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A Proposal for Ozone Science Podcasting in a Middle Science Classroom

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The use of podcasting has grown exponentially. Research projects are racing to keep up with this growth to understand implications for learning and instruction. This project specifically attempts to understand if the use and development of podcasts *by* students *for* students influence learning in a 7th grade science classroom. Using a technology integration model, both science and computer teachers will collaboratively teach technical and content knowledge in using podcasting to understand the implications of the ozone layer on the environment. Assessment practices include qualitative practices through interviews and discussions with participants. Quantitative data will include a pre and postsurvey, curriculum content assessments, and podcast quality rubric assessment. Forecasted expectations are that podcasts will increase student motivation, technical skills sets, and content knowledge based on the opportunity for students to create authentic products of their understanding using podcasting in a collaborative learning environment. The implications of the study will demonstrate how podcasts can be successfully used in education for learning and instruction.

INTRODUCTION AND NEED STATEMENT

Podcasting exploration is experiencing tremendous growth as a global tool for communication and learning (Campbell, 2005). The use of these current technology tools can offer alternative business and educational experiences. Educators are gathering research that indicates that podcasting is beneficial for cross cultural experiences (Zuckerman-Parker, 2006, personal communication) and classroom instruction and assessment. With this growth comes the need to clearly identify what is meant by podcasting and how it can be successfully used in education to benefit student learning. This article provides information to substantiate the use of podcasting as a tool for learning and describes a proposal for using this tool in a Middle School Science classroom.

BIRTH OF PODCASTING

Podcasting is a newly created term with conflicting origination. "Podcasts are recordings distributed across the Internet as downloadable MP3 files" (Broida, 2005). These multimedia files are accessible by mobile players or personal computers through the use of syndication feeds. Ben Hammersley is credited with the first publication of the term podcasting (Shaughnessy, 2005). The Education Podcast Network (*What is a*, 2006) described a podcast as a merger between blogging and radio. Jobbings (2005) explained that podcasting is essentially an Internet based radio show. Podcasting involves the process of creating and publishing a digital radio broadcast on the Internet (Jobbings). No matter what definition is used for it, partakers agree that podcasting is on demand, and may be accessed anytime, anywhere (Jobbings; *What is a*, 2006; Lum, 2006; Campbell, 2005). Lum noted as follows:

> Podcasts can be automatically routed through cyberspace to subscribers' personal media devices and consumed at their leisure, like a digital audio version of hard-copy magazines. And like magazines, podcasts can be shared and swapped over and over again. But unlike magazines, podcasts don't require any physical space, making the medium even more appealing. (p. 34)

Likewise, users may listen to podcasts single or multiple times while in the car, doing physical exercise, running mundane errands, or simply waiting for a person or event to occur.

Although many podcasting consumers associate iPods with the technology, listening to podcasts doesn't have to be expensive. All that are necessary are a microphone, a PC, and audio-editing software (Jobbings, 2005). While iPods and MP3 players certainly may play podcasts, $100 and an Internet connection are all that students need to start producing regular radio shows (Richardson, 2006). Accessibility has been one of the major contributing factors to the growing popularity of podcasting (Lum, 2006). Minimum requirements include a computer with audio and video downloading capabilities or any portable digital music player (Lum). Fortunately, podcasts are not tied to one platform and may be listened to on multiple computer operating systems including Windows, Mac OS X, and Linux. The interoperability has played a strong role in the continued exploration of the technology.

Further indicators of the popularity of podcasting are evident in the availability of downloadable content and programming. "Podcasting is growing at an exponential rate. Current estimates are that there are 20 million podcasts currently available up from 3 million just 5 months ago" (Kaye, 2005). Whether these figures are accurate or represent an exaggerated quantity, podcasting popularity has burgeoned. The Apple iPod just celebrated its fifth birthday on October 23, 2006 (Krazit, 2006). Apple's purported share is 77% of the MP3 playback device market and the potential for growth has no end in site (Bass, 2006). Udell (2005) listed five major reasons for the explosive development in podcasting: (a) the pervasiveness of the Internet, (b) large, available broadband speeds, (c) the given nature of the multimedia PC, (d) undistinguishable, streaming and downloading media content, and (e) the commonness of MP3 playback devices. This rise in podcasting content has had a marked effect on its integration into higher education as well as K-12 schools (Dillon; 2006; *Podcasts help*, 2006; Richardson, 2006; Borja, 2005; RECAP Limited, 2006). Dan Schmidt, an instructional-technology specialist at the University of Nebraska's college of education, points out that "Educators are starting to see how podcasting can help hone students' vocabulary, writing, editing, public speaking, and presentation skills…Students can also learn skills that will be valuable in the working world, such as communication, time management, and problem-solving" (Borja, p. 8). Thus, a circular pattern has developed. As educational podcasts proliferate, more teachers are implementing the technology within their curriculums.

The growing popularity of podcasting and associated hype of Apple iPods in the last few years caught the attention of higher education. By the fall of

2004, Duke University distributed over 1,600 iPods to its freshmen class. These new, portable media players came preloaded with the undergraduates' orientation schedules, academic calendar, athletic schedules, podcasts from administrators and upperclassmen, and even the school fight song (Flanagan & Calandra, 2005). In addition, Duke proposed to integrate iPods for academic use into 16 fall classes and 33 spring classes during the 2004-2005 academic year (Flanagan & Calandra). The Duke University iPod First Year Experience Final Report described five academic areas for iPod implementation including: course content dissemination, classroom recording, field recording, study support, and file storage and transfer (Flanagan & Calandra, p. 21). Other early adopters of podcasting technology include Arizona State University President Michael M. Crow, Mansfield University's campus life program, University of Denver's Information Technology and Business departments, as well as the Journalism and Mass Communications Department at North Carolina A&T State University (Lum, 2006, pp. 34-35).

EDUCATIONAL PODCASTING IN K-12 CLASSROOMS

The pioneering efforts of these institutions of higher education served as a proving ground for podcasting exploration and implementation, and paved the way for similar paths of introduction into the K-12 environment (Flanagan & Calandra, 2005). A plethora of podcasting articles describe examples of how elementary and secondary schools are employing this new technology in addition to providing resources for students and teachers seeking "how to" instructions. Borja (2005) reported that most of the K-12 teachers interested in podcasting come from the content areas of: English language arts, foreign languages, or social studies. Students can learn about Colonial Williamsburg and Thomas Jefferson (*Podcasts help make*, 2006, July 11) or download files from other historically accurate sites. Other examples of student developed projects include recorded essays and music about their hopes and dreams of the future by seventh graders at Longfellow Middle School in LaCrosse, Wisconsin (Borja). These same students also produced a photo presentation, Kids in the Coulee, about crayfish dissection and the life cycle of mealworms. Willowdale Elementary School students in Millard, Neb., wrote and directed a podcast that was part of their Revolutionary War study (Borja). They also recorded their play on their "Willowcast" broadcast network (Borja). Music-appreciation students at North High School students in St. Paul, Minn. produced podcasts for their music-appreciation class.

These podcasts reviewed the local, heavy-metal musician scene as well as musicians form the 1960s and 1970s (Borja). Besides these examples, the rapping student broadcasts recorded by Mr. Mayo's middle school students illustrate how podcasting can be used to make parts of the English language meaningful to these children (Richardson, 2006). Who knew that direct objects, pronouns, adverbs, and verbs could be so entertaining and motivating?

So exactly what are the benefits associated with podcasting for the K-12 classroom? Bull (2005) noted that podcasts complement traditional textual materials and provide alternate learning paths for students. Jobbings (2005) listed four areas where podcasting is beneficial in the classroom: (a) for figuring things out; (b) for developing ideas and making things occur; (c) for collaborating with information; and (d) for reviewing, editing, and evaluating work as it develops. In addition, several teachers and authors note the learner-centered characteristics of podcasting. Warlick explained, "Essentially, there's nothing new about podcasting-it's simply another source for compelling content. But it's also a new opportunity to make students better learners by turning them into teachers" (2005, ¶8). Podcasting assists in creating a constructivist focus in the classroom while engaging the students.

According to seventh grade teacher, Jeanne Halderson, podcasting is a form of teaching (Anderson, 2005). Like Warlick (2005), Halderson stressed that podcasting is just another medium to help deliver content and promote student-centered learning (Anderson). Her middle school students become researchers and report their findings in a recorded podcast format, rather than just writing a report. Jeanne Halderson's class is featured in several national news articles and is referred to earlier as the Longfellow Middle School in LaCrosse, Wisconsin. Anderson divulged that Halderson's effort is cross curricular including the areas of science, history, mathematics, language arts, or a combination of these subjects. Her students take pride in creating their podcasts, and in turn, see themselves as broadcasters. Halderson relates that her students receive a genuine thrill when their recordings are placed in music stores such as iTunes or elsewhere on the Web for others to listen to. The students speak proudly about their experience. They are sure of themselves, their team members, what they are learning, and the high standards their teacher is asking them to pursue. Anderson captured the motivational benefit of podcasting in the words of Halderson's middle school students as they "testify to the value of a teacher who inspires young people to leverage the power of technology to develop more productive lives" (p. 43). The students responded as follows:

> Podcasting is very motivating because people from all over the world are listening to you. We are competing with all the other student podcasts to be the very best.-Zach
>
> Podcasting isn't just an assignment. It is your way of being creative and showing the things that you love.-Brandon
>
> Podcasting is so motivating because you get to have fun while you are learning. You also get to team up with a partner and make a great piece of work.-Jay
>
> Podcasting to me is a fun and educating way to learn. Making something fun makes kids want to do it more, and if you mix in grammar and writing, you will have geniuses in no time.-Addison
>
> Podcasting motivates me to do better with my sentence fluency and my speech.-David
>
> GarageBand and iPhoto work together in perfect harmony with each other. GarageBand is very student-friendly, so it's easy to work with yet it lets you use all the functions you would ever need to make podcasts.-Luke (Anderson, 2005, p. 43).

As described by several of the previous podcasting examples, students are not limited to just their classmates as the intended audience. Sometimes the audience expands beyond their school to their community or even internationally. In fact, a growing number of school districts provide community members and other stakeholders with podcasts from board meetings, news updates, and other district information (Dillon, 2006; Lum, 2006). While some districts broadcast this information through local television stations, podcasting usually represents a cheaper, more accessible, and transportable method for the community. Cindy Randle from the Carrollton-Farmers Branch school district in Texas noted that her district wanted to walk the walk and talk the talk. She commented, "We wanted to model to our community that we're lifelong learners…We want our students to learn this new technology, so we as a school district need to learn it, too" (Dillon, ¶8).

Obviously, auditory learners particularly benefit from podcasting. However, podcasting represents more than just an audible instructional technology tool; it harnesses the power of the human voice. D'Angelo (2005) described the helpful impact of the human voice, "As infants and children we use our

vocalizations to express our needs and emotions. As we grow older these vocalizations become confined to language" (back cover). Wharton (2006) advised that podcasting is one way that we can "capture and revel in the power of the human voice." Podcasting provides students with an opportunity to collaborate in the creation of a unique learning product. In addition to the benefits of ownership and accomplishment, students involved in podcasting gain skills in sharing their thoughts and ideas using a technologically contemporary resource. Campbell (2005) stressed the privacy factor of podcasting. This technology permits learners to learn at their own pace without ridicule. Students can escape and listen to a podcast as a group or alone. In addition, students determine their own frequency requirements, whether once or multiple times.

As with any new instructional technology tool, its value is only promising if teachers are able to incorporate and make use of the technology in their teaching. However, many schools forget about an untapped resource for information and technology support—the school librarian. School librarians around the country are tuning into podcasting.

Ishizuka (2005) related how Sarah Chauncey, a school librarian, created podcast snippets of selected picture books for her K-3 students. Besides portions of the book, she also recorded inquiry questions related to the book. Chauncey describes Monsey as a high-need community where families have few books at home, "They are a bright, able group of kids, who've had a harder start and just need to be challenged" (Ishizuka, ¶3). She looks at podcasting as a way for parents to become more involved in their children's reading development. Chauncey hopes that these podcasts will entice parents to discuss books at home with their families. Besides downloading podcasts from the schools' webpage, children can also take home a complete CD recording of featured books. Chauncey completed most of the narration herself. Chauncey is also launching a school newspaper that includes podcasts produced by students.

Eash (2006) recommended that K-12 librarians create library orientation podcasts for students to orient them to the different areas and resources in the library. She also recommends podcasting for: doing research field trips, recording document interviews, making observations, and reciting notes. Eash related that when librarians are trained in podcasting techniques, they can support students in the creation of individual or collaborative podcasts. Eash recommended that schools contribute to community research projects.

She related the example of several primary schools in West Bromwich, U.K. who created podcasts about special places in their community. She also cited efforts by Mabry Middle School students in Marietta, GA, who "conducted oral history research by interviewing World War II veterans as a way of passing history from one generation to another and enabling students to create digital representations of their new knowledge in a medium that is relevant to their teen culture" (Eash, p. 18). Eash believes that school librarians can foster enhanced student learning, teacher participation, and collaboration. She proclaimed that podcasting helps to support differentiated instruction in the library by delivering research content and lessons to students who need remedial support or extended lessons (Eash). Librarians can help students and staff to find other creative uses of podcasting. Some of Eash's recommendations include podcasts to: promote the library, showcase student products to share learning, share school news, and provide professional development.

EDUCATIONAL PODCASTING RESOURCES

Where can teachers and librarians turn to find educational content? New websites dedicated to educational podcasting are springing up on the Internet. These sites provide links for classroom use that are searchable by subject area, topic, language, and grade level. *The Education Podcast Network* (Warlick & The Landmark Project, n.d.) started in May 2005 and provides a central database of educational podcasts where students and teachers may search for relevant material (Richardson, 2006). The *Podcast Directory* (2006) represents another similar resource. Examples of educational podcast programming listed on these sites includes: the UNICEF Podcast—a global radio service from UNICEF that focuses on issues of health, education, equality, and protection of children; a World of Possibilities—an award-winning, one hour weekly radio program delves into the deeper meanings of events; That's News to Me!—a current events trivia quiz podcast; and Earthwatch Radio—a science podcast from the Sea Grant Institute and the Gaylord Nelson Institute for Environmental Studies at the University of Wisconsin-Madison that covers science topics with special attention to global climate change, the Great Lakes and the oceans.

Teachers and staff members can also find pedagogical, best practices, copyright information, and "how to" support about podcasting from a

multitude of websites. Two excellent resources are Dodge's (2005) *Resources for Educational Podcasting* and *Podcast Pedagogy: Examples of Using Podcasts and Podcasting in Teaching and Learning* (*Podcasting and*, 2006) wiki. Teachers must understand copyright concerns to properly convey these concepts to their students. The *Podcasting Legal Guide* (Vogele, Garlick, & The Berkman Center, 2006) provided straightforward information relevant to teachers and students. Teachers need to particularly consider copyright matters related to distance learning. For issues related to appraising criteria about the quality of podcasts, faculty and staff may find the considerations in *Evaluating Podcasts for Teaching and Learning* (RECAP, 2006) to be worthwhile. In addition, rubrics for can be used for podcasting assessment; examples include the *BEAUT Podcast Rubric* (Ashby, 2006) and the *Mary D. Bradford High School Podcast Rubric* (Halderson, 2007; Ramey, 2005).

But perhaps the best source of information can come from schools themselves in the form of action research. Podcast Bangladesh (Lindsay, 2006) provides an excellent example about how this tool was used school-wide. This project involved multiple grade levels within the International School Dhaka. Students used podcasting for student projects, reflections about their learning, and a method of recording their ICT instruction. Lindsay (2006) noted that student-created podcasts may be used for assessment, reflection, interaction, and collaboration that focus on "real" dialogue (p. 16). Podcast Bangladesh provided students with an opportunity to discuss and interact about global issues such as the digital divide, debate online about local and global topics, discuss and reflect about their ideas for digital storytelling, and conduct curriculum-based interviews of and by students and teachers. Lindsay related that podcasting combined with the audio/multimedia capabilities of the Internet offer "interesting opportunities for cross-cultural and global collaboration" (p. 18). She cited the specific benefits of global collaboration and podcasting as being able to form a closer relationship with partners, affording an alternative to text-based communications to enhance meaning and understanding, learning in a fun way with technology tools (p. 19).

Lindsay (2006) observed the keen value that collaboration played in the success of Podcast Bangladesh. Earlier, Jerome Bruner (1966) remarked that:

> to instruct someone...is not a matter of getting him to commit results to mind. Rather, it is to teach him to participate in the process that makes possible the establishment of knowledge. We teach a subject not to produce little living libraries on that subject, but rather to get a student to think mathematically for himself, to consider matters as an historian does, to take part in the process of knowledge-getting. Knowing is a process not a product. (p. 72)

One such process oriented technique available to educators is collaboration. Collaboration "refers to the social discourse among students in a learning community that enables them to see perspectives and to construct knowledge socially from text" (Gutherie, 2001, ¶27).

COLLABORATION

However, this term of "collaboration" is easily confused because various educational models incorporate collaboration, cooperation, and coordination. Zuckerman-Parker (2006) elaborates about the differentiation between the terms collective, cooperative, and collaboration in her chart. "Collaboration can lead to an elaboration that can afterwards be discussed, which, in turn, can enhance generalizing facts as knowledge, grounded in students' situated understanding." (Miao, Fleschutz, & Zentel, 1999, p. 2). Constructivism emphasizes the importance of the context in which students work and the importance of collaborative learning. According to Miao et al., "no strict curriculum guides students through the learning issues, rather the environment as a whole stimulates them to construct knowledge for themselves" (p. 2). From separate voices of ideas and opinions, communities of practice form. "Communities of practice help weave broader value webs created by relationships and exchanges which in turn create extended knowledge systems" (Wenger, McDermott, & Snyder, 2002, p. 220). The middle school science podcasting project allows groups of students to work together to search for common understanding and meaning. Subsequently, these groups demonstrate their knowledge in the form of a collaborative podcast.

Middle school research specific to collaboration by Hootstein (as cited in Gutherie, 2001) and Zahorik (as cited in Gutherie, 2001) found "teachers believe that social collaboration in the classroom will increase interest in the content of learning" (¶27). Interestingly, with regards to gender issues in the technology-rich collaborative learning environments of middle school, "the

data suggest that not only are girls and boys are similar with regard to attitudes about computers and group work, but that during collaborative learning activities, girls may actually participate more actively and persistently regardless of the nature of the task," (Goldstein & Puntambekar, 2004, p. 505).

Specific to higher education learning environments, when collaborative learning was purposely infused within a college level astronomy course, "Central to the design of the course was our pedagogical commitment, which involved moving away from lectures and toward immersing students within a learning environment that they actively participate and engage in processes associated with scientific investigations" (Barnett, Barab, & Hay, 2001, p. 304). The students also expressed a great deal of satisfaction with the course that can be summed up by the following student comment: "Astronomy has always been interesting to me, but I didn't want to sit and be lectured to" (p. 304). Podcasting provides an alternative form of learning. It creates a classroom where students are actively engaged in sharing, discussing, and learning from one another. Podcastings shifts learning responsibilities from teacher-centered lectures to a more student-oriented environment.

Although the benefits of collaborative learning provide students with the potential for great results, the proper use of this technique by educators is critical. Additionally, some contend this process of learning provides "playtime." However, with clear guidelines of expectations and the use of rubrics for assessment, there is no issue about "playing around" and not staying on task. Students realize this is "real work." Fortunately, there are free resources available online to develop rubrics for group learning environments such as Rubistar (Advanced Learning Technologies in Education Consortia [ALTEC], 2006) and Teachnology (2007.).

The aspect of cultural shyness is also a phenomena profoundly reduced by podcasting. Students with various learning styles who may be introverted or unmotivated are literally able to gain instructional feedback quickly in various forms. There is nothing students enjoy more than an email from an instructor with written accolades and an audio clip to hear the excitement of their instructor giving them encouragement to continue working hard. With decreased student anxiety, motivation increases and performance improves. According to Archer (1992), "the power of the human voice is based in interpersonal communication. The emphasis is on the way we interpret a

speaker's voice in terms of accent, pronunciation, emotions, honesty, sarcasm, charisma, uniqueness, lifestyle, and geographic origin" (¶10).

With speech as a "fundamental means of human communication" (Nass & Brave, 2005, p. 1), it is hard to fathom the endless possibilities of podcasting. Specifically, stories (and examples) carry meaning unlike email. Stories are also easier to believe. A person needs to hear the actual meaning (i.e., the voice) to look for the sincerity, authenticity, and passion, which is needed for the trust and loyalty to grow (Pearce, 1998). When voices speak, they are "explaining, telling, inspiring, preaching, persuading.... voices filling that channel are telling stories that need to be told, saying things that need to be said, speaking truths that have for too long gone unspoken" (Shapiro, 1997, ¶1).

PROJECT DESCRIPTION

The Podcast Bangladesh (Lindsay, 2006) focuses on ICT, English as a foreign language, and social studies, and serves as an educational example demonstrating a cross-curricular, collaborative project involving multiples grade levels. Some of these grade levels were in the middle grades. This article contains a podcasting literature review that demonstrates the importance for teachers and educational staff to infuse emerging technologies into their curriculums. Therefore, the focus of this project will be the exploration of ozone science content into middle school science. This plan provides an example of how podcasting can be used in a science curriculum so that students can become their own "teachers" in learning and applying their knowledge about the ozone layers and encourages students to examine, discuss, and share information.

Problem Statement

How does the emerging technology of podcasting aid in the comprehension of science concepts in a 7th grade classroom?

Study Question and Purpose

Does the use and development of podcasts by students for students influence learning in a 7th grade science classroom?

The purpose of this project is to measure the impact of the use and creation of podcasts on the students' understanding of the ozone layer and its impact on our environment. Podcasting will be used as a tool for the retrieval, processing, and transference of information concerning the topic of the ozone layer and its implications for the future. Both the computer teacher and science teacher will collaborate to teach students how to create a podcast that incorporates the science content knowledge learned in class and downloaded podcasts into a product that demonstrates understanding about the social and environmental implications of the ozone layer on our future.

Anticipated Outcomes

One important reason that podcasts aid in learning is because they provide students with the tools and skills to build and present their own knowledge. Because students actively create and listen to podcasts, they develop their research and technical skills and acquire an understanding of the content. Podcasting, unlike any other medium presently available, allows students to develop a voice of their own to share with the class and world.

It is anticipated that the use of podcasting for this project will enhance the construction of knowledge and learning for students by increasing productivity, active class involvement, motivation, and understanding of the ozone layer for this project. Student groups will collaborate to build a podcast based on interviews, content research facts, and teacher instruction. Data will include surveys, tests, interviews with teachers and students, and the student's final voice podcast.

IMPLEMENTATION AND DISSEMINATION PLAN

While podcasts are being used more and more in our society (Madden, 2006) educators have not used them as a daily tool for instruction and

learning. To address the newness of podcasts in education, staff development will be offered to teachers as part of the project. The implementation plan consists of three components. They are teacher preparation, student instructional plan, and assessment. This is a five-week project that will be facilitated by a technology coach. A five-week schedule reflects the rotation cycle for computer classes and unit of study for science. Several days are built in to buffer unexpected school activities such as fire drills, assemblies, and so forth. During the five weeks, science and computer classes will simultaneously provide instruction on the ozone layer and podcasting respectively. Staff development is offered to teachers prior to the start of instruction to familiarize them with podcasting technology and to develop resources for the students. During the entire five weeks, the technology coach will assist the teachers in becoming comfortable with the technology and resources.

Parents or guardians of all middle school students will receive a set of documents describing the purpose of the research that requests written consent for their child's participation. All minor age students will require parental or guardian consent. In addition, minor assent forms are required for all students. Informed consent forms are required for teachers. The informed consent, parental and guardian consent, and minor assent forms explain the purpose and confidentiality of the study.

PREPARATION

The teachers involved in this project are the 7th grade science and computer teachers. Staff development will consist of podcast technical skills, development of podcast resources for students (including scientists to interview), acknowledgement and agreement on a research model, and science content knowledge concerning the ozone layer. The two curriculums will traverse between classrooms, but there are specific responsibilities for the teachers. The computer teacher will instruct the students how to download and create a voice podcast and assist with science research. The science teacher will teach the students about the ozone layer and assist in the podcast development. Both teachers will use the same research model and teach students how to triangulate data and create a storyboard to develop a podcast. Both teachers will use the same language and assist the students to understand both the science and podcasting technology.

In preparation for the ozone science unit, teachers may access resources at several online locations. *Twenty Questions and Answers About the Ozone Layer* (Fahey, 2002) provides a phenomenal source of content. This site is based on the most frequently asked questions by students, the general public, and leaders in industry and government. NASA provides two ozone lesson plans for middle school students (Murphy & Bean, 2006; Panec, 2006). One such lesson is *Trouble in the Troposphere.* The learning objective for *Trouble in the Troposphere* is to provide students with the opportunity to produce graphs comparing monthly and yearly ozone averages of several US cities. With access to real data from NASA, students are able to use the numbers and share ideas about what global citizens can do to protect themselves from further destruction of the ozone layer as well as how to preserve a healthy environment. As discussed in this proposal, students can podcast as part of this assignment. For example, students can share their individual thoughts about why there needs to be global cooperation in our attempt to lower tropospheric ozone levels. Another source for ozone lessons is *The Ozone Hole Tour* (Garrett & Carver, 2006) at the Center for Atmospheric Science. This site provides a series of four lesson plans including several movies and a glossary.

STUDENT INSTRUCTIONAL PLAN

Students attend science and computer class each day for 45 minutes during the five-week project.

Week 1

The first week students will divide into small, self appointed cooperative learning groups of two and receive the objectives and anticipated outcomes of the project. By the end of the week they will have developed a basic story-board for their project. They will take a presurvey that elicits their current perceptions about the ozone layer and both classes. This is a quest to collect qualitative data concerning the motivation, class participation practices, and ozone knowledge. The same survey will be administered at the end of the project. Instruction will start concerning the ozone layer and

podcasts in the respective classrooms. Students will also take an ozone science pretest. They will learn about the ozone layer in science and conduct research in computer class.

Week 2

In week two, students will continue classroom instruction for both science and computers. They will begin to download podcasts from the Internet to support their learning about the ozone and to document resources for their podcasts. They will review other podcasts for content and presentation and evaluate them for effectiveness. They will select two and present them to the class with an explanation of why they were chosen. They will be required to use a minimum of 7 bibliographical resources and contact resources for interviews (previously contacted by the teacher).

Week 3

In week three, students will create scripts and practice creating mini podcasts. They will use their podcast assessment rubric to evaluate their own work and those of other groups in the class. The assessments will be discussed in the group. This practice and formative assessment practice informs students of their progress and areas that need to be strengthened. Students will begin to finalize their storyboard, resources, and dialogue for the final podcast.

Week 4

Students will create their final podcast. Interviews will be given, research documented, copyright laws followed, and content reviewed for accuracy.

Week 5

Students will present their podcasts to class members and post them on the school Intranet. They will take a posted survey (Appendix A) and be interviewed to collect their verbal perceptions about using podcasts for learning science.

COST ANALYSIS

The project costs include those elements that are not part of the existing infrastructure or school budget. For example, computers are located in both the science classroom by way of laptop carts and computer lab by way of desktop iMacs. Short training sessions and discussions with teachers occur within the normal schedule of the school day.

The use of podcasting in education can have many layers with each offering various opportunities for learning with technology. Podcasts can be created and delivered by laptop or desktop computers. It can also be delivered using portable devices. This experience extends the use of podcasts between classrooms and throughout the school day with the option of using them at home. This offers students a chance to explore portable learning tools and use them in different environments. The cost of iPods includes 15 iPods for $350 each and 15 micromemo voice recording units for $80.00 each. The total equipment price is $6,540. Additionally both teachers will need substitute teachers to cover their classes for a full day of training and two half days of formative assessment practices. The total for these days is $160 per teacher for a total of $320. The final cost for the project is $6,860.

ASSESSMENT

Student assessments will include pre and postsurveys, teacher and student interview data, content tests for science class (pretests and posttests), and assessment of the podcast quality. Most importantly, students will have a discussion concerning their role in developing a learning tool for others and how podcasting can be used to learn in the future. Earlier, Jobbings (2005) described many benefits of podcasting. As an extension of this statement,

Jobbings created a matrix to match the kinds of podcasting activities for secondary pupils and the National Curriculum for ICT at Key Stage 3 (11-13 year olds) in England (UK). These same podcasting concepts are mapped to the ISTE (1998) Profiles for Technology Literate Students: Performance Indicators for Technology-Literate Students Grades 6-8 (Appendix B). Thus, teachers and technology support staff can coordinate technology curriculum adherence with this matrix.

Using a pre-post survey design will provide information about student attitudinal changes related to podcasting, science content, and collaborative group environments over the five-week project timeframe. Further information about student and teacher impressions of the project are gathered from interviews about using podcasts for learning science at the project's end. Students will take pretests to provide data about their previous learning of ozone science content. This data provides a benchmark about the students' previous knowledge so that teachers may facilitate knowledge construction to best meet the needs of the middle school students. This also addresses student-learning styles and helps the teacher to individualize instruction. Posttests given to the students will measure gains in student learning about ozone science content from the beginning of the project until its end.

To provide guidelines for podcasting creation as well as an evaluation tool, students will be given a podcasting rubric. Several podcasting quality rubrics exist (Ashby, 2006; Halderson, 2007; Ramey, 2005). Teachers may use one of these rubrics or develop a unique model. The rubric score provides a numerical indication of the podcast quality. Jobbings (2005) provided an excellent resource for evaluating podcasts for teaching and learning (Appendix C). Students will first self-assess their group's podcast before evaluating the podcasts of other groups. Likewise, students will receive a score from their teacher using the same podcasting rubric. Thus, the project provides many opportunities for students to receive feedback about their science content learning and podcast quality. One of the most important assessment pieces is qualitative in nature. Having a class discussion about how podcasting influences learning gives students an opportunity to understand how their work helps others to learn. Seventh grade students reflect and discuss about how their technology exploration with podcasting influenced their ozone science knowledge.

IMPACT/OUTREACH

The intended impact/outreach of this project will be increased use of podcasting in the school building and increased student technology skill sets. We think staff, students, parents, and administrators will request additional iPods and staff development. To illustrate the strength of podcasts for learning and communication a podcast will be created to demonstrate the outcomes of this project. Using video, voice, and text the podcast will review the projects course of action and offer future direction options. Bull (2005) anticipated that the educational uses of podcasting will increase and continue to build on this phenomena and the cultural success of podcasting. Only the future will tell if this is true. However, given the enormous growth within the daily culture of our society and the relevancy of this tool in the world of our students, Bull's prediction appears imminent. The use of podcasting will increase in our society and in education.

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APPENDIX A

THE OZONE LAYER AND PODCASTING SURVEY

Enter your name:

PODCASTS

1. How familiar are you with Podcasts or its overall subject? Check all that apply.

☐ I listen to Podcasts
☐ I am familiar with process of locating and downloading
☐ I am somewhat familiar with Podcasts
☐ I am not familiar with Podcasts

2. Have you ever created a Podcast?

☐ Yes, I have created podcasts
☐ No, I have not created a podcast
☐ Don't know
☐ If yes, please identify the podcast

PROCESS

3. Do you know how to create a storyboard?

☐ Yes
☐ No
☐ Not Sure
☐ A little

4. Are you comfortable speaking in public?

☐ Very Comfortable
☐ Sometimes
☐ Not Very Comfortable
☐ No Way!

5. We are going to work in cooperative groups that you choose yourself. Predict how your group will work together. In the boxes below describe how successful your group will be and why.

1.
2.
3.

SCIENCE CONTENT

6. Define ozone, as you understand it.
7. What are two industrial applications of ozone?

8. What is low-level ozone?

9. Identify three reasons why the ozone layer is important for all living things on earth?
   1.
   2.
   3.

PREDICTIONS

10. My group will complete this project by its due date.

Strongly Disagree	Disagree	No opinion /Neutral	Agree	Strongly Agree

11. I will work well with my group.

Strongly Disagree	Disagree	No opinion /Neutral	Agree	Strongly Agree

12. I will do my part to complete our group's work.

Strongly Disagree	Disagree	No opinion /Neutral	Agree	Strongly Agree

13. I will learn how to listen to and create a podcast.

Strongly Disagree	Disagree	No opinion /Neutral	Agree	Strongly Agree

14. I will learn about our planet's ozone layer.

Strongly Disagree	Disagree	No opinion /Neutral	Agree	Strongly Agree

15. I will form an opinion about the ozone layer and how I can help our environment.

Strongly Disagree	Disagree	No opinion /Neutral	Agree	Strongly Agree

APPENDIX B

Podcasting concepts mapped to National Curriculum for ICT at Key Stage 3 (11-13 year olds) in England (UK) and ISTE Profiles for Technology Literate Students: Performance Indicators for Technology-Literate Students Grades 6-8

(see next page)

Podcasting and the National Curriculum for 11-13 year olds (England). Reprinted from http://www.recap.ltd.uk/articles/podguide3.html, March 6, 2007, with permission. © 2007 RECAP Limited. All Rights Reserved.		**National Educational Technology Standards for Students (ISTE, 1998) as they relate to the podcasting activities established by Jobbings (2005).** National Educational Technology Standards for Students © 1998, ISTE (International Society for Technology in Education), www.iste.org. All rights reserved.	**Profiles for Technology Literate Students: Performance Indicators for Technology-Literate Students Grades 6-8 (ISTE, 1998) as they relate to podcasting activities established by Jobbings (2005).** ISTE (1998) National Educational Technology Standards for Students in parentheses.
Podcast activity	ICT knowledge, skills and understanding	1. Basic operations and concepts - Students demonstrate a sound understanding of the nature and operation of technology systems. - Students are proficient in the use of technology.	1. Apply strategies for identifying and solving routine hardware and software problems that occur during everyday use. (1)
Design and plan a podcast	Finding things out	3. Technology productivity tools - Students use technology tools to enhance learning, increase productivity, and promote creativity. - Students use productivity tools to collaborate in constructing technology-enhanced models, prepare publications, and produce other creative works. 4. Technology communications tools - Students use telecommunications to collaborate, publish, and interact with peers, experts, and other audiences. - Students use a variety of media and formats to communicate information and ideas effectively to multiple audiences.	4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research. (3, 5) 5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum. (3, 6) 6. Design, develop, publish, and present products (e.g., Web pages, videotapes) using technology resources that demonstrate and communicate curriculum concepts to audiences inside and outside the classroom. (4, 5, 6) 8. Select and use appropriate tools and technology resources to accomplish a variety of tasks and solve problems. (5, 6) 9. Demonstrate an understanding of concepts underlying hardware, software, and connectivity, and of practical applications to learning and problem solving. (1, 6)
Consider focus, content and format of audio material	a) to consider systematically the information required and to discuss its use		
Identify and acquire the sources of audio material to include within a podcast	b) how to obtain information suited to the purpose by choosing appropriate sources, using and adapting search techniques and questioning the value of the results		
Prepare scripts and plan recordings of audio material (talk, music, SFX)	c) how to collect, enter, analyse and judge quantitative and qualitative information and check its accuracy		
Record the podcast	Developing ideas and making things happen		
Record and edit audio material (talk, music, SFX)	a) To develop and investigate information, solve problems, produce new information for specific purposes.	5. Technology research tools - Students use technology to locate, evaluate, and collect information from a variety of sources. - Students use technology tools to process data and report results. - Students evaluate and select new information resources and technological innovations based on the appropriateness for specific tasks.	4. Use content-specific tools, software, and simulations (e.g., environmental probes, graphing calculators, exploratory environments, Web tools) to support learning and research. (3, 5) 5. Apply productivity/multimedia tools and peripherals to support personal productivity, group collaboration, and learning throughout the curriculum. (3, 6) 6. Design, develop, publish, and present
Produce and publish a podcast	Exchanging and sharing information		

Appendix C. Evaluating Podcasts for Teaching and Learning

1. Criteria for evaluating the quality of a podcast

   Some aspects to consider for evaluating the quality of podcasts as a teaching and learning resource.

   a) A podcast could be judged as high quality where:
      - The topic is presented in an interesting and imaginative way
      - The content is well structured and organized
      - Sources for further information (websites and email) are included
      - Effective use is made of the presenter, discussions and interviews
      - Vocals are clear without background noise or popping
      - Presenters are clearly heard above background music and effects
      - Any audio effects are used to enhance the content and presentation
      - Smooth edits are evident in transitions between segments

1. Criteria for evaluating the quality of a podcast

   b) A podcast could be judged as satisfactory quality where:
   - The topic is presented in an appropriate and relevant way
   - The content is suitably structured and organized
   - Further information (websites and email) is referred to
   - Effective use is made of the presenter, discussions and interviews
   - Vocals are audible and without distortion
   - Presenters can be heard above background music and effects
   - Audio editing means smooth transitions between segments

   c) A podcast could be judged as poor quality where:
   - The topic is presented in a tedious and uninteresting way
   - The content is unstructured and disorganized
   - No sources for further information (websites and email) are included
   - Ineffective use is made of the presenter, discussions and interviews
   - Vocals are inaudible or distorted
   - Presenters cannot be heard above background music and effects
   - Any audio effects detract from the content and presentation
   - Rough audio edits are evident in transitions between segments

1. Criteria for evaluating the suitability of enhanced podcasts

   Using an enhanced podcast rather than audio podcast for a learning resource is likely to be considered:

   a) Very valuable where:
   - high quality graphical images enrich the topic and convey stimulating visual material
   - the timings of image transitions are well matched to the audio content
   - hyperlinks are clearly displayed and relates to the topic's content and material
   - linked website pages provide good quality material and information for learners
   - chapters are clear, concise and closely match the topic's structure and presentation

   b) Appropriate where:
   - graphical images are of satisfactory quality and match the topic's content
   - image transitions are timed to complement the audio
   - hyperlinks are relevant to the topic's content and material
   - linked websites provide additional information and topic material for learners
   - chapter titles are meaningful, matching the topic's structure and presentation

   c) Inappropriate where:
   - the quality of graphical images is inadequate and unrelated to the topic's content
   - timings of image transitions occur in a haphazard way, unrelated to the audio
   - hyperlinks are irrelevant to the topic's material
   - linked websites do not provide any additional material for learners
   - chapter titles are misleading and unrelated to the topic's structure and presentation

1. Prompts for considering podcasts for personalised learning

   Aspects to consider when considering whether to use a podcast as a resource to support personalise learning.

   a) Pedagogical questions include:
   - Will the podcast make a positive contribution to the learning objectives for the subject/topic?
   - Would using a podcast match the learning styles of identified individuals or groups of learners and promote independent learning?
   - To what extent would using a podcast help learners acquire relevant knowledge, skills and understanding?
   - Should the resource be seen as essential for an optional activity for all children and young people?
   - How far would the podcast be useful as a supplementary, support or extension activity for different groups of learners?

   b) e-Learning questions include:
   - To what extent would the use of a podcast aggravate or combat the increasing digital divide amongst learners?
   - Would access to online sources for the podcast mean that the e-safety of learners needs to be carefully considered?
   - How confident will learners be in applying their ICT knowledge, skills and experience in using podcasts?
   - Do learners have access to appropriate guidance and support within the educational setting they are expected to operate?

3. Prompts for considering podcasts for personalised learning

c) Technical questions include:

- Is there good access to broadband for using podcasts online?
- Does the configuration of a school/college/university network allow for online use/downloading podcasts?
- Do computers have the appropriate software and "plug-ins" to download and "play" podcasts?
- Is there appropriate hardware installed to support efficient playback of audio-visual (AV) material, including podcasts?