the State of Nebraska. The data being used to measure achievement is focused only on combined districts within the State of Nebraska, NeSA test scores, four year graduation rate, and ACT composite data for grades 7-12.

Summary

By using the correlation method, the researcher was able to answer each of the research questions.

1. Does the use of one-to-one technology in grades 7-12 in Nebraska School Districts have a direct impact upon combined achievement scores specifically in the areas measured by NeSA, Graduation Rates, and ACT?
2. Does spending on technology tools in Nebraska K-12 School Districts (State of Nebraska Expenditure Code 1100-400) correlate to higher achievement?
3. Are Nebraska School Districts with one-to-one initiatives in grades 7-12 spending more on staff development and training (State of Nebraska Expenditure Code 1100-300) than those districts who do not have one-to-one initiatives in grades 7-12?

Even though there are limitations to the study, the findings are beneficial and useful to K-12 school districts which currently have, or are considering, one-to-one technology for their district. The expenditure of funds is a consideration that should be reviewed in depth, not only in the initial purchase, but in sustaining the devices over a period of time, as well as the other associated cost that go with maintaining this approach. In many cases, school

districts which pursue adding one-to-one devices have a strong belief that in order to increase achievement this purchase needs to occur. In fact, this may not be the case. The devices may be a factor in student achievement growth and as such should not be considered a correlated outcome. Information from this study will provide additional research and data to the conversation many school districts and communities are having about the most cost effective instructional tools and its correlations to achievement.

Chapter Four

Reporting of Results

Introduction

In order to answer the specific research questions being asked, the researcher conducted correlations to support the purpose of the study. That purpose is to compare 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts that do not expend funds for one-to-one technology. The results of this study will provide patrons and district administrators considering this investment in one-to-one technology with additional information related to student achievement and instructional technology.

The researcher compiled data from sixteen randomly selected school districts from across the state of Nebraska over a four year period from 2012-2013 through 2015-2016 school years. Eight of these school districts had one-to-one initiatives in grades 7-12 during this time period, and eight districts did not have one-to-one initiatives in grades 7-12 during this time period. The raw data gathered from the sixteen selected school districts can be found in Appendix A. Within each group of eight school districts, one was identified as urban, three were suburban, and four were rural. These definitions were in accordance with the definitions set forth by the Office of Management and Budget. Details of those definitions are included in Table 1.

Table 1

Definitions

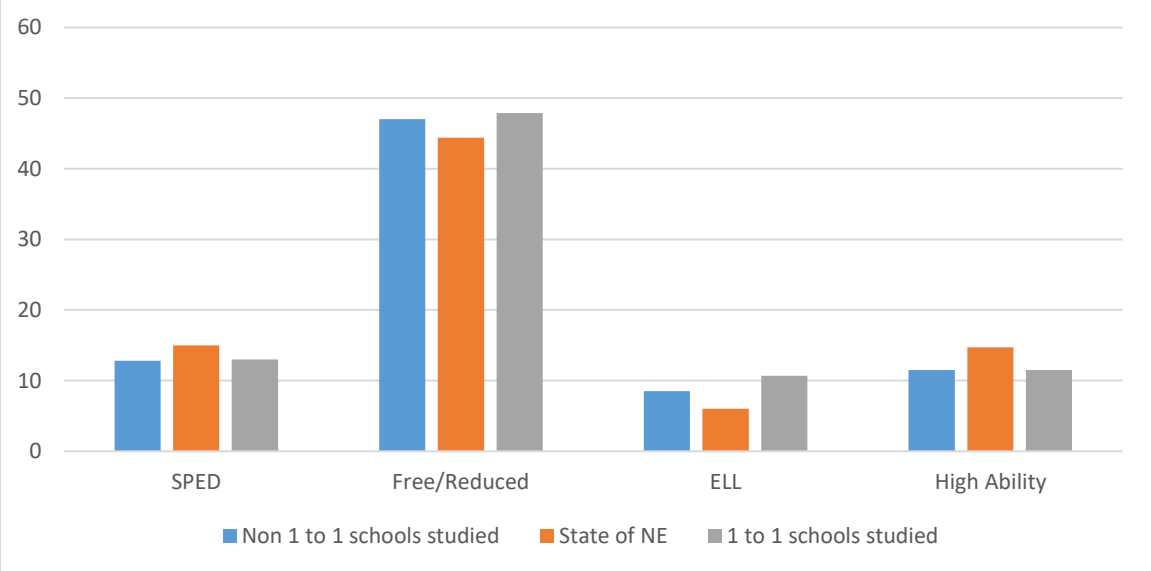
School District	Size	Definition
Urban	Large	Territory inside an urbanized areas and inside a principal city with population of 250,000 or more.
	Midsize	Territory inside an urbanized area and inside a principal city with population less than 250,000 and greater than or equal to 100,000.
	Small	Territory inside an urbanized area and inside a principal city with population less than 100,000.
Suburban	Large	Territory outside a principal city and inside an urbanized area with population of 25,000 or more.
	Midsize	Territory outside a principal city and inside an urbanized area with population less than 250,000 and greater than or equal to 100,000.
	Small	Territory outside a principal city and inside an urbanized area with population less than 100,000.
Rural	Fringe	Census-defined rural territory that is less than or equal to 5 miles from an urbanized area, as well as rural territory that is less than or equal to 2.5 miles from an urban cluster.
	Distance	Census defined, rural territory that is more than 5 miles but less than or equal to 25 miles from an urbanized area, as well as rural territory that is more than 2.5 miles but less than or equal to 10 miles from an urban cluster.
	Remote	Census-defined rural territory that is more than 25 miles from an urbanized area and is also more than 10 miles from an urban cluster.

Source: Office of Management and Budget (2000). Standards for Defining Metropolitan and Micropolitan Statistical Areas; Notice. Federal Register (65) No. 249.

Demographic Data

Figure 1 compares the following: Number of enrolled students needing special education services, number of students who qualify for free and reduced lunch, number of English language learner students and the number of learners with high abilities. The data is represented as four year averages from 2012-2013 through 2015-2016 school

years, and are also compared to the State of Nebraska averages from the same time period. The data in this figure is represented in percentages and demonstrates that the one-to-one districts and the non one-to-one districts had common demographics before doing the correlations. The demographic data from these districts is reported to provide stronger validity to the correlations conducted.

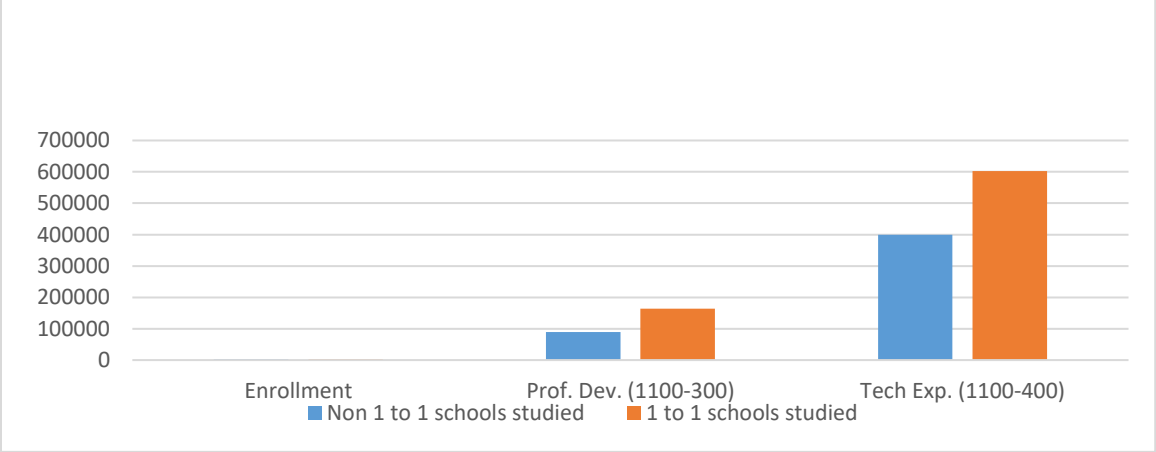


	SPED	Free/Reduced	ELL	High Ability
Non one-to-one schools studied	12.8	47	8.5	11.5
State of NE	15	44.4	6	14.7
One-to-one schools studied	13	47.9	10.7	11.5

Figure 1. Four-year demographic average of the two groups studied from 2012-2013 through 2015-2016 school years compared to State of Nebraska averages (Source: Nebraska Department of Education – State of Schools Report 2012-2013 through 2015-2016).

Financial Data

Figure 2 is a comparison of total K-12 enrollment, expenditures in professional development (State of Nebraska expenditure function code 1100-300) and technology expenditures (State of Nebraska expenditure function code 1100-400). The data in this figure is represented as four year averages of total student numbers and total dollars expended in professional development and technology from 2012-2013 through 2015-2016 school years. When comparing the non one-to-one districts to the one-to-one districts, each group had a similar number of total students, with the one-to-one districts expending more in staff development and technology than the non one-to-one districts.

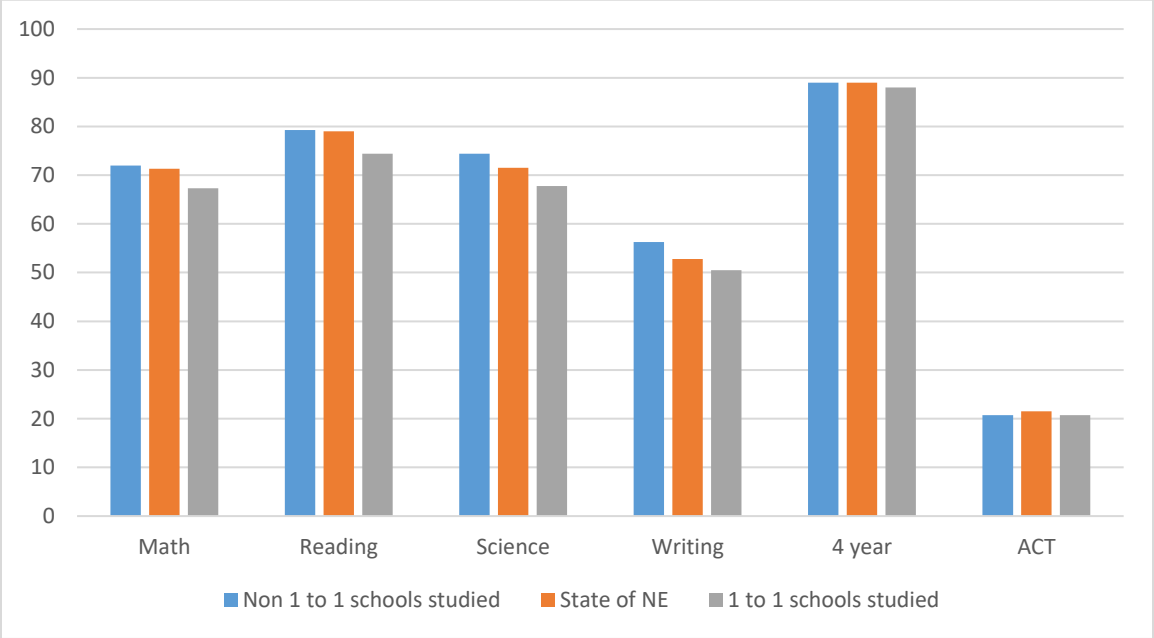


	Enrollment	Prof. Dev. (1100-300)	Tech Exp. (1100-400)
Non one-to-one schools studied	2358	$89,102.71	$399,929.02
One-to-one schools studied	2312	$163,649.16	$601,979.80

Figure 2. Enrollment, prof. development (1100-300) & tech expenditures (1100-400) Four year averages of the two groups studied from 2012-2013 through 2015-2016 school years (Source: Nebraska Department of Education – State of Schools Report 2012-2013 through 2015-2016).

Achievement Data

Figure 3 represents data specific to: District scores in NESA (Math, Reading, Science, and Writing), districts four year graduation rates and ACT composite scores. The data in this table is represented as total averages of grades 7-12 from 2012-2013 through 2015-2016 school years compared to the State of Nebraska total averages from the same time period.



	Math	Reading	Science	Writing	4 year	ACT
Non one-to-one schools studied	72	79.3	74.4	56.3	89	20.7
State of NE	71.3	79	71.5	52.8	89	21.5
One-to-one schools studied	67.3	74.4	67.8	50.5	88	20.7

Figure 3. Four year NESA averages from 2012-2013 through 2015-2016 school years of the two groups studied compared to State of Nebraska averages (Source: Nebraska Department of Education – State of Schools Report 2012-2013 through 2015-2016).

Results of Pearson Correlations

The data from Figure 2 and 3 were uploaded into a Pearson Correlation which created the comparisons reported in Tables 2, 3 and 4. Table 5 provides a descriptive statistic of all 64 correlations that were run for the study. The results of the correlations provided the researcher trends of significance in either a positive, negative, or neutral position. These results also provided the researcher data when answering the questions the study is focused on.

Pearson correlation tables. Detailed results of the correlations conducted in the study are found on pages 33, 34, 35 and 36:

- Table 2 – Correlations with one-to-one status being the constant when looking at expenditures and achievement among all 16 school districts.
- Table 3 – Correlations among one-to-one districts when looking at expenditures and achievement.
- Table 4 – Correlations among non one-to-one districts when looking at expenditures and achievement.
- Table 5 – Descriptive statistics of all Nebraska school districts studied.

Table 2

Correlations with One-to-One Status being the Constant When Looking at Expenditures and Achievement among all 16 School Districts

	Scale	1	2	3	4	5	6	7	8	9
1.	One-to-one	-	.404**	.278*	-.318*	-.347**	-.337**	-.391**	-.108	-.166
2.	Exp-Prof 1100-300	.404**	-	.442*	-.067	-.127	-.272*	-.156	-.302	-.158
3.	Exp-Tech 1100-400	.278*	.442**	-	-.091	-.182	-.400**	-.103	-.186	-.174
4.	NESA Math	-.318*	-.067	-.091	-	.885**	.765**	.673**	.454**	.753**
5.	NESA Reading-	-.347**	-.127	-.182	.885**	-	.774**	.739**	.567**	.733**
6.	NESA Science	-.337**	-.272*	-.400**	.765**	.744**	-	.810**	.590**	.839**
7.	NESA Writing	-.391**	-.156	-.103	.673**	.739**	.810**	-	.607**	.714**
8.	4Yr Grad. Rate	-.108	-.302	-.186	.454**	.567**	.590**	.607**	-	.590**
9.	ACT Composite	-.166	-.158	-.174	-.753**	.733**	.839**	.714**	.590**	-

* p < .05 n=64
** p < .01

Note: When reviewing Table 2 the constant variable is Nebraska School Districts with one-to- one initiatives grades 7-12 correlated against all the identified areas among all 16 school districts both one-to-one and non one-to-one districts. Each of the areas correlated is identified across the top and highlighted in yellow. Columns 1 and 3 are also highlighted in yellow and represent the correlations used to assist in answering the research questions. Areas with correlations that were significant are identified with an *

Table 3

Correlations among One-to-One Districts when Looking at Expenditures and Achievement

Scale	1	2	3	4	5	6	7	8	9
1. One-to-one only	-	.-024	.248	-.084	-.234	-.229	-.058	-.116	-.193
2. Exp-Prof 1100-300	-.024	-	.371*	.051	-.081	-.195	-.017	-.397*	-.103
3. Exp-Tech 1100-400	.248	.371*	-	-.074	-.174	-.489**	-.060	-.258	-.235
4. NESA Math	-.084	.051	-.074	-	.891**	.627**	.585**	.156	.704**
5. NESA Reading-	-.234	-.018	-.174	.891**	-	.713**	.676**	.297	.775**
6. NESA Science	-.229	-.195	-.489**	.627**	.713**	-	.801**	.446**	.834**
7. NESA Writing	-.058	.017	-.060	.585**	.676**	.801**	-	.503*	.825**
8. 4Yr Grad. Rate	-.116	-.397*	-.258	.156	.297	.446*	.503*	-	.371
9. ACT Composite	-.193	-.103	-.235	.704**	.775**	.834**	.825**	.371	-

* $p < .05$
** $p < .01$

Note: When reviewing Table 3 the constant variables are each of the identified areas correlated against 8 Nebraska School Districts with one-to-one initiative grades 7-12. Each of the areas correlated is highlighted in yellow. Those areas with correlations that were significant are identified with an *

Table 4

Correlations among Non One-to-One Districts when Looking at Expenditures and Achievement

Scale		1	2	3	4	5	6	7	8	9
1.	Non one-to-one only	-	.033	-.011	.642**	.341	.651**	.284	.333	.723**
2.	Exp-Prof 1100-300	.033	-	.400*	.134	.108	-.058	-.053	-.160	-.121
3.	Exp-Tech 1100-400	-.011	.400*	-	.176	.083	.075	.146	-.036	.053
4.	NESA Math	.642*	.134	.176	-	.845**	.922**	.694**	.755**	.824**
5.	NESA Reading-	.341	.108	.083	.845**	-	.801*	.727**	.842**	.699**
6.	NESA Science	.651**	-.058	.075	.922**	.801**	-	.756**	.799**	.899**
7.	NESA Writing	.284	-.053	.146	.694**	.727**	.756**	-	.785*	.652**
8.	4Yr Grad. Rate	.333	-.160	-.036	.755**	.842**	.799**	.785*	-	.731**
9.	ACT Composite	.723**	-.121	.053	.824**	.699**	.652**	.731**	-.233	-.685**

* $p < .05$
** $p < .01$

Note: When reviewing table 6 the constant variables are each of the identified areas correlated against 8 Nebraska School Districts with non one-to-one initiative grades 7-12. Each of the areas correlated is highlighted in yellow. Those areas with correlations that were significant are identified with an *

Table 5

Descriptive Statistics of All Nebraska School Districts Studied

	N	Minimum	Maximum	Mean	Std. Deviation
Expenditure-Prof. Dev. (1100-300)	64	.00	363266.00	126375.9403	89080.03284
Expenditure-Tech (1100-400)	64	105757.00	1951790.06	500954.4103	336050.57215
NESA Math	64	50.0	87.0	71.766	8.4717
NESA Reading	64	54.0	94.0	79.266	7.6599
NESA Science	64	46.0	89.0	73.719	9.9864
NESA Writing	48	42.0	88.0	71.208	10.0084
4yr. Graduation Rate	64	79.31	99.36	91.4559	5.07832
ACT composite	48	18.0	24.3	21.808	1.7461

Data Specific to the Research Questions

Question #1: Does the use of one-to-one technology in grades 7-12 in Nebraska School Districts have a direct impact upon combined achievement scores specifically in the areas measured by NeSA , Graduation Rates, and ACT? When looking at all 16 districts together, the relationship between districts with a one-to-one initiative status and math achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a moderate, negative correlation

between the two variables, $r = (-.318)$, $n = 64$, $p < .05$, with districts identifying as a one-to-one being associated with lower NESA math achievement (Table 2 column 1).

When looking at all 16 districts together, the relationship between districts with a one-to-one initiative status and reading achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a moderate, negative correlation between the two variables, $r = (-.347)$, $n = 64$, $p < .01$, with districts identifying as a one-to-one being associated with lower NESA reading achievement (Table 2 column 1).

When looking at all 16 districts together, the relationship between districts with a one-to-one initiative status and science achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a moderate, negative correlation between the two variables, $r = (-.337)$, $n = 64$, $p < .01$, with districts identifying as a one-to-one being associated with lower NESA science achievement (Table 2 column 1).

When looking at all 16 districts together, the relationship between districts with a one-to-one initiative status and writing achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a moderate, negative correlation

between the two variables, $r = (-.391)$, $n = 64$, $p < .01$, with districts identifying as a one-to-one being associated with lower NESA writing achievement (Table 2 column 1).

When looking at all 16 districts together, the relationship between districts with a one-to-one initiative status and four year graduation rate was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables, $r = (-.108)$, $n = 64$, with districts identifying as a one-to-one being associated with four year graduation rate (Table 2 column 1).

When looking at all 16 districts together, the relationship between districts with a one-to-one initiative status and ACT composite scores was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables, $r = (-.166)$, $n = 64$, with districts identifying as a one-to-one being associated with ACT composite scores (Table 2 column 1).

Question #2: Does spending on technology tools in Nebraska K-12 School Districts (State of Nebraska Expenditure Code 1100-400) correlate to higher achievement? When looking at all 16 districts together, the relationship between districts expenditures on technology tools and math achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the

assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables, *r = (-.091), n = 64* with districts technology expenditures and NESA math achievement (Table 2 column 3).

When looking at all 16 districts together, the relationship between districts expenditures on technology tools and reading achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables, *r = (-.182), n = 64,* with districts technology expenditures and NESA math achievement (Table 2 column 3).

When looking at all 16 districts together, the relationship between districts expenditures on technology tools and science achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a moderate, negative correlation between the two variables, *r = (-.400), n = 64, p < .01,* with districts expenditures towards technology tools and lower NESA science achievement (Table 2 column 3).

When looking at all 16 districts together, the relationship between districts expenditures on technology tools and writing achievement (as measured by NESA test scores) was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the

assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables, *r = (-.103), n = 64,* with districts technology expenditures and NESA writing achievement (Table 2 column 3).

When looking at all 16 districts together, the relationship between districts expenditures on technology tools and four year graduation rate was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables *r = (-.186), n = 64,* with districts technology expenditures and four year graduation rate (Table 2 column 3).

When looking at all 16 districts together, the relationship between districts expenditures on technology tools and ACT composite scores was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was no correlation between the two variables *r = (-.174), n = 64,* with districts technology expenditures and ACT composite scores (Table 2 column 3).

Question #3: Are Nebraska School Districts with one-to-one initiatives in grades 7-12 spending more on staff development and training (State of Nebraska Expenditure Code 1100-300) than those districts who do not have one-to-one initiatives in grades 7-12? When looking at all 16 districts together, the relationship between districts one-to-one initiative status and expenditures towards professional

development was investigated using Pearson product-moment correlation coefficient. Preliminary descriptive analyses were performed to ensure no violation of the assumptions of normality, linearity and homoscedasticity. There was a moderate, positive correlation between the two variables, $r = .404$, $n = 64$, $p < .01$, with districts identifying as a one-to-one associated with more expenditures towards professional development (Table 2 column 1).

Summary of Results

When reviewing the results of the correlations conducted, one can start to see identified themes with achievement, expenditures on technology tools, and professional development. These themes indicate Nebraska School Districts with one-to-one technology programs in grades 7-12 overall achieved at lower rates than the school districts that did not have one-to-one programs. When comparing the academic results against expenditures this initially shows that increasing expenditures in technology does not have a direct correlation to achievement growth.

In order to validate these findings in more depth, the researcher reviewed the correlations by grouping the one-to-one status districts and also those districts that were non one-to-one status. As a group, the one-to-one status districts (Table 3) demonstrated that there was no significant correlations in any of the different areas but the non one-to-one status districts (Table 4) as a group did show some positive correlations in Math, Science and ACT Composite scores. These identified themes will be discussed in more detail in the final chapter and how it relates to the research questions.

Chapter Five

Conclusions

Introduction

With the growing constraints on public K-12 district budgets, the researcher developed a study specific to the expenditures in technology and its relation to achievement outcomes. The specific purpose of the study was to compare 7-12 student achievement scores in Nebraska School Districts which expend funds for one-to-one technology with 7-12 student achievement scores in Nebraska School Districts which do not expend funds for one-to-one technology. The study specifically examined Nebraska financial and achievement data from the following sources:

- Technology and staff development costs from Nebraska State expenditure codes 1100-400 (regular instruction technology) and 1100-300 (regular instruction staff development/training).
- Composite district achievement data from Nebraska State Assessment (NeSA) data in the areas of Math, Reading, Science and Writing; Four year graduation rates and American College Testing (ACT) composite scores.

The researcher used the following questions to specifically focus the purpose of the study while also identifying any themes or trends in a positive, negative or neutral position from the correlations conducted.

1. Does the use of one-to-one technology in grades 7-12 in Nebraska School Districts have a direct impact upon combined achievement scores specifically in the areas measured by NeSA, Graduation Rates, and ACT?

2. Does spending on technology tools in Nebraska K-12 School Districts (State of Nebraska Expenditure Code 1100-400) correlate to higher achievement?
3. Are Nebraska School Districts with one-to-one initiatives in grades 7-12 spending more on staff development and training (State of Nebraska Expenditure Code 1100-300) than those districts who do not have one-to-one initiatives in grades 7-12?

Overall, the study provided valuable information for a variety of stakeholders in any school system which is currently asking the question about the cost vs. outcomes of using learning technologies in their districts. The study also provided discussion for other areas where additional research may be needed to provide additional data on specific staff training or type of one-to-one devices to be used.

Discussion of Findings

When looking at the first question (*Does the use of one-to-one technology in Nebraska School Districts have a direct impact upon the achievement of grades 7-12 students, specifically in the areas measured by NeSA, Graduation Rates, and ACT?*) the data reflects the following:

- A negative correlation between schools with one-to-one initiatives grades 7-12 and those that do not have a one-to-one initiative grades 7-12 when looking at impact upon achievement.
- A significant moderate negative correlation in the achievement areas as measured by (NESA in math, reading, writing and science).

- A small negative correlation between schools with one-to-one initiatives grades 7-12 and those that do not have a one-to-one initiative grades 7-12 when looking at Four year graduation rates and ACT composite scores.

After review the researcher concluded that having a one-to-one initiative alone does not have a positive impact on key achievement areas. The results of this study showed a negative impact on key achievement areas when specifically looking at one-to-one implementation alone. These results may be surprising but it also points to other key areas to keep in mind when considering having a one-to-one initiative in your district. These key areas for possible considerations should be:

- How much emphasis is placed on staff training in the use of these tools?
- Are lesson designs by instructors reflective in having these tools available to students?

When looking at the second question (*Does an increase in spending on technology tools in Nebraska K-12 School Districts (State of Nebraska Expenditure Code 1100-100 correlate to higher achievement?*) the data reflects the following:

- No correlation between schools with one-to-one initiatives grades 7-12 and those that do not have a one-to-one initiative grades 7-12 when looking at achievement areas as measured by (NESA in math, reading and writing)
- No correlation when looking at districts Four year graduation rate and ACT composite scores.

- A negative correlation when looking at (NESA science) between schools with one-to-one initiatives grades 7-12 and those that do not have a one-to-one initiative grades 7-12.

After review, the researcher concluded that dollars spent on technology does not have a direct impact on achievement. Even though these results reflect that a correlation does not exist, it does raise the question about the implementation of one-to-one initiatives as a targeted achievement growth strategy.

When looking at the third and final question *(Are Nebraska School Districts with one-to-one initiatives grades 7-12 spending more on staff development and training State of Nebraska Expenditure Code 1100-300?*) the data reflects the following:

- A moderate, positive correlation on spending for staff development and training between schools with one-to-one initiatives 7-12 and those that do not have a one-to-one initiative grades 7-12.

After review, the researcher concluded that districts with one-to-one initiatives are making larger investments in training and staff development. The researcher does not know the exact specifics of the training and acknowledges this limitation. This may be an area for further research when districts look at staff development spending, specifically the type of staff development with technology and how it correlates with achievement growth.

Summary

Many educators believe access to the web and information cannot stop at their classroom door and by eliminating that hurdle achievement growth will occur. Another

belief is that if students do not have access during the school day in all classes, they will begin to fall behind their counterparts in the global market. In an effort to eliminate these hurdles, educators and school officials have promoted the purchasing of a device for each student. By making this purchase, districts will create a one-to-one environment and access, throughout the school day, while embracing a 21st century education for their students. All of these rationales traditionally have been used by districts when making technology decisions, specifically implementation of a one-to-one program. When reviewing the data and results of this study, districts need to step back and review their overall technology plans in the areas of implementation, instructional use, staff training and student use. This is especially important for those districts considering a one-to-one initiative.

When isolating technology expenditures, the dollars spent do not have a direct correlation on key achievement areas. Implementation of a one-to-one initiative will not guarantee achievement increases, but actually may produce achievement decline. Previous research as well as this study provide evidence that the purchase alone will most likely not produce the desired achievement outcomes when looking at whether the dollars invested will make a direct positive impact on key achievement areas. This study does not demonstrate that technology is a bad investment, but using a rationale of increasing expenditures or implementing a one-to-one initiative will create positive gains in achievement cannot be supported by the results.

When school districts develop budgets, stakeholders review those budgets, and are wanting more researched based rationales for determining large expenditures. This study

in particular points out some serious flaws in common assumptions that exist when investing in a one-to-one program or technology in general. The use of technology continues to evolve and is continually changing in the current global society. Educators and students are consistently seeing new applications, programs and uses for devices daily. This study demonstrates that a one-to-one implementation which provides a device to each student can create many positives, but until districts determine specifically how to use the tool for learning it is an expensive approach to Internet, word processing, and social media access.

Chapter Six

Recommendations for Future Studies

One problem facing educators is that some schools have invested in one-to-one initiatives or classroom sets of technology before establishing clear plans for how to use these important tools. This type of increase in spending on technology represents a major and growing investment for K-12 education without much research or data behind those decisions. The benefits of learning technology have been discussed at great length, while the evaluation of the effects and its related cost have not. One might conclude that the continual push for technology investment is somewhat driven by perceived need or passion rather than by objectively assessing the actual achievement results and the cost of that investment.

With the focus of this study being specifically targeted at cost effectiveness and instructional value of one-to-one investments at grades 7-12, future research is recommended to be conducted to expand the data around this topic. The researcher recommends researching the type of lesson designs and staff training that is taking place in one-to-one districts, compared to non one-to-one districts. Correlations would be conducted between specific staff trainings and achievement growth. This would provide evidence if a specific type of staff development or lesson design helps increase achievement in one-to-one districts compared to non one-to-one districts.

With technology continually evolving, isolating its role as a learning tool and the types of hardware (iPads, Chromebooks, laptops) and software purchases (Lexia, IXL math, specialized apps) a school district makes is another area where further research is

recommended. Future research could isolate the types of devices and software school districts purchase in one-to-one, and non one-to-one districts. The research would correlate the specific device and software with core achievement areas. This would provide evidence if a specific device or software has a positive, negative or neutral impact on achievement growth.

The present study conducted focused on grades 7-12. Future research is recommended to be conducted on grades PK-6. Research on brain development demonstrates that the earlier students are exposed to learning impacts achievement growth positively as students get older (Brain Development and Early Learning, 2007). This research would provide data to districts looking at implementing technology or one-to-one initiatives at a specific grade level.

The recommended studies will potentially provide themes that may find direct correlations with:

- Specific staff development expenditures correlated to achievement outcomes either positively or negatively.
- Specific type of hardware or software used and its correlation to achievement outcomes.
- Implementing one-to-one devices at PK-6 level and its effect on student achievement.

The results of these recommended studies would add additional rationale when determining whether investments in one-to-one technology is a cost effective expenditure.

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Appendix A

Data Gathering of Select Nebraska School Districts with one-to-one initiatives 7-12 and those select Nebraska School Districts without one-to-one initiatives 7-12

Data Gathering of Select Nebraska Schools Districts with one-to-one initiatives 7-12 and those select Nebraska School Districts without one-to-one initiatives 7-12

Specific data will be gathered from select Nebraska school districts that have one-to-one technology initiatives with grades 7-12 and those select Nebraska school districts without one-to-one initiatives 7-12. The achievement data gathered will be data that is common to all of the districts in order to provide a common base to compare against. Instructional data over a four year period:

A. District scores on NESA (Reading, Math, Writing and Science)
B. District four year graduation rate
C. District ACT composite scores

Financial data will also be collected with these select Nebraska School Districts according to their official audits and AFR over the same four year period:

A. Overall technology cost within the general fund (1100 – 400)
B. Overall staff development cost within the general fund (1100-300)

The instructional and financial data will then be put into a spreadsheet and then uploaded into a Pearson Correlation for more detailed analysis. The researcher submitted the data to be collected with the Internal Review Board (IRB) to determine if specific permissions would need to be obtained. After review it was determined because the data being compiled was all public record IRB approval was not necessary.

E-mail sent to Nebraska Association of School Business Officials Members to start the data gathering process:

Bill Robinson is asking the following of the group. Please respond directly to him.

I have a couple of questions that I was wondering if you could e-mail out to the NABO membership on my behalf. I don't have the e-mail list in my system.

I am doing some research on districts with 1 to 1 technology and have a few questions that I would like to get some feedback on:

1. Does you district have 1 to 1 technology in grades 7-12, if not what grades?

2. How long has your district had 1 to 1 technoloogy?

Your response is much appreciated

Demographic data components

State Average	SPED	Free/Reduced	ELL	High Ability
2012-2013	14.6	44.2	5.9	15
2013-2014	15.8	44.9	6	15.2
2014-2015	14.7	44.2	6.2	14.5
2015-2016	14.7	44.1	6	14
Average	**15.0**	**44.4**	**6.0**	**14.7**

Non 1 to 1					Enrollment	Prof. Dev. (1100-300)	Tech Exp. (1100-400)
2012-2013	13	47	8.4	12.3	2332.6	$80,213.00	$433,429.33
2013-2014	12.1	46	8.5	11.7	2107.5	$68,374.79	$350,587.99
2014-2015	13.2	47	8.6	11.5	2453.9	$101,073.75	$390,839.86
2015-2016	13	48	8.6	10.6	2538.6	$106,749.29	$424,858.90
Average	**12.8**	**47.0**	**8.5**	**11.5**	**2358.2**	**$89,102.71**	**$399,929.02**
1 to 1							
2012-2013	13.6	47.8	10.2	12.6	2316.6	$162,334.30	$486,256.33
2013-2014	11.9	43.9	10	9.7	2246.8	$150,177.68	$618,793.49
2014-2015	13.3	50	11.2	12.1	2338.3	$172,102.12	$685,063.71
2015-2016	13.3	49.7	11.3	11.4	2346.1	$169,982.52	$617,805.68
Average	**13.0**	**47.9**	**10.7**	**11.5**	**2312.0**	**$163,649.16**	**$601,979.80**

2012-2013 data components

7-12 one to one initiative (1=Yes, 0=No)	Expenditure-Prof. Dev. (1100-300)	Expenditure-Tech (1100-400)	NESA Math	NESA Reading	NESA Science	NESA Writing	4yr. Graduation Rate	Enrollment K-12	Spec. Ed	Free and Reduced	ELL	HighAbility
0	87109	602864	68	75	70	68	87.24	4058	15.59	42.46	0.62	8.35
0	103438.84	238964.74	62	76	64	64	88.46	2875	15.95	51.87	6.82	15.72
0	12905.3	200729.45	74	83	76	82	95.77	1827	11.54	19.67	0.88	3.17
0	80347.66	579425.09	62	72	72	73	86.57	1634	13.74	51.54	23.44	14.69
0	72933.31	647789.68	79	88	81	82	98.38	3346	11.91	9.6	0	11.69
0	144755.97	247493.25	82	87	87	74	97.08	2006	7.81	14.5	0	26.42
0	89216.63	539503.46	71	73	71	62	79.31	645	12.61	37.23	10.85	12.87
0	50998	410665	79	86	86	74	93.98	2270	14.45	14.45	1.5	5.73
1	113027	177930	52	68	70	61	90.77	762	18.52	52.3	4.86	16.54
1	282117	712843	79	86	81	77	91.1	5985	14.96	30.52	2.31	10.41
1	155576.89	626585.25	66	70	57	61	80	1659	8.37	62.68	31.28	5.73
1	96978.06	264569.68	78	85	82	73	91.36	1083	16.8	35.2	2.31	14.87
1	20955.07	450457.87	75	77	80	67	95.27	1430	11.72	30.93	2.17	15.73
1	333162.25	934622.92	50	54	46	45	85.85	2678	9.22	76.99	33.08	9.34
1	56584	251283	65	74	75	64	87.01	961	13.6	46.7	1.77	11.34
1	240274.12	471758.9	69	73	69	69	85.06	3975	15.91	46.81	3.8	17.21

2013-2014 data components

7-12 one to one initiative (1=Yes, 0=No)	Expenditure-Prof. Dev. (1100-300)	Expenditure-Tech (1100-400)	NESA Math	NESA Reading	NESA Science	NESA Writing	4yr. Graduation Rate	Enrollment K-12	Spec. Ed	Free and Reduced	ELL	HighAbility
0	109097	633792	70	75	72	NA	88.01	4032	17.04	43.45	0.62	7.56
0	52941.14	269326.55	65	78	69	NA	88.45	2945	17.35	53.55	6.01	13.82
0	11788.77	161139.53	77	85	81	NA	95.62	1861	10.16	18.98	0.7	6.93
0	104875.91	410612.63	65	70	69	NA	82.11	1644	17.76	54.81	23.42	14.23
0	50172.51	581109.14	79	88	82	NA	97.92	3558	12.28	10.22	0	12.03
0	155170.94	363411.99	82	88	85	NA	98.14	2101	7.95	12.53	0	25.18
0	62952.03	385312.04	75	73	82	NA	90.41	719	14.19	40.62	10.29	14.05
0	50640	265317	79	83	85	NA	97.18	2250	13.96	13.96	1.16	5.6
1	77925	379460	58	71	82	NA	94.92	769	18.6	53.75	5.98	15.86
1	309486	606649	79	85	82	NA	90.11	6094	16.15	31.09	2.35	9.73
1	183495.72	627657.07	71	77	67	NA	82.44	1706	10.02	73.77	30.13	3.81
1	99659.93	290315.39	75	83	71	NA	89.9	1088	17.74	36.78	2.76	16.64
1	21140.97	449152.17	77	77	78	NA	95.14	1453	11.36	30.95	2	15.62
1	189688.21	1371803.85	58	61	48	NA	90.87	2701	9.85	77.4	35.88	9.51
1	55905	181857	61	71	72	NA	92.11	907	13.89	51.55	1.98	10.92
1	213480.61	778136.43	73	77	74	NA	85.17	4025	16.57	49.5	4.72	11.01

2014-2015 data components

7-12 one to one initiative (1=Yes, 0=No)	Expenditure-Prof. Dev. (1100-300)	Expenditure-Tech (1100-400)	NESA Math	NESA Reading	NESA Science	NESA Writing	4yr. Graduation Rate	Enrollment K-12	Spec. Ed	Free and Reduced	ELL	HighAbility
0	101824	451633	70	77	69	71	84.88	4097	16.06	45.58	0.81	6.59
0	134640.51	256144.05	63	75	64	68	85.78	2992	16.81	54.04	7.45	14.04
0	7689.61	229879.36	73	83	80	83	98.4	1934	11.01	18.59	0	7.29
0	117411.81	441989.4	71	76	72	79	86.15	1665	16.1	53.94	25.17	11.77
0	136222.25	592618.33	87	93	89	86	96.35	3814	11.48	9.16	0	11.82
0	145205.37	429343.89	83	92	87	86	99.36	2116	8.13	11.2	0	16.92
0	105705.45	472837.87	78	77	74	77	92.75	761	12.75	39.69	9.59	18.53
0	59891	252273	79	86	83	76	92.76	2252	13.06	13.06	1.07	4.97
1	115267	375545	60	73	75	73	90.14	761	17.08	55.93	6.31	13.4
1	363266	572293	79	83	81	77	93.72	6001	15.55	31.9	2.35	8.72
1	155142.92	775493.84	73	77	60	55	91.94	1762	9.14	76.59	31.33	8.91
1	142971.68	399445.73	75	83	78	78	98.28	1064	15.6	33.24	3.48	15.79
1	0	769048.92	78	82	72	74	95.4	1411	10.99	29.53	1.98	14.32
1	298057.32	644609.22	59	70	53	65	90.15	2717	10.31	73.72	37.95	9.31
1	53068	212367	61	68	65	60	95.38	924	12.12	49.16	1.73	9.2
1	249044	1731707	74	79	74	80	88.05	4066	15.96	49.87	4.85	17.07

2015-2016 data components

7-12 one to one initiative (1=Yes, 0=No)	Expenditure-Prof. Dev. (1100-300)	Expenditure-Tech (1100-400)	NESA Math	NESA Reading	NESA Science	NESA Writing	4yr. Graduation Rate	Enrollment K-12	Spec. Ed	Free and Reduced	ELL	HighAbility
0	90014	424494	70	81	69	59	89.46	4135	15.41	43.19	1.21	7.28
0	146905.51	298273.12	64	80	64	66	86.01	3153	15.7	54.75	6.91	12.81
0	11403.42	158547.69	74	87	81	82	96.58	1962	11.26	17.08	0	7.59
0	96688.06	559300.15	72	81	72	76	95.33	1669	15.58	55.54	25.88	5.81
0	181001.67	1116859.52	86	94	86	85	96.63	4115	11.06	8.19	0	11.66
0	143417.8	222801.04	86	93	87	88	96.58	2185	8.28	11.96	0.46	15.42
0	130314.82	261705.64	74	79	72	65	87.93	822	13.38	38.69	9.73	18.86
0	54249	356890	83	87	85	76	94.41	2268	13.05	13.05	1.15	5.6
1	146382	331682	65	78	71	73	96.88	717	16.32	55.05	6.69	11.99
1	278449	598676	78	87	79	78	93.78	6016	14.89	30.9	2.46	9.01
1	201734.11	560200.37	72	79	57	42	82.73	1824	9.65	78.19	31.8	6.91
1	143417.88	318743.32	78	85	76	70	89.89	1104	15.58	33.91	3.89	16.76
1	0	550914.66	78	88	81	75	98.43	1406	10.38	27.02	2.13	13.16
1	185035.15	1951790.06	58	73	47	58	89.34	2725	10.83	75.69	35.74	9.14
1	55095	105757	62	76	71	65	97.01	893	13.21	49.42	2.8	7.95
1	349747	524682	75	82	78	76	90.99	4084	15.55	47.03	4.87	16.23

Appendix B

IRB Form

University of Nebraska Lincoln	University of Nebraska-Lincoln Institutional Review Board (IRB) 312 N. 14th St., 209 Alex West Lincoln, NE 68588-0408 (402) 472-6965 Fax (402) 472-6048 irb@unl.edu	FOR OFFICE USE ONLY IRB# Date Approved: Date Received: Code #:

IRB NEW PROTOCOL SUBMISSION

Project Title:	The cost effectiveness and Instructional value of one to one Technology investments in School Districts.

Investigator Information:

Principal Investigator:	William Robinson	Secondary Investigator or Project Supervisor*:	Dr. Jody Isernhagen
Department:	Educational Administration	Department:	Educational Administration
Department Phone:	402-472-1088	Department Phone:	402-472-1088
Contact Phone:	402-472-1088 ON-CAMPUS, 2-1088	Contact Phone:	402-472-1088 ON-CAMPUS, 2-1088
Contact Address:	University of Nebraska–Lincoln Work132 TEAC	Contact Address:	University of Nebraska–Lincoln Work132 TEAC
City/State/Zip:	LincolnNE68588-0360	City/State/Zip:	LincolnNE68588-0360
E-Mail Address:	Bill.robinson5@yahoo.com	E-Mail Address:	jisernhagen3@unl.edu

* Student theses or dissertations must be submitted with a faculty member listed as Secondary Investigator or Project Supervisor.

Principal Investigator is:

	Faculty		Staff		Post Doctoral Student
X	Graduate Student		Undergraduate Student		Other

Type of Project:

X	Research		Demonstration		Class Project
	Independent Study		Other		

Does the research involve an outside institution/agency other than UNL*?	Yes [ ] No [X]

* Note: Research can only begin at each institution after the IRB receives the institutional approval letter

If yes, please list the institutions/agencies.	
Where will participation take place (e.g., UNL, at home, in a community building, etc)	**UNL**

Project Information:

Present/Proposed Source of Funding:	Not applicable		
Project Start Date:	June,2016	Project End Date:	June, 2017

*Please attach a copy of the funding application.

Type of Review Requested: Please check either exempt, expedited, or full board. Please refer to the investigator manual, accessible on our website: http://www.unl.edu/research/ReComp1/compliance.shtml, to determine which type of review is appropriate. **Final review determination will be made by the IRB.**

Please check your response to each question.

	Yes	X	No	1. Does the research involve prisoners?
	Yes	X	No	2. Does the research involve using survey or interview procedures with children (under 19 years of age) that is not conducted in an educational setting utilizing normal educational practices?
	Yes	X	No	3. Does the research involve the observation of children in settings where the investigator will participate in the activities being observed?
	Yes	X	No	4. Will videotaping or audio tape recording be used?
	Yes	X	No	5. Will the participants be asked to perform physical tasks?
	Yes	X	No	6. Does the research attempt to influence or change participants' behavior, perception, or cognition?
	Yes	X	No	7. Will data collection include collecting sensitive data (illegal activities, sensitive topics such as sexual orientation or behavior, undesirable work behavior, or other data that may be painful or embarrassing to reveal)?
	Yes	X	No	8. For research using existing or archived data, documents, records or specimens, will any data, documents, records, or specimens be collected from subjects after the submission of this application?
	Yes	X	No	8a. Can subjects be identified, either directly or indirectly, from the data, documents, records, or specimens?

[X] **Exempt** [ ] **Expedited** [ ] **Full Board**

Description of Subjects:

Total number of participants (include 'controls'):	10 districts

Will participants of both sexes/genders be recruited? Yes [ ] No [X]
If "No" was selected, please include justification/rationale.

The data collected is not gender specific

Will participation be limited to certain racial or ethic groups? Yes [ ] No [X]
If "Yes" was selected, please include justification/rationale.

What are the participants' characteristics?

Nebraska school districts of approximately 3500 to 4500 students with at least 40% free and reduced lunch population.

Type of Participant: (Check all appropriate blanks for participant population)

	Adults, Non Students		Pregnant Women		Persons with Psychological Impairment
	UNL Students		Fetuses		Persons with Neurological Impairment
	Minors (under age 19)		Persons with Limited Civil Freedom		Persons with Mental Retardation
	Victims		Adults with Legal Representatives		Persons with HIV/AIDS
X	Other (Explain):	Overall school district financial and achievement data			

Special Considerations: Yes [ ] No [X]
If yes, please check all appropriate blanks below.

	Audio taping		Videotaping		Archival/Secondary Data Analysis		Genetic Data/Samples
	Photography		Web-based research		Biological Samples		Protected Health Information

Project Personnel List:

Please list the names of all personnel working on this project, starting with the principal investigator and the secondary investigator/project advisor. Research assistants, students, data entry staff and other research project staff should also be included. For a complete explanation of training and project staff please go to http://www.unl.edu/research/ReComp1/compliance.shtml

Name of Individual:	Project Role:	UNL Status*	Involved in Project Design/Supervision? Yes/No	Collect Data? Yes/No
William Robinson	**Principal Investigator**	**Doctoral Student**	**Yes**	**Yes**
Dr. Jody Isernhagen	**Project Supervisor**	**UNL Faculty**	**Yes**	**No**
Dr. Rachael-Robinson Keilig	**Project Advisor**	**Faculty at Grand Island Community College**	**Yes**	**No**

Dr. Judy Obert	Project Advisor	Faculty at Metropolitan Community College, Omaha	Yes	No

*Faculty, Staff, Graduate Student, Undergraduate Student, Unaffiliated, Other

Required Signatures:

Principal Investigator:		Date:	
Secondary Investigator/Project Advisor:		Date:	
Unit Review Committee:		Date:	