IDENTIFYING THE EFFECTIVENESS OF PODCASTS IN LABORATORY SCIENCE

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SECTION I

INTRODUCTION

High school science education creates challenges for students especially when those students have little to no prior exposure to science skills. Laboratory experiences are new and exciting, but often difficult to grasp the underlying concepts and connections necessary for the level of expected outcomes. In my high school, students come in from at least five different feeder schools. Each of these schools has a different approach to science education, but none has an actual science teacher doing the lessons. Also, none of the schools uses a formal laboratory setting for the lessons. Finally, the time devoted to science ranges from 3 hours to 30 minutes on average per week.

The scientific method is a process that students have memorized from a list of key points, but not something they have utilized for understanding. The meaning of the terms is not linked to actual processes and therefore poorly grasped. Students need to understand the role of the scientific method in developing the world in which we live, but also to understand how to look critically and analytically at the things they observe.

Communication in science, as well as other academic areas, requires an ability to grasp key terms and their underlying meanings and uses. Students need to be able to observe situations and identify the concepts, processes, and outcomes to then articulate this into understanding. Through various assessment methods such as discussions, observations, and visual products students may demonstrate some

understanding. However, the level falls below my expectations and below the level that enables them to feel comfortable with evaluations.

AREA OF FOCUS STATEMENT

Having limited access and ability to engage with science in primary grades creates undo pressures on students in my secondary school laboratory sciences. Compounding this issue is the limited time available for instruction with the demands of state and federal evaluations. Students do not have the ability to reflect on laboratory experiences beyond what they have included in their notes and what I think to bring up in discussions. The labs take place in the duration of the class period. Often, this means that some of the preparation, lab, and the clean-up needs to be performed by the instructor.

Being able to go back and observe an activity from a different point of view can help develop better understanding. Podcasts and vodcasts, refered to collectively as podcasts hereafter, offer unique opportunities for students to reconnect with lessons and investigations when they are ready to learn. I intend to document laboratory investigations using video and audio files that will be used to generate podcasts for students to access. These will enable reflection on processes for use in developing the terminology, discussions and laboratory reports.

RESEARCH QUESTIONS

- Can podcasts be used effectively to support learning in grades 9-12 laboratory settings?
- Does student access to technology outside of class impact their ability to gain understanding from podcasts?
- Does podcast support for laboratory activities impact their attitudes towards science?

- Does podcast support for laboratory activities enhance student participation in scientific argumentation?

RELATED LITERATURE

Science is a subject filled with complex and abstract issues that can seem overwhelming for students. Active participation in the processes allows students to improve understanding of methods, enhance problem solving skills, develop interconnected relationships with concepts, improve communication through content knowledge, and develop positive attitudes (Lunetta, 1978). As students interact with the material in real scenarios, they have the ability to put it into context that they can relate and remember. Students who succeed in laboratory sciences achieve better scores on science achievement tests and develop positive science interests (Freedman, 1997; Bryant and Edmunt, 1987).

As technology continues to advance, video streaming is moving into the education realm as a reasonable option. The debate continues as to the effectiveness of this technology on student progress. Bennett and Maniar (2007) caution that the area needs to be studied and instructors need to define their intentions more fully when using the technology. The introduction of videoed lectures can be a powerful tool when specific niches are satisfied. Bennet and Maniar focus on two priniple areas for their use. Video used as attention grabbing and motivation has been proven effective (Oishi 2007; Hoover, 2006). Secondly, video used to exhibit reality otherwise impractical to bring into the classroom (Brunvand and Fishman, 2007; Wagener, 2006).

Podcasts are packets of digital media that have potential to fill a niche in the science laboratory similar to computer simulations and streamed video. Computer

simulations have been used to effectively to replace laboratory activities that have equipment or hazard limitations (Kelly et.al., 2008; Bayrak et.al., 2007). Streamed video with applications such as unitedtreaming has been shown to increase student achievement. (Reed) Podcast are a step away from both of these technologies that can offer some of the advantages but need to be monitored to ensure that they do not run into pitfalls. Duke University began an iPod project that involved giving the mp3 devices to all incoming freshmen in 2005 (Jaschik, 2005). The program has undergone revisions as it became evident that merely having the technology did not mean successful implementation. The program is still in effect, but with a more directed scale for departments and instructors that develop an implementation plan around the use of the technology.

This study will focus specifically on science education and the role that podcasts can play in improving student learning. Podcasts are audio files for download and replay at a users convenience while vodcasts are an integration of video with the sound. The file size, download speeds, and available resources are typically the determining factors for applicability.

DESCRIPTION OF INTERVENTION OR INNOVATION

I will be gathering data to analyze the role of podcasts on student comprehension, attitude, and communication in laboratory science settings. By observing classroom interactions, online discussions, and student survey responses, I will be able to identify trends positive or negative towards this resource.

SECTION II

OVERVIEW OF DATA COLLECTION STRATEGIES

Various data collection techniques will be utilized to help counteract any bias that may arise from one form of results versus another. The participants will be given a survey at the onset of the course to offer some quantitative data points. At this stage, they will understand that they are participating in a study, but will not have had any training from the study on what podcasts are or how to use them for the course. At the end of the course, students will be given the same survey with potentially a few additional questions if identified as useful from the first survey. To support the idea that podcasts are an effective educational resource, the data should show students increasing in use, understanding, and confidence with podcasts and science. T-Tests will be used to help identify significant statistical variances.

Teacher observation logs will be kept to track the implications of the technology in the classroom interactions. Student behaviors, response quality, and confidence levels will all be significant factors to identify growth. The log will be qualitative and therefore at risk for subjectivity, but in conjunction with the quantitative data sources, a good means to substantiate findings.

Laboratory grade comparisons from current and past students will be analyzed for significant statistical difference. This offers a quantitative measure, but again has room for error that needs to be factored with the other data sources to develop sound conclusions. Since each group of students from term to term offers unique environmental and social differences, grades need to be considered supporting yet subjective.

Online discussion boards are written records that students can self-monitor for growth throughout a course. They also offer excellent practice for students to develop their argumentation and communication skills. By observing the development of posts over the duration of the courses, it will be feasible to identify if students are making global connections for the material.

Ultimately, the project depends on combining qualitative and quantitative data from various sources to develop support for concluding arguments. No one measure is sufficient to overcome the unique differences among class participants. Together, however, they should be fairly conclusive for identifying trends and possible actions.

DATA SOURCES

Online student survey before and after the course.

Observation log of classroom interactions and activities.

Laboratory grade comparisons from previous and current courses.

Online discussion board participation observations.

DATA ANALYSIS PLANS

The pre- and post- course student surveys will be used to analyze development in laboratory learning, access impacts, and attitudes. Responses will be evaluated individually and collectively. Individual aggregates will be analyzed using a T-Test for statistical differences. Cumulative means will be reviewed for statistical differences as well. Excel will be used to graphically illustrate trends and help to identify relationships between questions and outcomes.

Laboratory grades for past and present courses will be used to look for progress. This particular data source is limited because of the significant variations of system

variables. However, significant differences will be indicators of potential modifications or indicators of further studies.

Discussion board participation will highlight development of student communication and scientific argumentation. The ability to connect abstract concepts internally and externally to enhance discussions will be indicators of growth. Further indicators will be interpersonal responses, length, extrapolation, and interconnectivity.

Teacher observation logs will be important to analyze course discussion and attitudes. Students' responses and integration into course lessons will be reviewed for similar characteristics to the discussion boards. The data will be connected back to the survey data to look for trends and the relationships between variables.

SECTION III

ADDITIONAL INFORMATION

Participants

This research program will be focused initially on my science classes alone. The knowledge and time constraints associated with creation of the podcasts are a limiting factor for other teachers within the school. However, if the process shows positive results and is refined in the first year, it may provide fodder for expansion.

Negotiations and Permissions

Administration, parents, and students will all be notified of their participation in the study. Aside from the survey, the remainder of the process will be incorporated seamlessly into the instruction or offered as an extra option. Individuals will have the right to opt out.

Timeline on an Individual Course Basis in a 12 Week Trimester System

Preliminary Activity: Complete action research plan and discuss implementation with administration.

Week 1: Discuss the action research plan and administer the pre-course survey.

Week 2 - 11: Train students on podcasts, develop and post podcasts for student access, maintain teacher observation log, support online discussion forum.

Week 12: Post-course survey.

Concluding Activity: Data compilation and analysis, revision of plan and re-implement study for subsequent terms, initial development of proposal of findings for dissemination and review subject to further data.

Implementation of Recommended Actions

The outcomes of this research will justify or disqualify the use of podcasts as a teaching tool in science laboratories. If justified, then the evidence can be disseminated to the rest of the staff along with training on creating and posting podcasts for students. As the technology coordinator for the school, I already have control over technology trainings. Since our school already participates in the Maine Laptop Technology Initiative (MLTI), there is already an installed mentality to utilize technology. The challenges to overcome are time and expected outcomes.

Ongoing Monitoring

The online survey and discussion boards are available for continued use. The individual teachers should implement a journal to monitor, but this data source will be limited because of point of view differences. The simplest mechanisms are the online components because of their flexibility and quantitative comparisons.

REFERENCES

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Lunnetta, V., Tamir, P. (1978) An Analysis of Laboratory Activities in Two Modern Science Curricula: Project Physics and PSSC. (Paper presented at the annual meeting of the National Association for Research in Science Teaching (51st, Toronto, Canada))

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Reed, R (2003). Streaming Technology Improves Student Achievement. *THE Journal*, Retrieved August 1, 2008, from http://www.thejournal.com/articles/16269

Wagener, D. (2006) Promoting Independent Learning Skills Using Video on Digital Language Laboratories. *Computer Assisted Language Learning*, 19(4-5), 279-286

APPENDIX A
Literature Matrix

9417 Action Research Project by David Consalvi - July 6, 2008						
Can podcasts be used effectively to support learning in grades 9-12 laboratory settings?						
		Variables Considered in the Study				
Author	**Year**	**Video / Podcast Learning**	**Computer Simulations**	**Computer Use**	**Laboratory (Hands-on) Learning**	**Attitudes**
Bayrak, Bekir; Kanli, Uygar; Kanil Ingec, Sebnem	2007		x	x	x	
Kelly, Janet; Bradley, Curtis; Gratch, Jonathan	2008			x	x	x
Halloun, Ibrahim	2001					x
Sahin, Sami	2006		x	x	x	
Copley, Jonathan	2007	x		x		
Rosell-Aguilar, Fernand	2007	x		x		
Bird, Terese; Morris, Jesse; et.al.	2008	x				
Colombo, Michaela, Colombo, Paul	2007	x				
Baldarrain, Yoany	2006	x				
Borja, Rhea	2005	x				
Fryer, Wesley	2008	x				
Literature Matrix from Mills, G.E., *Action Research, A Guide for the Teacher Researcher*, 3rd ed., p 42, ISBN 0-13-172276-X, Pearson Education, NJ, 2007.						
Secondary Considerations in the Research:						
Student computer use and access, Student attitudes towards science, Student participation in scientific argumentation.						

APPENDIX B
Data Collection Matrix

9417 Action Research Project by David Consalvi - July 13, 2008			
	Data Source		
Research Questions	**1**	**2**	**3**
Can podcasts be used effectively to support learning in grades 9-12 laboratory settings?	Teacher Observation Log	Laboratory Grades	Likert type scaled student survey - pre and post course
Does student access to technology outside of class impact their ability to gain understanding from podcasts?	Student Survey	Laboratory Grades	
Does podcast support for laboratory activities impact their attitudes towards science?	Likert type scaled student survey - pre and post course	Discussion Board Participation	Teacher Observation Log
Does podcast support for laboratory activities enhance student participation in scientific argumentation?	Teacher Observation Log	Laboratory Grades	Discussion Board Participation

Triangulation Matrix Exercise from Mills, G.E., *Action Research, A Guide for the Teacher Researcher*, 3rd ed., p 78, ISBN 0-13-172276-X, Pearson Education, NJ, 2007.

APPENDIX C
Data Analysis Matrix

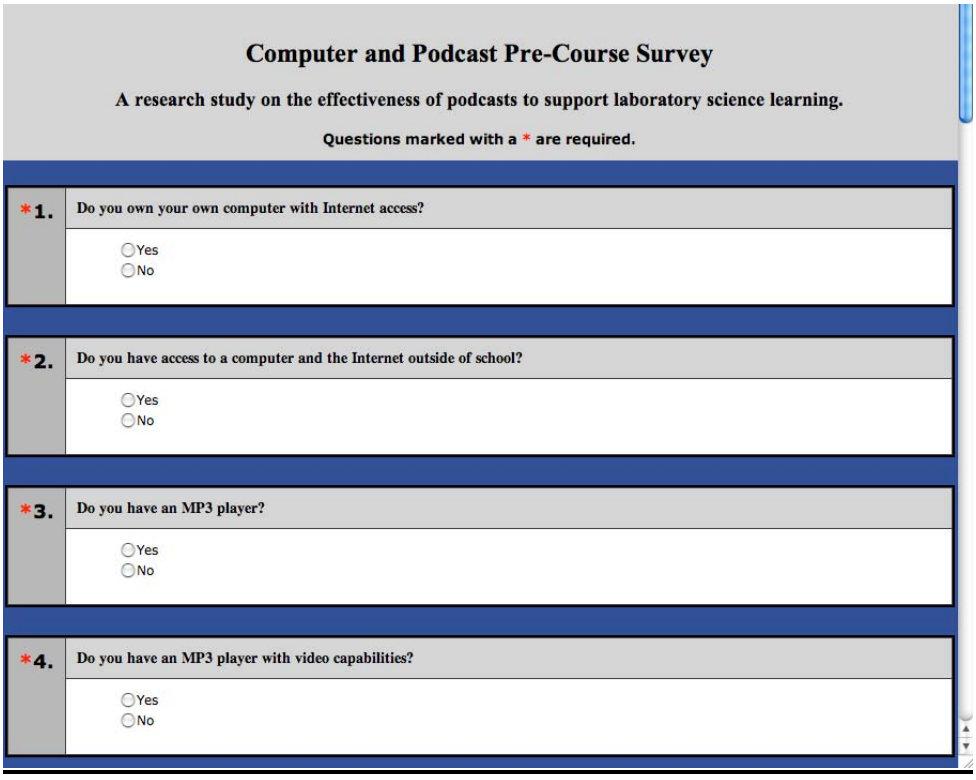
9417 Action Research Project by David Consalvi - July 20, 2008 - Data Analysis Matrix			
Data Collection Technique	**Data Analysis Strategy**		
	1	**2**	**3**
Pre and Post Study Student Survey	Aggregate survey responses for each question and evaluate range of differentiation using MS Excel	Calculate mean for the survey to look for overall difference pre and post study.	Use T-Test to evaluate responses pre and post study for statistical difference.
Laboratory Grade Evaluation	Calculate the mean scores for students using and not using podcasts to identify trends.		
Discussion Board Participation	Examine the responses of students in online discussions for improvement.	Look for improvements in depth of responses for length, extrapolation, and interconnectivity.	
Teacher Observation Log	Evaluate student participation. Compare student responses in students using podcasts and not.	Evaluate response quality. Compare student responses in students using podcasts and not.	Look for improvements in depth of responses for length, extrapolation, and interconnectivity.
Data Analysis Matrix from University of Missouri-Columbia, School of Information Science and Learning Technologies, 2008.			

APPENDIX D
Data Collection Instrument

Online survey available at:
http://professional.cdfarmsite.com/survey/public/survey.php?name=podcastpre

The preceding survey will be given to all students enrolled in a laboratory science at the onset of the course. The delivery format will be through a digital survey tool, phpESP (php Easy Survey Package), which will allow for anonymous submissions. Prior to taking the survey, students will be informed that they are going to be taking part in a research study looking at whether podcasts play a role in understanding and for laboratory sciences. They will not be given any information about what podcasts are or how to use them for the preliminary survey. This will identify a necessary piece of data on where student understanding is with this technology at the beginning and end of the course.

The survey will be given a second time at the conclusion of the course with additional questions added if deemed appropriate from analyzing the preliminary survey responses. By the time the students take the second survey, they will have received instruction and opportunities to use podcasts for a laboratory science course. The data from the survey will be exported from the database to be analyzed using Excel.

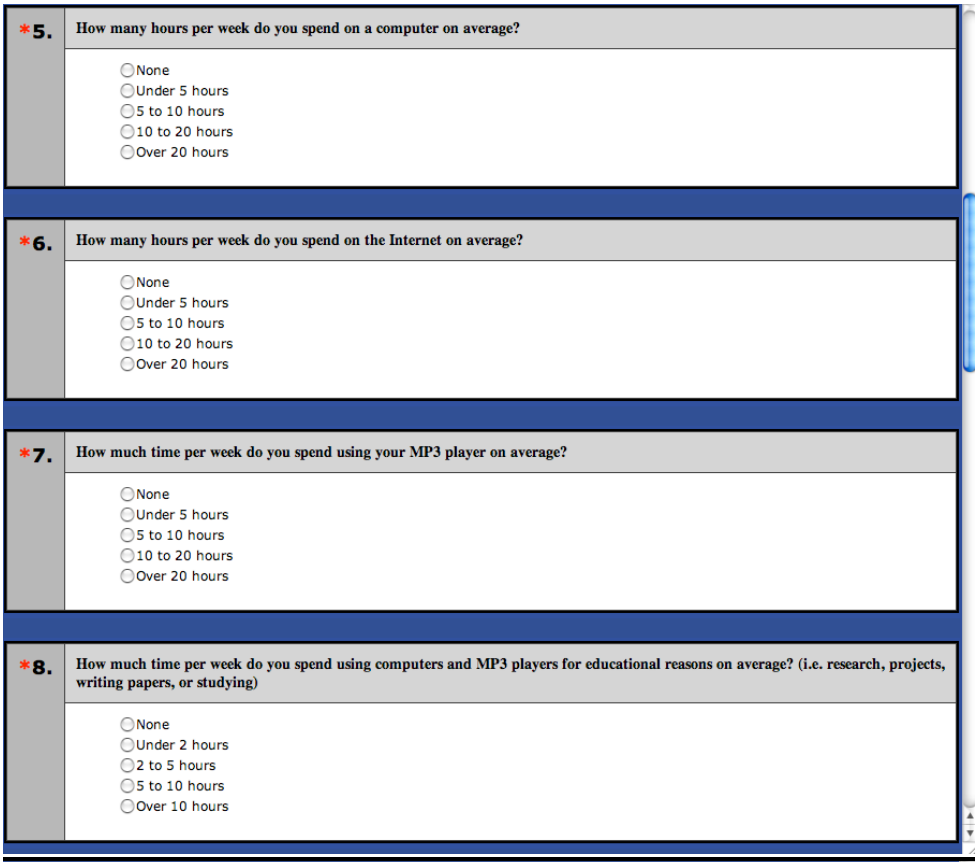


Computer and Podcast Pre-Course Survey

A research study on the effectiveness of podcasts to support laboratory science learning.

Questions marked with a * are required.

*1.	Do you own your own computer with Internet access? ○ Yes ○ No
*2.	Do you have access to a computer and the Internet outside of school? ○ Yes ○ No
*3.	Do you have an MP3 player? ○ Yes ○ No
*4.	Do you have an MP3 player with video capabilities? ○ Yes ○ No



*5. How many hours per week do you spend on a computer on average?

- None
- Under 5 hours
- 5 to 10 hours
- 10 to 20 hours
- Over 20 hours

*6. How many hours per week do you spend on the Internet on average?

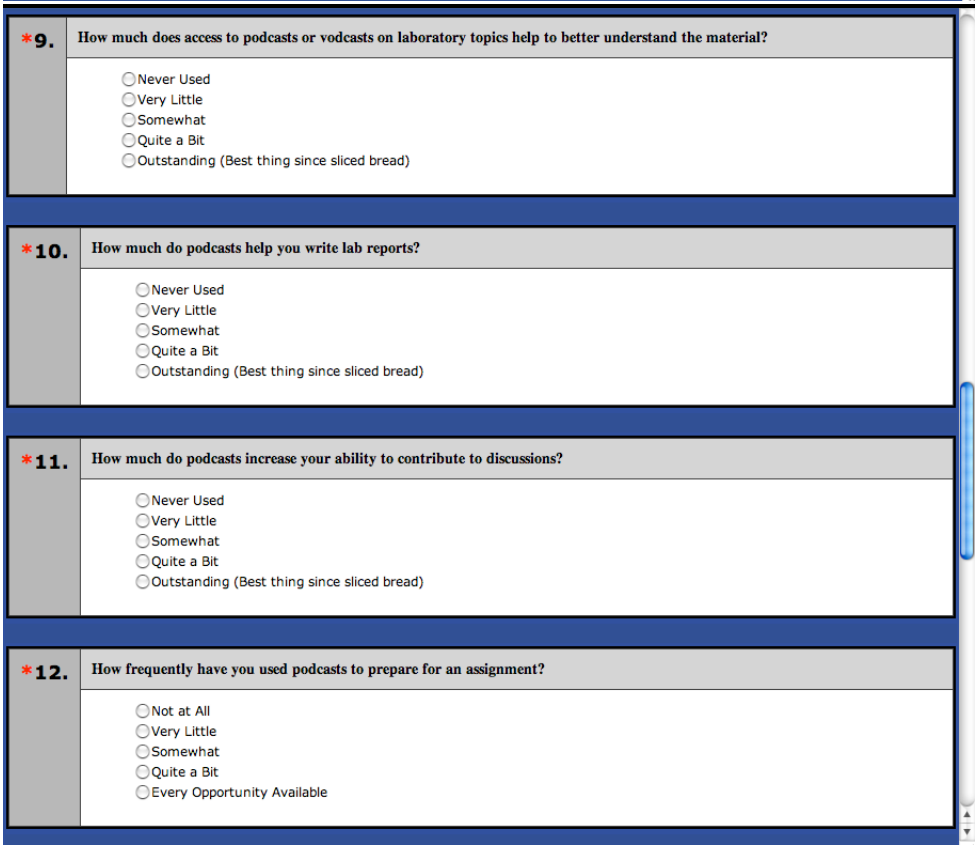
- None
- Under 5 hours
- 5 to 10 hours
- 10 to 20 hours
- Over 20 hours

*7. How much time per week do you spend using your MP3 player on average?

- None
- Under 5 hours
- 5 to 10 hours
- 10 to 20 hours
- Over 20 hours

*8. How much time per week do you spend using computers and MP3 players for educational reasons on average? (i.e. research, projects, writing papers, or studying)

- None
- Under 2 hours
- 2 to 5 hours
- 5 to 10 hours
- Over 10 hours



*9. How much does access to podcasts or vodcasts on laboratory topics help to better understand the material?

- Never Used
- Very Little
- Somewhat
- Quite a Bit
- Outstanding (Best thing since sliced bread)

*10. How much do podcasts help you write lab reports?

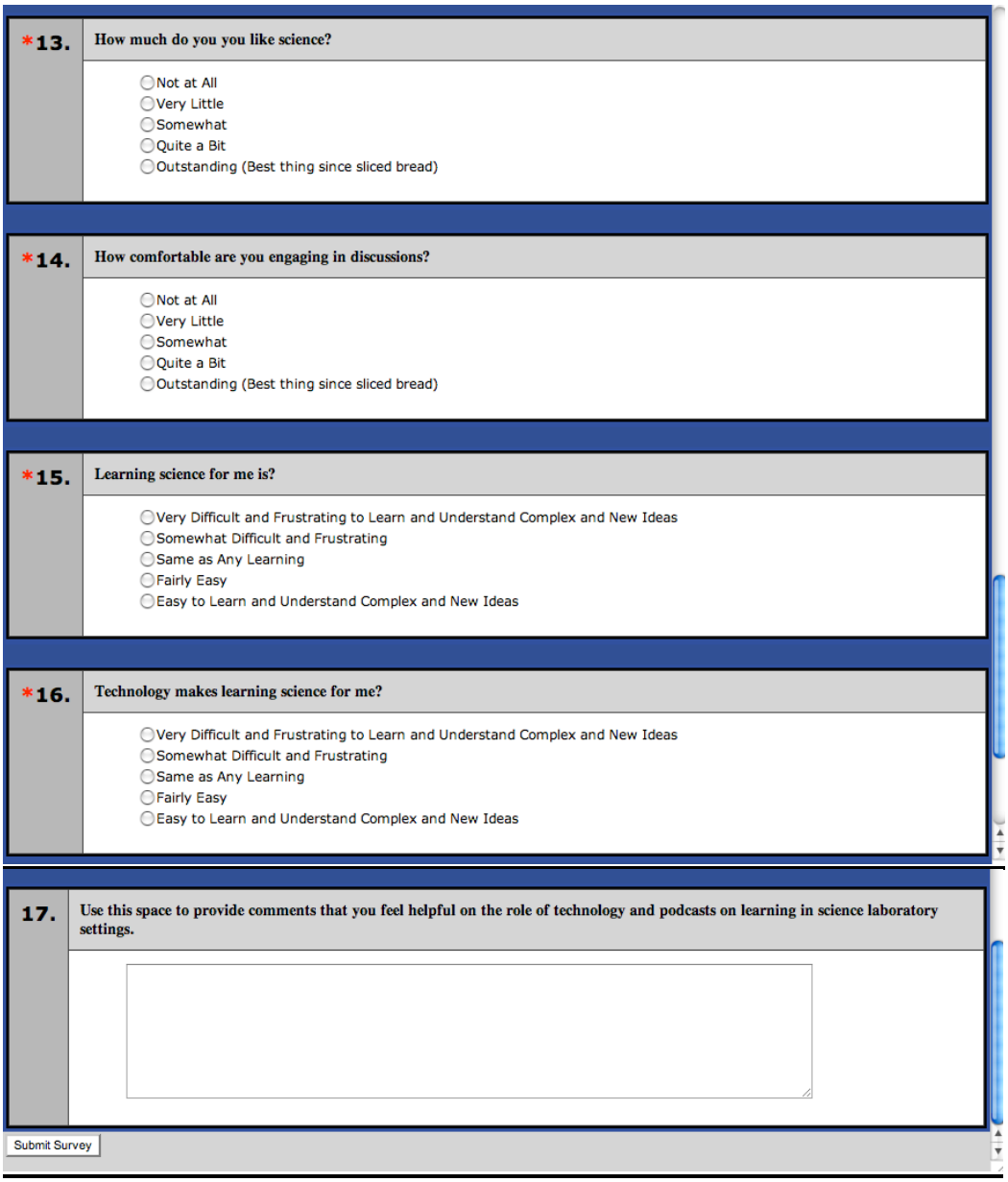
- Never Used
- Very Little
- Somewhat
- Quite a Bit
- Outstanding (Best thing since sliced bread)

*11. How much do podcasts increase your ability to contribute to discussions?

- Never Used
- Very Little
- Somewhat
- Quite a Bit
- Outstanding (Best thing since sliced bread)

*12. How frequently have you used podcasts to prepare for an assignment?

- Not at All
- Very Little
- Somewhat
- Quite a Bit
- Every Opportunity Available



*13. How much do you you like science?

- Not at All
- Very Little
- Somewhat
- Quite a Bit
- Outstanding (Best thing since sliced bread)

*14. How comfortable are you engaging in discussions?

- Not at All
- Very Little
- Somewhat
- Quite a Bit
- Outstanding (Best thing since sliced bread)

*15. Learning science for me is?

- Very Difficult and Frustrating to Learn and Understand Complex and New Ideas
- Somewhat Difficult and Frustrating
- Same as Any Learning
- Fairly Easy
- Easy to Learn and Understand Complex and New Ideas

*16. Technology makes learning science for me?

- Very Difficult and Frustrating to Learn and Understand Complex and New Ideas
- Somewhat Difficult and Frustrating
- Same as Any Learning
- Fairly Easy
- Easy to Learn and Understand Complex and New Ideas

17. Use this space to provide comments that you feel helpful on the role of technology and podcasts on learning in science laboratory settings.

Submit Survey

Science is intertwined in every aspect of life but students in our area are often afraid of it. This action research process is a scientific investigation that uses the scientific method as a base.

The major, culminating project for this course is an Action Research Plan. Remember, to meet the NET standards, your project should be focused on:

0. using technology resources to collect and analyze data, interpret results, and communicate findings to improve instructional practice and maximize student learning.

AND/OR

applying multiple methods of evaluation to determine students' appropriate use of technology resources for learning,communication,and productivity.

A. Introduction: This section should introduce the reader to your study. Also, the context in which your study is occurring

B. An Area of Focus Statement: What is the "problem?" Having defined this problem, what will you do to address it? What you will do to address the problem becomes the purpose for your action research plan. The purpose of your action research plan should be included in your Area of Focus Statement

C. Research Questions: State the research question(s)that drive your study

D. Related Literature: This should be a brief summary of the literature that supports your study. (See page 167 in Mills for an example of a review of related literature). You will do a Literature Matrix as one of the activities for this course. The literature review section of your action research project should be a summary/overview of the literature identified in the matrix.

E. Description of intervention or innovation: This is a description of what you will be doing to improve the situation/to address the teaching learning issue that you have identified.

Section II: A. Overview of your Data Collection strategies Provide a general 1-2 summary paragraph of your overall data collection approach. Include how you will address issues of validity and reliability, and ethical considerations (See page 168 in Mills for an example.)

B. Data Sources Briefly describe your major data sources. (See page 168 in Mills for an example.) The Data Collection Matrix that you will complete as an activity provides the basis for this section.

C. Data Analysis plans This should be summary of HOW

you plan to analyze your data. For example, if you do a survey, do you plan to analyze the survey using descriptive statistics, identifying item means? Or, if you use interviews, do you plan to do a content analysis of the interview data? by question? by overall themes? Use the Data Analysis Matrix that you will complete as an activity as a basis for this section.

Section III: In this section, briefly respond to the following questions: 1. Will there be other people involved in your action research project? If so, who are they and what would be their responsibilities? 2. What negotiations would you need to undertake prior to beginning your project? For example, would you need to secure an administrator's permission? Parents' permissions? 3. What is the projected timeline for collecting, analyzing, and interpreting data? 4. What is the projected timeline for developing your recommended actions? 5. What would be your overall strategy for implementing any recommended actions resulting from your project (e.g. , who would need to be involved in the implementation process? what support might you need? what factors in your school culture might inhibit or support any innovation or intervention actions?) 6. What would be your process for ongoing monitoring (data collection and interpretation) of

recommended actions?

References: You should have a References page in your report that includes all the references you cited in your report. This reference page should be APA style which means (besides the appropriate format and punctuation) that you can ONLY include the literature cited in your report. This is NOT a bibliography in which you can include anything that you've read related to the topic.

Appendices: The following appendices should be included in your report:

Appendix A. Literature Matrix (p. 39 Mills) Appendix B. Data Collection Matrix (p. 73 Mills called "Triangulation Matrix Exercise) Appendix C. Data Analysis Matrix Appendix D. Instrument that you developed

FORMAT:

5-8 pages	Sections I, II, and III
1-2 pages	References
3 pages	Appendices A, B, & C: Literature Matrix, Data Collection Ma

1-3 pages	Appendix D: Instrument

Must be APA Style Must NOT exceed page maximums identified above Submit as a MS Word document

Criteria:

0-10 points	All Parts of the assignment are included--the assignment is comp
0- 5 points	APA style is used in citations and references.
0-20 points	The write-up (Sections I, II, and III) is clearly written, well c
0-10 points	All aspects of the planned project "fit" - that is, the data colle the area of focus and research question(s), the literature discus
0- 5 points	The write of and matrices correspond - that is, the data to be up corresponds with that data collection matrix, etc.
0-10 points	Overall quality of assignment

Total Possible Points = 60 0-5 points will be deducted if any of the maximum page lengths for any part of the assignment are exceeded.

Statement / Observation:

a.) Students do not have the ability to reflect on laboratory experiences beyond what they have included in their notes and what I think to bring up in discussions. The labs take place in the duration of the class period. Often, this means that some of the preparation, lab, and the clean-up needs to be performed by the instructor.

b.) Being able to go back and observe an activity from a different point of view can help

develop better understanding of the topic.

Question: How can podcasts be used to support learning in laboratory settings?

Methods of education are being redefined with the integration of computer technology systems. Teachers are finding access to resources more plentiful and mechanisms to interact globally to develop their curriculum. Students are able to find study materials, virtual lessons, and opportunities to expand their understanding beyond the classroom walls. All of these truths flood the walls of my small, low income, rural high school. The challenge is that the social setting is not developed to comprehend how to utilize this power.

Podcasts