Narrative Description

Science literacy is a critical requirement for students' futures (National Academy of Science, 1996). Yet one of the most difficult tasks in teaching science can often be making a lesson or activity relevant to a young adolescent. While not often addressed by instructional designers learner motivation significantly impacts students' ability to retain and apply new knowledge (Hardre & Miller, 2006). In addition, authentic learning experiences enhance students' ability to transfer and apply new knowledge (Jonassen, 2012).

Within confines, such as the school campus and predetermined curriculum, creating authentic experiences that have value and provide adequate motivational incentives is a complex, often overwhelming goal. However, utilizing technology, particularly mobile technologies, such as tablets and cell phones, can provide learners opportunities (Sharples, 2005). Augmented and hybrid reality hold promise as an innovative, adaptable application of technology to enhance learning and engage students.

The proposed project utilizes a combination of technology-delivered information and data with physical activity, mental challenge, and adult guidance to provide students with an active, authentic crime solving experience. Someone has bear-napped Ms. Oleksa's prized polar bear! Who would do such a thing? Is there a ransom? Where in the school could one hide a 4-foot high, 2 1/2-foot wide stuffed bear? What about the security cameras? Students will travel around the school, talk to individuals, solve puzzles, and collect clues to deduce what happened. In addition, each student group

will be asked to create a crime scenario of their own, using “BEAR-NAPPED!” as a model, for future students.

The activity is designed to resemble a CSI or CLUE-style mystery, incorporating concepts from both problem and game-based learning to engage students and motivate them to move through the activity. Currently, target students are inexperienced in problem-based learning so this activity is designed to scaffold these students to ensure a successful, positive initial experience so may lack some authenticity. Independent work groups provide students an opportunity to learn to work together and problem solve both academic and interpersonal and social problems as they arise.

Working cooperatively allows students to support each other, draw on each other strengths and improve weaknesses through direct peer support and modeling (Delisle, 1997). Students will build on the skills developed in “BEAR-NAPPED!” in future problem-based learning activities. Although, as an introductory activity this project is quite structured, student groups control their path, time spent, individual roles, and how much adult support they receive which still provides a modified constructivist learning environment.

Frequent and real-time feedback from students allows the instructor to adapt or modify the activity as needed and offers students immediate feedback on performance (Shute, V., Rieber, L.P., & Van Eck, R., 2012). Mobile technology and electronic forms allow the instructor to maintain contact with student groups in varying locations. Learning objects such as modular puzzles and riddles can be interchanged and reused between crime scenarios for future applications, minimizing the amount of revision required to implement the activity year after year. In addition, each puzzle could be used

independent of the activity as a check for understanding, a warm up or closure activity within the classroom setting, or as homework and most materials are adaptable to a non technology-based format, which although limiting some of the benefits with regard to student feedback and technology exposure (NETS, 2007), increases the adaptability of the activity.

A key consideration during the design of this activity included learner motivation, self-efficacy, and perceived ability. The activity will be outside of the classroom for large portions and students need to be confident in their ability to meet challenges provided and obtain assistance if needed. Features such as the assignment of roles, "*Ask a Question*" and "*Report a Problem*" feedback forms, remote communication with an adult advisor, and the use of varied media to present information all enable students of varying competence, experience, and confidence levels to participate in the same activity. Several of these features also allow the instructor to make real-time, instantaneous modifications to the activity based upon current student needs.

Students often misinterpret the scientific process as a one way, school-defined construct and limit its usefulness and relevance to science class. "BEAR-NAPPED" and its related activities offer an opportunity to engage and motivate students and blur the walls between the classroom and the real world application of knowledge.

Project CMap Link: http://cmapspublic3.ihmc.us/rid=1KJR15LY0-1ZF3TFN-Q7/Final%20Project.cmap

Statement of Need

Students need to experience the scientific process and develop problem-solving and critical thinking skills through an engaging, challenging, and fun activity. In

addition, students need a common experience which can be referenced and built upon in subsequent activities and discussions.

National Science Education Standards Addressed: Students will ...

- •Acquire/improve abilities necessary to do scientific inquiry.
- •Develop an understanding about scientific inquiry.
- •Understand science as a human endeavor.
- •Understand the nature of science.

National Education Technological Standards for Students Addressed: Students will ...

- •Interact, collaborate, and publish with peers, experts, or others employing a variety of digital environments and media.
- •Contribute to project teams to produce original works or solve problems.
- •Process data and report results.
- •Plan strategies to guide inquiry.
- •Collect or analyze data to identify solutions and/or make informed decisions.

Target Group or Population

The target population for this project is 13-14 year old public school science students, both boys and girls, of varying academic abilities.

Delivery System

The project will utilize a combination of technology-delivered and collected information and data (iPads, laptop computers, cell phones) plus guidance from a teacher and peers in the classroom. Depending on the size of the class and/or school parent or community volunteers may also be utilized to assist students.

Goals

(1) Apply the scientific process
(2) Develop logical thinking/problem-solving skills
(3) Learn to work in cooperative groups to create a common experience

Performance Objectives

Students will be able to ...

(1) Apply the scientific process to solve multi step problems.
(2) Utilize problem-solving skills to reason through problems.
(3) Develop strategies to work successfully in cooperative groups.

Instructional Strategy

(1) ***Apply the scientific method to solve multistep problems:*** Students will be presented with a "crime scenario" that has occurred in the school. Students will have to collect and interpret clues from around the school using and augmented reality application to solve the crime. Formative and summative assessment tools will be employed (see Assessment section below) to benchmark progress, provide feedback, and allow students to both self-assess and provide data to improve the quality of instructional materials.

(2) ***Utilize problem-solving skills to reason through problems:*** Several clues will present information in the form of a puzzle, riddle, or logic problem for students to solve. Correct solutions will result provide information about the crime scenario (evidence, information about a suspect or victim, etc.) and allow students to progress through the activity. Incorrect solutions will provide redirections and hints to help students determine the correct solution. A record of attempts and redirections will be kept to evaluate student mastery.

(3) ***Develop strategies to work successfully in cooperative groups:*** In order to move successfully through the school, collect clues and solve problems students will need to work cooperatively in groups of 2 or 3. Some clues and problems will be constitute a physical challenge that will require teamwork to overcome. Student groups will be monitored by a teacher or adult volunteer (parent or community member) to scaffold activities as needed.

Assessments

Daily (formative): At the end of each day of activity each student will submit a simple, graphic organizer depicting their thought process and which part/parts of the scientific process they utilized during their activity and what results were found. Prior to the restart of the activity the teacher or adult volunteer will evaluate the organizers and conference with students who may need assistance.

As students move through activity (formative): At key clue locations student groups will be instructed to send an electronic "Progress Report" to their "Captain", the teacher or adult volunteer assigned to their group. The progress report will evaluate how many clues they have collected and which problems they have solved correctly to that point. The teacher and adult volunteers will assess

each group's progress and provide appropriate feedback and suggestions about a possible course of action for the group.

Student feedback: Individual students will complete a self-evaluation survey periodically through the activity. Questions included could be similar to

"I participated _____ in my group today.

a.) As a leader
b.) A lot
c.) Some
d.) A little
e.) Not at all"

The augmented reality application will also include submissions for "*Like*", "*Dislike*", "*Ask a Question*" and "*Report a Problem*." Beyond allowing students to communicate with their teacher or adult volunteer without having to leave the activity, these submissions will also help evaluate the fluidity and ease of use of the application, the clarity of the information provided to students, and their preferences for the various parts of the activity.

Summative Assessment

The end product of the activity will be a Crime Investigation Report presented by each student group. Groups may present their information as a written, audio, video, or poster presentation designed to convince the class their version of the crime is the best explanation for the given clues. Students will be assessed based upon their adherence to the scientific process, their solutions to problems given along the way, and their performance as a group based upon self-assessments and adult observations.

In addition, students will be asked, as the term progresses, to develop their own crime scenarios, utilizing "BEAR-NAPPED" as a model. These scenarios are may be used with future students.

Task Analysis and Flowcharts

General Student Task Analysis

1.) Students select work group/team.
2.) Identify problems involved in investigation.
3.) Select focus problem to begin investigation.
4.) Identify information/knowledge/actions needed to solve problem.
5.) Pick or assign roles to team members.
6.) Learn augmented reality application features.

7.) Collect information from various sites.
8.) Return to classroom.
9.) Discuss information found with group and adult.
10.) Use information and attempt solution with group.
11.) Comment, constructively, on proposed solutions.
    a. Accepted solution: Begin presentation
    b. Rejected solution: Revisit sites and clues as needed.
12.) Share solution with class.
13.) Decide, as a class, if activity is completed.

Clue from Location 1: Front Stairwell

Wisps of white fur were found here by Pat, the night-shift custodian. Being an animal lover he immediately checked all living animals in the building and found all were safe and secure.

Where could the fur have come from? When was it left there?

Click on the link below to see how scientists and crime investigators use such ***trace evidence*** to help solve crimes*.

http://videos.howstuffworks.com/investigation-discovery/33312-solved-trace-evidence-video.htm
Should your team take a sample of the fur with you for analysis? If you decide yes, place the sample in

your evidence collection bag. Make note of where it came from and the type of testing that might be done later (from the video).

Taking a sample?

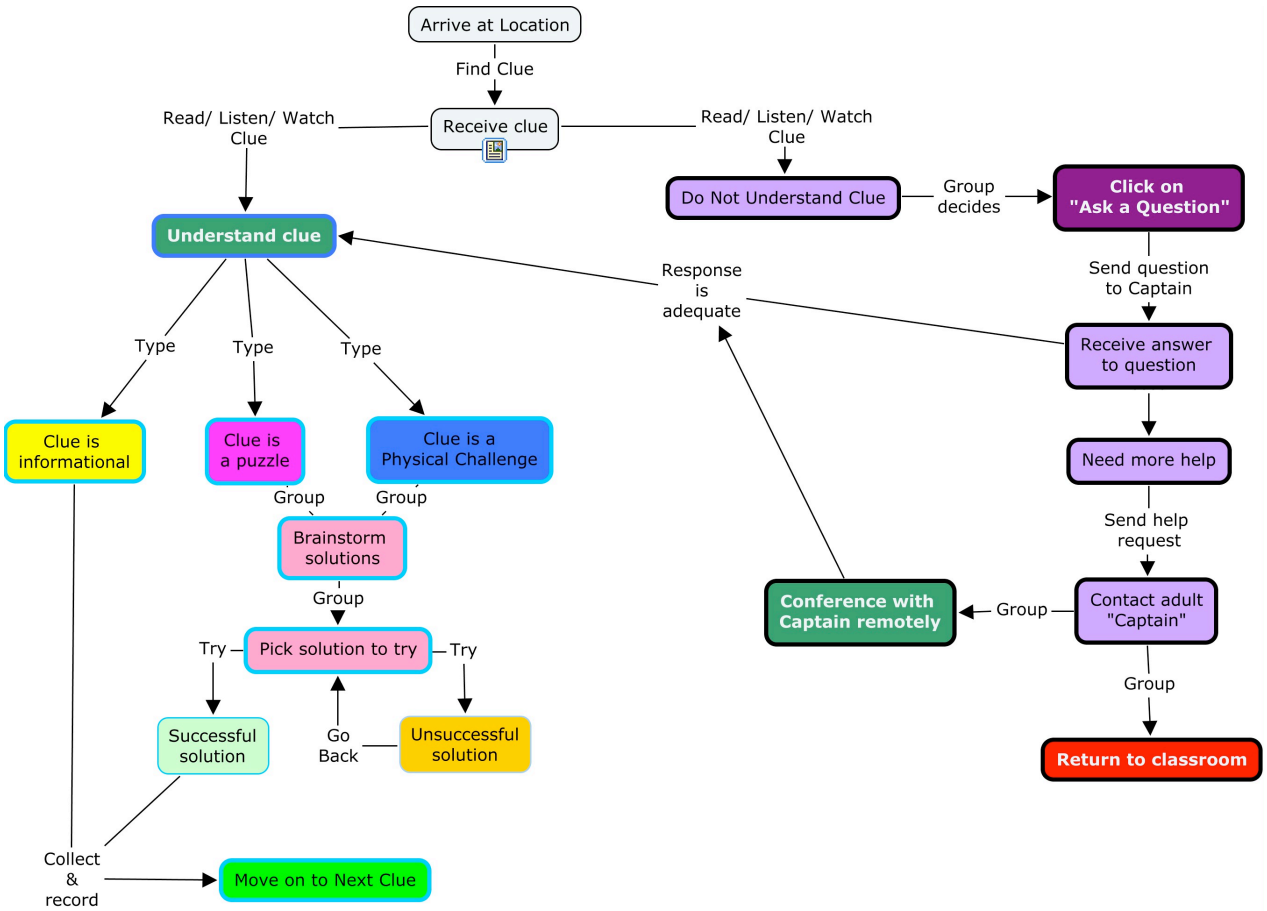
Move down the hall toward the elevator to find your next clue!!

* The photograph and video used in this clue are for the purpose of illustration only and will be replaced with original or properly copyrighted materials. Taken from all-about-forensic-science.com.

    a. If complete: compare actual solution with proposed solutions.
    b. If incomplete: determine future course of action to complete
14.) Follow set course of action from 15.
15.) Create new crime scenario.

Sample Student Clue

Sample Student Clue Analysis



To view above as web page go to http://bit.ly/l2tEOA

Sample Evaluation & Feedback Process

1.) Students complete “Report a Problem” feedback form as follows
    Class Period: 5
    Group Name: Stealthy Sherlocks
    Location: Front Stairwell
    Problem with: Supplies
    Issue: Out of Fur Samples
2.) Adult captain receives feedback form.
3.) teacher will pull supplies and have runner take to location. One sample will be kept for the reporting group to add to their evidence bag when they return to the classroom.
4.) Teacher will adjust materials list to add supply needs.
5.) Students complete “Ask A Question” form.

6.) Adult captain receives form.
7.) Adult sends response to student group.
8.) Students receive answer.
   a. Answer is acceptable: student group continues with activity
   b. Answer is not acceptable: student groups ask for conference.
   c. Answer is not acceptable: student group returns to classroom for additional help.
9.) Student questions and responses are recorded by adult captain.
10.) At the end of day's activity adult captains review student responses and feedback forms and make a note of any patterns.
11.) Patterns are relayed to teacher.
12.) Teacher uses pattern information to revise materials as needed.

Extensions

The school district for which this activity is intended is divided into fairly distinct neighbors such as Forks, College Hill, and South Side. As an extension activity the development of cross curricular, augmented- reality-based mysteries in each of the neighborhoods would be developed and made available to students and their families. Students could complete these activities as extra credit or just for entertainment. The vision exists that having participated in "BEAR-NAPPED" students will be motivated to experience more augmented reality outside the school environment.

Works Cited

Delisle, R. (1997). *How to use problem-based learning in the classroom*. Alexandria, VA: ASCD.

Hardre, P. & Miller, R. (2006). Toward a current, comprehensive, integrative, and flexible model of motivation for instructional design. Performance Improvement Quarterly, 19(3) 27-54.

Jonassen, D. (2012). Designing for Problem Solving. In Reiser, R. & Dempsey, J. (Eds.), *Trends and issues in instructional design and technology*. (???). Boston, MA: Pearson.

NETS Project. (2007). *National Education Technological Standards for Students*. retrieved from http:// www.iste.org/Libraries/PDFs/NETS-S_Standards.sflb.ashx

National Academy of Science. (1996). *National Science Education Standards*. National Academy Press, Washington, D.C. retrieved from http://www.nap.edu/openbook.php?record_id=4962&page=R1.

Sharples, M. (2005) Learning as conversation: Transforming education in a mobile age. Paper to presented at Conference on Seeing, Understanding, Learning in the Mobile Age, Budapest, Hungary, April 2005. retrieved from http:// www.eee.bham.ac.uk/sharplem/write.htm.

Shure, V., Rieber, L.P., & Van Eck, R. (2012). Games ... and ... Learning. In Reiser, R. & Dempsey, J. (Eds.), *Trends and issues in instructional design and technology*. (???). Boston, MA: Pearson.