USING BLOGGING TO INCREASE SCIENCE CONTENT KNOWLEDGE AND

TRANSFER

by

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a master's degree at Montana State University, I agree that the MSSE program shall

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DEDICATION

I dedicate this Capstone paper to my mother, Judith Alexander, and father, Clifford Alexander, who instilled in me a strong work ethic, perseverance, and the understanding of the importance of a good education. I would also like to dedicate this to my husband, Richard, and my sons, Joshua, Nate, and Dickie, who supported me during my education and endured the good and the bad through this process. I also dedicate this to my mother- and father- in law who were constant cheerleaders throughout my schooling.

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ABSTRACT

This study looked at using blogging in the general science classroom to increase the acquisition of science content knowledge and transfer. Research questions considered blogging as it relates to increased critical thinking skills along with improved acquisition and transfer of content knowledge. Other considerations included improvement of test scores due to blogging and the impacts of blogging on teachers, both positive and negative. The participants of this research project were forty 5th grade students at a small rural school in Maine. Methods consisted of implementing a classroom blog with strict guidelines in one group of nineteen students while not implementing the same for the second group of students. All other methods of teaching, including lecture, discussion, labs, and text readings were the same. Data collection and analysis included classroom observations, student surveys, teacher reflection, student reflection, and classroom assessments.

INTRODUCTION

Houlton Southside School is located in Houlton, Maine, a rural town of roughly 10,600 people located in the mid-eastern section of Aroostook County, bordering Canada. The school has 282 students in grades 4-6 and is part of the Regional School Unit (RSU) #29 district, with 1303 students, of which 87% are white, 10% American Indian, 1.5% Hispanic, and less than 1% are African American or Asian. Of the students attending Houlton Southside School, 49.9% are eligible for free or reduced price hot lunch.

Local testing data from previous years show that students at Houlton Southside School have had limited exposure to critical thinking skills, which might be the result of focusing more on content instruction and less on skill-building. As a district, we have adopted the Common Core Standards in Math and English Language Arts to ensure excellence in content alignment. Because the Common Core Standards do not include Science standards, and we would like all students to be prepared for what lies ahead for Science and Technology as well, we are in the process of aligning our science curriculum to the Next Generation Science Standards. At Houlton Southside School, we want our students to be self-directed, lifelong learners. To accomplish this, I integrated blogging with instruction into my science classes to develop, foster, and maintain critical thinking skills through the acquisition and transfer of content knowledge in the science classroom. Establishing an environment in which students feel free to express ideas, explore alternatives, and devise solutions, is crucial in creating a learning environment that fosters critical thinking skills.

Transfer of knowledge occurs when automaticity of knowledge is gained, and students can apply learning from one problem-solving situation to another problem-

solving situation (Oregon Technology in Education Council, 2000). My capstone project

focused on the impact of classroom blogs on content knowledge retention and the transfer

of that knowledge. My intervention was to develop a blog for classroom use and hold

discussions concerning science content on the blog. In doing so, the students' critical

thinking skills were fostered as they analyzed scientific situations, and wrote to explain

their understandings. The main purpose of the research was to find out: How does

blogging contribute to building critical thinking skills among students and what effect

does it have, if any, on knowledge acquisition and transfer? Sub questions included:

What characteristics make a blog successful for increasing content knowledge

acquisition? What critical thinking skills do students need to develop in order to transfer

content knowledge to real-life situations?

The participants in this intervention were members of the 5th grade class in the

school year 2013-2014. There were two classes of 19-21 students each, one of which was

the prescriptive group for the Environments unit, while the other group was control for

the same unit. Each class met three times per week, with variation in class time of only 5

minutes, for a total of 2 hours and 40 minutes a week, and contained heterogeneously

grouped students including special education students and average students. There were

no identified gifted and talented students in either group. The total intervention and data

collection period for this project was about eight weeks.

CONCEPTUAL FRAMEWORK

According to a National School Board Association survey conducted in 2010, an

overwhelming 96% of 9-to 17-year olds who have Internet access use social networking

technologies, such as blogging, texting, chatting, and instant messaging (Sawmiller,

2010). Teachers have the opportunity to expand their teaching styles and methodology to incorporate more aspects of learning because of student proficiency in the digital world and expanding access to technology. One way in which teachers can incorporate web tools into their teaching is through a blog.

Web blogs are tools that serve as online journals that contain text, audio files, video postings, and links to other pages that pertain to a particular subject (Colombo, 2007). Web logs, abbreviated to blogs, can be valuable assets to any classroom, with guidance by a teacher. The use of blogs, known as "blogging", can work to supplement classroom texts, incorporate a wider variety of teaching styles to create differentiation opportunities, increase excitement for students, and create a safe place for students to express knowledge and opinions, as well as increase critical thinking skills. There are four main types of blogs utilized in classrooms: teacher-communication blogs, dialogue-generator blogs, student blogs, and teacher blogs (Leight, 2008). Primarily teachers utilize teacher-communication blogs in order to communicate with other adults. Dialogue-generator blogs are used to create dialogue among a particular group of people on specific topics. Student blogs are used mainly by students to communicate with one another about a variety of topics and are often created by students themselves. Teacher blogs are mainly created and maintained by teachers, but aimed at getting students involved in conversation about classroom topics. In order to obtain the information I am interested in, the nature of this research lends itself best to the dialogue-generator blog, which is one that generates discussion regarding a specific topic, resulting in student reflection.

Blogging represents a new kind of space for learning that connects the traditional classroom experience to opportunities for discussion, exchange of passions among students, teaching others, as well as learning from others beyond the classroom (McGrail 2011). When students have access to the Internet, classroom content moves far beyond the four walls of a teacher's realm. Blogging helps to focus the educator's outreach for students, and supplement the materials available within the classroom. By creating links to content, designing visual and audio content, and providing text and a space to respond to that text, students are empowered in their own learning.

Blogging promotes a variety of content interactions, thus meeting the needs of differentiation in a classroom. Blogs contain audio content to support auditory learners, video and text to support visual learners, a community of posts to reinforce content for social learners, links to outside content to engage logical learners, and a safe environment to express ideas to support the solitary learner (Sawmiller, 2010). Through blogging, students gain a valuable way to gain content knowledge, break down barriers between minds and conflicting personalities in the classroom, move beyond the impasse of apathy, and continue on to logical deduction within and about major concepts (Glassman, 2011).

Critical thinking skills are an integral part of any science classroom. Teachers work to increase the ability of students to use critical thinking skills beyond the four walls of the classroom. Blogging offers another opportunity to achieve this goal. Blogs offer an extension of how human minds connect and weight different pockets of information. Community knowledge-building is only a part of blogging potential; how we learn and solve problems are critical aspects of this process (Sawmiller, 2010).

According to Duda (2008), students who use blogs regularly feel more empowered in their own learning. When students feel they are in charge of their own learning, they become more engaged in the process. A study conducted in a high school physics class showed a correlation between participation in the class blog and the final course grade. This was a class that required a significant amount of outside reading to be able to participate in a meaningful way during lessons. The blog was not a mandatory aspect of the class, but students who participated in the blog showed an overwhelmingly positive attitude toward physics as a result of their participation (Duda, 2008). In a study by Mcgrail (2011), students typically began the blogging process weakly, concentrating on the teacher as the audience, therefore only considering their own needs as learners, and not considering the needs of readers. As time progressed, however, students acknowledged their full audience, became powerful participants, and began taking ownership of their own learning (McGrail, 2011). Students in Shana's study (2009) were required to read and respond with text to questions posed by the instructor, as well as peer posts. According to this study done involving university freshman students, blogging increased test scores significantly, when compared to those of students using only a traditional textbook (Shana, 2009).

According to Luehman (2008), students who participate in classroom blogging increase content knowledge and retention of concepts. Classroom blogs create opportunities that allow teens to engage themselves in conversations, thus further developing metacognitive skills in an online environment. Careful consideration should be taken when implementing blogs into any classroom. Teachers need to be aware of the obstacles as well as the advantages of blogging in the classroom. Support of teachers and

students, access to technology, student safety, time constraints, and student expectations

are some obstacles that should each be examined when utilizing a classroom blog.

Teachers and students need support when using blogging as a teaching and

learning tool, especially for the first time. A discussion forum-learning environment

requires careful and complete preparation for the effective experience where students

become the focus and thus play an active role in the teaching process. Because the

classroom blog is required to be a learner-centered, task-oriented, non-threatening, safe

space where students can ask and express feelings and convey ideas openly and freely,

teachers must put in a fair amount of time beyond classroom time to ensure all of these

things take place (Shana, 2009). Classroom blogs must be viewed and critiqued for

pedagogical usability to ensure differentiation for students, without creating a

replacement for classroom textbooks (Hadjerrouit, 2010). Time consumption is the major

concern teachers must consider when creating classroom blogs; formatting content-area

material into an online format for all learners and evaluate its effectiveness through

formative assessment is a vast undertaking. Therefore, professional development and

administrative support are key factors in success of implementing blogging in a

classroom setting. Schools need to access highly qualified teachers to train, create, and

use blogs with students (Colombo, 2007).

Another consideration is access to technology. Though a large percentage of

homes and schools now have access to computers and the internet, thus making digital

content more accessible, teachers must be careful to not make content solely available in

an online format. Internet use is complex and varies in implementation and impact; for

blogging to be used effectively, it may place unexpected demands on the teacher using it in the classroom (Wallace, 2004).

Student safety is a major factor that must be recognized when implementing a classroom blog. It is critical to recognize the Family Educational Rights and Privacy Act regarding publishing work of minors, including photographs of students, student work, and identification of students by first or last name (Sawmiller, 2010). Different school districts have varying plans concerning how to protect the privacy of students and their identifying criteria. Some require extensive training, while others have policies and forms regarding coding student work, photographs, and names.

Expectations of students and the role of the teacher should be clearly defined before beginning a classroom blog. Students, at least in the beginning stages, will need much teacher guidance and modeling to ensure a positive, responsible, and effective use of the blog for science content learning. In one study, Hungerford-Kresser suggests that students should be not only allowed, but required to respond to teacher posts with more than just text (Hungerford-Kresser, 2011). Other ways that students can respond are labeled digital diagrams using Word or Google, audio files uploaded to the blog, or video files uploaded to the blog.

Blogging in the classroom provides improvement of content retention when used to supplement traditional classroom content delivery (Luehman, 2008). Because students are generally familiar with digital content, implementing a blog, with solid guidelines and direction from the teacher is the next logical step in meeting the learning needs of a diverse group of students in an ever-evolving classroom. The blogging experience spans

far beyond the reaches of the typical classroom, and causes students to be self-directed, life-long learners in a world that expects nothing less.

METHODS

My project took place during the Environments unit, which covered the topics of: terrestrial, aquatic, and subterranean environments, the role of water in our environment, the importance of variety of biotic and abiotic factors in an environment, and the balance among biomes. My intervention included a classroom blog incorporated into my science curriculum that was intended to enhance content knowledge retention and transfer while developing critical thinking skills. I set up a classroom blog on Kidblog, hosted by Kidblog.org, which provides a safe, secure blogging environment for teachers and students. During the intervention, students in my treatment class visited the classroom blog two times per week, both in school and out of school to post on assignments, answer poll questions, and discuss forum topics. The blog was designed to create a learning environment that fostered critical thinking skills. The research methodology for this project received an exemption by Montana State University's Institutional Review Board and compliance for working with human subjects was maintained.

The students in my control group (N=21) consisted of 24% special education students and 76% regular education students. This group consisted of 5% American Indian and 95% Caucasian. In my control group, males and females were fairly balanced, with 48% girls and 52% boys. The students in my treatment group (N=19) consisted of 26% special education students and 74% regular education students. This group consisted of 5% American Indian students and 95% Caucasian students. The treatment group

comprised 53% girls and 47% boys. There were no students identified as gifted and

talented in either group. Table 1 shows the demographic information for the groups.

Table 1
Demographics of Nontreatment and Treatment Groups

Race

Nontreatment Group (N=21)		Treatment Group (N=19)	
American Indian	Caucasian	American Indian	Caucasian
5%	95%	5%	95%

Gender

Nontreatment Group (N=21)		Treatment Group (N=19)	
Female	Male	Female	Male
48%	52%	53%	47%

Education Services

Nontreatment Group (N=21)		Treatment Group (N=19)	
Special Education	Regular Education	Special Education	Regular Education
24%	76%	26%	74%

I created a Student Familiarity Survey to gauge students' familiarity with

blogging and to find out how well they understood what was expected of them in terms of

blog posts. Students were familiarized with the format and purpose of the science

classroom blog, and given time to explore the blog and ask clarifying questions. Before

students began blogging, examples of acceptable blog posts were modeled in class. We

discussed elements of a standard blog post, including proper grammar and sentence

structure. As a class, we established guidelines for posting to the blog, specifying that:

each student must contribute to the class blog a minimum of 2-3 times per week, each

post had to be approximately 100 words or in the designated alternative form, and each post must remain on the topics covered in class. Alternative forms of blog posts were: drawing an explanation using ArtStudio on their iPads, recording reflective thoughts using GarageBand, or creating a chart of data, and uploading that to the blog. Students were required to incorporate at least one other method besides writing into at least one blog post. As a class, we also remained clear about unacceptable blog posts, such as "Hey, what's up?" or "Do we have practice tonight?"

Parameters were also set for timing of blog posts. Students were to post before the end of class periods when instructed. Because my science classroom is set up to accommodate centers, blogging became a natural center and students spent time blogging during class. On the days we did not meet together, students were allowed library or computer lab time, and, those students with access, could post from home as well.

Each week, for the duration of the Environments unit, students in the treatment class were responsible for answering questions concerning content from the week's lessons, and posting responses to at least 2 other student-generated blog posts. At the end of each week, students also answered a prompt about the lab performed that week. We supplement our science material with Full Option Science System kits, or, FOSS, which provide activities that students perform to gain experience with science content. The students in the treatment group were engaged in discussion on the blog about science content, while the control groups used science journals and traditional paper-and-pencil methods without online discussion. Questions that students were required to answer on the classroom blog ranged in Marzano's Taxonomy (Appendix A), and were designed to scaffold their learning:

•"Explain how you would show that the atmosphere composition includes condensed water. Use details from Monday's lab."

•"Predict what would happen to living things if the atmosphere were to diminish."

•"Identify two reasons the water is important to maintaining life on Earth."

•"Describe 3 different terrestrial environments, several biotic and abiotic factors of those environments, and how the abiotic factors affect the biotic factors, citing specific examples."

The questions that students answered were developed using Robert Marzano's Proficiency Scale Bank to prepare for our district's adoption of Next Generation Science Standards while moving toward standards-based learning. Through the classroom blog, students met standards such as, "Analyzing and interpreting data", "Constructing explanations (for science) and designing solutions (for engineering)", "Engaging in argument from evidence", and "Obtaining, evaluating, and communicating information" (National Academy of Sciences, 2011).

Though the research I read did not explicitly consider the social aspects of blogging, it is apparent that student interactions are an integral part of blogging activities. The classroom blog included embedded links and activities that required students to have discussion about those activities. For example, an online activity concerning the baobab tree and its adaptations to its environment was posted for students to analyze and synthesize an organism's ability to adapt to its environment over time. During the unit, students in the control group had access to the same activities through Portaportal (www.portaportal.com), but did not use blogging discussion techniques when answering content questions. All students were required to complete pre- and post- assessments included in the FOSS program.

Both the students in the control group and the students in the treatment group were expected to meet or exceed specific Next Generation Science Standards when answering science content questions, since our district is working to align these with our curriculum. Students were also expected to meet or exceed the Common Core English Language Arts Standards and were expected to integrate content knowledge through literature in posts as well. The literature was comprised of magazine articles, online texts, and nonfiction leveled readers.

Data collection tools were utilized throughout the intervention time and began with the Blogging Familiarity Survey, which students in the treatment group submitted on paper. Student attitude surveys were given periodically, once at the beginning, once in the middle, and once at the end of the intervention in order to gauge whether or not there were changes in how students felt about the impact of blogging on their own learning. Once per week, students were required to write reflective blogging entries concerning the content from that week's activities. In order to track student learning in quantitative data, students were given beginning and final assessments concerning the content learned and the treatment group's data was compared to the non-treatment groups' data. Exit slips were also utilized periodically for all groups as students moved through the science content. Teacher observations were written every two days concerning the quality and content of the blogging entries, using the rubric supplied to the students. The FOSS-provided assessments and lab assessment data was collected and compared between the treatment and non-treatment groups. In order to gauge the impact on the teacher, pre-and post-surveys, teacher reflective journal entries, and a post-treatment interview were assessed. The data collected is shown in Table 2.

Table 2
Data Triangulation Matrix

Focus Questions	Data Source 1	Data Source 2	Data Source 3
Primary Question:			
1. Does blogging increase content knowledge acquisition and transfer?	Exit slips	Pre- and Post-assessments	Student pretreatment journal entries on content acquisition and post-treatment journal entries on content acquisition attitudes
Secondary Questions:			
1. What is the effect of blogging on building critical thinking skills?	Teacher observation using rubric for online blogging entries	Student interviews	Blogging reflections and student attitude surveys
2. Do student attitudes about blogging affect critical thinking skill – building?	Teacher observation and online blogging entries	Pre and post student attitude surveys	Post-treatment student interviews

The variety of data collection tools used in the intervention was designed to gather multi-faceted information and capture the essence of what students in the intervention group learned through blogging. Objective summative data does not complete a picture in and of itself, so subjective data was also collected in the form of student interest, student attitudes, informal anecdotal notes, and student interviews.

In the first week of the intervention, students were given a familiarity survey to determine whether or not they had been exposed to blogging prior to treatment. According to the Familiarity Survey results, 58% of students were unfamiliar with blogging altogether, 26% of students felt "a little familiar", 11% wrote that they were "very familiar" with blogging, and 5% were unsure how to answer that question. There was a common thread among the 11% that claimed familiarity in that those students

asserted that they had blogging practice on sites such as Facebook and Instagram. I wanted to make sure students had an idea about what blogging was, and we cleared up misconceptions by working on some practice blogging questions. Students signed in to their Kidblog accounts and I modeled a blogging entry as it was projected at the front of the room. Students used the blogging entry rubric to critique my entry, and then practiced blogging with one another for the remainder of the first class. One unexpected glitch was that, in order for students to respond to other students' posts, I had to approve all posts as they were written because I was the facilitator of the group. This proved to be time-consuming at first, but became less laborious as I became familiar with the process. Blogging with future classes, I will choose a different blogging forum, as the approval is required in the free Kidblog forum.

DATA AND ANALYSIS

Students at Southside School, having limited exposure to blogging were the prefect candidates for this study. The data collection answered my questions, then raised a few new ones that I had not previously considered.

The impact of blogging on acquisition of science content knowledge was positive. Students in the treatment group (N=19) showed a 40% increase in test scores between the pre and post-tests while the non-treatment group (N=21) showed only about a 13% increase in test scores over the same period. Basic content knowledge, as measured through the multiple choice portion of the assessments showed an average increase of 21% for the treatment group, while the non-treatment group showed an increase of only 8% on average. When I compared the short-answer portion of the test, which required critical thinking skills through application of the content knowledge, students in the

treatment group showed a 39% increase in learning as a class average while the non-treatment group averaged increased scores of only about 25%. This shows that by developing those critical thinking skills through blogging, students in the treatment group were able to apply those skills and increase scores compared to their non-treatment counterparts.

The development of critical thinking skills improved over time through the blogging. At the beginning of treatment, student answers to questions were content-related without application. As discussion through blogging became more comfortable and students began to explore other ideas with one another through the blog, their posts began to show more application of ideas along with being content-specific. Figure 1 shows a student post response at the beginning of treatment, and Figure 2 shows a student post response at the end of the treatment period. For consistency, the same student posted in both figures.

February 26, 2014 at 12:43 PM
Three things that I think of when I hear terrestrial environments are outside, camp, and the ocean. Three materials that I think of are dirt, sand, and water.

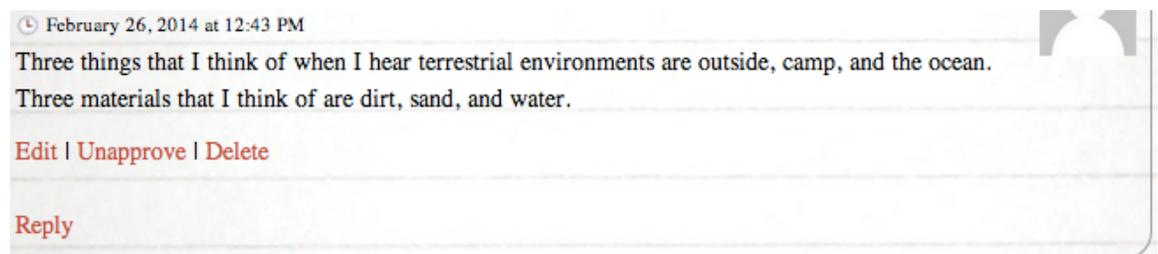Edit | Unapprove | Delete

Reply

Figure 1. Student Blog Post Near the Beginning of Treatment Period.
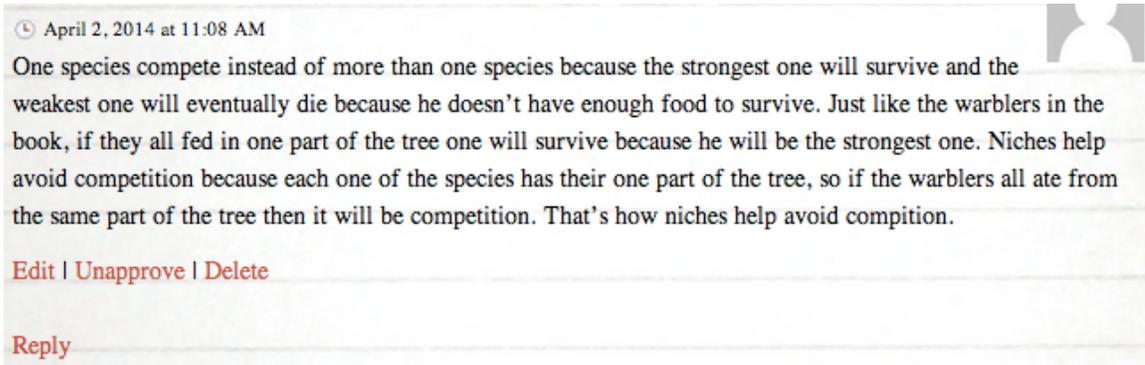
Figure 2. Student Blog Post Near End of Treatment Period.

Development of critical thinking skills was apparent when comparing blog posts of the treatment group to the written answers of students in the non-treatment group as well. Student answers in the non-treatment group tended to have single-word answers and did not apply the science content to situations presented in writing, whereas blog posts of students in the treatment group exhibited application of that content knowledge. Figure 3 shows the question presented, while Figure 4 shows a non-treatment group (N=21) student answer in writing, and Figure 5 displays a treatment group (N=19) student answer in a blog post.

Figure 3. Question Presented to Students in Both Treatment and Non-treatment Groups.
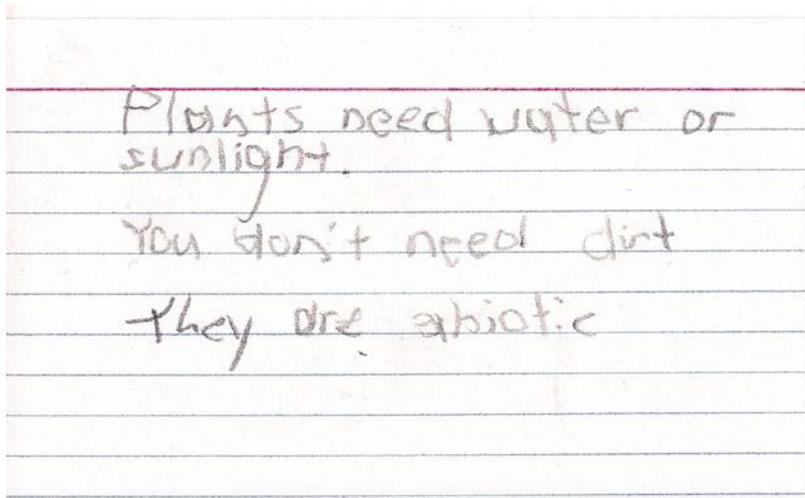
Figure 4. Student Answer from Non-treatment Group.
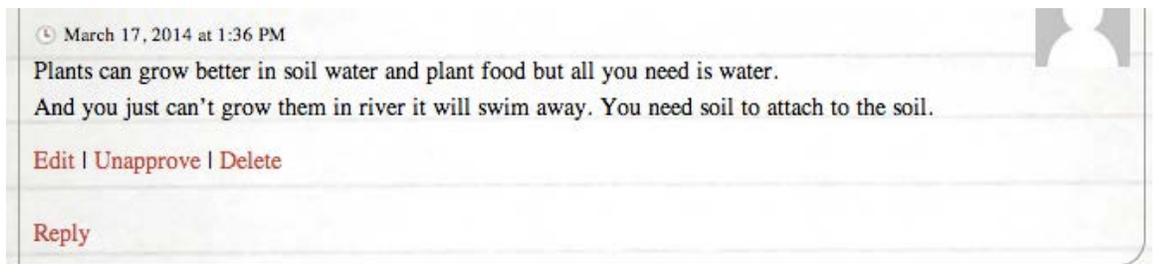
Figure 5. Student Answer from Treatment Group.

Figure 4 shows a student from the non-treatment group answering the basic

question, without demonstration of critical thinking skills. Though the answer is content-

accurate, there seems to be no critical thinking applied. Although the answer given by the

student in the treatment group in Figure 5 inaccurately describes the plant as "swimming"

away, this student shows the use of critical thinking skills as applying reasoning that

though plants don't "need" soil, the roots of plants anchor themselves to soil.

In performing an unpaired t-test, using the online tool "Quickcalcs", developed by

Graphpad Software, the results comparing the groups before intervention showed as

statistically insignificant, while post intervention showed as statistically significant. Prior

to the intervention, students' average scores on the pretest were 24.36% with a standard

deviation of 19.684 for the non-treatment group and 23.361% with a standard deviation

of 16.761 for the treatment group. The t-test results showed that the difference between

the two groups was not statistically significant, t=0.1720, p=0.8643. Post-test results for

the non-treatment group were a mean of 37.32%, with a standard deviation of 24.931.

The post-test results for the treatment group were a mean of 55.689% with a standard

deviation of 21.379. According to the t-test, the difference between the two groups

showed an increase that was statistically significant, t=2.4882, p=0.0173. This

demonstrates that though the two groups started out without much statistical difference,

the treatment group made greater gains in their learning of science content.

Exit slips were also utilized to gather evidence of gains in content knowledge and

critical thinking skills. Figure 6 below shows a sample answer on an exit slip from a

regular education student in the non-treatment group. Figure 7 below shows a sample

answer on an exit slip from a regular education student in the treatment group.

List three ways that species can disperse:
1.wind
2. water
3. living things
Explain how mountain ranges and climate can each limit a species' distribution.
The mountain has 3 different climates. Some animals can't adapt to all three.
Give an example of a physical barrier. How might it affect where a species is found?
A lake. Some fish can't be in cold water or warm water. Fish are limited on how they can get in or out.

Figure 6. Student Response on Exit Slip, Non-treatment Group.

> *List three ways that species can disperse:*
> **1.wind**
> **2. water**
> **3. living things**
> *Explain how mountain ranges and climate can each limit a species' distribution.*
> **Mountain ranges and climate can each limit a species distribution by A.)Mountain ranges go up higher and higher, and the higher you get, the colder it gets so a mosquito wouldn't be able to survive in a higher range. B.) Climate is overall weather so if there is not a lot of water, then cactus might be able to live there, but other plants would not survive there.**
> *Give an example of a physical barrier. How might it affect where a species is found?*
> **If all elephants live in Africa and they want to go to North America, the Ocean would be a physical barrier. It would affect where a species of elephants live.**

Figure 7. Student Response on Exit Slip, Treatment Group.

The student responses in Figure 7 show a much more thought-out reasoning than do the student responses in Figure 6. The student's answer shown in Figure 7 implies that information and connections to discussions between classmates through blogging impacted learning. The non-treatment group did not have the opportunity to use blogging to discuss the topics in previous activities, while the treatment group did have opportunities to use blogging to discuss the topics with one another. During Kidblog discussions, students prompted one another to "explain a little more about that", or commented approval with, "I hadn't thought about it that way." Students also were willing to respond to one another's feedback and modify posts accordingly. Student responses were typically content-related in the beginning, but became increasingly more thoughtful toward the end of the treatment period.

In general, students had a positive attitude about blogging. Of the students in the treatment group (N=19), 68% felt that blogging helped them remember science content and think about science differently, according to the Post-Student Interviews. Students

were posed the post-student attitude survey item, "I believe blogging is an easy classroom tool to use. (Explain) why or why not"? Students made comments like, "…you can learn to explain in blogging", "…because you can reply to others and have a conversation", and "…you just have to type what you think and others can tell you what might be wrong". A few students found blogging to be "confusing" and "frustrating". The general consensus of positive attitudes seemed to have an impact on their learning through blogging.

The post-student interviews were also very telling about student attitudes about blogging and whether or not they felt they had built critical thinking skills. All but one student felt that blogging helped them remember science information and apply it later (N=19). According to the interviews, students felt that a combination of tools, including blogging, helped them understand the science content and apply that knowledge. While the lab experiments let students "see what was happening", the blogging helped them "understand why the lab worked the way it did", and "get information that wasn't clear with just the lab." According to question 2 on the Post Student Interview, students in the treatment group (N=19) felt that blogging with classmates helped them learn and remember science information. Figure 8 below shows the results from that question.
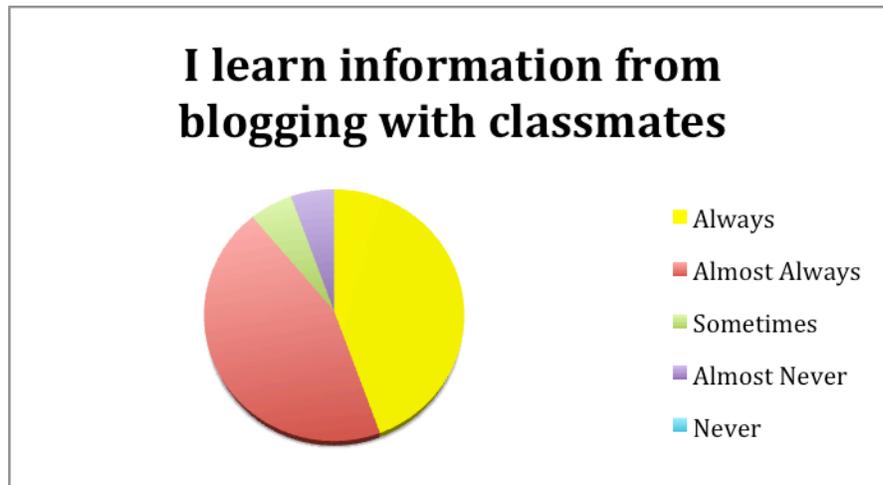
Figure 8. Results from Question 4 on the Post-student Attitude Survey, (*N*=19).

Post-student interview data also indicated that students with special needs in reading had more difficulty with blogging than did students considered average. Students need to have strong comprehension skills in order to gain any value from blogging with their peers. Of my treatment group students, 26% receive special education services in reading (N=19). Of those students, 80% receive special education services specifically tailored to comprehension strategies. Students who did not have reading difficulties tended to feel more confident in their abilities while using blogging techniques. I was surprised to find that those students did not find the video links or other alternative formats helpful when blogging. In reflection, I did not specifically or sufficiently train the Educational Technicians who work one-on-one with students in the blogging process or in the variety of was information was presented in the blog. I believe this had a direct effect on those particular students' attitudes because I did not provide as much support as they needed to blog as successfully as their regular education counterparts. The attitudes of students receiving special education services compared to those not receiving such services is broken down in Table 3.

Table 3
Attitudes About Blogging: Special Education Students vs. Regular Education Students

Description of Data	Students receiving special education services (%) (*N*=5)	Regular education students (%) (*n*=14)
Blogging helped you gain and retain more science content	16%	100%
Discussing with classmates helped you remember science information	50%	90%
Links and Videos helped you remember science information	30%	82%
Combination of methods helped you understand science information INCLUDING blogging	16%	50%
Combination of methods helped you remember science information INCLUDING blogging	16%	67%

Students who received special education services for reading comprehension were less likely to believe that blogging helped them gain or retain information than other methods of learning, while their regular education counterparts believed blogging helped them with science content. Discussion through blogging also showed as less likely to help special education students than regular education students. According to the interview results, links and videos were less likely to benefit students with special education needs than those without the same needs. The final questions on the post interview form again showed that students with special needs in reading comprehension felt that blogging, along with other methods of information delivery, was not helpful in understanding or remembering science information.

INTERPRETATIONS AND CONCLUSIONS

The world our students live in and learn in is increasingly media-oriented. Most students tend to be technologically savvy and we need to meet their needs as learners because there are overwhelming numbers of students with access to technology (Sawmiller, 2010).

This study provides evidence that student blogging increases acquisition of science content knowledge and building critical thinking skills in science content areas. Considering my primary research question on whether or not blogging increased science content knowledge acquisition, I found that students in the treatment group, on average, increased scores over the non-treatment group. There was an exception with students with special needs, which is expected since the need area is reading. In order to blog successfully, students must have a grasp on reading, so they can respond to questions and have a virtual conversation without significant misunderstanding. Students with special needs in the area of reading comprehension expressed more frustration because, as one student expressed, "I couldn't do it by myself". Even though the reading struggles were expected, I was surprised at the level of frustration my students expressed. In any of my research, I had not uncovered the discrepancy between special education students and regular education students, and therefore had not considered the question. Before further implementation of classroom blogs, I will specifically research establishing a classroom blog with the needs of special education students in mind, and train other adults in the use of the variety of blogging techniques before using blogging with students.

Teacher attitudes, or how students perceive teacher attitudes may also play a part in blogging being successful for all students. I was very surprised, and a bit embarrassed

that one of my students with special needs felt like he couldn't "bug the teacher with questions" while we were blogging in class. I thought I had been clear with students by this point in the year that questions about any task in class is expected and welcome because I'd rather clear up a misunderstanding than have a student feel lost. I attribute part of this student misunderstanding because he commonly has a one-on-one that assists him and she is his "go-to" when he has a question, rather than me as the classroom teacher.

Students expressed excitement that they could chat with one another in a way that they had not done before. One girl stated, "I sometimes think of things later that have to do with a topic we talk about in class and it feels like there's no time to go back to it. Blogging made it so I could say it any time." Classroom content was then able to move beyond the classroom rather than being forgotten by the next time class met. This expansion of classroom walls linked classroom experience to opportunities for afterthought and discussion, which is the goal of technology integration (McGrail, 2011).

My enthusiasm for teaching either the treatment group or the non-treatment group seemed consistent most days. Of course, as all teachers do, in the lecture and discussion parts of class, if one particular discussion point did not go as planned, it was tweaked for the next class. Sometimes that was true for the treatment group, sometimes for the non-treatment group, as we have a rotating schedule and I see the groups at varying times throughout the week. I am confident, in reviewing my Teacher Daily Reflection Forms that I was as consistent as possible for the treatment and non-treatment groups. According to the Teacher Daily Reflection Forms, classes were given equal amounts of time to study the same material. Both the treatment and non-treatment group had science class for 200

minutes per week. When working with both the treatment and non-treatment groups, I made sure to consider the findings in other research and provide access to technology, ensure student safety, have clearly defined expectations, and provide teacher support for each student. Those meant different things for the different groups, but consistency was maintained.

Through teacher student interviews, testing data, blogging entries, and exit slips, students in the treatment group demonstrated an increasing grasp of science concepts and a problem-solving approach that utilized critical thinking skills than students in the non-treatment group. Careful planning, though it is not a guarantee of creating a perfect learning environment, is key to successful student learning through blogging (Leuhman, 2008). There are many tools at a teacher's disposal, but it's how we use those tools that impact our students' learning and growth as learners.

VALUE

The students in the regular education program gained skills in science content acquisition and retention through blogging. Those same students also increased their critical thinking skills through practice and conversation on the blog. The students who receive special education services did not perceive blogging as a helpful tool, but rather more of an obstacle with extra reading, with which they struggle. I plan on using blogging in future classes, with emphasis on creating more alternative methods of information than reading. Though blogging prompts often had video links and other alternatives to reading, the fact cannot be ignored that my special needs students require more support than what I gave during this study. Students with special needs can use the rubric, but I will support those students by holding small group sessions to explain the

blogging requirements each time to alleviate the anxiety and barriers that accompany comprehension problems.

Using the blogging strategy has changed the way I teach and the way my students learn. Discussion techniques have become more refined, with more students being prepared to participate in whole group discussions since they have used the blog as a discussion forum beforehand. Students improved their ability to follow the rubric provided as time went on and the blogging became more familiar to them. As a teacher, I found that I was able to give more direct and informed feedback to students, who were then able to edit responses and use that information to respond to peers. I also found that students were anxious to get the feedback from me and other students and make corrections or improvements accordingly. Students became more confident in their abilities to review peer responses, and would often use resources to enhance responses, and reinforce their learning in the process. I am very excited to use this technique in my other classes for the remainder of this school year, and most definitely in following school years.

I was very surprised at the discrepancy in attitudes between my students receiving special education support and my students who do not receive special education support services. Though the testing data showed improvement for all students on average, I feel that no student should feel like a learning tool is more work than other students, so I will have to find a way to modify the blogging techniques used in my classroom.

Data collection is something we are very familiar with in our district, but it is done on a quantitative basis only to make academic decisions for our students. Through this research project, I am seeing a need for including qualitative data as well, to ensure

that the learner's needs, other than academic, are met at the same time. If a student does

not feel comfortable with a method, I believe the maximum benefit is not going to be

achieved for that particular student. As with any teaching mode, a wide variety of

teaching techniques need to be utilized while blogging to best provide differentiation for

each student. Teachers need to be aware of student attitude and potential issues in order

to provide the best learning environment for each student. In light of the gains made by

students during this research project, and the differences between my students in each

learning environment, I will continue to use blogging as a technique in all of my classes,

but will also continue modifying the use of blogging and the amount of support students

with special needs receive to meet each student where they are to increase their learning

potential.

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APPENDICES

APPENDIX A

MARZANO'S TAXONOMY VERBS

Marzano's Taxonomy (adapted from aheadoftheclass.webs.com)

Recognize *recognize (from list) *select (from a list) *identify (from a list) *determine (true/false)	**Retrieval**
Recall *name *list *describe *state *identify who, where, or when *describe what	
Executing *use *demonstrate *show *make *draft *complete	
Integrating *summarize *paraphrase *describe the key parts of *describe the relationship between *explain the ways in which *describe how or why *describe the effects	**Comprehension**
Symbolizing *use models *symbolize *depict *represent *draw *illustrate *show *diagram *chart	
Matching *compare and contrast *categorize *sort *differentiate *discriminate *distinguish *create an analogy or metaphor	**Analysis**
Classifying *classify *organize *sort *identify different types or categories *identify a broader category	
Analyzing Errors *edit *revise *identify errors or problems *evaluate *identify issues or misunderstandings *assess *critique *diagnose	
Generalizing *form conclusions *trace the development of *generalize *what conclusions can be drawn *what inferences can be made	
Specifying *make & defend *predict *what would have to happen *develop an argument for *judge *under what conditions *deduce	
Decision-making *select the best among the following alternatives *which of the following would best *what is the best way *decide *which of these is most suitable	**Knowledge Utilization**
Problem-solving *solve *adapt *develop a strategy *figure out a way *how would you overcome	
Experimenting *experiment *generate & test *test the idea that *how can this be explained *how would you determine if *based on the experiment, what can be predicted	
Investigating *investigate *research *find out about *take a position on *how & why did this happen *what would happen if *what are differing features of	

APPENDIX B

FAMILIARITY WITH BLOGGING SURVEY

1. How familiar are you with blogging?

2. I have used Kidblog in the past.

- ☐ Yes

- ☐ No

3a. I have used another blogging site in the past.

- ☐ Yes

- ☐ No

  b. If so, name which blogging site. _____

4. I have read the guidelines for posting to the blog.

- ☐ Yes

- ☐ No

5a. I understand the guidelines that have been presented in class and can follow the provided rubric.

	1	2	3	4	5	
Not at all	☐	☐	☐	☐	☐	Definitely

  b. I do not understand the guidelines that have been presented in class because....

6. When I make a blog post on Blogger, I should: (check all that apply)

- ☐ Ask what friends are up to after school.

- ☐ Answer the blog post from the teacher

- ☐ Answer the blog posts from my classmates

- ☐ Discuss my favorite sports

- ☐ Use the rubric for blog posts to make sure I have used the guidelines presented in class

APPENDIX C

TEACHER DAILY REFLECTION FORM

Please note that this "Teacher Daily Reflection Form" was created by Andrea Robbins
and used with her permission.

Date: _____

Non-treatment Group   Treatment Group   (circle one)

Content Objective:

_____

_____

Learning Activities:

_____

_____

Rate on a scale of 1-5 (1 being very low and 5 being very high), my perception of:

1. My Enthusiasm for teaching: _____

Comments:

2. My Motivation for teaching: _____

Comments:

3. My preparation for teaching: _____

4. Student Motivation to learn: _____

Comments:

6. Students' Attitude (1= poor, 5=great): _____

Comments:

APPENDIX D

BLOG ENTRY RUBRIC FOR STUDENTS

Criteria	4	3	2	1
Content and Originality	Postings provide evidence of understanding and reflective thought about the topic by • building a focused argument around a specific issue OR • asking a new related question OR • making an oppositional statement supported by personal experience or related research	Postings provide moderate evidence of understanding and reflective thought about the topic. Postings are generally well written with some attempts made to stimulate dialogue and commentary	Posting provide minimal evidence of understanding and reflective thought about the topic. Postings are brief and unimaginative, and reflect minimal effort to connect with the audience.	Postings show no evidence of understanding or reflective thought about the topic. Postings do not stimulate dialogue and commentary and do not connect with the audience.
Timeline and Tags	Updates blog as often or more often than required; all posts are date-stamped and the most recent posts are placed at the top of the page. Post is categorized and topics are tagged appropriately.	Updates blog when required; most posts are date-stamped with the most current posting listed at the top. Post is categorized and tagged.	Updates blog when reminded; posts are often missing a date stamp. Post is not categorized and tagged appropriately.	Does not update blog within the required time frame. Does not categorize and tag the topic appropriately.
Citations	All images, media, and text created by others display appropriate copyright permissions and accurate citations.	Most images, media, or text created by others display appropriate copyright permissions and accurate, properly formatted citations.	Some of the images, media, or text created by others does not display appropriate copyright permissions and does not include accurate, properly formatted citations.	No images, media, or text created by others display appropriate copyright permissions and do not include accurate, properly formatted citations.
Quality of Writing and Proofreading	Written responses are free from grammatical, spelling or punctuation errors. The style of writing facilitates communication	Written responses are largely free of grammatical, spelling, or punctuation errors. The style of writing generally facilitates communication.	Written responses include some grammatical, spelling, or punctuation errors that distract the reader.	Written responses contain numerous grammatical, spelling, or punctuation errors. The style of writing does not facilitate effective communication.
Quality of Blog Post According to Classroom Guidelines.	Weekly posts follow all classroom guidelines, including at least one form of communication other than written response.	Weekly posts follow most classroom guidelines, but may be missing one form of communication, either written response or other approved form.	Weekly posts follow some classroom guidelines (less than half).	Weekly posts follow minimal classroom guidelines.

(Adapted from Karen Franker's "A Rubric for Evaluating StudentBlogs")

APPENDIX E

STUDENT ATTITUDE SURVEY

1. I believe blogging is an effective tool for gaining knowledge about science content.
   o   yes

   o   no

   o   not sure

2. I believe blogging helps me learn more about science content than only classroom discussion and textbooks.
   o   yes

   o   no

   o   not sure

3. I believe blogging is an easy classroom tool to use.
   o   yes

   o   no

Why or why not?
4. I believe blogging helps me build critical thinking skills.
   o   yes

   o   no

   o   not sure

5. I believe blogging allows me to explore new ways to apply science content to real-life situations.
   o   yes

   o   no

   o   not sure

APPENDIX F

POST- STUDENT SURVEY

Name:_____

      Date:_____

Interviewer:_____   GT AV SE (Circle One)

On a scale of 1-5, with one being Never and 5 being Always, answer the following questions:

                                      Never

      Always

1. Creating a blog post is easy.   1   2   3   4   5

2. I am able to provide all of the information required in the blog posts during a week.

                                        1   2   3   4   5

3. Blogging helps me better understand science concepts about Environmental Science.

                                        1   2   3   4   5

4. I learn information from my classmates while participating in blogging.

                                        1   2   3   4   5

5. I learn better from listening to the teacher than by blogging.

                                        1   2   3   4   5

6. I learn better from reading information in a textbook than by blogging.

                                        1   2   3   4   5

7. I was better able to express my ideas on the class blog with written responses.

                                        1   2   3   4   5

8. I was better able to express my ideas on the class blog with drawing.

                                        1   2   3   4   5

9. I was better able to express my ideas on the class blog with audio/speaking.

                                        1   2   3   4   5

10. In general, I learned more by using the class blog than if I had only had lecture, text readings, and labs.   1   2   3   4   5

APPENDIX G

POST-STUDENT INTERVIEW

Did blogging help you gain and retain (remember) more science content? Why or why not?

Thinking about using Kidblog, did discussing science topics with classmates help you remember science information?

Thinking about using Kidblog, did discussion about links and videos help you remember science information?

Thinking about different techniques used by your teacher during class time (lecture, discussion, whole-group reading, independent reading, blogging, videos, and hands-on lab experiences), which helped you **understand** the science material presented? (you may choose more than one)

Thinking about different techniques used by your teacher during class time (lecture, discussion, whole-group reading, independent reading, blogging, videos, and hands-on lab experiences), which helped you **remember** the science material presented? (you may choose more than one)