USING PREZI TO MOTIVATE MIDDLE SCHOOL SCIENCE STUDENTS

By

CAROLINE BENDER* PRINCE HYCY BULL**

** M.A., North Carolina Central University.*
*** Associate Professor, Educational Technology, North Carolina Central University.*

ABSTRACT

This study examines the effects of the use of a non-linear multimedia presentation model, Prezi, on middle school students' attitude toward learning science, engagement in school science, and the impact on learning science. Prezi was used as the primary instructional model for an intensive six-week intervention period in seventh grade science classrooms. A total of 28 students, from two science classes, participated in the study. Each student completed a pre- and post-survey to determine attitudes and beliefs about learning science and also completed two surveys at the end of the intervention to determine the effectiveness of Prezi as an instructional tool. Findings indicate small improvements in both students' attitudes and beliefs about learning science in general. However, results do show that Prezi is effective as a learning tool because it engages students in learning, helps students retain information, and for its ease and style of design and presentation. Results also indicated that Prezi was, most notably, effective in informing students about science topics, presenting information in an understandable way, and that Prezi would be an effective learning tool if used in other courses.

Keywords: Prezi, Multimedia, Technology Integration, Science Education, Middle School Technology Integration.

INTRODUCTION

According to research over the past three decades, students' declining attitudes toward learning science has been of considerable concern for educators. Longitudinal research studies show that since 1983, students' attitudes about science sharply decrease at age 11 and onward (Osborne, Simon, & Collins, 2003). Studies show that middle school science is failing to engage and interest students compared with other core subjects (Archer et al., 2010). Theories abound with explanations and causes for students' disinterest in learning science. Osborne et al. (2003) completed a review of the major literature about attitudes toward science over the previous two decades and identified the following factors that influence students' attitudes toward science including: gender, environment, classroom and teacher factors, curriculum variables, and the perceived difficulty of science.

Science, at its core, is a technology-based subject, more often associated with technology than other middle school courses such as English and Social Studies. The challenge current science teachers face is how to effectively implement this core technology into instruction and science education. In fact, the entire field of education is struggling with this same issue and is in the process of shifting instruction to more adequately mirror the technological gains of society to be able to reach students growing up and learning in the 21st century.

District administrators, principals, teachers, and students are voicing their opinion on the need for more appropriate and effective educational technology. In a national survey conducted by NetDay in 2010 (http://www.netday.org/SPEAKUP/), middle school students report that when technology is used in the classroom it makes them more motivated to learn, apply their knowledge better to practical problems, and take ownership of their learning. The middle school teachers reported that as a result of using technology in the classroom students are also more motivated to learn, apply their knowledge to practical problems, and take ownership of their learning. Yet, in this same survey, only 36% of these middle school teachers are using communication tools and technology to connect with students and only 53% of those teachers are creating multimedia presentations for students – a tool middle school teachers identified as a highly effective and motivating instructional tool. In another study completed in North Carolina by Spires, Lee, and Turner (2008), middle school students reported using computers and doing research on the internet as activities they liked best in school and listening to teachers explain things and doing worksheets as activities they liked the least.

Multimedia integration is the key to successful integration of technology in a science class. The term multimedia has been used in industry, business, and education to describe the presentation of information in multiple forms. Mayer (2001, p. 2) defined multimedia as the "presentation of material using both words (spoken or printed) and pictures (e.g. maps, graphics, animations, diagrams, videos)." Mayer identified the following five principles for effective instructional multimedia design (p. 186):

- *Spatial Contiguity*: Students learn better when corresponding words and pictures are presented in close proximity, rather than far from each other on the page or screen;
- *Temporal Contiguity*: Students learn better when corresponding words and pictures are presented simultaneously rather than successively;
- *Coherence*: Students learn better when extraneous words, pictures, and sounds are excluded rather than included;
- *Modality*: Students learn better from animation and narration than from animation and on-screen text; and
- *Redundancy*: Students learn better from animation and narration than from animation, narration, and on-screen text. Students comprehend the material better when the words were presented auditorily and visually rather than auditorily only.

The multimedia tool selected for this research study is Prezi. Prezi is a web-based presentation tool functionally and conceptually similar to Microsoft PowerPoint and Apple Keynote, but because it is web-based, does not require the purchase of software. Prezi can be accessed from any computer with an Internet connection. Prezi is considered a non-traditional presentation tool because both linear and non-linear presentation components can be integrated. This is a fundamental difference between Prezi and the more common presentation tools mentioned above. Constructing a Prezi is done through a single, large "canvas" approach (versus slide by slide) that better enables an audience to see the big picture and make more meaningful connections. A Prezi "canvas" can include text, audio, video, hyperlinks, and PDF documents. Presentations can also be shared, allowing multiple people to collaborate on a single presentation (http://www.prezi.com/). Prezi is considered a transformative tool that builds on students' abilities to present information through logical, visual, and spatial relationships (Perkins, 2009). According to Rockinson-Szapkiw (2011), Prezi enables "educators to escape the confines of linear presentations and encourage knowledge construction via higher order thinking skills in a manner that uses both visual and auditory channels…Prezi encourages learners to identify patterns, comparisons, relationships, and differences between information" (2011, n.p.). Teachers and administrators feel that Prezi can be a more effective way to convey new ideas and concepts to student learners versus PowerPoint and Keynote because of the above-mentioned qualities (Perron & Stearns, 2010). Although there has been research demonstrating Prezi's effectiveness as a presentation tool, very little research has been completed on the use of Prezi in an educational environment and as an instructional tool.

The 21st century learner is using new information and communication technologies in different ways to create their knowledge and understanding. This knowledge reflects a constructivist view of how humans learn. Constructivism is both a philosophy and a progressive theory of learning that views learning as an active process of creating, rather than acquiring knowledge (Spires et al., 2008: Bull, 2012). Constructivism as a learning theory is one that has seen wide acceptance in with science educators. Constructivism key characteristics of assimilation and accommodation of knowledge are seen as a preferred alternative to the behaviorist view on learning that learning is the absorption and reproduction of knowledge (Malcolm & Keane, 2001; Bull, 2009). According to Stears, a science curriculum "informed by social and critical constructivist principles has the potential to facilitate the achievement of outcomes other than science outcomes…allowing for the personal and social needs of learners to be met" (2009, p. 398). The flexibility and variety of teaching practices utilizing a constructivist approach allows for accommodation and adaptation to students with a variety of learning styles and the design of this study utilized the above characteristics of this learning model to integrate a student- and technology-centered classroom intervention (Bull, 2010).

Literature Review

Instructional technology and learning

The use of learning, or instructional technologies, has become a major focus of state and national efforts to improve students learning outcomes and overall engagement in education. Educators, administrators, and policymakers are recognizing technology present in students' daily lives and their ties to future opportunities for students, who will have to compete in a global, knowledge-based workplace (Friedman, 2005). In order to capitalize on these 21st century students natural inclinations as learners, schools must move beyond conventional modes of teaching and learning and integrate technology available beyond the traditional boundaries of the school day and school walls (Shapley, Sheehan, Maloney, & Caranikas-Walker, 2011). Findings from a 2006 study completed by Partnership for 21st Century Skills state that, "technology-enhanced learning experiences also can help students develop 21st century competencies, such as thinking and problem solving, interpersonal and self-directional skills, and digital literacy". Learning experiences that emerging technologies can provide are supporting more innovative forms of teaching and learning and are important because research shows that students learn more when they are engaged in meaningful, relevant, and intellectually stimulating work (Bransford, Brown, & Cocking, 2003). The integration of technology into a classroom changes not only the learning environment, it also changes what is actually being learned, why and how it is learned, the role of the teacher, social interaction between students and their teachers and students and their peers (Dix, 2005). The use of multimedia as an instructional tool, as utilized in this research study on Prezi, has also been shown to have a positive effects on student learning outcomes (Chen & Howard, 2010; Hsieh, Cho, Liu, & Schallert, 2008; Liu, 2005; and Teoh & Neo, 2007).

Learning science through technology

Science as a field has always been at the cutting edge of technology, however, the carryover of this technology into science education has been an area that many educators are trying to improve upon. Chen and Howard (2010) discovered that the scientific learning process, specifically data collection, visualization, meaningful thinking, problem solving, and reflection can all be developed in the science classroom through the use of technology. The National Research Council (NRC, 1995) recommended that science teachers engage students in active inquiry, which includes modeling and guiding scientific attitudes that facilitate learning. The NRC recommended the use of technology-enhanced teaching and learning environments to achieve these goals and strongly discouraged the primary use of traditional teaching practices, such as copying notes from lecture or learning scientific terms without content. The latter provides poor learning opportunities for science students. The National Research Council (2011) recently released new standards for science education, the first such publication since 1998. The use of technology in science classrooms is one of the primary new recommendations because technology provides a context in which students can test their own developing scientific knowledge and apply it to practical problems. Osbourne et al. (2003) found common aspects of teaching that were perceived to be effective by both science teachers and students, including the use of preview and review of lesson content, an ability and willingness to allow for different cognitive styles and ways of engaging with the learning process through the use of different types of illustration and modes of presentation.

Student-centered learning

Spires et al. (2008) conducted a study with 4,000 middle grade students in North Carolina to determine from students what engages them to achieve in school. The researchers found that students make a strong connection between the use of technologies in project-based learning and academic engagement. Students also enjoyed conducting projects that use technology as a tool to learn new information. These students also rated activities that they enjoyed least about school, including copying notes and listening to teachers lecture. Odom et al. (2007) found that student-centered teaching methods were the most effective at conveying the nature and methods of science and scientific reasoning – key components of scientific literacy. The middle school science students in their study indicated note-copying to be boring and note learning provided little opportunity for students to construct knowledge or develop conceptual understanding of the processes of science.

Instructional Technology in Middle School Education

The following studies are examples of instructional technology being utilized in middle school classrooms. These other examples of technology are mentioned here because there has not been significant research completed on the use of Prezi as an instructional presentation tool, perhaps because of its very recent development. "Live simulation" was utilized by Chen and Howard (2010) to examine the effect on students' science learning and attitudes. Live simulation was chosen because it has emerged as one of the most popular instructional tools for delivering quality instruction. Their findings revealed positive changes in students' attitudes and perceptions toward scientists. "Hypermedia Problem-based Learning" was utilized by Liu (2005) to examine its effect of sixth-graders' science knowledge, attitude toward learning science, and motivation toward learning. Liu determined that students' attitudes toward science and their intrinsic goal orientation were significantly higher after using the technology application. Hernandez-Ramos and De La Paz (2009) studied eighth grade history students as they created multimedia mini-documentaries related to their curriculum. The researchers examined content knowledge tests, group projects, and attitude and opinion surveys of the students who participated in the technology-assisted project-based learning (PBL) experience and contrasted their experiences to those students who received more traditional forms of instruction. They found evidence that the students' within the PBL group had significantly more positive attitudes toward learning history, working with others and rated the experience favorably.

Science student attitudes, motivation, and engagement

Osbourne et al. (2003) indicated a decline in attitudes toward science starting at age 11 (middle school year) and onward. They also discovered that middle school students actually have a more positive attitude toward science in general than their general attitude toward learning science in school. Liu (2005) indicated that motivation plays an important role in influencing learning and achievement in science. The use of instructional technology has a positive effect on students' attitudes toward learning and on student self-concept as students feel more successful in school and are, therefore, more motivated to learning when technology is integrated into their curriculum (Dix, 2005). Odom et al. (2007) discovered that student attitudes about science were positively associated with student-centered teaching practices and negatively associated with teacher-centered teaching practices. Teaching practices that utilize technology and student-centered learning influence middle school students' motivation, effort, and attitudes toward school (Chen & Howard, 2010).

Student Engagement and Measures

Student engagement is gaining more attention as emphasis is placed on the impact of school improvement plans, drop outs, standardized testing, and technology infusion in the classroom (Frederick, Blumefield, and Paris 2004). According to the National Research Council and Institute of Medicine (2004), engagement declines as students progress through elementary grades and middle school. Yazzie-Mintz (2007) identifies high poverty as one reason for declining student engagement. However, there are several major facts that can impact students' engagement. The National Research Council and Institute of Medicine (2004) describes engagement as "behaviors (persistence, effort, attention, taking challenging classes), emotions (interest, pride in success), and mental and cognitive aspects (solving problems, using metacognitive strategies)." To increase student engagement in any concept or activity is to find efficient ways to measure it.

Engagement measurement encompasses quantitative and qualitative metrics collected from student engagement in specific activities. Engagement framework is the level of involvement, interaction, intimacy, and influences a student experiences with an activity over time (Haven and Vital, 2008).

- Involvement is the presence of a person at various levels of development, implementation and evaluation of an activity or concept. In this study, students were involved in the process of using Prezi as a technology tool to engage them in science learning activities.
- Interaction is the actions people take while present as concepts are introduced, developed, designed, implemented, and evaluated. In this study, students interacted as various level of using Prezi to learn science concepts.
- Intimacy is the affection of aversion a position displays when introduced to a concept. Intimacy is aligned with a person's self-efficacy (Bandura, 1977). Persons with positive attitudes to a concept tend to have a more intimate relationship with the concept or task. Persons with negative attitudes to a concept tend to have a less intimate relationship with the concept or task. In this study, intimacy was a critical component of using Prezi to learn science concepts.
- Influence is the likelihood a person is to develop a preference for an activity or concept. In this study, the goal was to have student develop a preference for learning science by using Prezi to design activities and products.

Research Questions

This research study on the use of Prezi to motivate middle school students to engage with science activities was guided by the following questions:

- Does the use of Prezi improve seventh grade students' attitudes toward learning science?
- Does the use of Prezi impact students' level of engagement and interest during science class?
- Does the use of Prezi impact the way students learn science?

Method

Sample

Two seventh grade science classrooms at a North Carolina middle school were selected for this research project. The subjects were 28 seventh grade science students. The same science teacher instructed both classes. The students did not have one-to-one or daily access to computers. However, Netbook laptop computer carts were accessed at certain points during the intervention to provide each student with a computer. Students were from a variety of socioeconomic classes and ethnicities and there were roughly the same number of males and females. Please note, no demographic information was obtained from the subjects and the above-mentioned demographic information is from casual observation of the instructor. A letter was sent home to each student in the class, explaining the intervention and requesting either approval or disapproval from guardians to participate in the study. All 28 students received permission from their guardians to be involved in the study. Students were also given the option to not participate in the study, meaning, they would not fill out pre- and post-surveys or take place in any discussion regarding the intervention. Participation in the study had no bearing on a student's grade and this was clearly explained to all students. Due to the design of the intervention, all students received the intervention utilizing Prezi as a multimedia instructional tool.

Intervention

The multimedia tool, Prezi, was utilized as the primary instruction tool over the course of a 6-week period in the fall 2010 of a seventh grade science course. The seventh grade science curriculum is broken down into large units or "competencies" (i.e. weather and atmosphere, human body, physics and motion, etc.) and there are multiple sub-units, or "learning objectives", within each of these larger units. Table 1 shows the more detailed description of unit and sub-units/learning objectives taught during the Prezi intervention.

Each sub-unit was taught to the students exclusively through the use of a Prezi presentation. The design of each Prezi followed Mayer's (2005) five principles for effective instructional multimedia design: spatial contiguity, temporal contiguity, coherence, modality, and redundancy. At the end of each larger unit, the students were then put into groups of two. Each pair created their own Prezi in which they had to follow guidelines from the teacher to make a “summary” presentation on a specific sub-unit that was then shared with the class and used as a review tool at the end of the science unit. These student-created summary Prezis were completed at the mid-point and end-point of the intervention period. Each student-designed Prezi was required to contain a video, animation, a graph or chart, and visual facts about their sub-topic. Students were given the freedom to add any other multimedia feature to their Prezi they felt was effective at conveying knowledge to their classmates about each topic. All student-designed Prezis also followed Mayer's five principles of design. Prezi presentations were shared and presented in class.

Competency Goal: The learner will conduct investigations and utilize appropriate technologies and information systems to build an understanding of the atmosphere.

Objectives

1 - Explain the composition, properties and structure of the atmosphere:
  * Mixture of gases
  * Stratified layers
  * Each layer has distinct properties
  * As altitude increases, air pressure decreases
  * Equilibrium

2- Describe properties that can be observed and measured to predict air quality:
  * Particulate matter
  * Ozone

3- Conclude that good health of environments and organisms require:
  * The monitoring of air quality
  * Taking steps to maintain healthy air quality
  * Stewardship

4- Evaluate how humans impact air quality including:
  * Air quality standards
  * Point and non-point sources of air pollution in North Carolina
  * Financial and economic trade-offs
  * Local air quality issues

5- Examine evidence that atmospheric properties can be studied to predict atmospheric conditions and weather hazards:
  * Humidity
  * Temperature
  * Wind speed and direction
  * Air pressure
  * Precipitation
  * Tornados
  * Hurricanes
  * Floods
  * Storms

6- Assess the use of technology in studying atmospheric phenomena and weather hazards:
  * Satellites
  * Weather maps
  * Predicting
  * Recording
  * Communicating information about conditions

Table 1. Grade Seven Standard Course of Study: Competencies and Objectives

Measurement

As stated earlier, to increase student engagement in any concept or activity is to find efficient ways to measure it. Student engagement could be measured through student self-reports, teacher report measures, and observational measures. Student's self-report measures address behavioral, emotional, and cognitive engagements, (Appleton, Christenson & Furlong, 2008; Spires et al., 2008). Teacher report measures primarily address rating of student's engagement with a concept or activity, (Appleton, Christenson & Furlong, 2008). Also, teacher reports tend to address positive and negative aspects of behavioral, emotional, and cognitive engagement in a lesson or class activity. On the other hand, observational measures of student's engagement tend to focus on student's on-and off – task behavior or time engaged in classroom setting (Yazzie-Mintz, 2007). This study integrated student self-reports measures and observational measures.

The study predominantly utilized student self-report measures to collect data. Student self-report measures bring the critical voices and perspectives of students into school to affect change in addressing their learning needs (Spires et al., 2008). Each student completed a pre-survey and post-survey that included two different sections. Each question or statement was evaluated on a five-point Likert scale from “strongly agree” to “strongly disagree.” The surveys were filled out using the Google survey tool. The first section of the survey was from the Test of Science-Related Attitudes (TOSRA) (Fraser, 1983). The 10-question “Enjoyment of Science Lessons” subsection (Cronbach's Alpha = .93) of the TOSRA was utilized to determine students' attitudes toward learning science in school. Examples of questions from this section: “I really enjoy science lessons“, “I dislike science lessons“, and “School should have more science lessons each week”. The second section is a “Science Interest” survey (Cronbach's Alpha = .85) and was utilized to determine students' interest in learning science (Ioannou et al, 2009). Examples of questions from this section: “Overall, how interesting do you find your science class?”, “How interesting do you find learning about scientific topics?”, and “How interesting do you find learning about science through technology?" In addition to these two sections, the post-survey also had an "Instructional Effectiveness" survey (Cronbach's Alpha = .88) to specifically evaluate Prezi as a teaching and learning tool (Ioannou et al., 2009). Examples of questions from this section: "How effective was the use of Prezi in presenting the information in an understandable way?" and "How effective was Prezi in informing you about the Science topics?" Also at the end of the intervention, students filled out a survey with open-ended questions designed to gain more detailed reasons why students may have liked or not liked the Prezi intervention and to determine areas of improvement or satisfaction. In addition to self-report measures, the study utilized observational measures. The teacher made anecdotal records of Prezi infusion, students' participation, and evaluation of students' products.

Results

The results of the pre- and post-surveys that measured students' attitudes toward science and toward learning science, Science Interest and Enjoyment in Science Lessons, are presented in Table 2 and Figure 1.

Each measurement tool was based on a 5-point Likert scale. In analyzing the pre-survey data from these two measurement tools, the students in this research study, indicated both positive attitudes towards science and also toward learning science in school. When the post-survey data is analyzed along with the pre-survey data for these two measurement tools, both the Science Interest and the Enjoyment in Science Lessons, mean scores increased, even if only by a small amount (change of +0.07 for the Science Interest tool and change of +0.03 for the Enjoyment in Science Lessons). This data indicates that the 6-week Prezi intervention did not have a significant impact on students' general attitudes toward science or on their general enjoyment in school-based science lessons. It is also important to indicate that neither means decreased, meaning, even if the impact of Prezi was small in regard to attitudes and enjoyment in science, it was still positive.

Measurement Tool	Pre Survey Means	Pre Survey Standard Deviations	Post Survey Means	Post Survey Standard Deviations
Science Interest	3.14	1.05	3.21	1.08
Enjoyment in Science Lessons	3.45	1.04	3.48	1.06

Table 2. Results of Science Interest & Enjoyment in Science Lessons Surveys

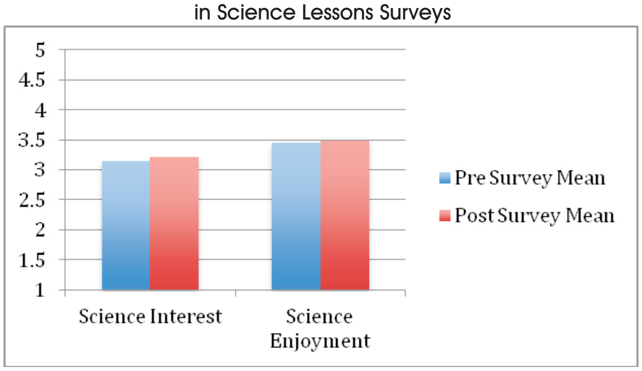

Figure 1. Results of Science Interest & Enjoyment in Science Lessons Surveys

Two different instruments were utilized to determine the effectiveness of Prezi as an instructional tool. The first was an Instructional Effectiveness Survey, which was again based on a 5-point Likert scale. Results from this survey are below in Table 3. The mean for the entire Effectiveness survey is 3.17. However, since Prezi was the central variable in this research study, each question was analyzed and is presented in Table 3. Students indicate that, overall, Prezi was an effective instructional tool. Most notably, Prezi was effective in presenting information in an understandable way and informing students about Science topics. Students also indicated that Prezi would also be an effective instructional tool in their other courses. Results showed that Prezi was least effective in helping students remember new information and in helping students observe details. The result in general shows a positive trend.

The second way in which Prezi was analyzed was through an open-ended survey given to students after the Prezi intervention. This survey was meant to gather more detailed

Question	Mean
How effective was the use of Prezi in presenting information in an understandable way?	3.4
How effective was Prezi in informing you about the Science topics?	3.6
How effective was Prezi in motivating you to learn more about the Science topics?	3.0
If Prezi was used in other classes, how effective do you think they would be in helping you learn?	3.3
How effective was Prezi in helping you pay attention?	3.1
How effective was Prezi in helping you remember the new information?	3.0
How effective was Prezi in helping you observe details?	2.9

Table 3. Results of Instructional Effectiveness Survey

information from students mostly about Prezi, but also about the use of technology in their education. The qualitative data taken from this open-ended survey was analyzed and organized into broad, common categories for each of the four questions. The most popular response categories along with the number of responses are presented in Tables 4-8 below. Please note this survey was open ended, so each student could have more than one response for each questions.

The final component of the data analysis was from a journal kept by the science instructor for this intervention. The instructor, and also a researcher for this intervention, kept an informal journal based on comments made by students and general instructor-observations during the course of the 6-week Prezi intervention. As can be expected, there were both positive and negative comments and observations. Perhaps the most important observation made during the course of the intervention was that every student in both science classes were immersed in making their own Prezi (at mid-point and final-point) with focus and engagement rarely seen in a middle school classroom.

What did students like about using Prezi?	Number of Responses	Percentage
Components and Aesthetics	20	71%
Easy to use and present	14	50%
Enjoyable and fun to use	11	39%
Learned and observed more	9	32%
Technology - based learning	8	28%

Table 4. What did students like about using Prezi?

What did students dislike about using Prezi?	Number of Responses	Percentage
Program "glitches"	14	50%
Difficult formatting layout	13	46%
Confusing/Difficult to use	13	46%
Built in graphics and fonts are limited	9	32%
Took to long to make	7	25%

Table 5. What did students dislike about using Prezi?

How has Prezi helped students learn and retain information?	Number of Responses	Percentage
Helped with knowledge retention and learning	16	57%
Organized and effective presentation to understand info	9	32%
Individualized/Student-centered learning	8	28%

Table 6. How has Prezi helped students learn and retain information?

Are you more motivated to learn and complete assignments when they are technology based?	Responses
Yes	86%
No	14%

Table 7. Are students more motivated to learn and complete assignments when they are technology-based?

How does technology help students learn and complete assignments?	Number of Responses	Percentage
More motivated to learn when technology is used	10	36%
Prefer technology over traditional teaching methods	9	32%
More efficient and effective than traditional learning	7	25%
More individualized to different learning styles	3	11%

Table 8. How does technology help students learn and complete assignments?

Based on instructor observations over the first half of the Prezi intervention, many students in the two science classes had improved interest and engagement in class since the introduction of the Prezi. When Prezi was first utilized in the classroom during the beginning of the school year, students seemed reluctant to accept Prezi and learn about it, making statements such as, "I don't know how to operate this (Prezi) and I don't know how to move my picture" and "Why can't we just use PowerPoint, we know how to use it". At the end of the intervention, there was a positive change of tone from students toward Prezi with student statements such as, "Check out my cool video I put in my Prezi" and "It's so easy to make a Prezi" and "I like that I get to access my Prezi through my own email account" and "I love that I can make my Prezi my own, it helps me learn the way I want to".

In summary, students' attitudes toward learning science and enjoyment in science lessons only indicated a slight, non-significant, increase through the two surveys. However, analysis of the qualitative data indicate that engagement and attitudes toward learning in the science course did improve, even if students could better convey this through open-ended questioning versus standard questions/statements. Most importantly, students indicate that Prezi helped with knowledge retention and learning, was an organized and effective tool to help understand new information, and was an individualized and student-centered learning tool.

Discussion

Prezi is a relatively new multimedia presentation tool, developed only in 2009, so there has been a limited amount of research completed pertaining to its use and effectiveness as an education-based instructional tool. The concept of a non-linear presentation tool such as Prezi parallels the increasingly popular dynamic-systems teaching and learning models, such as constructivism, that are being utilized in progressive educational programs today. Meaning, Prezi, and other programs with similar designs should be a "just right fit" in regard to the direction 21st century education is moving. However, as with any new tool, software, hardware, or emerging technology, there is a learning curve. As indicated by many of the students who participated in this research study, Prezi was difficult to learn at first, and because of the short duration of this intervention, many students did not have enough time to work through the "frustrating" phase associated with learning any new tool, to the "mastery" phase. This study is small in size and scope, but the hope is that future research on the use of multimedia presentation tools, especially non-linear ones such as Prezi, can demonstrate both the value and effectiveness of this type of technology in education at all levels. Researcher in this study believe that Prezi, just as all other technology, would be most effective when combined with traditional teaching and learning models, so the widest variety of learners and learning styles are impacted in a positive manner.

Appendix

Science Interest: 5 – Item Scale (Cronbach's Alpha = .85: (A. Ioannou et al))

Response scale

Not at all interesting /Slightly interesting /Somewhat interesting/Quite interesting /Extremely interesting

1. Overall, how interesting do you find your science class?
2. When you hear about science in the news, how interesting do you find it?
3. How interesting do you find learning about scientific topics?
4. How interesting are the assignments you are given for this class?
5. How interesting do you find learning about science through technology?

Enjoyment in Science Lessons*:* 10 – Item Scale: (Cronbach's Alpha = (.93) (Test of Science Related Attitudes)

Response Scale

Strongly agree/ Agree/ Not sure/ Disagree/Strongly Disagree

1. Science lessons are fun.
2. I dislike science lessons.
3. School should have more science lessons each week.
4. Science lessons bore me.
5. Science is one of the most interesting school subjects.
6. Science lessons are a waste of time.
7. I really enjoy going to science lessons.
8. The material covered in science lessons is uninteresting.
9. I look forward to science lessons.
10. I would enjoy school more if there were no science lessons.

Instructional Effectiveness Attitude*:* 7 – Item Scale: (Cronbach's Alpha = (.88) (A. Ioannou et al))

Response scale

Not at all effective/ Slightly effective/ Somewhat effective/ Quite effective/Extremely effective

1. How effective was the use of Prezi in presenting the information in an understandable way?
2. How effective was Prezi in informing you about the Science topics?
3. How effective was Prezi in motivating you to learn more about the Science topics?
4. If Prezi was used in other classes, how effective do you think they would be in helping you learn?
5. How effective was Prezi in helping you pay attention?
6. How effective was Prezi in helping you remember the new information?
7. How effective was Prezi in helping you observe details?

References

[1]. Appleton, J.J., Christenson, S.L., and Furlong, M. J. (2008). Student engagement with critical conceptual and methodological issues of the construct. *Psychology in the Schools,* 45, 369-386.

[2]. Archer, L., Dewitt, J., Osborne, J., Dillon, J., Willis, B., & Wong, B. (2010). "Doing" science versus "being" a scientist:

Examining 10/11-year-old schoolchildren's constructions of science through the lens of identity. *Science Education,* 94, 617-639.

[3]. **Bandura, A. (1977).** *Social Learning Theory*. New York: General Learning Press.

[4]. **Bransford, J., Brown, A., & Cocking, R. (2003).** *How people learn: brain, mind, experience, and school.* Washington, DC: National Academy Press.

[5]. **Bull, P. (2009).** Cognitive Constructivist Theory of Multimedia Design: A Theoretical Analysis of Instructional Design for Multimedia Learning. In G. Siemens & C. Fulford (Eds.), *Proceedings of World Conference on Educational Multimedia,* Hypermedia and Telecommunications 2009 (pp. 735-740). Chesapeake, VA: AACE.

[6]. **Bull, P. (2010).** Spatial Constructivist Thinking Theory: A Framework To Address Needs of Digital Visual Learners. In *Proceedings of World Conference on Educational Multimedia,* Hypermedia and Telecommunications 2010 (pp. 1297-1302). Chesapeake, VA: AACE.

[7]. **Bull, P. H. (2012).** Using Spatial Constructivist Thinking Theory to Enhance Classroom Instruction for Students with Special Needs. In Aitken, J. E., Fairley, J. P., & Carlson, J. K. (Eds.), *Communication Technology for Students in Special Education and Gifted Programs.* (pp. 66-81). doi:10.4018/978-1-60960-878-1.ch005

[8]. **Chen, C., & Howard, B. (2010).** Effect of live simulation on middle school students' attitudes and learning toward science. *Educational Technology,* 13(1), 133-139.

[9]. **Dix, K. (2005).** Are learning technologies making a difference? A longitudinal perspective of attitudes. *International Education Journal*, 5(5), 15-28.

[10]. **Fraser, B. (1981).** *Test of science-related attitudes.* Victoria: Radford House

[11]. **Fredricks, J.A., Blumenfeld, P.C., Friedel, j., and Paris, A. (2005).** School Engagement. In K.A. Moore and L. Lippman (Eds.), *What do children need to flourish?: conceptualizing and measuring indicators of positive development.* New York: Kluwer Academic/Plenum Press.

[12]. **Fredericks, J., McCloskey, W., Mell, J., Montrosse, B., Mordica, J., & Mooney, K. (2011).** *Measuring student engagement in upper elementary through high school: a description of 21 instruments.* Institute of Education Science. National Center for Education Evaluation and Regional Assistance. Retrieved January 21, 2012 from http://ies.ed.gov/ncee/edlabs/regions/southeast/pdf/REL_2011098.pdf

[13]. **Gagne, R., Briggs, L. & Wagner, W. (1992).** *Principles of instructional design.* Fort Worth, TX: Harcourt Brace Jovanovich

[14]. **Haven, B., & Vital S. (2008).** *Measuring Engagement: Four Steps To Making Engagement Measurement a Reality.* Forrester Research, Inc. Retrieved January 20, 2012 from http://www.adobe.com/engagement/pdfs/measuring_engagement.pdf

[15]. **Hernandez-Ramos, P., & De La Paz, S. (2009).** Learning history in middle school by designing multimedia in a project-based learning experience. *Journal of Research on Technology in Education*, 42(2), 151-173.

[16]. **Hsieh, P., Cho, Y., Liu, M., & Schallert, D. (2008).** Examining the interplay between middle school students' achievement goals and self-efficacy in a technology-enhanced learning environment. *American Secondary Education,* 36(3), 33-50.

[17]. **Ioannou, A., Brown, S., Hannafin, R., & Boyer, M. (2009).** Can multimedia make kids care about social studies? The globaled problem-based learning simulation. *Computers in the Schools*, 26, 63-81.

[18]. **Liao, Y. C. (1999).** Effects of hypermedia on students' achievement: A meta-analysis. *Journal of Educational Multimedia and Hypermedia,* 8, 255-277.

[19]. **Liu, M. (2005).** The effect of a hypermedia learning environment on middle school students' motivation, attitude, and science knowledge. *Computers in Schools,* 22(3/4), 159-171.

[20]. **Malcolm, C. & Keane, M. (2001).** *Working scientifically in learner-centered ways.* Paper presented at the International History and Philosophy of Science and Teaching Conference, November 7-11, in Denver, Colorado.

[21]. **Manning, C., Brooks, W., Crotteau, V., Diedrich, A., Moser, J., & Zwiefelhofer, A. (2011).** Tech tools for teachers by teachers: Bridging teachers and students. *Wisconsin*

English Journal, 53(1), 24-28.

[22]. Mayer, R. E. (2001). *Multimedia learning.* New York: Cambridge University Press.

[23]. National Research Council. (1995). *National science education standards.* Washington, DC: National Academy of Sciences.

[24]. National Research Council. (2011). *A framework for k-12 science education: Practices, cross-cutting concepts,* and core ideas. Washington, DC: National Academy of Sciences.

[25]. National Research Council and Institute of Medicine. (2004). Engaging Schools: Fostering high school students' motivation to learn. Committee on Increasing High School Students' Engagement and Motivation to Learn. Board on Children, Youth, and Families, Division of Behavioral and Social Science and Education. Washington, DC: The National Academy Press.

[26]. Odom, A., Stoddard, E., & LaNasa, S., Teacher practices and middle-school science achievements. *International Journal of Science Education,* 29(11), 1329-1346.

[27]. Osbourne, J., Simon, S., & Collins, S. (2003). Attitudes toward science: A review of the literature and its implications. *International Journal of Science Education,* 25(9),1049-1079.

[28]. Partnership for 21st Century Skills. (2006). *Results that matter: 21st century skills and high school reform.* Retrieved January 21, 2012 from http://www.21stcenturyskills.org/index.php?option=com_content&task=view&id=204&Itemid=114

[29]. Perkins, J. (2009). Where are the instructions? Understand more, remember better: *Learning to use prezi in the 21st century.* Digital Pedagogies.

[30]. Perron, B., & Stearns, A. (2010). *A review of a presentation technology:* Prezi. Research on Social Work Practice.

[30]. Prezi (2009). *Prezi website.* Retrieved from http://prezi.com/

[31]. Project Tomorrow. (2011). *SpeakUp 2010 national findings*. Retrieved on January 21, 2012 from www.netday.org/SPEAKUP/

[32]. Rockinson-Szapkiw, A. (2011). Prezi: Trading linear presentations for conceptual learning experiences in counselor education. Council for Higher Education Pedagogy.

[33]. Shapley, K., Sheehan, D., Maloney, C., & Caranikas-Walker, F. (2011). Effects of technology immersion on middle school students' learning opportunities and achievement. *The Journal of Educational Research,* 104(5), 299-315.

[34]. Spires, H., Lee, J., & Turner, K. (2008). Having our say: Middle grade student perspectives on school, technologies, and academic engagement. *Journal of Research on Technology in Education,* 40(4), 497-515.

[35]. Stears, M. (2009). How social and critical constructivism can inform science curriculum design: A study from South Africa. *Educational Research*, 51(4), 397-410.

[36]. Teoh, B., & Neo, T. (2007). Interactive multimedia learning: Students' attitudes and learning impact in an animation course. *The Turkish Online Journal of Educational Technology,* 6(4).

[37]. Yazzie-Mintz, E. (2007). *Voices of students on engagement: a report on the 2006 high school survey of student engagement.* Bloomington, IN: Indiana University, Center for Evaluation and Education Policy. Retrieved January 20, 2012 from http://www.indiana.edu/~ceep/hssse/images/HSSSE%20Overview%20Report%20-%202006.pdf.

ABOUT THE AUTHORS

Ms. Bender is a middle school science teacher employed by Chapel Hill/ Carrboro Schools, North Carolina. She graduated in December, 2011 with her M.A. degree in Instructional Technology.

Dr. Prince Hycy Bull is an Associate Professor and Program Coordinator of Educational Technology at North Carolina Central University School of Education. His research activities include, but not limited to technology integration with preservice and in-service teachers, learning technologies, emerging technologies, and technology integration with K-20 faculty and staff. He is a graduate of the University of Sierra Leone, Fourah Bay College, North Carolina Central University and North Carolina State University. He has extensive knowledge in integrating technology in education. His credentials are North Carolina teaching licenses for Intellectual Disabled (Mild and Severe), Mentor, Curriculum Specialist, Instructional Technologist, School Principal and Exceptional Children's Director.