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# Student Use of Cell/Smartphones Integrated in a Field-Based Science Curriculum

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STUDENT USE OF CELL/SMARTPHONES INTEGRATED IN A FIELD-BASED  
SCIENCE CURRICULUM

by

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A capstone submitted in partial fulfillment of the requirements for the degree of Master  
of Arts in Education: Natural Science and Environmental Education.

Hamline University

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## **CHAPTER ONE**

### **The Capstone Project Overview**

#### **Introduction**

Teachers in today's classrooms have many job titles. We are coaches, instructors, trainers, lecturers, disciplinarians, listeners, counselors and also students ourselves. We wear many hats. Some days even I ask myself, "Is the job worth the time and stress?" I always end up answering, "yes it is!" As teachers, we are always striving to get students motivated to participate in the classroom and become academically successful. Recently the crusade in schools has come to be on how to deal with cell/smartphones. This lead to my capstone question "How many functions and/or applications do students use on their cell/smartphones when it is integrated in a field-based curriculum?"

My capstone question is my attempt to figure out how to address my students' use of their cell/smartphones while also accomplishing academic goals. Finding an effective way to deal with cell/smartphones is important as some days I am asking students repeatedly to put away their phones. Other times, I take phones away from the students who cannot seem to stay off the music videos or texting and focus on finishing their assignments. This quickly becomes exhausting. My students love to text their friends, watch videos, and/or play games. They seem to lack the constraint for keeping their phone away when doing work and knowing when it is appropriate for social media time or games.

According to some of my students, they cannot "live" without their cell/smartphones. I have had a few who would rather get kicked out of my class instead of handing me their phone for the class period. With the options and potential of what

cell/smartphones has to offer, no wonder teenagers are addicted to them. Cell phones are here to stay rather we like it or not. According to Todd Haselton (2013), writing for TechnoBuffalo, “The latest Teens and Technology 2013 study from Pew Research found that 78 percent of teens aged 12 – 17 now own a cell phone, and 47% of them are carrying a smartphone” (p. 1). This teenage generation has grown up with a cell/smartphone in their hand. Parents can buy toy cell phones for toddlers that have working buttons and look just like the real cell/smartphones.

The older generation, me included, grew up without the cell/smartphone technology. I will forget my phone at home and not get upset about it, leave it in my vehicle, put it in the house when I go for walks or when I am outside gardening. My own children, who are adults now, get upset when they cannot get a hold of me right away. They even ask me why I do not take my phone. I tell them I love the peace and quiet without the interruptions of the phone. I guess some of us will never know the full extent of the attraction the cell/smartphones has on the younger generation.

### **Rationale for Choosing Cell/smartphones**

When considering what topic to approach for my research when the time came, I thought about the popularity of cell/smartphones among teenagers. I wondered if I could change the way other teachers and I battle with cell/smartphones in the classroom. Could I make the cell/smartphone a viable learning tool in the classroom? Why not combine the phones my students cannot live without with the nature I appreciate and love? Combining nature with cell/smartphones could be relevant in the student’s connection with nature. My research topic focus became, “How many functions and/or applications do students use on their cell/smartphones when it is integrated in a field-based curriculum?” For me, I

wanted to experiment with the idea and maybe find some answers to many challenges others and I have with cell/smartphones in the classroom.

The availability of cell/smartphones is everywhere. Teenagers can buy them individually or combine plans with other family members. Most of the teenagers going to my alternative high school have a cell/smartphone. Using them as a learning tool with no added cost from the school's budget makes them practical, viable, and gives the students real-world applications. They can take out their cell/smartphones and in an instant take a picture they can save to review later. This can also be useful in a field-based curriculum.

For example, when out in the field students can take photographs of their natural environment in the prairie, wooded, and/or wetland biomes to study in detail at a more convenient time. By reviewing the pictures, the student remembers exactly where it was taken and what she/he was doing. If they are afraid they might forget, they can type notes down in their phone. There is no additional equipment to carry or worry about getting lost or no film to develop. Students can download their pictures and copy them off with little down time.

I have read articles about cell/smartphone use in the classroom, talked to other teachers if they use them, and searched the Internet. From the people I have talked to, students' use of these devices has been used to look up terminology or research. I did not find an abundance of information on how to use the cell/smartphone in a field-based curriculum. This peaked my attention because I wanted to find out how to use it with lesson plans, activities and projects in the science classroom. To start, I need to explore the attitudes my science students have about using their cell/smartphones as a learning tool and how many apps they use. To grow as a teacher, it is essential to find answers

concerning challenges in the classroom and try to improve students learning. This is the focus of my new adventure with using cell/smartphones in the science classroom.

### **Expectations**

This research project will allow me to explore my students' personal views about using their cell/smartphone in a field-based science curriculum. From a teacher's point-of-view, I would like to utilize the cell/smartphone as incorporating technology as much as possible. In order to do this, I need to know if the students even like using their cell/smartphones as a learning tool. If they do not, that will be new information I can still use. If they do, I can learn to utilize it in as many ways as possible for education. However, I realize that what I learn from this capstone research in my science class might have totally different views from another science class.

I have many unanswered questions. Trying to answer them will only move my teaching abilities and the students' learning forward. How do my science students use their cell/smartphone? Do they use it mainly for social media or do some use it to benefit their learning? As a teacher, I do not know how many apps students use on a regular basis for personal use or for school academics. If I answer these and many other questions I have, I can introduce the cell/smartphone as a learning tool to benefit them in their education. My science students can then also use their cell/smartphone in the future for learning in many other aspects of their life. My research will also help validate that the use of cell/smartphones in the classroom is beneficial to learning using current and accurate information on the Internet to provide students with the facts needed for completing research, activities, and projects.

The information I analyze from the pre- and post-survey, essay questions, attendance, and assignments handed in during this capstone research will give me the tools I need to make appropriate changes in my teaching, how I integrate technology, and how I implement a field-based curriculum for my science students. This research will also help me to design other research projects to benefit my science students and my approach to teaching. I am always willing to learn new things and I never want to stop growing as a teacher.

Chapter Two will discuss some of the work that has already been researched or completed by people who have been interested in integrating cell/smartphones in the classroom. The prior work and/or research done by these authors will be the foundation I build my capstone from and which will give me the knowledge to move forward. Chapter Three will be a description of my methodology; my approach and the tools I plan on using to accomplish my research. The findings of my research will be analyzed and discussed in Chapter Four. I will then conclude my research findings with my chapter reflection in chapter five, recapping on my interest in the topic I chose, the design of my research, limitations, positive and negative outcomes from formal and informal observations, my opinions, and what I learned from my journey through my research project.

## **CHAPTER TWO**

### **Review of Literature**

#### **Chapter Overview**

According to a 2010 Kalser Family Foundation study, cell phones are owned by: “85% of high school students, 69% of middle school students, and 31% of eight to ten-year-olds (Using Cell Phones in the Classroom, 2010). With the numbers constantly increasing, using cell/smartphones as a learning tool to support the curriculum makes it a wise choice. Many schools ban the use of cell/smartphones but mine has not. It has been a constant battle to keep my students off their phones during class time. Instead of using my energy to deter the use of cell/smartphones in my classroom, I am eager to integrate them in a field-based curriculum in my science class. I am heeding the wise words of Jim Henson, “If you can’t beat them, join them” (n. d.). My capstone will explore “How many functions and/or applications do students use on their cell/smartphones when it is integrated in a field-based curriculum?”

In this chapter I will include a brief history of the cell phone, review some of the literature pertaining to students learning styles, positive and negative viewpoints of the cell phone, potential benefits of the cellphone in learning, to implementing cellphones in curriculum, and the challenges that arise from using the cellphone in a learning environment.

#### **Cell Phone History**

According to Brookes (2012), the cell phone is a relatively new device developed in today’s society. Brookes (2012) notes that the granddaddy of all cellular phones was developed in the 1960’s. In the late 70’s he explains how the first generation phone used analog cellular networks allowing users to travel distances without losing the caller on

the other end. It was a revolution built on existing, analog technology with the first being built in Chicago in 1977 (Brookes, 2012). According to Jimmy on the Timetoast website (n.d.) the 1G swept into the 1980's with a price tag of \$3995 for a 1982/83 Motorola DynaTAC 8000X, with only one hour of talk time and stored up to 30 phone numbers. However, it was not until the 1990's that the 2G, second generation, cell phones appeared. According to Lycamobile's (A History of Cell Phones & Cellphone Technology, 2015) website, the 2G became a digital network that runs on digital narrowband. The 2G phones offered the first camera options, Lycamobile (A History of Cell Phones & Cellphone Technology, 2015), in addition to first internet access, text messaging, caller ID, ringtones and graphics but came with expensive contracts, slow downloading, and limited data flow.

Since the introduction of the 2G technology keeps advancing every year. They have gone from being used by the elite few businessmen owning them to being a common owned device in the palms of most teenagers and adults. Around 2014, the 4G smartphone was on the market. These fourth generation phones have high definition music streaming, voice streaming, and real-time gaming among many other options. The prices vary depending on the memory and options a person chooses. For example, at the time this capstone was written, an iPhone 4s can be bought for approximately \$149.86 while a phone with 32 GB of memory costs on the high end of \$790.00 prepaid. The phone companies make it more enticing to buy a contract with the phone. The \$790.00 Galaxy s6 edge drastically drops to \$199.99 with a 2-year contract (U.S. Cellular, 2015) making the monthly payments \$39.50 for the phone. The plans that many cellular companies offer make it very affordable for teenagers who are working even at a part-time job to

own a cell/smartphone. The popularity and convenience of owning a cell/smartphones has made them an essential piece of equipment for many. With the capabilities the cell/smartphone has, it is difficult to ignore the possibilities of using it as a tool for student learning. A summary of current views located in research literature regarding student learning is described in the next section.

### **Student Learning**

Student learning is explained in many different ways. There are various types of learning with just as many different styles of teaching. Learning itself is an abstract concept. According to the Eberly Center (Teaching Excellence & Educational Innovation, n. d.) “Learning takes place in students’ heads where it is invisible to others. This means that learning must be assessed through performance: what students can do with their learning” (Teaching Excellence & Educational Innovation, n. d., Whys & hows of assessment, How to Assess Students’ Learning and Performance, ¶ 1). Cell/smartphones are a new tool that can be used to assess what students can do with their learning as recommended by Eberly Center (Teaching Excellence & Educational Innovation, n. d.).

In addition to being used for assessment the cell/smartphone can be used to facilitate participatory learning. Given the importance of assessment and the growth in access to cell/smartphones using them as one mode of assessment is a realistic approach. Assessment gives educators an inside look at what students have learned. In addition to cell/smartphones being one more tool for assessment, cell phones can be used to support the differentiation of the learning environment based on how a student learns.

In my experience what a student learns and how much they retain depends on their motivation to learn, the teaching method used, the learning style of the student, and

the interest in the topic that is presented. With the many different types of learning styles in my classroom I should not rely on just one style to teach by. I have some students who like to take notes during a lecture, while others like to do independent work, watch a documentary or video, be involved in demonstrations and experiments, others like to be involved in discussion groups, just to name a few. My belief for the need in using multiple teaching methods to facilitate student learning and retention is supported by the works of Brooks and Brooks (as cited by NDT Education Resource Center, 2001-2014).

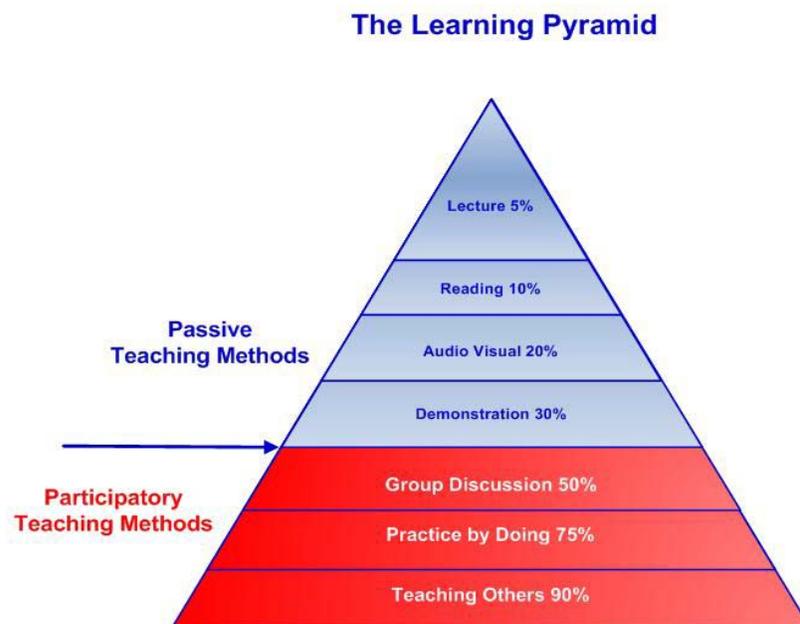
These NDT Education Resource Center (2001-2014) describe various leaning approaches with the corresponding percentages of students who retained the information learned when using that approach. According to the authors not all teaching strategies result in the same level of learner retention. The strategies and the associated learner retention rates are as follows (as cited by NDT Education Resource Center, 2001-2014, Home, Teaching Resource, Classroom Tips, Teaching with the Constructivist Learning Theory, How Students Learn Best, ¶ 3) (Table 1.)

Table 1. Percentage of Learner Retention according to Teaching Style

Teaching Strategy	Percent of Learner Retention
Lecture	5 %
Reading	10 %
Audiovisual	20%
Demonstration	30%
Discussion Group	50%
Practice by doing	75%
Teach others / immediate use of learning	90%

Similar conclusions were also found in the Learning Pyramid on The Peak Performance Center website (n. d.).

The Learning Pyramid goes one step further by dividing the pyramid in two color-coded sections, into passive teaching methods and participatory teaching methods as shown below (Figure 1).



<http://thepeakperformancecenter.com/educational-learning/learning/principles-or-learning/learning-pyramid/>

Figure 1. The Learning Pyramid illustrates student retention using passive and participatory teaching methods.

With all the learning styles and teaching methods given, the pyramid should be used only as a guideline because Daniel Willingham (as cited by Valerie Straus, 2013), notes that many variables affect memory retrieval, that you cannot assign specific

percentages of recall without specifying many more of them [such as]: what material is recalled, age of subjects, the delay between study and test, what were

subjects instructed to do, how was memory tested, what subjects know about the to-be-remembered material. (as cited by Straus, 2013, ¶ 5)

However the review of the research does suggest that different teaching strategies result in different outcomes and that not all learners react to them in the same manner.

The review of the research for this capstone confirmed for me what I have observed as a teacher - in my experience working with high school students it is clear that not all equal when it comes to their IQ, personality and/or anatomy. They are individuals. They are not all going to fit into a cookie cutter design like The Learning Pyramid. But, used as a tool and observing the highest percentage given to participatory teaching methods the information can be useful in preparing for lessons and activities. My take away from the idea of the Learning Pyramid as both a rationale and a frame when thinking about how I can incorporate cell/smartphones into the curriculum as a participatory device for the students. Prensky (2010) also provided another rationale and frame for thinking about how to integrate cell/smartphones in my curriculum.

Prensky (2010) notes how all students and teachers know that students get the greatest reward for their efforts when things are individualized and customized for each student. If one accepts Prensky's (2010) idea of the need for more individualization in the learning environment then he believes the ideal classroom for optimal learning would be small, giving the student a more individualized instruction. Until recently, Prensky (2010) acknowledges that the reality for many students is an educational experience that is a large classroom and limited resources for teachers and/or students. The current reality for many students leads Prensky (2010) to claim that,

The greatest single boon of the arrival—albeit slowly and unevenly—of digital

technology in our schools is that it will, in the long run, enable teachers and students to partner in this much more personal and individual way, that is, for each student to learn on his or her own, with the teachers' coaching and guidance. (p. 17).

Prensky's (2010) statement can be used to support the idea that cell/smartphones has the potential to help increase personalization and differentiation for learner. Another strategy that Prensky (2010) recommends for increasing personalized learning is partnering.

Partnering as described by Prensky (2010) is a concept where students in the classroom focus on using new [technology] tools. With the technology tools they find information and create their work. The teacher's role in this partnering concept is to have the end results for the students showing quality work. In partnering the teacher will coach and guide, as mentioned above, along with question the student while providing context so the student will be motivated to work and find meaning in his/her end results (Prensky, 2010).

Prensky (2010) makes a case that teachers in today's educational system cannot keep teaching the same old material in the same old way. Unless something changes in the presentation of curriculum and the mechanics of it, the results will not change. Classroom teaching needs to be revamped in order to benefit the future generations. Teachers cannot keep with the old ways when the world around us is changing at a fast pace. Prensky (2010) makes many plausible recommendations in his book on how to turn around teaching by incorporating technology to make it real, personal, and beneficial for the students. Through my research I have found many authors who give brilliant examples on integrating cell/smartphone use in the classrooms and the reasons why. The

following section is devoted to individuals supporting cell/smartphones use in the classroom.

### **Research Supporting the Using Cell Phones in the Curriculum**

With the Ed-tech plan set forth by President Obama (Ash, 2010), technology in the classroom will be changing in all schools. According to the Ed-Tech Plan many believe there is a need to push for technology advancement in K-12 schools to keep up with the outside world. When the president himself stands behind an Ed-Tech plan, it is my professional opinion that teachers need to listen and start taking a pro-active approach instead of a passive one. According to Katie Ash (2010), the Obama administration urged educators and policymakers “. . . to embrace a host of digital-learning approaches it says will make k-12 schools better, including putting a computing device in the hands of every student”(p. 1). My understanding of the Ed Tech Plan is the goal is for not just a few schools to use digital-learning approaches. The goal is for all schools in our nation to use digital-learning approaches to bring the younger generation to a higher level in technological education.

Ash (2010) describes key points to the plan, “Transforming American Education: Learning Powered by Technology,” set forth by President Barack Obama, as “it recommends enabling every student to learn through digital technology in school and at home, a 1-to-1 computing approach using cellphones, laptops, and other mobile-learning devices that is taking hold in a growing number of school districts” (p. 1). Digital technology is not the type of item that fellow educators and I want to put on the shelf such as a book. As time goes by, so does the current data and information. Communities

need to keep up with the changing pace of technology to keep our students informed and capable of functioning in our society.

It has always been my understanding that an educators' main goal in their job is to educate the younger generation effectively for them to retain information and expand their knowledge to function in today's world. How do we do that? We plan, organize, and implement concepts, topics, and ideas that will be beneficial to them and our society. In the Connected Principals website, Jonathan Martin (2010) calls the students in today's society the "digital generation" (p. 1). He describes how this generation is already using cellphones on a daily basis to socialize and collaborate with their friends or team members, organize and plan events for work and play and so much more.

I and other teachers have observed how dependent students have become to their cell/smartphones. They can text with lightning speed and fluency across tiny letters and numbers. They have operating skills in many versatile applications that I do not even know about. Their cell/smartphone is their source of communication and entertainment whenever and wherever they want to access it. With all the knowledge they have acquired and know-how on the operations and many apps on their cell/smartphones, we tend to ignore their capability as an educational tool when students come to school. Some teachers allow them to be used periodically while others have banned them altogether. Martin notes,

Just as importantly, knowing that in their college and adult careers they will be expected to do so [use digital tools] in nearly every work-place, how can we deprive them of developing mastery in their skilled use of these tools? (2010, p. 1).

I have to agree with Martin. We expect cell/smartphones to be hidden in the students' backpacks or bags during class time but expect them to know the technology that is already in the workplace after they graduate high school. I truly believe by giving students the best and most updated education in all areas of broad knowledge and technology is equivalent to arming them with a survival tool for their future.

Jack T. Tessier's (2014) research titled, *Eliminating the Textbook: Learning Science With Cell Phones*, describes his research findings when he compared an ecology class in one semester, spring of 2012, using textbooks and another semester, spring of 2013, where he let the students access their cell phones for information. In one of the classes he taught, Tessier (2014) used the standard textbook, lectures, group-work learning and labs. His other ecology class was textbook-free. Instead of using a textbook Tessier (2014) had his ecology students use their cellphones (mostly smartphones) and dove into the many resources it had to offer such as being able to access the professor's power-point presentations.

In the ecology section that was text-book free, Tessier (2014) observed that the "students in the cell phone semester lacked the organization power of the textbook for notes that they could bring to the quiz but had access to more information during the quiz because of their cell phones" (¶ 8). The class where the ecology students used a textbook was also permitted to use their notes and other data during the quiz but not the textbook itself. The quiz scores were compared from each class.

In his results, Tessier (2014) reported that test scores were significantly higher for the textbook free class where the ecology students used their cell phone. Tessier (2014) also states there was not a significant difference between semesters for students' scores

on the high level quiz questions and exam grades. Even though his research was based on college level students, the findings still provide support for cellphone use. How Tessier integrates cellphones into his ecology college class in areas of data collecting, research, and quizzes can also be used as guidelines at the high school level. In his conclusion Tessier (2014) recognizes that “The challenges posed by eliminating the textbook are readily overcome with sound course development, and the benefits realized from such action are well worth the investment” (§ 19). Personally, I do not think I could ever eliminate the textbook from the classroom altogether. I still have students who prefer to use the textbook because the chapters follow the worksheets more accurately than surfing online. On the other hand, I have students who ask to use their cell/smartphone because that is the tool they prefer. Keeping both options available will cover the preferred mode for all students.

My colleagues and me live in a digital age. Jonathan Martin (2010) was appropriate in calling our students the “digital generation” (p. 1). We should embrace the digital technology devices that are no cost to the schools and use them to give students learning opportunities. Rosemary Miller recognizes that, “In our district, especially at high school, students have a cellphone on them at all times just like a pencil – it’s an underused tool” (as cited by Trotter, 2009. p. 1). Trotter makes an excellent point that the cell/smartphone is an underused tool, in my opinion. I have relied on students using their cell/smartphone when another class has been using the computer lab. I can quickly ask students to take out their cell/smartphones with no delay or interruptions that take time away from the students’ learning.

In the book *Teaching Digital Natives* Marc Prensky (2010), states that, “In the 21<sup>st</sup> century, so many of our old assumptions and strongly held ideas have been turned around-and so many more upheavals are on the way-that it is clearly a different place in which our kids are growing up” (p. 1). I grew up with out a cell/smartphone. I have seen so much change in technology that makes it accessible to everyone, including teenagers and younger children. The advancements in technology for the medical, automotive, agriculture and media fields, to name a few, have been amazing and beneficial to our society.

But, I have not seen a huge growth in technology in K-12 education. It could be due to budget restrictions like it is at my school or the lack of lesson plans augmenting the use of technology. Whatever the issue, we are expecting our students to learn the same old standard way. Students should not have to wait until college to learn from technology enhanced lessons. Prensky also notes that, “Our students see a new world coming--their world--a world in which what they think should be important actually is (p. 2). Through his research, Prensky (2010) has found out what students want from their school based on approximately one thousand interviews.

Prensky’s (2010) analyses of these interviews revealed a high degree of consistency regarding what students want in the pre-K-12 school context. The student’s desire the following:

- They do not want to be lectured to.
- They want to be respected, to be trusted, and to have their opinions valued and count.
- They want to follow their own interests and passions.

- They want to create, using the tools of their time.
- They want to work with their peers on group work and projects (and prevent slackers from getting a free ride).
- They want to make decisions and share control.
- They want to connect with their peers to express and share their opinions, in class and around the world.
- They want to cooperate and compete with each other.
- They want an education that is not just relevant, but real. (pp. 2-3)

Prensky's (2010) research provides educators with additional support regarding the kind of changes students want and a potential road map for making changes in how they teach and learn with their students. Engle and Green (2011) also describe a potential positive outcome of integrating cell/smartphones in K-12 learning.

Engle and Green (2011) suggest that improved learner participation is a significant outcome of appropriate integration of cell/smartphone in the learning environment. In their article, *Cell Phones in the Classroom: Are we Dialing up Disaster?* Engle and Green describe different rolls the cell/smartphone can play in the classroom and the benefits. They stress the importance of selecting a few key roles for the cell phone instead of many various applications to "help ease in the use of the devices in a manageable way" (p. 40). In a pilot program, according to Engle and Green (2011), cell phones were integrated into a in a pre-calculus course in the following ways:

- "As an audience response system (polling)
- As a research tool

- As a tool for collecting evidence of student work through photographs and video recordings” (p. 40).

During the pilot program obstacles encountered and prepared for where accommodating a student who did not have a cell phone and students with learning disabilities. The student with out a cell phone was given the opportunity to use an iPod Touch with SMS text capability and a digital camera. The student with learning disability/disabilities was given differentiated instruction and appropriate time to complete the assignments. The pilot program including making explicit rules and guidelines for appropriate and inappropriate use of the smart/cell phones during class time. In addition prior to the start of the program parent support and approval was obtained.

The pre-calculus students used their phones in class for polling, group work, data collecting, research and taking on the role of peer reviewer. How the smart/cellphones were used in this pilot program supports one goal of a 21<sup>st</sup> century classroom, to transform students from passive to active learners (Engle & Green, 2011). In the Engle and Green (2011) pilot program the students used their smart/cell phone to post images of their work on Flickr and reflect on the content of their work. They also used their smart/cell phones to complete peer reviews on images classmates posted to Flickr. Engle and Green (2011) observed that by having the students complete peer reviews, they increased their understanding of the material and engaged them on a deeper level of learning.

The success of the pilot program is based on observations completed by the researchers and comments they obtained from the participating students. In their analyses

Engle and Green (2011) noted that, “In addition to an element of increased participation and in assessment levels, we were able to see strong student reflection pieces developed throughout the year” (p. 44). As teachers experiment with pilot programs and experience success with integrating technology, the more important planning for cell/smartphone integration will become. A teacher cannot hand an assignment or project out to the students and just say do it with no guidelines or preparation. This is also true with cell/smartphones. We as teachers need to plan lessons and try to figure out the best possible ways to integrate them to benefit the students’ education.

### **Importance of Well planned Cell Phone Integration**

“Technology integration in schools is not easy to achieve, no matter how much evidence we have that it can help learning” (Driscoll, 2012. p. 1) The author notes it takes planning like any other lesson in a teacher’s curriculum and the teacher also needs to know how to use the technology. Writers like Driscoll (2012) suggest that introducing cell phones into a class’s curriculum is not as easy as having the students just take them out and start researching. It would be like handing out an enormous project to each student with no direction on what to do with it or a completion timeline for sections.

To effectively integrate cell phone in the learning environment Driscoll (2012) notes requires planning like any other lesson in a teacher’s curriculum and the teacher also needs to know how to use the technology. As cell/smartphone technology advances, I hope so will the lesson plans, activities, and projects teachers can use to integrate cell/smartphone use in the classroom become available to all teachers. I have not had the luck of finding a seminar or workshop on cell/smartphone integration in the classroom as of yet. I hope that changes soon.

It is my belief that cell/smartphones in education are not always viewed as a positive integration to all teachers and administration. Some schools still ban the use of mobile technology devices; iPads, iPods, Nooks, cell phones, etc. Just as there are arguments supporting cell phones in the classroom, there are articles explaining why cell phones should not be used. Schuster Simon (2013) writing for The State News interviewed professor Richard Brandenburg who teaches at Michigan State University.

Professor Brandenburg describes how he views cellphones and laptops as a distraction. He elaborates in the following quote, “the distractions that technology allows interferes with learning” (p. 1). According to Professor Brandenburg another reason to limit or keep smart/cell phones out of the classroom is because students are constantly interacting with the outside world through texting, videos, and face book. Interacting with the outside world using their cellphones limits their time students focus on class content such as power points, lectures, notes, or important examples written on whiteboards. When students are not engaged in lessons, even though we as teachers think it is interesting, it may not be for the students. Distracted students could be taken as an opportunity to look for alternative ways to present the material or revamp the lesson entirely. As teachers, we need to keep trying to obtain the students’ attention.

Exploring options for lessons integrating the use of cell phones is creating more frustration than some think. As Thomas Greaves (as cited by Manzo, 2010), an education and technology consultant based in Encinitas, California, explains, “you can’t just take something you use on a big screen and move it to a little screen and have it work well” (p. 1). Some parts of a lesson are better viewed on a larger screen or larger format, such as a movie, power-points, and quizzes/tests. Manzo (2010) comments on the difficulty

there can be when taking instructional material meant for bigger screening and putting it on a small screen of a cell/smartphone. The margins and formatting are different on a big visual screen than a small, tiny screen. Some data could be lost through the transition of viewing from the different sized screens (p. 1). The success of integrating cell/smartphones comes through trial and error by teachers experimenting on their own or researching to try to find lessons adapted to the cell/smartphone. The later is more difficult because integrating cell/smartphones is still a relatively new concept. I have scoped online sites to find that there is not an abundance of lessons/activities using cell/smartphones.

Changes and/or improvements in schools do not come cheap. Upgrading computers or buying laptops can cost thousands of dollars that is not always available for teachers. Katie Ash states,

But making those changes, people in the field say, requires support to build a stronger technological infrastructure in schools and expand opportunities for professional development for teachers and administrators. That takes money, and so far, some advocates for educational technology don't see the federal financial support matching the rhetoric from the administration. (2010, p. 2)

Having the majority of high school students owning a cell/smartphone, a teacher can utilize them in the classroom when other technology is not available or is outdated.

Connecting to the Internet via cell/smartphones will keep teachers and students current on information without budgeting in monies for technology costs.

In the article Jennifer Imazeki (2014) wrote, three negative aspects of the cell phones are common ailments among schools. One, some students might not have a cell

phone due to lack of income or low-income families. Two, integrating smart/cell phones in the learning environment requires schools to be dependent on cell service provided to schools. This service might not be available during bad weather or blackouts. Three, teachers also have to consider the fact that students can be easily distracted when smart/cell phones become a tool in the learning environment. For example, when completing an assignment on the cell phone, any one can quickly check text messages or face book without the teacher knowing. Educators using cell phones in class will need to take a leap of faith in trust that the students will use the phone properly.

As an educator I have experienced students misusing cell/smartphones in the classroom. There are always going to be those who need to be redirected back to the task at hand. Students losing focus will happen with or without cell/smartphone use. Using cell/smartphones in the classroom still has many more benefits than not using them.

### **Benefits of Using Cell Phones**

Cellphones offer many benefits for the students and brings countless opportunities with it to the classroom. They are small, mobile, lightweight, and vary versatile. Harris writes, “in most cases, those devices are more powerful than the aged desktops and notebook computers that schools are struggling to maintain on meager budgets ” (2011, p. 1). They are mini computers that are easy to use inside the classroom as well as in the field for investigation.

For example, an article in Curriculum Review (Using Cell Phones in the Classroom, 2010) describes different examples of how cell phones can be used as a small computer. One example is that cell phones can be used by students to post texts or recorded material to class blogs for students to access. A second potential use of cell

phones is downloading podcasts and other materials rather than using a desktop computer. A third way a cell phone can substitute for a computer is its ability to take photos of different geographical places, posting quick thoughts, questions and reactions (p. 1). Switzer, Callahan, and Quinn (as cited by INTIME, 1999-2001), asserts teachers can use technology resources to provide opportunities for learning and create the “conditions that optimize learning (Home, Technology as a Facilitator of Quality Education: A Model, The Model (text version), Technology: Summary, ¶ 1). Andrew Trotter (2009) explains another potential use of a cell phone in the learning environment.

In his article Trotter (2009) describes how cellphones with cameras have great potential for simple data collection. They can enrich fieldwork or field trips by allowing students to snap images of, say, leaves, for later identification. Students also can snap pictures of museum exhibits and placards to fuel classroom discussions (2009, ¶ 18). Taking photos can be empowering, in my opinion, for adults and students. They are a moment frozen in time. Having students photograph places, plants, animals, and/or other organisms can be used at a later time for classroom discussion, as mentioned by Andrew Trotter (2009) in the above quote, or to analyze more in depth to complete an assignment or activity. There is no special equipment to order, haul around, or budget for. Each student just needs to pull their cell/smartphone out of their pocket and start using it as an educational tool with the guidance of their teacher.

My review of the research literature provides support for the idea that it makes sense to use the technology devices in school when society is also demanding it from their employees. Several authors, such as Prensky (2010), Trotter (2009), Tessier (2014), and Martin (2010), suggest that by using cellphones in the classroom, teachers are

encouraging the development of technology skills needed in everyday life such as communication, analysis, research, organizing, planning, etc., most of which students may already have knowledge in doing.

With the completion of my research for the literature review, the next challenge is to design a plan for the research to integrate cell/smartphones. Chapter Three will continue with an explanation of my methodology for my research, “How many functions and/or applications do students use on their cell/smartphones when it is integrated in a field-based curriculum?” I will include a description of the participants, setting, the research paradigm and the rationale for using this design along with the places we ventured to and the tools used to collect data.

## **CHAPTER THREE**

### **Methodology**

#### **Chapter Overview**

Throughout my years of teaching I have tried many different strategies to help students' process their information and succeed academically. Now in recent years, the battle has come to be with trying to get my science students focused on their academic work and not on their cell phones. This battle has plagued me with questions on how to approach the ideas of banning cell phones or find a way to integrate them into my instruction so that my students use them as a learning tool instead of just a social communication device. This battle resulted in my capstone question, "How many functions and/or applications do students use on their cell/smartphones when it is integrated in a field-based curriculum?" This chapter will describe my research approach for addressing the question.

It includes identifying the research paradigm, presents a referenced rationale for using this research paradigm and explains the specific data collection tools used along with my rationale for selecting them. I also describe the setting where the research took place, the participants, and the places and dates of the field trips.

#### **Selecting a Qualitative Research Approach: Action Research**

I used a qualitative research approach to address my capstone question. The approach used in this capstone is a qualitative individual teacher research approach called action research. According to Rory O'Brien (1998), "Action research is used in real situations, rather than in contrived, experimental studies, since its primary focus is on solving real problems [and] who apply this approach are practitioners who wish to

improve understanding of their practice” (An Overview of Methodological Approach of Action Research, ¶ 14). A real problem for my colleagues and me is how to get our high school students to use their cell/smartphones for learning instead of checking texts, facebook, and other forms of communication or entertainment. Another reason for selecting an action research approach is because I felt it was the best approach to study my question, How many functions and/or applications do students use on their cell phones when it is integrated in a field-based curriculum?

In the action research guide written by Geoffrey Mills (2011), he states that, “. . . educational change that enhances the lives of children is a main goal of action research. But, action research can also enhance the lives of professionals” (p. 8). As I wanted a research approach that could give me the tools for growth in my teaching skills and strengthen my connection with my students, action research was a good fit. My capstone question created a professional growth opportunity for me to study and research methods for incorporating more technology into my curriculum. The cell phone was the logical choice for me as the device to use to incorporate more technology in today’s classroom. Mills (2007) provides one additional reason for my selection of an action research approach to my capstone question.

He notes that, “simply informing teachers about research is unlikely to bring about change. Therein lies the beauty, power, and potential of action research to positively affect practice” (p. 13). In other words, in my experience just telling teachers to incorporate more technology in the classroom does not mean teachers and/or students will automatically know what to do. However, Mills (2007) suggests that action research is another way of taking an idea, implementing it through lessons and then reflecting on

the outcome to understand if the method and/or methods have changed the way the students and teachers achieve their projected goals. For these reasons action research had the potential to support my growth as a teacher as well as help me learn about what can happen when cell phones are used as an instructional tool.

### **Action Research Data Collection Tools**

My action research design made use of the following data collection tools described a) pre- and post- unit survey, b) student attendance records, c) student journals, d) classroom assignments turned in and/or completed and e) classroom projects.

#### **Pre- and Post- Unit Survey**

The data collection started with a pre-unit survey to help me understand what kind of applications my students typically used on their cell/smartphone, if any, to support their learning in or outside of school. The information collected from the pre-unit survey was then compared to a post-unit survey on the use of applications in a field curriculum biology class.

According to Kendra Cherry (2014), who wrote, “What is a Survey?” surveys have their advantages and disadvantages. She states how, “Surveys may focus on factual information about individuals, or . . . aim to collect the opinions of the survey takers,” (What Is a Survey, ¶ 1). A survey provided me with the ability to use a standardized method to collect factual information from my students regarding their use of functions and applications on their cell phones. In addition the survey was easy to use, implement in a consistent manner, and ensure that the baseline data was collected. Another advantage of the pre- and post-survey was that it saved time by using one located on the

Internet and revising it rather than creating one from scratch. The survey answers were also easy to tally in a short amount of time compared to interviews and essays.

Another advantage of using a survey was that it allowed for student input that they might not provide in a direct one-to-one oral question situation. For example, a survey allows students who are shy or have a tendency to refrain from voicing their answers and/or opinions in a classroom or directly to their teacher to have the freedom to express him or herself without embarrassment from verbally speaking. The disadvantage of using a survey is the credibility of the answers the students provide. Would they be honest? They could quickly and randomly choose answers without reading the content of the questions.

### **Pre and Post Unit Survey Design**

The pre and post-unit surveys I administered consisted of four sections. Section A contained the following four yes or no questions.

#### Section A Questions:

1. Do you own a cell phone?
2. Do you bring a cell phone with you to school?
3. Do you like using your cell phone better than a desktop or laptop computer in class?
4. Do you like doing schoolwork on your cell phone?

Section B contained 15 questions with answers on a scale of strongly disagree, disagree, agree, and strongly agree. Section B was focused on how students use their cell/smartphones, if they use it for texting, accessing the Internet, and using it as an

educational tool for assignments. I also included questions concerning their opinion on their natural environment. Section B contained the following fifteen questions:

1. I use my cell phone most often to access the Internet.
2. I use my cell phone most often for texting.
3. Having access to my cell phone helps me learn better.
4. Using my cell phone on my assignments helps me complete them all the time.
5. Using my cell phone on my assignments helps me complete them most of the time.
6. I feel I can accomplish more schoolwork using my cell phone.
7. I feel I am more organized using functions/apps on my phone.
8. I am most comfortable using my cell phone instead of a computer to do my schoolwork.
9. The cell phone is my first choice to use as a learning tool, such as research, outside of school.
10. Using my cell phone in class keeps me current on environmental topics.
11. I like being in the outdoors?
12. I think cell phones should be integrated into a field-based curriculum (labs/ activities outside)?
13. I like learning in an outdoor class more than an indoor class?
14. I would learn more about the natural environment if more class time were spent outdoors?
15. I would learn more about the natural environment if I could use my cell

phone in outdoor labs/activities?

Section C provided data on how often my students use their phone and how many different apps they use. My science students marked answers ranging from zero to eleven or more times they used their cell/smartphone in different situation. Section C questions provided a concrete number on how many times students use their cell/smartphone for their personal use and how many times they use it as an educational tool. Following are the five questions I included in section C.

1. How many times during the school day do you use your cell?
2. How many times during the science class do you use your cell phone (for anything)?
3. How many times during the science class do you use your cell phone just for science related things?
4. How many different apps do you use on your cell phone outside of class for your personal use?
5. How many different apps do you use on your phone for your science class?

In Section D I chose short answer questions. This section provided me with additional knowledge on how my students use their phone, how important they feel their phone is for different situations and the class. Section D questions included:

1. I use my cell phone mostly for:
2. How important to your learning do you feel having access to use your cell phone is (do you learn better from using your cell phone)?
3. Would you like to have a science class during he school day that spent more time learning in the outdoors using your cell phone? Explain:

4. What do you hope to learn in the science class?

The entire pre-unit survey is located in the Appendix B.

The post-survey included the same questions as the pre-survey except for the addition of two questions in section D. The two additional questions asked the students about their experience in my science class. These two questions provided me with the students' personal opinion about the experiences they had in my science class. This information gave me tools to help me plan future classes. The entire post-survey is located in Appendix B.

The following two additional questions were included in the post-survey section D:

5. What were your most favorable experiences with this class?
6. Would you take another science class knowing you could use your cell phone as a learning tool? Explain:

### **Student Attendance Records**

Another collection tool I utilized was the attendance record for my science students. I used it to explore the possibility if there is a concrete correlation between the students' attendance and their success in my science class. Good attendance is vital for academic success no matter what the age the students are. I have observed in some other classes I have taught that the students who come to school on a regular basis tend to experience more academic success than those who had poor attendance. I sought to find if this was also true in my science class for this specific unit. Comparing attendance with grades seemed a reasonable avenue to look into.

## **Student Journals**

The writing tool I used to collect information from my students was a journal. The journal consisted of a template my students filled out during our field-based activities. My reason for using the journal was to have another qualitative data source. Even though the journal questions/summaries were basic, my goal was to determine if over the course of the capstone project the students would increase their descriptive observations out in the field.

In science, it is important to write descriptive observations about experiments, experiences, observations, etc. in detail. The journals were a guide for the students to focus on descriptive analysis. I was striving for students to elaborate on the descriptions of their surroundings in their natural environment. The journal questions were selected after reviewing a plethora of surveys and by putting myself out in the field and focusing on what I wanted my students to observe.

Journal questions selected for use in this unit were designed to get my students to write a general description of the area where the field based experience took place. In their general description my students could write about things such as weather conditions, points of interest, new things they discover, new words they come across, along with a section for them to summarize and/or reflect upon their thoughts and ideas. The students had a total of six journals to write for each of the field trips. Following is an example of the journal I used in my science class (Figure 2).

**Journal**

Name: \_\_\_\_\_ Date: \_\_\_\_\_

Title (optional): \_\_\_\_\_ Class: \_\_\_\_\_

Questions/Summaries	Notes
<ol style="list-style-type: none"> <li>1. Describe area (wooded, aquatic, open/grass, etc.)</li>   <li>2. Weather (clear, cloudy, drizzle, cool, warm, hot, etc....)</li>   <li>3. Points of interest: what stands out for you? Why? Describe:</li>   <li>4. New things you discovered?</li>   <li>5. Vocab: New words you came across</li> </ol>	
<p>Summary/Reflection: This is open to your thoughts and ideas. Following are a few questions for guidance if you are having trouble. <b>USE THE BACK OF THIS PAPER IF YOU NEED MORE ROOM!!!</b></p> <ul style="list-style-type: none"> <li>• What are your thoughts on today's activity? Was it interesting/boring? What did/didn't you like about the assignment or area? Would you change anything?</li> </ul>	

Figure 2. Blank journal page designed for my students to complete.

### **Classroom Assignment Completion**

One significant challenge in an alternative setting is trying to get the students committed to completing their assignments. From my experience teaching in an alterative

setting there is a direct correlation to completion of assignments and student attendance. When my students come to school on a regular basis, they are connected, committed and want to succeed. In addition to my other data sources I analyzed the attendance and assignment completion rates and/or assignments turned in during the course of my capstone project. In my experience when students are motivated to attend class, they are more eager to get their assignments in completed or mostly completed to succeed with a passing grade. I will compare the student's attendance with their final grades to determine if there is an association between the two.

### **Data Analysis**

According to Geoffrey Mills (2011) data analysis is explained as, “an attempt by the teacher researcher to summarize collected data in a dependable and accurate manner” (p. 148). Mills (2007) also notes that data interpretation is an attempt by the researcher to find meaning in the data” (p. 143). My capstone research design includes several different types of data analyses the first being the pre- and post- unit survey analyses.

#### **Pre- and Post- Unit Survey Analyses**

The first data I summarize was from the pre-survey to determine how often students use their cell phone in general and how many different applications students use for science curriculum in and outside the class to help them complete assigned work and for understanding science concepts. This baseline data was then compared to a post unit survey to see if using cell phones in a field-based science curriculum increased the number of applications they use over the nine-week period starting September 8<sup>th</sup> and ending November 4<sup>th</sup>, which was our first quarter. The analyses of pre and post unit survey was to determine

- What % of students increased the number of applications they used?
- What % stayed the same?
- What % like doing schoolwork on their phone?
- What general types of apps, or how many, they are using for schoolwork, entertainment, and/or social communication?
- How they like being outside and using their phones in a field curriculum?

### **Student Journal Analyses**

During the capstone project my students were required to complete a journal. The journal was designed using a template rather than free form. This meant that my students would respond to a standard set of journal prompts during our outside excursions. The students were assigned a total of six journals during the fall quarter of 2015.

I sent my science students the journal template from my email in Google docs to their cell/smartphones to complete their journal writing assignment for the field curriculum. After my science students completed their journals, they could send them to me by email. My students also had the option to complete a paper copy of the journal prompts (see Appendix C Student Journal) and hand it in to me after they had time to finish them in the classroom. Both options, paper and paperless, were available throughout the capstone research to insure my students would fill out the journals if they preferred one method to the other.

To be consistent in analyzing the science journals for all students, I used a science journal rubric. I looked for six main categories; a description of the area we were in, the current weather during our outing, points of interest, new things discovered, vocabulary, and a summary/reflection piece. I used a scale from zero to five for grading. Zero points

were placed on no attempt to writing out the journals to five points for accuracy, clearly presented descriptions and/or ideas and listing at least three or more new vocabulary words. Following is the science journal rubric I used for analyzing their journals. The students could score between zero and thirty points (Figure 3).

Criteria	5	3	1	0
Describes area	Describes area accurately (grassland, wooded, marsh, lake, river, etc.), geological features (hills, flat, cliffs, etc.), gives detail, listing 4 or more plant descriptions, approx. area. Clearly presented and easy to understand	Describes area and some features listing 3 plant descriptions, easy to understand	Briefly describes area listing 1-2 plant descriptions, not clearly presented or easy to understand	Does not attempt
Describes weather	Describes all 4 topics in detail: cloud types, temperature, wind, precipitation. Examples: Temp: hot, muggy, warm, cool, cold Clouds: clear, cloudy, partly cloudy, hazy Wind: gusting, strong, breezy, calm Precipitation: dry, mist, rain, hail, sleet, snow  Clearly presented, detailed and easy to understand.	Describes 3 of the 4 topics: cloud types, temperature, wind, precipitation. Examples: Temp: hot, muggy, warm, cool, cold Clouds: clear, cloudy, partly cloudy, hazy Wind: gusting, strong, breezy, calm Precipitation: dry, mist, rain, hail, sleet, snow  Easy to understand	Briefly describes 2 of the 4 topics: Temperature, clouds, wind, precipitation.  Not clearly presented or easy to understand.	Does not attempt
Points of interest	Lists 3 or more interesting points and explains why/what is interesting about them. Clearly presented, detailed and easy to understand.	Lists 2 interesting points and explains what is interesting about them.  Easy to understand	Lists 1 interesting points and explains what is interesting about it.	Does not attempt
New things discovered	Clearly presented, detailed and easy to understand.	Easy to understand	Not clearly presented or easy to understand.	Does not attempt
Vocabulary	Lists 3 or more words	Lists 2 words	List 1 word	Does not attempt
Summary/Reflection	Clearly presented, organized, detailed, and easy to understand.	Clearly presented & easy to understand	Not clearly presented or easy to understand.	Does not attempt

TOTAL \_\_\_\_\_/30

Figure 3. Rubric used to assess the journal entries submitted by my students.

### **Setting and Participants**

The school where this capstone research tool place is an alternative school setting in a large first ring suburb of a major metropolitan area in the upper Midwest.

The school population is small, approximately sixty, but has a diverse background. The students are of Hispanic, Caucasian, Black, Native American, and Mongolian. They represent a wide range of academic skills with a broad range of attitudes toward school. Included among the student population is a student on an Individualized Education Program (IEP). The class, even though small, symbolizes the diverse communities of the urban schools in the surrounding area of this large metropolitan area in the upper Midwest.

During the capstone process my biology class met five days a week for 75 minutes each day. The quarter was nine weeks with a total of 40 days. The students in my study totaled only ten when I started in the fall quarter of 2015. My science class consisted of high school students who were juniors and seniors. The weeks that followed brought a few more students. By the fourth week my class totaled nineteen. At the end of the fifth week my science class consisted of seventeen. That number stayed consistent until the end of the quarter.

The attendance policy at my school is that students who do not attend for 15 days in a row are automatically dropped from our program. The attendance in the first half of the quarter resulted in a mean of 12 students. The attendance for the second half of the quarter resulted in having a mean of 14 students. The attendance of the students was the hardest variable to work with because I had no control over it. Overall, my science class started with ten students and finished having 17. Table 2 (formatted to fit the page) is a

summary of the weekly attendance during the project with the letter X is put in place of attendance on non-school days or in-service days.

Table 2. Daily Attendance of Students

Week #	# of Students	M	T	W	TH	F	Weekly Mean
Week 1	10	X	10	7	9	9	8.75
Week 2	16	10	11	14	12	11	11.6
Week 3	18	15	13	15	15	6	12.8
Week 4	19	10	16	14	14	5	11.8
Week 5	17	13	14	13	11	10	12.2
Week 6	17	11	9	X	X	X	10
Week 7	17	9	12	11	12	9	10.6
Week 8	17	11	13	12	7	10	10.6
Week 9	17	12	13	11	11	X	11.75
Mean	16.44	11.38	12.33	12.13	11.38	8.57	11.12

Having smaller classes was beneficial. It gave me the flexibility to take my class outside more frequently. My biology class and I ventured out to six various parks and wild areas around the community for their assignments and/or activities. With a field-based curriculum, students were able to use their cell phones as a learning tool for documenting, taking pictures, researching, along with many other uses to complete their assignments and projects.

### **Human Subjects Approval**

The Hamline School of Education Human Subjects Committee approved my application to conduct my capstone research on July 29, 2015. Prior to the approval from the Human Subjects Committee, I received a formal approval from the principal of my school. In order for students to be included in my capstone research all students had to return a completed parents/guardian consent letter prior to starting the research.

### **Limitations of the Research Design**

There were two major limitations to the research design for my capstone. One is related to trustworthiness of the data collect. The information collected during the study is from my students who could fill out their data collection tools anyway they wanted to and not be truthful. The research design did not include a way to verify what my students reported. Failure to answer honestly and/or accurately left the study open for errors.

A second limitation was the weather and attendance. Weather cannot always be predicted and could potentially interfere with the number of field trips. It would have been an advantage to take the students out each of the nine weeks of the capstone research period. However, that was not possible given that the first week of the quarter was devoted to introductions, reviewing classroom rules and expectations, and sending home the parental permission form. Another week was lost due to a short week for non-school days. I had to cancel a field trip only once due to weather. The extra three outings would have granted me three more days of data collection.

### **Summary**

The overall strategy I will use to answer my capstone question, “How many functions and/or applications do students use on their cell phones when it is integrated in a field-based curriculum?” is with an action research approach. I began with a survey before the field-based unit and before cell/smartphones were introduced and ended with a post-survey using similar questions. Journals accompanied the assignments for me to compare my students’ thoughts and ideas about using cell/smartphones in a field-based curriculum. All of my research took place with my biology class consisting of a very diverse group of 11 – 12<sup>th</sup> graders in natural wild areas.

My goal in conducting this research was to gain a better understanding if my students used their cell/smartphone to help them do their assignments and projects. At the start of the capstone research I understood there are many things that can influence how my students use their cell/smartphones that were out of my control. For example, I could not control if some students would get distracted with videos, texting, and/or finishing their assignments, etc. Through out the research I adjusted as needed. Chapter Four is a description of my data analyses and an introduction to the insights I gain during the data analysis.

## **CHAPTER FOUR**

### **DATA ANALYSIS**

#### **Introduction/Chapter Overview**

In the Fall of 2015 after completing a quarter in a high school Biology course geared toward students using their cell/smartphones in a field-based curriculum, the students took a post-survey that I compared to a pre-survey they previously took at the beginning of the quarter. My research focused on, “How many functions and/or applications do students use on their cell/smartphones when it is integrated in a field-based curriculum?” The student body at this alternative high school was diverse for a small group.

During the fall of 2015, I collected multiple sources of data from my students. The data sources included a pre- and post-survey, attendance records, completed assignments, and journals. The pre-survey consisted of five yes/no questions, 20 varying degree of responses, along with four essay questions. The post-survey was the same as the pre-survey except for the addition of two new essay questions to better understand if my students overall liked the class.

Along with the surveys, I assigned a journal template for my students to fill out during some of our outdoor excursions. I used the journals to observe if the students increased their vocabulary of graphic words when describing the environment visited during our field trips. This chapter describes my analyses of the data and what I learned about my students use of cell/smartphones in this field-based curriculum and any insights I have gained about whether or not their use could be an advantage for the students’ academic success.

### **Analyses of the Pre- and Post-Unit Survey**

As a teacher my hope is that the first day of school should be anticipated with excitement from all the students. However, at the alternative high school where I teach, the staff expected low attendance the first week of Fall 2015 term and we were right. For my biology course I started off with ten students. The first day of school I introduced an activity for logical thinking called, “Is Sammy Alive?” After the activity I explained to the students what was planned for the fall 2015 quarter and about how they were going to be using their cell/smartphones in a field-based curriculum. I also presented them with an overview and purpose of why I am incorporating cell/smartphones. The second day, September 9<sup>th</sup>, I decided to jump into chapter one, Understanding our Environment, with a critical thinking worksheet to complement it. I distributed and explained the consent forms and the pre-survey on the 11<sup>th</sup> of September.

I expected that the majority of my students had cell/smartphones. In fact, according to the pre-survey, that indeed was the case. Sixteen out of 17 students reported owning and bringing their cell/smartphone to school with them. Given my sense that teenagers get distracted with texting, snap chat, and video games, I thought the percentages would be high for my students wanting to use their cell/smartphones for science. Many of the questions answered by my students on the pre-survey were informative, even though some were not what I expected.

Section A, my student’s responses to questions four and five regarding their perception that carrying a cell/smartphone is much easier than a laptop or iPad out in the field proved disheartening to me as a teacher. I assumed my students would prefer their cell/smartphone than another electronic device. The pre-survey indicated that 76% of the

students do not like using their cellphone/smartphone better than a desktop or laptop computer in the classroom. The post-survey, for the same question, decreased to 64.3%. However, a closer examination of the post-survey result reduced called into question the numerical decrease between the pre- and post-survey.

Two students did not select either yes or no for a specific question. Instead these two students marked their answers in between yes and no even though this was not an option I intended. This created a 14.3% error in the post survey. When these two students responses are considered a yes, the possibility of students who do like using their cell/smartphone better than a desktop or laptop increases during the capstone research from 24.0% in the pre-survey up to 35.7% in the post-survey. When these two students responses were considered a no, the possibility of students who do not like using their cellphone better than a desktop or laptop computer increases from 76.0% to 78.6%. Section B statements of the surveys were focused towards the science students' responding to strongly disagree, disagree, agree, and strongly agree are considered next.

The section B questions were geared towards cell/smartphone use and their natural environment. A few of the questions I developed were similar to questions four and five in section A. My intent in doing this was so that I could compare the information collected to confirm or contradict if my students liked using their cellphone/smartphone as a learning tool for their science class.

To better understand the students' responses, I combined the number of the categories for responses in section B. I grouped strongly disagree with disagree and agree with strongly agree giving me two categories instead of four. This allowed me to simplify

the responses in percentages and better represent some of my findings in a graph that would be easily understood.

In section B question four asked my students if they agree/strongly agree that they complete assignments using their cellphone. I thought the percentage would be much higher after the fall 2015 quarter than in the beginning of the quarter. According to the results, 64.7% of my students agree/strongly agree they complete assignments using the cellphone compared to 50% in the post-survey.

One interpretation of this result is that during the time of the capstone research more students in this biology class ended up not liking to use the cellphone/smartphones as a learning tool than when the class started. It would be interesting to ask question four in a survey in the future to note any change in percentage from this class. As a teacher, I expected the students to complete more assignments using the cellphone/smartphone as the quarter moved forward with cellphone/smartphone use.

Question six asked my students if they accomplish more schoolwork using the cellphone. Here again, I expected an increase in percentage from beginning to the end of the fall 2015 quarter. The percentage fluctuated very little from 64.7% in the pre-survey to 64.3% in the post-survey.

For question eight in the graph, I wanted to explore if my students are comfortable using the cellphone/smartphone for schoolwork. There was only an eight percent increase from the pre-survey to the post-survey. Even with the data showing only a small increase, I did expect a larger increase after using cellphones/smartphones in the curriculum during the fall 2015 quarter.

In section B the largest increase of 18.5% was on question nine where 71.4% of the students agree/strongly agree that the cellphone is their first choice for a learning tool in the post-survey compared to 52.9% in the pre-survey. As an educator, I was pleased to see the increase in this area after the emphasis on cellphones/smartphones in the curriculum. According to question twelve, 70.6% of the students agreed/strongly agreed that cellphones should be integrated in field-based class. This increased in the post-survey to 78.6%. I anticipated the students favoring using their cellphone/smartphone in a field-based curriculum versus handling a laptop, which can be cumbersome. Also noted in the post-survey was that 71.4% of my students agreed that their cellphones/smartphones keep them current on environmental topics compared to 58.8% in the pre-survey as seen in question ten.

As I viewed question 15 data regarding the students learning about their natural environment using cellphone outdoors I noticed a decline by 2.9% from the pre-survey to the post-survey. This decrease contradicts the increase in percentages in questions eight, nine, ten, and twelve. An interpretation of this contradiction could be that when the students are outside in their natural environment, they enjoy learning and exploring in a more carefree environment instead of collecting data for assignments and/or projects in any form.

Analyzing the information from the questions in section B regarding the students' attitude on cellphone use has left me with more questions than definitive answers. The increases and decreases in percentages among the questions show some contradiction and room for possible error. However, these differences are inconclusive and it could be as simple as the science students in my class are not use to having their cellphone/

smartphone as a learning tool but would like to start having classes incorporate them.

Figure 4 is a graph representing my students' attitudes on cellphone use.

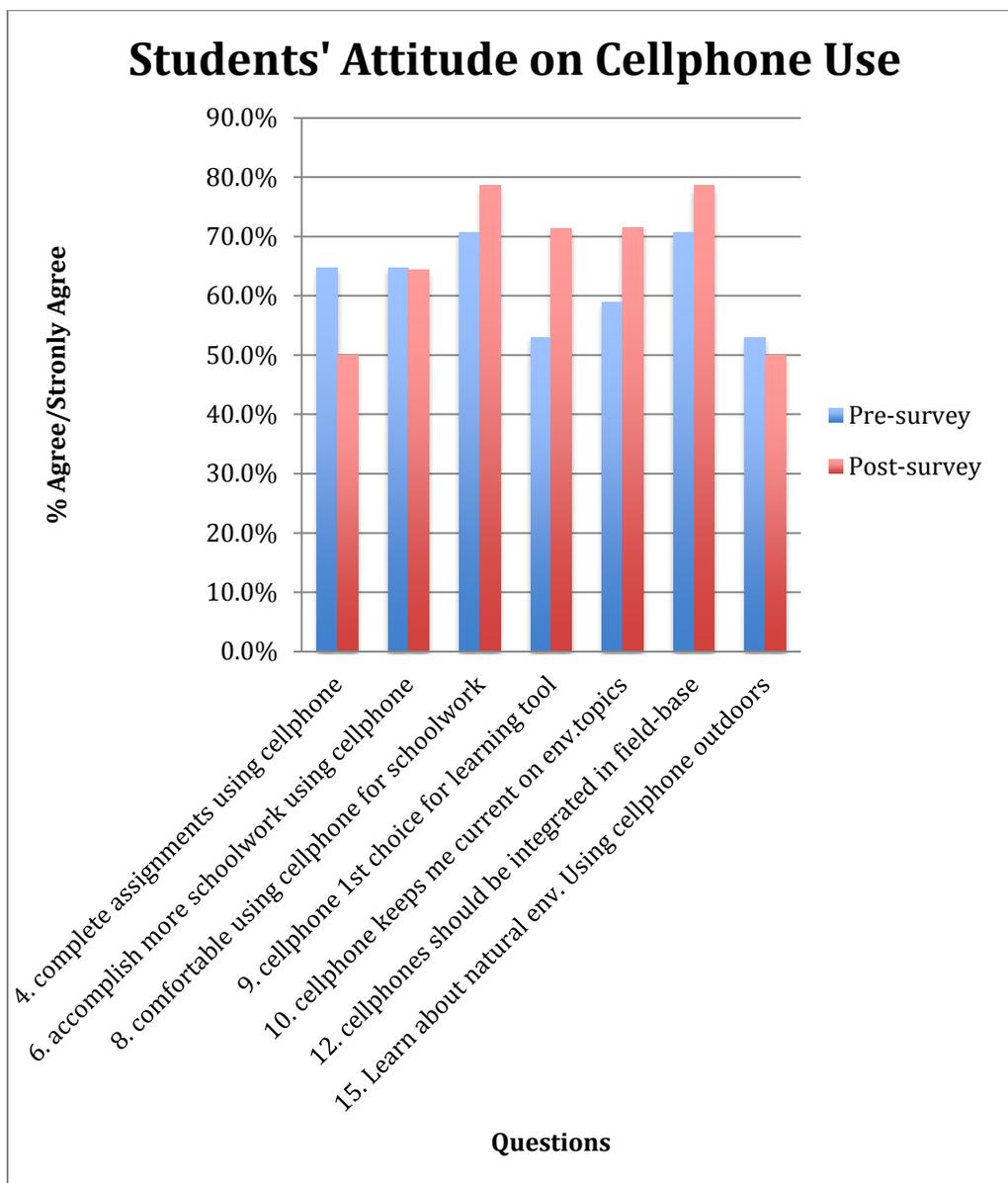


Figure 4. These questions correspond to the numbered questions in the surveys. They are shortened to fit better.

As a teacher in an alternative high school located in an urban area one reason I created a field-based curriculum was to generate student interest in the natural environment. My assumption is that exposing students to their natural environment is one

way to support them in becoming interested in nature and care about what happens to their natural world. The outdoor labs and activities used during this capstone research were geared towards peaking my students' interest and broadening their knowledge about their natural environment while integrating the use of cellphones/smartphones. Three questions on the pre- and post- survey were design to understand the students' attitude towards their natural environment before and after the experience. The analyses of these three questions (Question 11, 13, 14) are addressed next.

The analyses of the survey results did confirm that the majority of my students liked going outside for the labs/activities. In the pre-survey 70.6% of my science students indicated agreed/strongly agreed that they liked being in the outdoors (Question 11). At the end of the quarter the percentage rose to 78.6%. Question 13, also supporting the integration of out-door activities, asked if the students like learning in an outdoor class more than an indoor class. This question resulted in a 12% increase from the pre- to the post- survey.

Question 14 ask my students to rate the degree to which they learn more in an out door class. In the pre-survey, 58.8% of the science students in class agreed/strongly agreed. The percentage rose to 71.4% at the end of the field-based science class, confirming, in this case, that there was an increase in the number of my science students who indicated that they like learning in an outdoor class when given the exposure to nature. Figure 5 represents the three questions I included in the surveys to understand the students' attitude towards their natural environment.

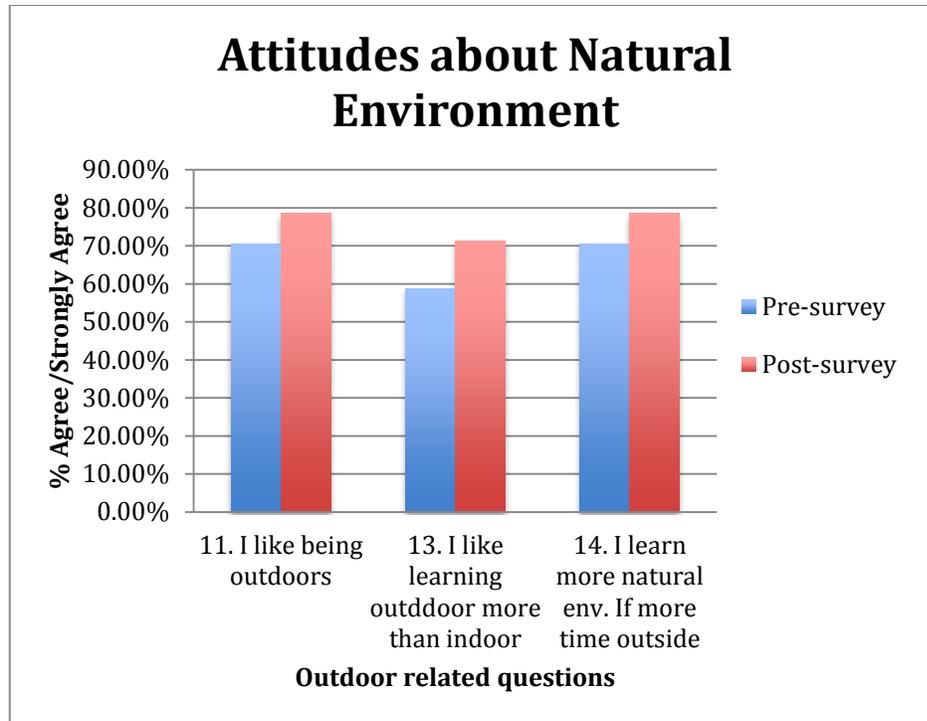


Figure 5. Questions relating to outdoor labs/activities in the natural environment included in the pre- and post-survey.

Section C on the pre- and post-surveys was focused on how many times the students use their cellphones and/or apps in different situations. According to the pre-survey, 15 out of 16 students reported using the zero to two apps for science and only one student reported using seven to eight apps for science in the pre-survey. According to the post-survey after the fall 2015 quarter, eight out of 13 students reported using zero to two for science, a decrease of seven that was the intended outcome. On the post-survey all students reported using more apps. Two students reported using three to four, one student reported using five to six apps while two other students reported using 11+ apps. Figure 6 is a visual representation of the number of-how many students ended up using more apps during and after the quarter was complete.

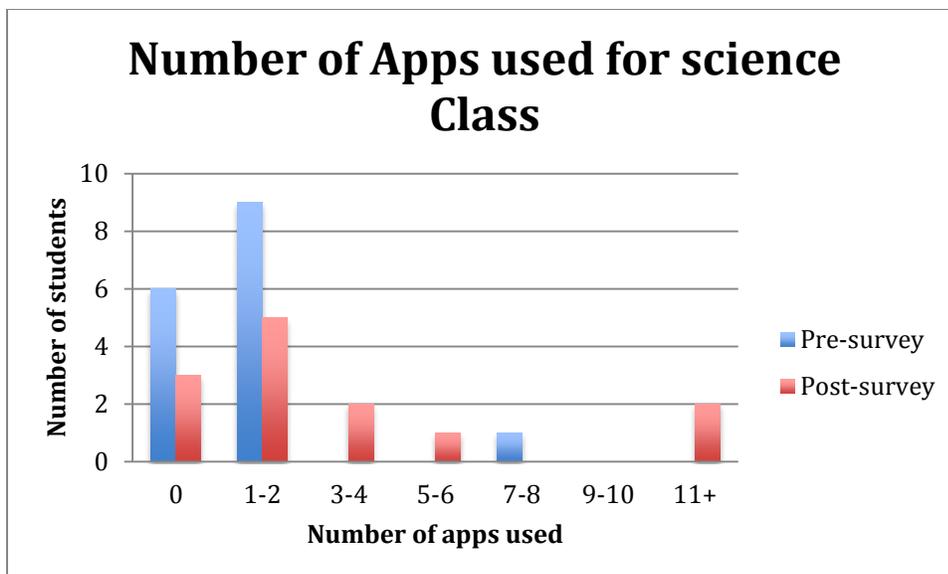


Figure 6. Represents the number apps my science students reported using during the class in the pre- and post-survey.

Included on the post-survey were essay questions regarding the science students' use of their cell/smartphones. All the students who participated in this study reported using their cell/smartphones for messaging, web, games, social media, music, etc., only one student stated they used their cell/smartphones for schoolwork in the pre-survey. In the post-survey five students stated using their cell/smartphones for the following features: calculator, camera, and looking up information for assignments. A positive outcome of analyses is that there was an increase in my students' use of their cell/smartphones as a tool. Another data source were the student journals completed by my students during the research period. The analysis of the journal data is described in the next section.

### **Analysis of Journal Data**

At the beginning of my capstone project my students were introduced to a general journal to fill out during some of our outdoor excursions. I had planned out six outdoor

lab/activities for the science students throughout the fall 2015 quarter. I encouraged them to use their phones for taking pictures, video recording, texting, taking notes, looking up vocabulary and any other apps on their phones when we are outside and include this information in their journals.

The first outing was to a near by park within approximately a mile walking distance. September sixteenth was a beautiful day so my students were eager to get outside. I handed out 14 journals to the students who were in attendance that day. When we entered the park, I asked the students to take pictures of natural areas as well as other areas. I told them they could use their pictures to add more to their journals later.

During the field trip I asked guided questions as we walked. The students behaved well, which I expected. They were joking around and enjoyed themselves as they were making observations. When several sat down at a picnic table, they observed the section in their journal that was devoted to new words they heard and/or learnt. I was flooded with questions, asking me to tell them new words. Instead of just telling them words, I decided I was going to make it interesting and increase their knowledge about plants without them realizing it. I proceeded to point and walk to various trees and plants around the area giving them descriptions, features and names of the plants in the area. Students realized quickly that when they followed me and kept asking questions, they were gaining a wealth of information.

Out of the 14 journals I handed out, 14 journals were handed in as completed work. No one took the opportunity to text or email their journals in, which was discouraging. I was still happy they did the hard copy journals. I also requested the students send me any pictures they had taken during the field trip. Of the 14 students who

participated in the field trip only two students sent me pictures from the park. Given the low participation in the submission of photos taken during the field trip, I decided to change the credit given for the photos and tell the students they could earn extra-credit points for any that were sent to me. I hoped this would encourage them to take lots of photos.

The next opportunity for journal writing for my science students was the adventure to a local nature center on September 28th. The previous night I sent the class a template of the journal to ensure they would have it. I gave instructions on the ecosystem study they were assigned. To increase student engagement in the assigned work, I handed out hard copies of the journals to the students who requested one. Once at the nature center the science students went off to explore with partners or groups. Eleven out of 19 of my science students were in attendance for the outing. They ventured into the prairie, lake, wooded, and wetland areas to study the habitats closely. Only five students handed in journals out of the 11 that went to the nature center. Even with the low participation rate during the nature center field trip my plan was to have my students complete journal assignments in the upcoming outdoor excursions to try to increase the number handed in, either by hard copy or texting.

The week of October 7<sup>th</sup>, the whole school went up to a park with a small falls, outcrops, potholes, and other interesting geologic features. We had a guided tour around the pothole area. Thirteen of my science students participated on this excursion. The students took notes and were again encouraged to take lots of photos. I was happy to see they did. By my observations, over half of all the students who went were taking pictures with their cell/smartphones. My science students had an assignment to complete as well

as their journal. Everyone then took the boat excursion down the river. I encouraged them to fill out their journals and other assignment as we were boating down the river. All of the students were involved and excited to explore. This adventure proved to be the best according to the students' comments. The following day four students turned in their journals. I reminded the other students they could keep turning in the journals, but to my disappointment, no one else did.

A field trip to a local ravine was the last big excursion and it took place on October 13. I was concerned about the date of this trip as it was the day before the statewide teacher conference in the state where the research took place. As a result of the statewide teacher conference October 14 our high school was closed. In my experience student attendance is lower at the alternative school where I work just prior to a scheduled break. Only nine students out of 17 showed up for science class on October 13.

For the ravine field trip a co-worker and I drove two vans to the location. For their assignment I included concepts from the journal template I used previously. I thought it might be received better combined as one assignment rather than having the journal as a separate assignment. The other students still had the opportunity to venture out to the ravine and do the assignment. Three of the science students ended up completing the combined assignment that included the journal writing.

During the data collection period the completed journal assignments handed in were low. After the first outing to the park, 14 students handed in their completed journals out of a possible 16. I was anticipating the rest of the journals for the field trips would produce similar results. The following outside lab produced a return of five journals and the next lab only four. For the remainder of the outdoor labs none of the

students handed in a journal. Given how many completed journals were turned in I determined that there were not enough to analyze and compare to determine if there was an increase in descriptive words. As a data source the journals did not inform my capstone question. A final data source was the attendance of my students during the capstone period and is reported in the next section.

### Attendance

The students' attendance is a variable that has been in constant flux in the past school years and also during my capstone research. One of which, I had no control over. The quarter went over a span of nine weeks and totaled 40 days. The average number of students enrolled weekly was approximately 16.4. Figure 7 is a graphic representation of the total number of students enrolled each week with the average number of students who attended during the capstone research.

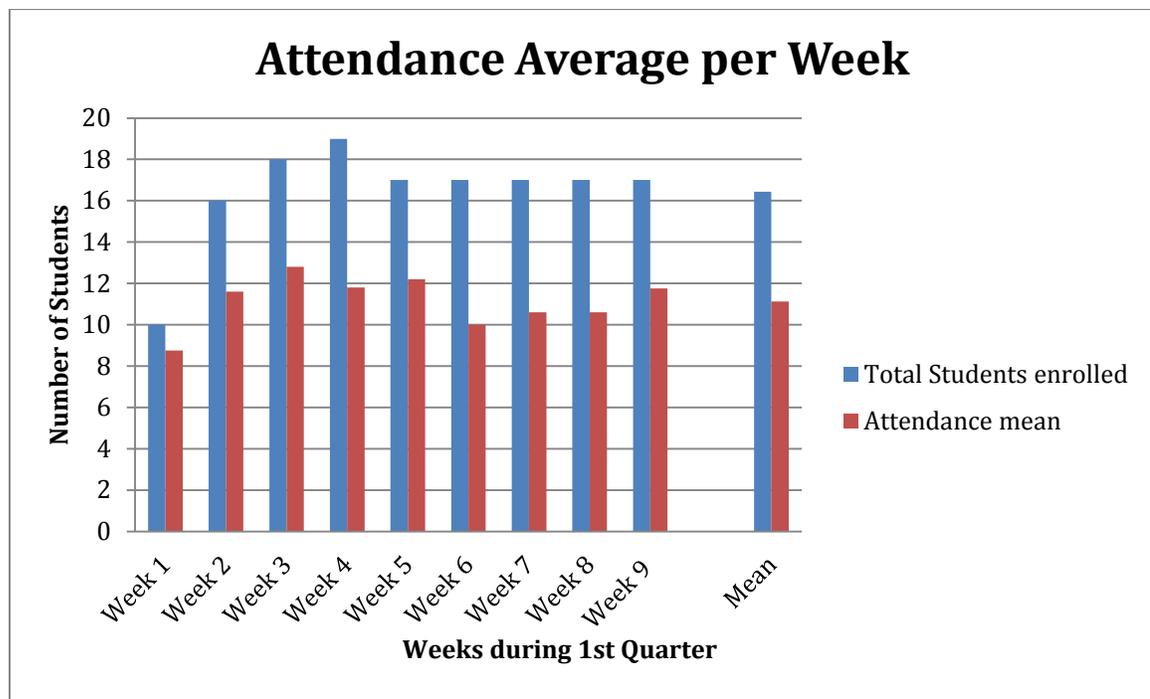


Figure 7. Represents weekly students enrolled each week compared to their attendance.

Viewing the graph, the only two consecutive weeks with a constant attendance mean are weeks seven and eight with an average attendance of approximately 11 students. The other weeks in the quarter of fall 2015 fluctuate between nearly nine to 13 students. The overall mean for daily attendance was 11.12 students.

As a teacher, I am well aware how attendance plays a huge part in a students' academic success. When my students miss school, they miss participation in notes, discussion of topic, and clarity in instructions for work assignments. Even when my students have excellent attendance, a few tend to not take the opportunity to complete work. During the capstone research the majority of the students had decent attendance. However, some fell short in handing in an adequate number of assignments.

In addition to tracking attendance I also compared my students attendance and the number of assignments turned in. The total number of days in attendance was 40 and the total number of assignments was 38. The students with the highest attendance were students one, four, five, six, and seven. Out of these students, student one and six handed in 52% of his/her assignments. Student number five only handed in 39.5% of his/her assignments and student number seven handed in 31.6% of his/her assignments. On the other end of the spectrum were students with low attendance but high percentage of assignments handed. For example, student fifteen who attended eleven days handed in 71.1% of his/her assignments. Student nineteen attended 21 days but managed to hand in 92.1% of his/her assignments. Even though I assumed low attendees would produce a low percentage of assignments handed in, there are still a few students who surprise me (Figure 8).

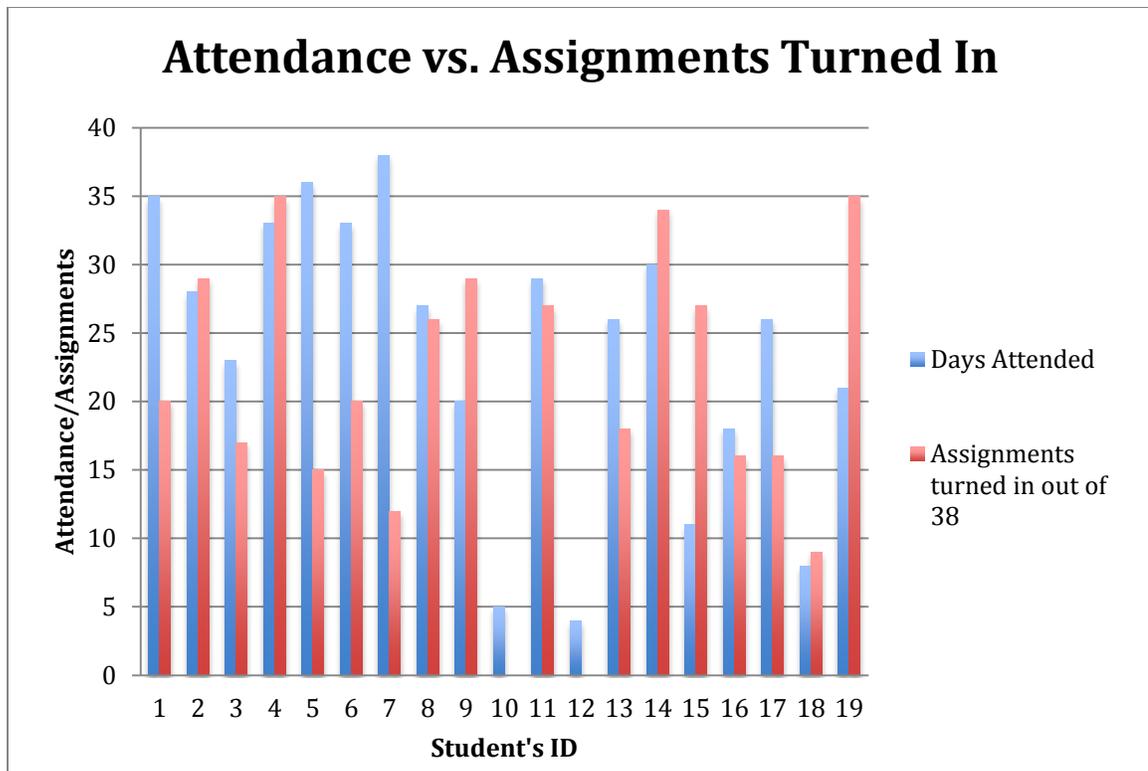


Figure 8. Total days attended for each student compared with the number of completed assignments. \* Students 10 and 12 were dropped due to lack of attending.

I decided to look at the quarter in two parts. The staff at my school splits the quarters in half to benefit the students. This produces two grading periods instead of one per quarter. Students have the potential of acquiring 0.5 credits for the core classes, including my science class. If they fail the quarter they would lose out on the whole 0.5 credit. By splitting the quarter into two grading periods, they could potentially pass half of it gaining 0.25 credits.

In my science class I divided the quarter into science A and science B to compare and contrast how the first-half of the quarter would differ from the second-half. Science A dated from September 8<sup>th</sup> to October 2<sup>nd</sup> and Science B was dated from October 5<sup>th</sup> to

November 5<sup>th</sup> in the fall 2015 quarter. The first half of the quarter, Science A, showed more success for students handing in assignments than Science B (see Figure 9).

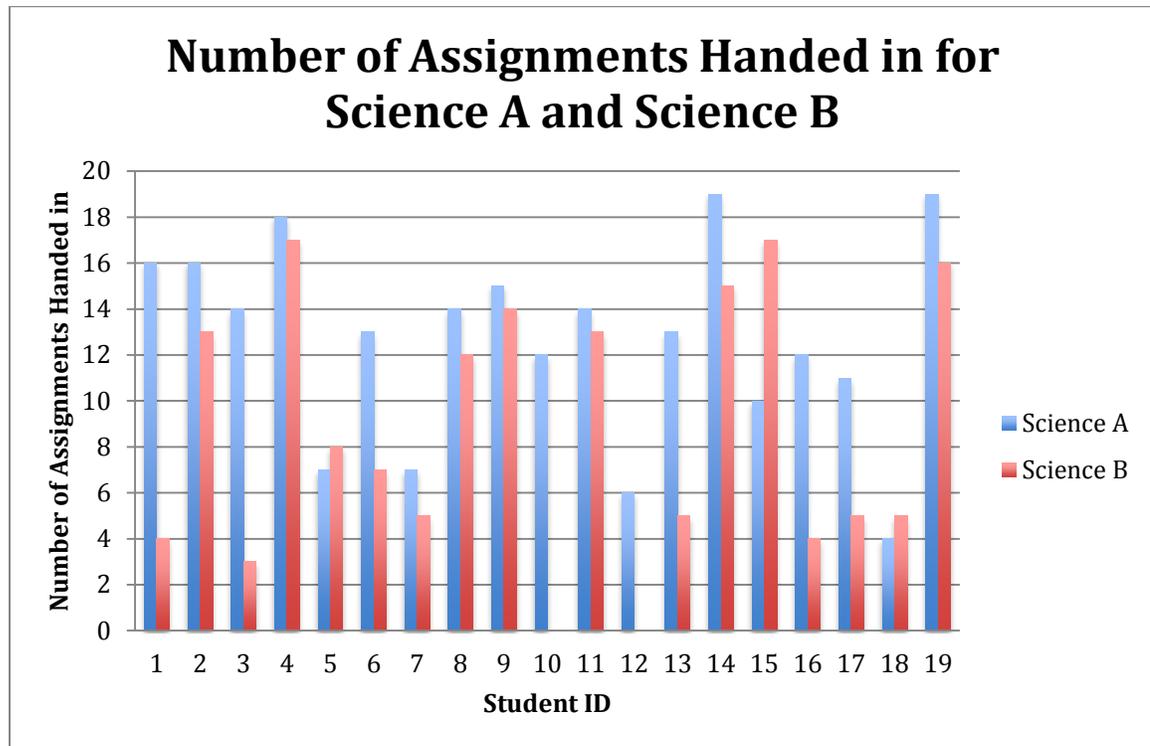


Figure 9. Total number of assignments (out of 19) students handed in for the Science A and Science B.

When I compared the number of assignments turned in between Science A and Science B there were a higher number of assignments handed in for Science A. The number of assignments turned in in Science A was 18% higher. I am not sure what changed for my students that resulted in them lowering the number of assignments they turned in half way through the quarter. The explanations for the difference could be many but it would be interesting to perform a study and possibly finding out the reasons. Figure 10 represents the percentage of assignments that were handed in during my capstone research between Science A (the 1<sup>st</sup> half of the quarter) and Science B (the 2<sup>nd</sup> half of the quarter).

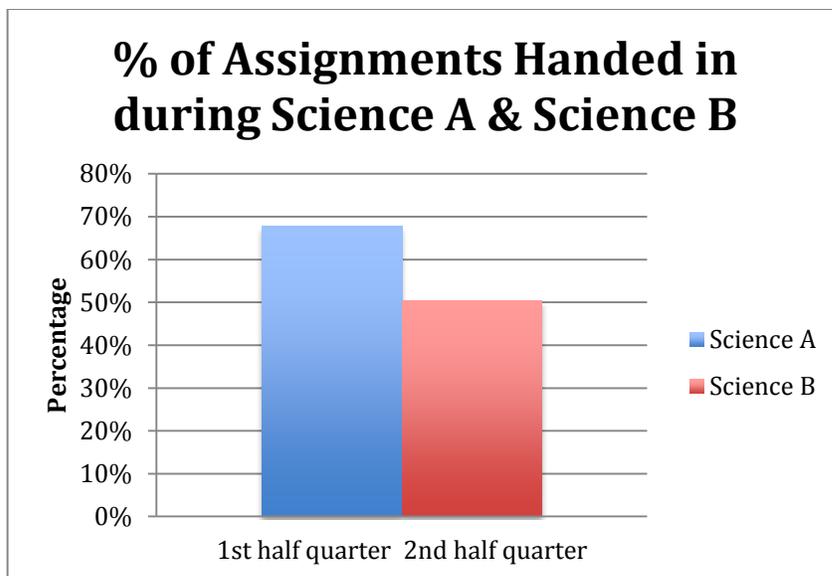


Figure 10. Percentage of students' assignments handed in during Science A and Science B.

The final source I collected information from my research was my personal observations during the capstone project and they are described in the next section.

### **Unanticipated Outcomes-Based on Personal Observations**

My personal observations during the field trips did reveal to me an outcome that I had not anticipated at the start of this project. What I did not anticipate were a couple of the students engaging and taking on leadership roles. For example, during the visit at the nature center, one of my female students announced she had been there several times. My first reaction was because of her prior experience at the nature center it was going to be a challenge to keep her focused. I was skeptical at first but then I was quickly surprised at how she conducted herself. She started to point out the direction to the ponds, wooded area, and farm animals. I was reassured by her knowledge of the area that she was capable of leading a group. Keeping her focused was not an issue. She took charge and told several students who have never been there they could go exploring with her and she

would show them some cool stuff. I was very proud of her and the maturity and leadership skills she exhibited.

Another surprise was the reaction of one male student, who does not engage much in school, to the field trip experience. This male student has verbally expressed to me how he does not like school. I also have observed how he is distracted by his cell/smartphone and gets caught up in playing video games. However, when my class would venture outdoors, it was clearly observed that he was in his element and showed great interest in certain activities.

Through conversation with him, I found out he enjoys the outdoors and goes up to a different region of the state to a cabin for outdoor recreational activities. He enjoys fishing, riding 4-wheelers, helping his dad cut wood and various other outdoor activities. When my class went on a boat ride down a local river I could not find the male student who enjoys the outdoors and his cell/smartphone. I asked a fellow teacher if she knew where he disappeared to. I was afraid he was sitting down below deck playing on his phone. Much to my surprise, he was in the wheelhouse with the captain. In observing him, he never took his cell/smartphone out. After the boat ride was over, I asked what was his favorite part of the trip? He told me being in the wheelhouse. The captain was answering his many questions; explaining the mechanics of the boat and running it in varying levels of water throughout the year. He was definitely engaged.

I was also excited when many of the students expressed their excitement when visiting the site with the small waterfall. I was encouraged to notice many of the students taking pictures of outcrops, potholes, cliffs, selfies, and many scenes along the river. I was surprised at how many had an abundance of pictures.

### Summary of Data Analyses

The main conclusion I can draw from my data analyses was a surprise. My data analyses indicated that my students do not like using their cell/smartphones for schoolwork. One of the reasons could be that they are used to using them for their own entertainment, such as music, texting, video streaming, and other social aspects instead of schoolwork. Question five in section A of my survey asks, “do you like doing schoolwork on your cellphone?” When I use this survey again, I will add a follow-up to question 5 in section A. If students answer no to question five the follow-up will ask them why they did not like using their cell/smartphone for schoolwork. Adding that follow-up question could help me clarify how to structure the transition to using cell/smartphones to increase student buy-in. Moving forward I can not or will not assume teenagers would jump at the chance to use their cell/smartphones in a field-based curriculum.

Analyzing the survey brought many aspects to light. For instance, the number of apps the students use for science class. I am not sure if I believe two students used 11 or more apps for their science class when doing work. The number seems extremely high for what we were doing. They could have possibly counted each time they used the same app to look up trees or locations. This would increase the number they reported. It would have been an advantage to have the students confirm the different apps they used on their assignments or the source they retrieved information, stored their pictures, or used to support their thoughts and ideas.

The percentage of assignments handed in between the first half of the quarter and the second half showed a difference of 18%. It could just be that the excitement and energy of a new school year wore off or something else. It would be interesting to try to

figure out what happened between Science A and Science B. Trying to figure out what helps students stay motivated, focused and successful would definitely benefit my teaching approach and the students' academic success.

The study did give me certain valuable information. Even for the students who did not care to be outside, the fieldtrips were their most favorable experiences with the class according to the post-survey. For this group of students outdoor labs/activities can be a success. If students enjoy being outside and are willing to work, they will gain knowledge. Only one student responded that homework was their most favorable experience in class. I am skeptical when a student loves homework. The majority of my students do not like school. But I do get a student every now and then who likes to do research and homework. I wish I really knew if the student was being honest or just sarcastic. Some students are harder to understand than others.

The next chapter, Chapter Five, is the final chapter of my capstone and I will present a summary of my capstone research, reflect on acquired knowledge I gained, limitations I observed, touch on possibilities for using the results I revealed, and my recommendations for future research.

## **CHAPTER FIVE**

### **Capstone Reflection**

#### **Overview of Chapter Five**

In this final chapter I will describe my interest in my research topic, “How many functions and/or applications do students use on their cell phones when it is integrated in a field-based curriculum?” I am including a summary of my research design and limitations I discovered during and after the fall quarter of 2015. A section where I will recap my major findings will follow. In my summary I am including a reflection on the pre- and post-survey, a vital data collection tool, which in turn, displayed valuable information. Also included in this section is a description of my informal observations during my research that I felt were valuable in moving forward with using cell/smartphones in my classroom. Integrating technology in my classroom was a trial and error process. In the paragraphs that follow, I will share some of my mistakes and successes through my journey.

The research I chose to explore during the fall quarter of 2015 was, “How many functions and/or applications do students use on their cell phones when it is integrated in a field-based curriculum?” My goal in introducing cell/smartphones in the science classroom was to provide my students with an economical device they could use to photograph, document, and do research for the labs/activities out in the field. At the start of this research I assumed that by just integrating cell/smartphones into the field-based activities my students would be excited to use them. While positive outcomes were revealed by the data analyses a major learning for me is that providing my students the opportunity to use cell/smartphones does not make it an automatic accepted learning tool.

When considering different issues for my research topic, I looked at ideas that would be applicable in my science classroom along with being a learning experience for me to improve my teaching and application skills to help students be successful. For me, technology was a forerunner. The advancements in the last twenty years have been by leaps and bounds. To bring technology in the science classroom would be giving my students real-world applications they can apply to their every day life now and in the future.

### **My Interest in the Research Topic**

My search for an economical device to support field-based activities is because for many years I have been challenged with little or no equipment in my science classroom. In addition to lack of equipment my students were also limited to the information provided by me during discussions, notes on the whiteboard, PowerPoint, and/or videos. This is what I would call a typical and sometimes outdated classroom. Incorporating the cell/smartphone is an inexpensive tool for teachers to utilize for their students to become connected to more knowledge with no burden on the school budget or the teacher's personal budget. In addition to a lack of equipment, students had limited access to information. I have a professional responsibility to incorporate technology in today's science classes to keep students on the technological path our society is driven towards. The results of my research surprised me in many ways.

A positive outcome of my research was the confirmation of my student's ability to complete their labs/activities on their cell/smartphones. My informal observations also supported me in deepening my understanding of how my students were using or not using their cell/smartphones in a field-based curriculum, journals, and their attitudes towards

their field-based activities. The most significant outcome of this research opportunity is that I now have new information to improve on my future teaching techniques and the successful academic development of my science students. The next section includes a summary of my research design and its limitations.

### **Summary of Research Design and Its Limitations**

My research started in the fall quarter of 2015. At the start of the process I was extremely confident every student would be eagerly waiting to use his or her cell/smartphone as a learning device. The approach I chose was qualitative teacher research. I presented a pre-survey to the class during the first and second week of the fall quarter to cover all students coming in before the end of our two week enrollment deadline. The purpose of the pre-survey was to acquire a basic understanding of how my science students felt about using their cell/smartphone, how many apps they use for science and in general, their attitudes towards their natural environment and other things before the research was started. I compared the pre-survey to a similar post-survey given to the students after the completion of the fall quarter. Other data collecting tools I used throughout the fall quarter were attendance, journal writing, assignments, projects and general observations of my own.

The science class ventured outside almost every week to various parks and nature centers over the nine weeks making up the fall quarter of 2015. The weather was extremely cooperative, filled with sunshine and warmth. I only cancelled outside activities twice due to the weather. I wish my school had a better outside area for exploring, but where we are located in an urban setting made it necessary for us to venture elsewhere. I felt the overall outdoor experience the students were exposed to was

great for the science class and their learning experience. The principal and my co-workers were extremely helpful and flexible to help plan the outdoor adventures.

During the data analyses and reflecting on the results, the limitations of my research design became more explicit. The limitations highlights that this type research was new to me and because of this I made some rookie mistakes. The first mistake I made was not having enough hard copies for the first lesson. I made the assumption that all the students would automatically pick up their cell/smartphones and know what to do for the lessons and/or activities in the beginning of the fall quarter. I only made enough hard copies for approximately half of the students. After a short delay, I rushed to make the extra copies needed for all the science students who asked. I encouraged the use of their cell/smartphones, but much to my dismay, they preferred to have the hard copies. I knew I had to take little steps to entice the students to engage in doing their assignments/activities on their cell/smartphones.

Another issue that came up, of which I let happen only once, was not going over the assignment before venturing outside. Once we were at the locations for the field-based curriculum, it took much more energy to draw the students back together to go over the specifications of the assignment. I learned very quickly to go over all the details before leaving the classroom and then be open for individual questions as the students explored their natural environment to complete their work. I also became aware of the drawback of how not having a control group or another class to compare my results with. While there were limitations in my research design I was aware of, this research still gave me insight into how the students performed, what they thought, and new ideas for

classroom strategies. The next section is a description of the outcome from the pre- and post-survey.

### **Major Learning Pre- and Post- Survey**

The outcome of the research was different than what I originally expected. My first reaction to my analyses of the data was that it did not support continuing the use of cell/smartphones in my science classroom. My reaction was based on the small amount of change in the answer from the pre- and post- survey data. My viewpoint for success was to have percentages increase across the board by twenty percent or more. This did not happen. However, my review of all the data collected, did support that the majority of the outcomes were positive and informative.

I focused my research on cell/smartphone use because the majority of the adult population owns one and a study by the Kalser Family Foundation (Using Cellphones in the Classroom, 2010) reported that, “85% of high school students own a cell phone” (¶ 9). One positive outcome of this capstone is the confirmation that in my science class 16 out of the 17 science students own a cell/smartphone and bring it to school. The high percentage of my students who had access to a cell/smartphone supported my decision to explore the possibilities and advantages of integrating them into my instruction and classroom environment. My pre- and post-survey also supported my decision to explore ways of integrating cell/smartphone.

The results from the pre-survey in the science class revealed that 52.9% of the overall students agree/strongly agree that the cellphone is their first choice for a learning tool. This result surprised me as I took it for granted that the percentage would be much higher from my observations of the students frequently using their cell/smartphone

during the science class for non-science work such as, texting friends, Skype, videos, etc. After the field-based curriculum study was completed the post-survey revealed that the students' attitudes in using their cell/smartphone as their first choice for a learning tool rose to 71.4%, resulting in a 18.5% increase in favor of using their cellphone/smartphone as a learning tool. This is a definite success even with an increase just under 20%. Another positive outcome supported by the analyses of the pre- and post-survey data was related to the use of cell/smartphones as a tool in field-based activities.

According to the pre- and post-survey there was an 11.7 % increase in the students who liked using their cell/smartphone during the field-based curriculum. On the pre-survey 24% of my students indicated that they liked using cell/smartphones. In the post-survey this increased to 35.7% indicating that they liked using cell/smartphones in a field-based curriculum.

Exposing the students to a field-based curriculum, as I expected, promoted a positive attitude toward being in nature. For example, in the pre- survey eight percent of my students indicated that they learn more about the natural environment by spending time in it. By the end of the research 12.6 % of the students indicated that they learn more about the natural environment by spending time in it. While this is not a huge increase it does provide evidence of my advocating for field-based opportunities for my students. Further as a teacher I enjoy and appreciate the benefits the natural environment has to offer and wanted to share my enthusiasm with the students.

My pre- and post- survey has provided me with a deeper understanding of how the integration of cell/smartphones can support me in sharing my enthusiasm for field-based activities. However, in addition to my data analyses I learned a great deal from

my informal observation of students during the research and these are described in the next section.

### **Positive Outcomes Revealed by Informal Observation**

Other areas in my research I consider small successes did not come from the data collected, it came from observing and interacting with the students. To start off the class I needed to have the students give me their email. I created a Google doc account for the science class. Each student put in their contact information on my computer to ensure I did not make errors in spelling. I sent them all a welcome and then had them send me their first assignment. I asked them an introduction question, “what was their favorite thing they liked about science.” I had 11 out of 21 students respond back to me within a day, which is approximately a little more than half of my class. For an alternative setting, this was a good start. A couple more students sent me responses by the end of the week.

I was thankful for the time spent before school started in the teacher’s workshops. My co-workers and I were instructed in Google docs and given hands-on activities/ examples to benefit our use of it in the classroom. The plethora of possibilities for using Google docs in any classroom is amazing. Moving forward as I become more confident in using Google docs, I will incorporate more lessons and/or activities. Most of my science students were familiar in using Google docs and have their own accounts set up. I think having my students use Google docs is a smart move due to the ease of access on any computer. I like the ability to share documents with all my science students or have an alternative assignment they could easily access on their own.

Another success I observed was when a student came to me and wanted another copy of a worksheet she had done. She wanted to redo the writing because hers was too

sloppy according to her own writing standards. Instead of copying off a hardcopy for her, I asked if she would text the answers on her phone. She thought it was a great idea. She redid her assignment on her phone and successfully emailed them to me. I was taken aback by her request.

I very rarely get a student to ask for a new worksheet so they can redo it. I can only remember one time last school year a student ask me that. The general conception about schoolwork is, “it is good enough.” I receive a lot of complaining if I ask a student to redo their work because I cannot read it. With the resistance I received from the class in doing work on their cell/smartphones this was a step forward. I thought this was a small success in the right direction, influencing one student at a time.

I could see by observing the students there was less resistance using cell/smartphones as the quarter moved forward. The more interacting the science students did on their phone, the more comfortable they became. When students came to ask me science questions, I immediately asked how they could find the answer instantly without a book. They would give me a funny look on their face and answer, “on my phone?” I would tell them to go ahead and start looking. Even at the end of the quarter, I still had students asking for permission if they could use their cell/smartphones in class. Old habits are hard to break, even for teenagers. While my informal observations of the students were valuable completing my capstone also helped me grow professional and better understand the trial and error process of integrating technology.

### **Integrating Technology: A Trial and Error Process**

During my research in the literature review, I discovered that using a cell/smartphone in the classroom is a fairly new concept. In an article by Kathleen Manzo

(2010), she identifies a problem faced by many teachers is not knowing how to use cell phones in the classroom. Manzo (2010) attributes this lack of knowing how to integrate cell/smartphones to teachers not having the appropriate education and/or support.

According to Manzo (2010) teachers who have had success with using cell/smartphones use mainly a trial and error approach. Reflecting on my research design I also used a trial and error approach that resulted in success but more importantly provided me with a deeper understanding of how to use these devices moving forward.

Using a new approach in the classroom comes with apprehensions. I wanted the cell/smartphones to be widely accepted, which would make using them as an educational tool easier. With any new idea and/or approach, there will always be doubts or what if? After diving into my research and trying different activities with the cell/smartphone, I will not hesitate to try other new things in the classroom. I would not have learned about my students, their likes/dislikes, or possibilities for integrating technology without taking that first step in doing my research.

One aspect of my research design or trial and error approach that did not work was the journal writing template that were part of my data collection. I included the journals to see if the students would increase their descriptive scientific observations during the capstone study in the fall grading quarter. Unfortunately there were too few journal entries completed to compare with each other. Even though the majority of the students in the capstone study did not complete journal entries I am not going to disregard the use of journal writing in the science class. As a result of my capstone my plan is explore how other teachers have used them and reintegrate the idea in future classes. I am not giving up on journal writing because writing is key to improving

observational descriptions in the science classroom. It builds vocabulary along with writing skills students can carry through to their next level of education.

Another lesson I learned as a result of my trial and error approach is that even though I did not achieve what I hoped to in my research, success does not always come in gigantic leaps but in small steps. Sometimes you have to take the little successes as a victory. The information and little successes I acquired as a result of completing this capstone project were and will be beneficial to my learning and teaching experience in moving forward.

Issues I and other teachers face daily in an alternative setting is getting students motivated about coming to school and doing their work to be academically successful on a daily basis. The diversity of the attitudes that my students have towards school, the incomplete work, missing assignments and the students' fluctuating attendance are concerns we face every day. Three of my science students involved in this research had such low attendance that they were put on a contract for academics and attendance. We use the contracts at our alternative setting to make the students conscious of their academics and/or attendance in hopes they will improve their situation. Unfortunately these students failed to commit to the attendance contract set up by the lead teacher and were moved to online classes outside of the seat-based setting in school.

As teachers we can only do so much for the students. I am willing to help every student who will meet me halfway. I cannot force them to do their work or do it for them. They need to decide that task on their own. My anticipation by introducing the cell/smartphone into the curriculum was that my students would become self-motivated to complete their assignments on their own.

### **Teacher's Responsibility in Working with the Digital Generation**

Jonathan Martin (2010) dubs today's society the "digital generation" (p. 1). All teachers, myself included, need to keep pace with technology advancement. This capstone has shown me ways I can keep pace with technology advancement, by building the use of cell/smartphones into the design and implementation of my curriculum. If I do not continue experimenting with integrating technology through the cell/smartphones, my students will be a step behind in our digital world and what it has to offer.

Not being a step behind the digital world is extremely important in the school setting where I work. My school has a small student population and a small budget. If I can provide them with lessons that incorporate today's cell/smartphones as a learning tool, they will be a step ahead in the digital world and experience some academic success, a success that some students rarely see. Providing my student's with all the advantages I can is important because many of them who come to our school have personal issues they are dealing with every day.

For example, I have students who are raising themselves because their parents chose not to be in their life. Some students are raising their younger siblings or are parents themselves, while others are floating from one friends house to another, working two jobs, trying to stay out of drug treatment facilities and trying to make a better life for themselves away from gang influence. The students who come through our doors have many problems and uncertainties about their future.

My capstone has provided me with data that by utilizing the students' cell/smartphones is a step in the right direction towards integrating technology and giving them an edge in the future. The research I did in the fall of 2015 was incredibly

educational for me. I look back at it as a learning experience with tools I can apply in the present and future. Just integrating cell/smartphones does not make it an automatic accepted learning tool to the students in a classroom. The way I approach integrating cell/smartphones will be at a gradual increased pace instead of full submersion from day one.

With regards to the diversity of students I have in aptitude and abilities, I will introduce new technology at a slower pace and familiarize the students with one concept at a time and break bigger projects into smaller ones. The student participants in this capstone love taking pictures with their cell/smartphones and are comfortable doing this inside and outside of school even on their own. In the future I will have students take pictures, print them out, and then move on to analyzing the contents of them. Then I can introduce to the students different types of data to observe and help them come to conclusions about the pictures and data they collected.

One concern that became apparent when integrating the cell/smartphone is that not all teachers might have the opportunity to use cell/smartphones in their classroom due to the schools policy and security for privacy. As technology moves forward, I believe there will be more apps directed toward teacher's lessons and activities, besides Google docs. Perhaps there will be programs in place by the academic year 16/17 school year for the teachers at our school to use.

The more other teachers and I implement the use of cell/smartphones in different activities and lessons in the classroom, the easier and more effective the cell/smartphones will become. Sharing lessons and/or activities through the Internet is an effective way to communicate what we learn and pass it on. The higher the number of teachers using

cell/smartphones in the classroom successfully, the more they will be accepted. The cell/smartphone will then become acknowledged as an educational tool in the academic world with no burden to the school's budget.

### **Recommendations for Additional Research**

Doing this research has opened up many new ideas I could use to refine my data collecting. I would like to, or encourage other science teachers, to replicate my research in another science class to find out if the results are similar or different and explore the reasons why. The results collected from a larger pool could strongly encourage the idea for other schools to integrate cell/smartphones in a field-based curriculum or other standard classroom.

Another recommendation I would do or others could do is to revise the pre- and post-survey to target the questions to focus on more direct answers. A piece of information I would have liked to have gained is what apps students use on their assignments and/or projects, not just how many. This could pave the way for teachers to introduce new apps for the science classroom or even have the students recommend apps they like using and are familiar with. There are many possibilities to adapt my research or take it to a new level. I hope I planted a seed for other science teachers to use and grow with it by putting their own twist on it.

### **Communicating the Results**

Seeing the results from my data collected in the research project revealing themselves are exciting to see and should be shared. Working in a small school, the results will be easy to share and discuss with my co-workers. They have been supportive

in my adventure during my capstone and are always willing to discuss situations, ideas, and solutions.

In the state where I work there are conferences for teachers working in alternative learning. I like the idea you can go to one building and experience many different workshops throughout the day and walk away with new ideas. The more ideas or concepts teachers have in their back pocket, the more tools they have to create a successful classroom for their students and themselves. If the opportunity arose, I would consider sharing my research design and what I learned with others at the workshops. I would like to give back and share my discoveries with others as so many teachers before me has publicly shared theirs.

My journey through this exploration has opened my eyes to many new possibilities for myself in my teaching methods and for strategies I can utilize for my students. In closing, I would like to share the following Chinese proverb that for me expresses how the most effective natural learning processes takes place for students and adults.

Tell me and I will forget.  
Show me and I will remember.  
Involve me and I will understand.  
Step back and I will act.

Chinese proverb

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## APPENDIX A

## 2016 Fall Quarter Biology Curriculum Topics

- I. How the Ecosystem Works
  - A. Community Interactions
    - a. Characteristics of Living things
    - b. Energy Flow in the Ecosystem
    - c. Food Chains/Food Webs
    - d. Keystone species
  - B. Ecosystems
    - a. Freshwater: ponds, lakes, wetland
    - b. Prairie
    - c. Woodland
- II. Ecosystems
  - A. Habitats
    - a. Habitat & Niche
    - b. Cloning ancient trees
    - c. Ecological succession
  - B. Environmental stresses
    - a. Population density
    - b. Predation/starvation
    - c. Air quality

## APPENDIX B

## Pre- and Post-Survey

## Pre-Unit Survey -Cell Phone Use

Cell phone use: Check appropriate answer		
A. Questions	Yes	No
1. Do you own a cell phone?		
2. Do you bring a cell phone with you to school?		
3. Do you like using your cell phone better than a desktop or laptop computer in class?		
4. Do you like doing schoolwork on your cell phone?		

B. Statements				
Check the best response	Response			
	Strongly Disagree	Disagree	Agree	Strongly Agree
1.I use my cell phone most often to access the internet.				
2.I use my cell phone most often for texting.				
3.Having access to my cell phone helps me learn better.				
4.Using my cell phone on my assignments helps me complete them all the time.				
5.Using my cell phone on my assignments helps me complete them most of the time.				
6.I feel I can accomplish more schoolwork using my cell phone.				
7.I feel I am more organized using functions/apps on my phone				
8.I am most comfortable using my cell phone instead of a computer to do my schoolwork.				
9.The cell phone is my first choice to use as a learning tool, such as research, outside of school.				
10.Using my cell phone in class keeps me current on environmental topics.				
11.I like being in the outdoors?				
12.I think cell phones should be integrated into a field-based curriculum (labs/activities outside)?				
13. like learning in an outdoor class more than an indoor class?				
14.I would learn more about the natural				

environment if more class time were spent outdoors?				
15. I would learn more about the natural environment if I could use my cell phone in outdoor labs/activities?				

C. Statements Mark the best answer							
Statement	0	1-2	3-4	5-6	7-8	9-10	11 or more
	1. How many times during the school day do you use your cell phone?						
2. How many times during the science class do you use your cell phone (for anything)?							
3. How many times during the science class do you use your cell phone just for science related things?							
4. How many different apps do you use on your cell phone outside of class for your personal use?							
5. How many different apps do you use on your phone for your science class?							

Essay questions:
1. I use my cell phone mostly for:
2. How important to your learning do you feel having access to use your cell phone is (do you learn better from using your cell phone)? Explain:
3. Would you like to have a science class during the school day that spent more time learning in the outdoors using your cell phone? Explain:
4. What do you hope to learn in the science class?

Post-Unit Survey  
Cell Phone Use

A. Questions Check appropriate answer	Yes	No
1. Do you own a cell phone?		
2. Do you bring a cell phone with you to school?		
3. Do you like using your cell phone better than a desktop or laptop computer in class?		
4. Do you like doing schoolwork on your cell phone?		

B. Statements Check the best response	Response			
	Strongly Disagree	Disagree	Agree	Strongly Agree
1. I use my cell phone most often to access the internet.				
2. I use my cell phone most often for texting.				
3. Having access to my cell phone helps me learn better.				
4. Using my cell phone on my assignments helps me complete them all the time.				
5. Using my cell phone on my assignments helps me complete them most of the time.				
6. I feel I can accomplish more schoolwork using my cell phone.				
7. I feel I am more organized using functions/apps on my phone				
8. I am most comfortable using my cell phone instead of a computer to do my schoolwork.				
9. The cell phone is my first choice to use as a learning tool, such as research, outside of school.				
10. Using my cell phone in class keeps me current on environmental topics.				
11. I like being in the outdoors?				
12. I think cell phones should be integrated into a field-based curriculum (labs/activities outside)?				
13. I like learning in an outdoor class more than an				

indoor class?				
14.I would learn more about the natural environment if more class time were spent outdoors?				
15.I would learn more about the natural environment if I could use my cell phone in outdoor labs/activities?				

C. Statements							
Mark the best answer							
Statement	0	1-2	3-4	5-6	7-8	9-10	11 or more
	1.How many times during the school day do you use your cell phone?						
2.How many times during the science class do you use your cell phone (for anything)?							
3.How many times during the science class do you use your cell phone just for science related things?							
4.How many different apps do you use on your cell phone outside of class for your personal use?							
5.How many different apps do you use on your phone for your science class?							

Essay questions:
1. I use my cell phone mostly for:
2. How important to your learning did you feel having access to use your cell phone in this class was (did you learn better from using your cell phone)? Explain:
3. Would you like to have a science class during the school day that spent more time learning in the outdoors using your cell phone? Explain:
4. What did you hope to have learned in this science class?

5. What were your most favorable experiences with this class?
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6. Would you take another science class knowing you could use your cell phone as a learning tool? Explain:
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## APPENDIX C

## Journal template used in field-based curriculum

## Journal

Name: \_\_\_\_\_

Date: \_\_\_\_\_

Title (optional): \_\_\_\_\_

Class: \_\_\_\_\_

Questions/Summaries	Notes
6. Describe area (wooded, aquatic, open/grass, etc.)	
7. Weather (clear, cloudy, drizzle, cool, warm, hot, etc....)	
8. Points of interest: what stands out for you? Why? Describe:	
9. New things you discovered?	
10. Vocab: New words you came across	

Summary/Reflection: This is open to your thoughts and ideas. Following are a few questions for guidance if you are having trouble. **USE THE BACK OF THIS PAPER IF YOU NEED MORE ROOM!!!**

- What are your thoughts on today's activity? Was it interesting/boring? What did/didn't you like about the assignment or area? Would you change anything?

## APPENDIX D

## Informed Consent

## To Parents/Guardians Requesting Permission for Minors to Take Part in Research

September 8, 2015

Dear Parent or Guardian,

I am your child's science teacher at [*name of the school -- omitted to protect confidentiality*] and a graduate student working on an advanced degree in education at Hamline University, St. Paul, Minnesota. As part of my graduate work, I plan to conduct research in my classroom during the first quarter of the school year 2015-2016. I have received approval for my study from the School of Education at Hamline University and from the principal of [*Name of Principal and School- omitted to protect confidentiality.*] The purpose of this letter is to ask your permission for your child to take part in my research.

In my science class students participate in outdoor lessons and activities. In the past I have not included cellphones/smartphones as a learning tool when outdoors. However, with the majority of teenagers owning a cellphone/smartphone, a mini computer in their hands, it is important to explore how they would use it if given the opportunity. In this study students will have the option to use their cell phone to complete field-based activities. Students will be encouraged to use their cell phone to record data or take notes and take pictures of the field-based activities and the site. Students who do not want to use their cell phones will be provided with a field notebook as has been done in the past.

I will start my research by having the students fill out a survey about their use of cellphones/smartphones. This will identify their knowledge level and awareness of cellphones/smartphones use. I will conduct my science class as usual with outdoor lessons and activities but the students will have the option to use their cell phones to record, photograph, and document data at various sites to be further researched back in the class. For students who do not wish to use their cellphones/smartphones to complete the activities will use other tools that I provide such as a field notebook. At the end of the quarter, I will be submitting another survey to compare students' before and after levels of cellphone/smartphone use in their natural environment.

There is little to no risk for your child to participate. All results are confidential and anonymous. I will not record information about individual students, such as names, nor report identifying information or characteristics in my research. Participation is voluntary and you may decide at any time and without negative consequences that information about your child will not be included in the capstone.

This research is public scholarship and the abstract and final product will be cataloged in Hamline's Bush Library Digital Commons, a searchable electronic repository. My results might also be included in an article for publication in a professional journal or in a report at a professional conference. In all cases, your child's identity and participation in this study will be confidential.

If you agree that your child may participate, keep this page. Fill out the duplicate agreement to participate on the following page and return to me. You can return the form by mail, fax, or your child may return the form to me no later than September 14, 2015.

Sincerely,

Cindy Hougo

[Contact information deleted for confidentiality]

### Informed Consent to Participate in Research

I have read your letter about your study to provide students the option of using their cell phone to complete field-based activities that are part of a science unit you are teaching. The student is to allow students the option of using their cellphone/smartphone to record data or take notes and take pictures of the field-based activities and the site. Students who do not want to use their cellphones/smartphones will be provided with a field notebook as has been done in the past. As part of the research students will complete a pre- and post- survey about their use of cell phones. I understand there is little to no risk involved for my child, that his/her confidentiality will be protected, and that I may withdraw or my child may withdraw from the project at any time.

Parent/Guardian Signature \_\_\_\_\_ Date \_\_\_\_\_

Parent/Guardian Copy – Please Keep

### Informed Consent to Participate in Research

I have read your letter about your study to provide students the option of using their cell phone to complete field-based activities that are part of a science unit you are teaching. The student is to allow students the option of using their cell phone to record data or take notes and take pictures of the field-based activities and the site. Students who do not want to use their cell phones will be provided with a field notebook as has been done in the past. As part of the research students will complete a pre- and post- survey about their use of cell phones. I understand there is little to no risk involved for my child, that his/her confidentiality will be protected, and that I may withdraw or my child may withdraw from the project at any time.

Parent/Guardian Signature \_\_\_\_\_ Date \_\_\_\_\_

Researcher Copy