HOW THE USE OF CURRENT EVENTS IN AN EARTH SCIENCE CLASSROOM AFFECTS STUDENT SCIENTIFIC LITERACY, CONTENT KNOWLEDGE, AND ENGAGEMENT

by

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A professional paper submitted in partial fulfillment
of the requirements for the degree

of

Master of Science

in

Science Education

MONTANA STATE UNIVERSITY
Bozeman, Montana

July 2016

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ABSTRACT

In my classroom I have noticed a disconnection between students' learning inside the classroom and world outside the classroom, although making connections outside the classroom is critical. My action research explored if current events in an Earth science classroom can increase students' scientific literacy, content knowledge, and engagement.

Students were given instruction without using a current world event and with using a world current event. Through the use of multiple-choice tests, student surveys, observations to analyze how the instruction affects student scientific literacy, content knowledge, and engagement.

The analysis shows that the only significant change in students is engagement during the current event instruction. Future action research plans would investigate how the use of technology can engage students, affect content knowledge, and build scientific literacy in students.

INTRODUCTION AND BACKGROUND

As a high school student, I experienced a significant disconnect between the classroom and natural world. It was not until I became a college student and then a science teacher that I realized the connection between science in the classroom and outside the classroom. When I became a teacher, I was able to present the content to the students but found difficulty getting them to effectively apply the information to their lives. This seemed to result in low student engagement, and students lacking the ability to make applied and informed decisions with the content. Many current events in our society are focused around Earth science. Natural disasters, climate change, extreme weather, volcanoes and earthquakes can be focal news in society. There is a need for scientifically literate citizens who are able to make informed decisions that will drive our society's ability to handle and overcome changes happening on our planet. My goal as a teacher is to provide students the knowledge and skill set to become scientifically literate, educated citizens and possess critical thinking skills to face the current and future environmental challenges.

Porterville High School (PHS) in Porterville, California is a rural agricultural community located in central California's San Joaquin Valley. According to Education Data Partnership (www.ed-data.org) the student population is approximately 2,000 students. Seventy percent of students qualify for free and reduced lunch although free lunches are provided to the all students and designated a Title 1 school. Demographic statistics from the California Department of Education report the student population includes 74% Hispanic, 18% white, 4% Native American, with a small population of other ethnicities.

As of the 2014-15 school year, 13.5% of the students were considered English learners (ELL). According to the California Department of Education (www.cde.ca.gov) students that are in the process of learning the English language are assessed yearly, which is known as the California English Language Development Test (CELDT). Students are categorized in five categories by their ability to read, write, speak, and listening; beginning, early intermediate, intermediate, early advanced, and advanced. Currently, the population of ELL students in the two sections of the Earth science is 31%.

At Porterville High School, Earth science is a class not recognized as a laboratory science class in California universities, therefore the class is primarily students not planning on attending a four-year university directly after high school. The implementation of Next Generation Science Standards (NGSS) for the 2016-17 school year will include all sophomores taking Earth science in line with the expectations of "all students, all standards" (A Framework for K-12 Science Education, 2012). The high percentage of ELL students, along with a large number of socioeconomically disadvantaged students results in a teaching challenge.

My focus question for this study was, *"Can the use of current events in the classroom engage students while guiding the students on the path to science literacy?"*

CONCEPTUAL FRAMEWORK

Historically, scientific facts have been emphasized as opposed to understanding scientific thinking and practices of engaging in and performing science (Cavagnetto, 2010). More recently, science has undergone a major change in education with the adoption and implementation of NGSS focusing on producing a scientifically literate citizen (A Framework for K-12 Science Education, 2012). Analyzing the relationship between science and the other disciplines of math, language, and engineering, the NGSS are looking to produce a scientifically literate citizen (Stage et al., 2013). Miller (1983) stated that a society should be scientifically literate to be able to make decisions on science policy.

There is consensus among educators that science literacy is required to produce scientifically literate citizens, but there is little agreement about is the definition of science literacy (Laughksch, 1999). Although not a detailed definition, a generalized overview of scientific literacy can be thought of as, “what the general public ought to know about science” (Durant, 1993, page 129). Many citizens only comprehend science at a basic level. Without higher-level knowledge, a citizen may not be able to support ideas with evidence and make evidence-based decisions. To be scientifically literate, a person must possess specific skill set to be able to integrate science skills and concepts, metacognition processes, critical reasoning skills, and cultural aspects involving science (Cavagnetto 2010).

How do educators produce scientifically literate citizens? Not all students will become scientists so the skills taught in the classroom should be directed at the final outcome of scientific literacy. One challenge with science is how the information is presented to students. The complexities of the language of science, data presentation in the form of graphs and tables, and the need for reading multiple texts to limit any bias by sources of information pose a difficult challenge to overcome (Britt & Rouet 2014).

Hazen and Trefil (1990) state that scientifically literate individuals should be able to critically analyze science current events in the news and communicate the information with others. Using current event articles in the classroom provides the student with relevant exciting information written in a way to hold the attention of the reader as well as the use of domain specific terminology in the article (Jarmine &Mclune 2007).

Literacy is difficult to assess in the classroom. Shwartz grouped literacy into four domains: general scientific ideas, key ideas, subject specific content, and affective aspects. Based on these four groupings, Shwartz evaluated and analyzed each category using different statistical methods including Likert-type scales, open-ended questionnaires, and multiple-choice questionnaires. The results of the study showed most students had a nominal increase of basic chemical knowledge and a lack of application of that knowledge to conceptual ideas. This study concluded that a change in pedagogy, curriculum, and content must take place to produce scientifically literate citizens (Shwartz et al 2006).

Much research has been devoted to the lack of interest in science by students, which can be attributed to teaching to standards and becoming inflexible for incorporation of current events outside the classroom (Bentley 1995). Students tend to view learning to be more meaningful when using resources to obtain information about real world events which results in a connection between the classroom and the outside world (Bennett 1999).

Analyzing scientific literacy has been a challenge due to the lack of a coherent definition of the concept but the agreement is all students need to exit high school with an appreciation and understanding of the importance of the nature of science and technology. DeBoer argues that standards based education should guide teachers in their content and delivery, but the ultimate goal should be scientific literacy (DeBoer 2000).

NGSS provides a scaffolded science education from kindergarten through 12th grade to prepare students for college, career, and citizenship. NGSS emphasizes a deeper understanding on the content and it's application to jobs and current issues in society. Taking a novice to an expert in the content allows for a deeper understanding of the content and its application (A Framework for K-12 Science Education, 2012).

Although NGSS is a marked change from older standards including the most recent National Science Education Standards, both have the same goal for student scientific literacy, "Scientific literacy entails being able to read with understanding articles about science in the popular press" (National Science Education Standards, page 22). Although the concept for scientific literacy is multifaceted, this definition was used for the study.

METHODOLOGY

The study was conducted using two Earth science classes consisting of 11th and 12th grade students (N=58) during the third quarter of the school year. Instruction during the study involved plate tectonics with an emphasis on volcanoes and earthquakes. The study focused on using current event articles in the classroom and how it affects students' understanding of the content, science literary, and the engagement of students during the unit. The treatment unit involved the content related to earthquakes that included the use of current event and was compared to the nontreatment unit of volcanoes. Montana State University's Institutional Review Board approved this research project and compliance for working with human subjects was maintained (Appendix A).

Both nontreatment and treatment units included a ten question multiple choice pretest and posttest, Volcanoes Unit Nontreatment Test (Appendix B) and Earthquake Treatment Test (Appendix C). The tests were given before and after instruction. Results were analyzed for student gains and a paired t-test was used to analyze the paired data for differences and trends between content knowledge before and after the units of study.

The students completed a nine question Student Likert survey (Appendix D) before and after current event instruction to examine quantitative data in student engagement and relevance of the content before and after instruction for both nontreatment and treatment units. The questions were grouped into three catagories; engagement, content knowledge, and literacy. The quantitative data collected from the Likert Survey using the categorical rankings of *Strongly Disagree* (1), *Disagree* (2), *Neutral* (3), *Agree* (4), or *Strongly Agree* (5). A Wilcoxon Signed Rank test was used for data analysis to examine any trends or significant changes to student attitudes and engagement.

The treatment unit on earthquakes included student annotation of the Current Event (Appendix E), and five written response Text Dependent Questions (Appendix F) for students to analyze the information as applied to real world applications. Student work was then analyzed using for content using the Text Dependent Questions Rubric adapted from iRubric to determine student understanding of the current event text (Appendix G).

Data were collected on student engagement using a scale for Student Engagement Observations and randomly collected in one-minute intervals during the current event instruction during the treatment unit and instruction not involving the current event

(Appendix H). A Wilcoxon Signed Rank Test to analyze differences in student engagement.

Six short response Open Ended Survey Questions were used to get qualitative data regarding students' attitudes about science and the use of current events for both the nontreatment and treatments of the project (Appendix I). These data were analyzed for common themes among the students as well as any supporting evidence for the quantitative data collected in this research.

The data table below shows the data collection instruments used for this study (Table 1).

Table 1
Triangulation Matrix

Focus Questions	Pre/post test	Rubric	Likert Survey	Open Ended Survey	Observations
How do using current events in the classroom affect student content knowledge?	X	X		X	
How do using currents in the classroom affect scientific literacy?	X	X		X	
How does the use of current events affect student engagement?			X	X	X

DATA AND ANALYSIS

The results of the Volanoes Unit Nontreatment Pretest and Posttest showed no significant unit gain, with a p value of 0.21 (*N*=42). However, the mean score of the

Posttest was 42% higher than the Pretest. The results of the Earthquake Treatment Pretest and Posttest also indicated no significant gain, with a p value of 0.23. The mean score of the posttest was also 34% higher than on the pretest.

The Wilcoxon Signed-Rank Test showed no significant difference ($p = 0.96$) between pretreatment and posttreatment when engaged with current events. Likert Survey Questions addressing scientific literacy resulted in no significance ($p=0.89$) between pretreatment and posttreatment of the current event. The questions from the Likert Survey addressing content knowledge also showed no significant change ($p=0.47$). Student perceptions as measured through the Likert Survey did not change student from the beginning of the study to the end of the study.

Student responses to Text Dependent Questions were varied when assessed using the Text Dependent Question Rubric (Table 2). The last question, “What recommendations do you have to reduce mass hysteria when the next earthquake strikes Indonesia?” was used to gauge student literacy. Student responses were varied, including responses such as recommending an evacuation plan, emergency drills, better warning system, and updates via the television and radio. Responses also included partial and inappropriate responses such as recommending building a wall, not living in Indonesia, and have plans if there is an earthquake.

Table 2
Text Dependent Question Rubric Response Count

Question Number	No Answer	Needs Improvement	Adequate	Quality	Exemplary
1	2	33	5	2	3
2		38	3	3	1
3		32	8	3	2
4	1	29	10	4	1
5	1	37	4	1	2

Student Engagement Survey results did show significant change (p = 0.01) when current events were being used in the classroom compared to an assignment from the book not using current events. When observations were made during times when students were not involved in current events, 52% of the students were observed in off-task behavior, 29% were somewhat engaged and 19% were on task and engaged (Figure 1). When observed during a current events lesson, students not on task dropped 33% (from 52% to 19%), students somewhat engaged increased 14%, and students engaged in on task behavior increased 19% (Figure 2).

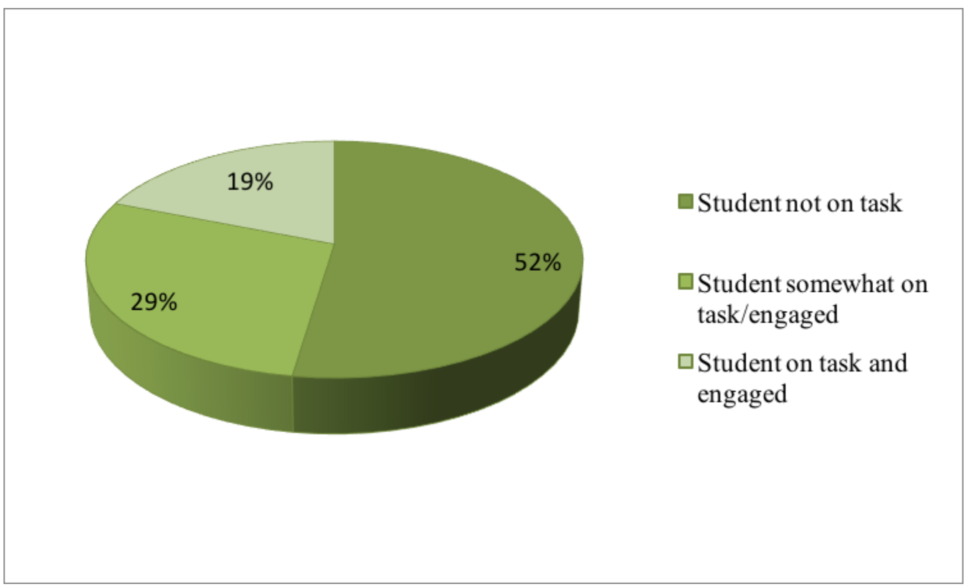

Figure 1. Student Engagement Survey without current event instruction, (*N*=42).

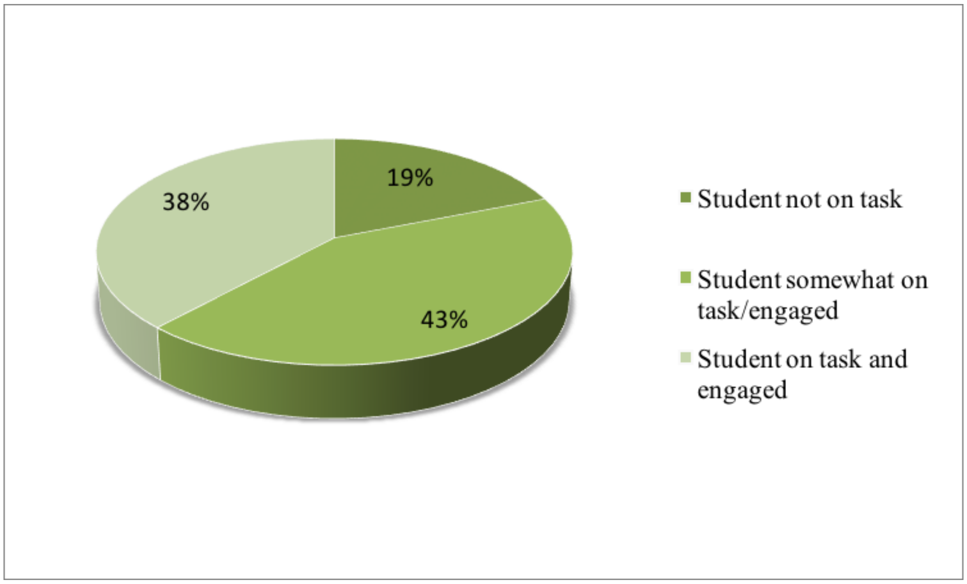

Figure 2. Student Engagement Survey during current event instruction, (*N*=42).

Open Ended Survey questions reflected a range of student responses, which was reflected in the quantitative data. Multiple students responded to the survey question, "How can the teacher make science class more relevant to your life outside of class?" expressing that using relevant events to the students in their town, and "talking about the world." Students also expressed that outdoor laboratory activities would make the content more relevant to their lives. One student expressed in the open-ended survey that science is not relevant to them because it is not involved in their future career.

INTERPRETATION AND CONCLUSION

When looking at the qualitative and quantitative data of this action research, it becomes apparent that there is a disconnection in student thinking between the classroom and outside of the classroom, the real world. Students seemed to understand how current events impacted others in the world, but could not relate current events to their learning and their lives. When asked “How can the teacher make science class more relevant to your life outside of class?” one student responded, “I have no idea how a teacher could do this.” Even the use of a current event to drive instruction of a unit does not result in any significant changes to learning and content knowledge in this study.

The only significance found in when using current events in the classroom was engagement when compared to using the textbook. Although this measurement was using a current event and the textbook, the analysis does not necessarily measure the use of a current event, just the use of two different instructional tools. There may be a student bias against textbooks which results in a significant different when comparing a textbook for instruction versus other forms of instruction.

VALUE

Before my action research project, I didn’t realize the uniqueness of my teaching situation and my students. Teaching in a rural socioeconomically low area resulted in a whole set of challenges not faced by many other teachers in their settings. The migrant lifestyle exhibited by many of my students resulted in students and their families moving seasonally to follow the seasons of agricultural crops. Students may start school late or leave school weeks early to help their family in the fields. The migrant lifestyle and language barrier was a contributing factor to low classroom performance and low scores on state testing.

When speaking to others teachers in the MSSE program, I realized that many of my students lack basic skills in English and do not perform at the level of their peers across the country. This realization readjusted my teaching to not just be a science classroom, but to also be a classroom where basic reading, writing, and speaking skills are learned and practiced.

Using current events in the classroom was my attempt to introduce students to broad issues that connect the classroom content to the outside world. Although many of my students travel for migrant work, they are still sheltered on issues outside of their lives. I wonder if reading current events in the classroom helped my students or if the time better spend elsewhere to increase student engagement, scientific literacy, and content knowledge. Even after this project, I'm not sure the answer is clear. I would like to modify how current events are used in the classroom and incorporate peer-to-peer academic conversation, written responses, and peer editing.

I wonder if it is more valuable to use current events in the classroom or to connect students with the tools to know and understand current events that are happening worldwide. I clearly looked at one type of tool, a current event printed on paper chosen by me, and measured student engagement versus students working from a textbook. Would there have been more of a difference in allowing the students to use different types of technology to research a current event related to the content on their own?

Although the study resulted in no significant changes to student content knowledge and scientific literacy, it has raised the question of student attitudes towards outdated materials in this 21st century society. Have textbooks become outdated? Do textbooks still play a role in a 21st century learner when they have access to technology and apps at their fingertips? Can textbooks be replaced with resources such as smartphones, tablets, apps, Internet access and would using this technology in the classroom result in a student who is engaged, understands the content, and be scientifically literate? There are questions I'd like to further explore.

Williams and Pence (2011) argue that the use of smart phones in a chemistry classroom is a vital research tool equivalent to having a library worth of information and needs to be utilized. Many companies use technology and apps as part of a job, and therefore the technology it should be used in a classroom, not only to teach the students how to use the technology, but also apply the information learned to the classroom content. I think this is an interesting idea that could be utilized in my classroom, although it presents some challenges. Would using technology engage students and help motivate students in their studies, or does it provide a welcome distraction from classroom learning? Along with new ways to research, just-in-time phenomena, current events, can be used to increase student skills of academic conversation and written responses to bring my disadvantaged students closer to the skills of their peers. My students are fully capable to reaching high levels of academic achievement, but challenges from their family situation require assistance from teachers and schools to help them achieve what they are capable of academically.

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APPENDICES

APPENDIX A

MONTANA STATE UNIVERSITY INSTITUTIONAL REVIEW BOARD APPROVAL

INSTITUTIONAL REVIEW BOARD

For the Protection of Human Subjects

FWA 00000165

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MEMORANDUM

TO: Kristin Tesiny and John Graves

FROM: Mark Quinn, Chair *Mark Quinn CJ*

DATE: December 2, 2015

RE: *"The Use of Current Events in an Earth Science Classroom on Scientific Literacy, Content Knowledge, and Engagement" [KT120215-EX]*

The above research, described in your submission of December 2, 2015, is exempt from the requirement of review by the Institutional Review Board in accordance with the Code of Federal regulations, Part 46, section 101. The specific paragraph which applies to your research is:

_X_ (b) (1) Research conducted in established or commonly accepted educational settings, involving normal educational practices such as (i) research on regular and special education instructional strategies, or (ii) research on the effectiveness of or the comparison among instructional techniques, curricula, or classroom management methods.

_X_ (b) (2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified, directly or through identifiers linked to the subjects; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability, or be damaging to the subjects' financial standing, employability, or reputation.

____ (b) (3) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures, or observation of public behavior that is not exempt under paragraph (b)(2) of this section, if: (i) the human subjects are elected or appointed public officials or candidates for public office; or (ii) federal statute(s) without exception that the confidentiality of the personally identifiable information will be maintained throughout the research and thereafter.

____ (b) (4) Research involving the collection or study of existing data, documents, records, pathological specimens, or diagnostic specimens, if these sources are publicly available, or if the information is recorded by the investigator in such a manner that the subjects cannot be identified, directly or through identifiers linked to the subjects.

____ (b) (5) Research and demonstration projects, which are conducted by or subject to the approval of department or agency heads, and which are designed to study, evaluate, or otherwise examine: (i) public benefit or service programs; (ii) procedures for obtaining benefits or services under those programs; (iii) possible changes in or alternatives to those programs or procedures; or (iv) possible changes in methods or levels of payment for benefits or services under those programs.

____ (b) (6) Taste and food quality evaluation and consumer acceptance studies, (i) if wholesome foods without additives are consumed, or (ii) if a food is consumed that contains a food ingredient at or below the level and for a use found to be safe, or agricultural chemical or environmental contaminant at or below the level found to be safe, by the FDA, or approved by the EPA, or the Food Safety and Inspection Service of the USDA.

Although review by the Institutional Review Board is not required for the above research, the Committee will be glad to review it. If you wish a review and committee approval, please submit 3 copies of the usual application form and it will be processed by expedited review.

APPENDIX B

VOLCANOES UNIT NONTREATMENT TEST

Chapter 18 Volcanoes

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. The broad, slightly dome-shaped volcanoes of Hawaii are ____.

a.	composite cone volcanoes	c.	pyroclastic volcanoes
b.	shield volcanoes	d.	cinder cone volcanoes

____ 2. A volcano that is fairly symmetrical and has both layers of lava and pyroclastic deposits is a ____.

a.	cinder cone volcano	c.	pyroclastic volcano
b.	shield volcano	d.	composite cone volcano

____ 3. The most violent volcanic eruptions are associated with what type of volcano?

a.	cinder cones	c.	composite cones
b.	shield volcanoes	d.	fissure eruptions

____ 4. Most shield volcanoes have grown from the ocean floor to form ____.

a.	islands	c.	tectonic plates
b.	dikes	d.	canyons

____ 5. The volcanic landforms at divergent ocean plate boundaries are ____.

a.	oceanic ridges	c.	continental volcanic arcs
b.	volcanic island arcs	d.	ocean trenches

____ 6. Most of the active volcanoes on Earth are located in a belt known as the ____.

a.	circum-Atlantic belt	c.	Ring of Lava
b.	Ring of Fire	d.	East African Rift Valley

____ 7. Which type of landform develops at plate boundaries where one oceanic plate descends beneath another?

a.	rift valley
b.	volcanic island arc
c.	mountain ranges formed by a batholith
d.	lava plateau

____ 8. The igneous activity in Yellowstone National Park is associated with what tectonic setting?

a.	divergent plate boundary
b.	convergent oceanic-oceanic plate boundary
c.	intraplate setting
d.	convergent oceanic-continental plate boundary

____ 9. The Hawaiian Islands are associated with what type of volcanism?

a.	intraplate volcanism
b.	subduction zone volcanism
c.	volcanism at a divergent plate boundary

d.	volcanism at a convergent plate boundary

____ 10. Most volcanoes occur ____.

a.
along convergent boundaries
c.
along divergent boundaries
b.
far from tectonic plate boundaries

APPENDIX C

EARTHQUAKES TREATMENT UNIT TEST

Chapter 19 Earthquakes

Multiple Choice
Identify the choice that best completes the statement or answers the question.

____ 1. A fault is ____.

a.	a place on Earth where earthquakes cannot occur
b.	a fracture in the Earth where movement has occurred
c.	the place on Earth's surface where structures move during an earthquake
d.	another name for an earthquake

____ 2. An earthquake's epicenter is ____.

a.	the place on the surface directly above the focus
b.	a spot halfway between the focus and the surface
c.	the spot below the focus
d.	any spot along the nearest fault

____ 3. When an earthquake occurs, energy radiates in all directions from its source, which is called the ____.

a.	epicenter	c.	fault
b.	focus	d.	seismic center

____ 4. Earthquakes are usually associated with ____.

a.	violent weather	c.	large cities
b.	faults	d.	the east coast of North America

____ 5. The San Francisco earthquake of 1906 occurred along what fault?

a.	the San Francisco fault	c.	the California fault
b.	the Pacific fault	d.	the San Andreas fault

____ 6. Which seismic waves travel most rapidly?

a.	P waves	c.	surface waves
b.	S waves	d.	tsunamis

____ 7. Which of the following is NOT a characteristic of S waves?

a.	They travel more slowly than P waves.
b.	They temporarily change the volume of material by compression and expansion.
c.	They shake particles at right angles to the direction the waves travel.
d.	They cannot be transmitted through water or air.

____ 8. The scale most widely used by scientists for measuring earthquakes is the ____.

a.	seismic scale	c.	moment magnitude scale
b.	Richter scale	d.	epicenter magnitude scale

____ 9. Tsunamis are ____.

a.	often generated by movements of the ocean floor
b.	waves that are produced by tidal forces
c.	waves that cannot cause damage on land

d.	also known as tidal waves

____ 10. A tsunami can occur when there is vertical movement at a fault under ____.

a.	a mountain range	c.	the ocean floor
b.	the San Andreas Fault	d.	a small inland lake

APPENDIX D

STUDENT LIKERT SURVEY

Student Likert Survey

Your participation is voluntary and in no way affects your grade or standing in class.

	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1. The information I learn in this class relates to my life outside of school.					
2. Science is relevant to my life.					
3. I enjoy learning science.					
4. Science gives me a better understanding of what is happening in the world.					
5. Current events are important to understand even if they don't directly affect me.					
6. Current events make science interesting.					
7. It is important to understand what is happening in the scientific world even if I'm not interested in science.					
8. Science is boring.					
9. Current events help me understand what I'm learning in the classroom.					

APPENDIX E

CURRENT EVENT

http://www.reuters.com/article/indonesia-earthquake-sumatra-idUSKCN0W41JC

Huge quake strikes off Indonesia but tsunami warnings cancelled

JAKARTA | BY KANUPRIYA KAPOOR AND EVELINE DANUBRATA

A massive quake struck on Wednesday off the Indonesian island of Sumatra, a region devastated by the 2004 Indian Ocean quake and tsunami, but initial fears of another region-wide disaster faded as tsunami warnings were cancelled.

Indonesian and Australian authorities called off their tsunami alerts within two hours of the 7.8 magnitude tremor, though it was still unclear if the quake had destroyed any buildings or killed people in Sumatra.

A National Search and Rescue Agency official gave an initial report of some deaths, but later withdrew those comments. "Up until now, there is no information about deaths," said Heronimus Guru, the agency's deputy head of operations. Any rescue operation will be hampered by the dark, which falls early in the tropical archipelago.

There were no immediate reports of damage, but the shallower a quake, the more dangerous it is. The U.S. Geological Survey originally put the magnitude at 8.2, revising it down to 7.8.

The epicentre was 808 km (502 miles) southwest of the coastal city of Padang. It was 24 km (15 miles) deep, it said, after first putting its depth at 10 km.

"So far there have been no reports (of damage)," Andi Eka Sakya, head of the National Meteorological Agency, told TVOne. "In Bengkulu (in southwest Sumatra) they didn't feel it at all."

The National Disaster Mitigation Agency said a tsunami was unlikely. "Local governments of the city of Padang and some other areas in west Sumatra have said there was no tsunami and the warning can now be revoked," spokesman Sutopo Purwo Nugroho said.

President Joko Widodo was staying overnight at a hotel in Medan in North Sumatra and was safe, palace officials said. A Medan resident said he did not feel the quake. Erwin, a resident of Mentawai, a chain of islands off Sumatra, told Metro TV: "I am at the beach currently looking to see any tsunami sign with my flashlight. There's nothing. A few minutes have passed but nothing, but many people have already evacuated to higher places."

On Pagai, an island off the west coast of Sumatra, resident Jois Zaluchu told Reuters by phone that there were no reports of damage or casualties there. But Kompas TV said patients at hospitals in Padang were being evacuated. A TVOne reporter said Padang residents were panicking and there were heavy traffic jams.

Indonesia, especially Aceh, was badly hit by the Indian Ocean tsunami in 2004. A 9.15-magnitude quake opened a fault line deep beneath the ocean on Dec. 26, 2004, triggering a wave as high as 17.4 meters (57 feet) that crashed ashore in more than a dozen countries to wipe some communities off the map in seconds. The disaster killed 126,741 people in Aceh alone.

Indonesia straddles the so-called "Pacific Ring of Fire", a highly seismically active zone, where different plates on the earth's crust meet and create a large number of earthquakes and volcanoes.

Additional reporting by Randy Fabi, Agustinus Beo Da Costa, Gayatri Suroyo, Cindy Silviana and Heru Asprihanto; Writing by Nick Macfie; Editing by Clarence Fernandez and Mark Bendeich

APPENDIX E

TEXT DEPENDENT QUESTIONS

Name: Period:

Text Dependent Questions: Huge quake strikes off Indonesia but tsunami warnings cancelled

1. What type of plate boundary caused this earthquake and what features are associated with this type of boundary?

2. What evidence indicates that this article was written shortly after the earthquake?

3. Write your experience with the most recent earthquake from the point of view that you were Indonesia for 2004 earthquake and the 2016 earthquake.

4. What needs to be implemented or designed to limit loss of life in Indonesia when and earthquake strikes?

5. What recommendations do you have to reduce mass hysteria when the next earthquake strikes Indonesia?

APPENDIX G

TEXT DEPENDENT QUESTIONS RUBRIC

	No Answer 0 pts	Needs Improvement 1 pts	Adequate 2 pts	Quality 3 pts	Exemplary 4 pts
Content **0 pts**	No Answer Did not answer question.	Needs Improvement Answers are partial or incomplete. Key points are not clear. Question not adequately answered.	Adequate Answers are not comprehensive or completely stated. Key points are addressed, but not well supported.	Quality Answers are accurate and complete. Key points are stated and supported.	Exemplary Answers are comprehensive, accurate and complete. Key ideas are clearly stated, explained, and well supported.
Organization **0 pts** (Answers are clearly written and articulated.)	No Answer Did not answer question.	Needs Improvement Organization and structure detract from the answer.	Adequate Inadequate organization or development. Structure of the answer is not easy to follow.	Quality Organization is mostly clear and easy to follow.	Exemplary Well organized, coherently developed, and easy to follow.
Writing Conventions **0 pts** (Spelling, punctuation, grammar, and complete sentences.)	No Answer Did not answer question.	Needs Improvement Displays too many errors in spelling, punctuation, grammar, and sentence structure. These errors make the response difficult to understand.	Adequate Displays some errors in spelling, punctuation, grammar, and sentence structure. Errors do not interfere with understanding.	Quality Displays a few errors in spelling, punctuation, grammar, and sentence structure. The student made an effort to use appropriate writing conventions.	Exemplary Displays no errors in spelling, punctuation, grammar, and sentence structure. The student shows a command of writing conventions.

Adapted from iRubric.com

APPENDIX H

ENGAGEMENT OBSERVATIONS

Student Name	Student Not on Task (1)	Student Somewhat on Task and/or somewhat engaged (2)	Student on task and engaged (3)

APPENDIX I

OPEN ENDED SURVEY QUESTIONS

Participation is voluntary and will not affect your grade in any way.

1. Is the use of current events in class important for understanding science? Explain your answer.

2. Do you feel that learning science is important to your future? Explain your answer.

3. How can the teacher make science class more relevant to your life outside of class?

4. How can information be presented other than reading an article on the topic?

5. How can you use the skills in this class to be up to date on science news outside the classroom?

6. What do you like best about this class? What do you like least about this class?