

## Google Cardboard for a K-12 Social Studies Module

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**Abstract:** Virtual reality (VR) is an emerging possibility for delivering educational content and experiences to students. To make VR a viable solution, this research study examined Google Cardboard as a low-cost 3D viewer in conjunction with a provided smartphone. The purpose of the instructional design project was to develop a module within a learning management system (LMS) and to gather affective domain research data on student perceptions of those who utilized a Google Cardboard device to view content for a high school social studies class at a Hawai'i Public Charter School. This study included an even mix of male and female grade 9 students.

### Introduction

Learning Technology (LT) as a discipline contributes by adding technology enhancements to curriculum in addition to working with subject matter experts (SME) to create educational content for various audiences. As current and future practitioners of the discipline, we need to continually look to the horizon to better bridge technology in education. Generation Y is comprised of digital natives and are typically technophiles that do not have a fear of technology. A 2014 study by Edison Research found that 75% of 12-17 year olds had a smartphone (Webster, 2014). In harnessing the capabilities student-owned smartphones for academic purposes, bring your own device (BYOD) initiatives at schools helps to empower student learning by leveraging devices they already know how to use. Keeping students engaged is a challenge to educators, and one way of addressing the level of engagement for learning is through creating virtual reality experiences as a part of the curriculum being taught.

The interest in selecting and wanting to further research BYOD is a current topic that the local charter school that our research unit is partnered with was facing. Like other schools who have a one-to-one program, BYOD is typically a logical progression for a blended or exclusive transition. One-to-one programs have a high price tag in that school budgets typically cannot sustain in the long run. With the charter school's pilot BYOD program in mind, the focus on leveraging BYOD devices, and conducting research on how the device is being used, frequency of use, and what type of teacher professional development would be needed to sustain the future of BYOD.

This research study zeroed in on the use of a specific, low-cost technology product named Google Cardboard. The instructional design module was built in an online learning management system (LMS) for high school students. The students were tasked to assemble and familiarize

themselves with a Google Cardboard device, learn about VR technology, and then complete a simple social studies lesson utilizing *A History of Hawai'i* (Menton & Tamura, 1999). The students were from a local, K-12 public charter school in Honolulu, Hawai'i.

The results of the study provided initial data of students perceptions of Google Cardboard, and some initial findings for organic use of BYOD devices. Since the BYOD program at the school site is still in a pilot, further research will be needed to assess the viability of BYOD. The impacts are great for BYOD as schools, school districts, and educational systems can save costs on technology should the right balance be achieved with such programs.

### **Literature review**

The world that Generation Y lives in requires us as LT practitioners to do a better job in bridging curriculum, instruction, and technology. As university instructors it may be incumbent upon us to recognize these skills specifically in the ambiguous nature of current learning environments, however, in the long run, improvisation of teaching in steady smaller steps will be critical in alleviating the challenges of working with the demands of a new generation. (D'Souza, 2010). More efforts need to be placed on curriculum enhancements with embedded technologies. Leveraging the use of student-owned smartphones is one way to implement low-cost curriculum enhancements.

The purpose of the instructional design project was to develop a module within a learning management system (LMS) and to gather affective domain research data on student perceptions of those who utilized a Google Cardboard device to view content for a high school social studies class at a Hawai'i Public Charter School. In order to understand the reasons for selecting Google Cardboard as a VR platform, we need to understand its beginnings. Google Cardboard was launched in the summer of 2014, and is only in its infancy as of this publication. Cardboard is beginning to take off with help from the Education team at Google. They have committed resources for designing educational content through their Expeditions program.

With Google Expeditions slated to launch in the fall of 2016, teachers and students will have the opportunity to explore places where they would not ordinarily have an opportunity to visit through guided 360° photos. The 360° photos also known as photospheres immerse the viewer in a visual experience that include famous landmarks around the world. With the official release of Expeditions, underwater and other unique experiences can be expected. Other notable features of Expeditions is the ability for a master device, such as a teacher's tablet to guide students, while using their Cardboard device, through the VR experience by tapping on points of interest contained in the VR selection. The points of interest have additional text detail about what the student is viewing. One of the advantages to a guided experience is that the teacher can act as a docent as students explore for the first time.

The low cost of Cardboard and leveraging the use of smartphones is the key to making VR learning affordable. As of the publication of this paper, Google Cardboard can be purchased for under \$20 a unit. Compared to other VR products, Google Cardboard is by far low in cost that makes it viable in the education arena. In looking back two years ago, it would have seemed that

a product like this was an April Fools prank. Google launched a product made out of cardboard while it was also selling a hard to obtain product named Google Glass. Glass was a \$1,500 product that also required a smartphone, but was eventually put on the backburner.

Google Cardboard (Figure 1.) was conceptualized out of the 20% time that Google employees are afforded to vision a project and try to bring it to fruition.

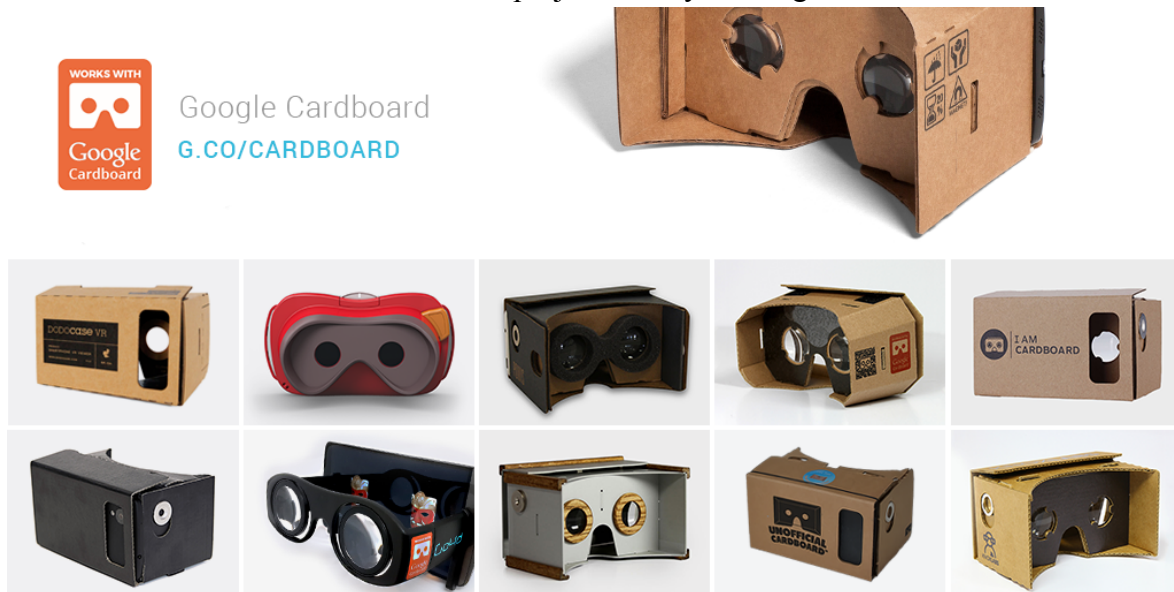


Figure 1. Examples of various Google Cardboard models

The hardware side of Google Cardboard uses low-cost viewers, with the reference design made of foldable cardboard (hence the name) 45mm plastic lenses, and a magnet or capacitive-taped lever to operate the screen. Once you get everything folded into the right configuration (most kits come pre folded and assembled) you slip your phone into the front of the viewer (Figure 2) (usually held in place by velcro or rubber bands) and run an app designed to work with Cardboard. (Hildenbrand, 2015)

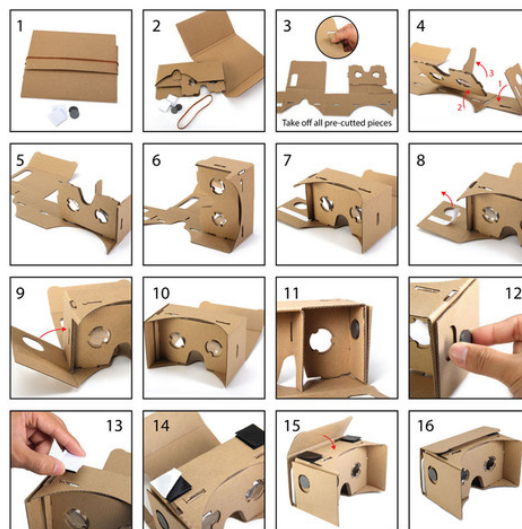


Figure 2. Examples of how to assemble a basic Google Cardboard

With the completed Cardboard device, the students were able to view content with the Cardboard app on their smartphone. While there is limited content currently available for Cardboard, Google has launched an open software development kit (SDK) and their education initiative entitled “Explorers” to further develop apps and content. The Explorers program is to allow students to virtually travel to other destinations to be able to experience places they would not ordinarily get to visit. This research project did not have access to creating experiences in Google software and leveraged YouTube for the content delivery for the Cardboard experience.

Traditionally, virtual reality has been out of reach for most people, especially when it comes to using VR in the classroom. Virtual reality, “An artificial environment created with computer hardware and software and presented to the user in such a way that it appears and feels like a real environment.” (Webopedia, 2015), is how it has traditionally been known. VR previously required a desktop or laptop computer to view content. Virtual reality offers unique learning experiences due to its ability to provide real-time three-dimensional visualization and afford various types of interactivity within virtual learning environments. (Chen, 2015) VR has come a long way and many improvements have been made to the technology. Improvements such as headworn devices bring the viewer or audience closer to being immersed in a VR world through the use of three dimensional (3D) head-worn devices attached to computers.

The fully immersive learning experience of VR can be used to increase knowledge-based, abilities-based, or skill-based measures. The assumption underlying the rapid rise in the use of desktop-based virtual reality technology in instruction is the unique affordances that it offers in enhancing learners’ cognitive skills. (Merchant, 2013) In part of the study, the researchers were able to determine that students were able to have an easier time recalling factual information, but did not experience the same ease with acquisition of skills. The Merchant study also determined that VR instruction had good results when students were tested immediately after being presented the lesson. The results of this meta-analysis are encouraging in that they provide evidence that virtual reality-based instruction is an effective means of enhance learning outcomes. (Merchant, 2013) The Merchant study paves the groundwork for current research endeavors such as examining the use of Google Cardboard as low-cost VR for K-12 curriculum enhancement applications.

Companies like Oculus VR created a product called Rift back in 2014. In March of 2014, Facebook acquired Oculus VR for \$2 billion dollars. Other competitive products include Samsung Gear VR, which requires a qualified Samsung phone to use the software. Both of these products are cost prohibitive when it comes to price point per unit. Google cardboard is the first concept that allowed you to use any Android or iOS enabled phone in conjunction with a VR device made from cardboard to view VR content. The cost of a Google cardboard is typically less than \$20 USD.

Other companies such as Mattel, a well known toy manufacturer also owns View-Master, one of the original, widely commercially available product that introduced stereoscopic experiences by placing a disc of tiny images into the product. To use the product, the user would then pull down on a lever on the side of the device to advance the wheel of images, and a new image would be

displayed. Mattel has created their own cardboard compatible device made from its signature red, plastic material. As of the publication of this project, the 2016 version of the VR View-Master is within the same price range as Google Cardboard, retailing for under \$20 USD a unit.

### **Project Design**

The learning objectives of the course were as follows: (1) to understand the attack on Pearl Harbor brought the United States into World War II (WW II), and (2) to understand how martial law was declared for Hawai‘i and the drastic impact it had on life in the Hawaiian islands. Additional factors in the project was to introduce a technology device, in this case Google Cardboard as a supplementary curriculum enhancement device. The two development items were to create a module in a LMS using instructional design, and to develop a complementary VR component to the module. Because of the cutting edge technology used for VR, the video component had to exist outside of the LMS

A website (Appendix C) was created to provide a central place to know what the research was about, the schedule, and to provide additional technical background about the VR being used for the research. Content directly related to various assessment pieces were contained with the the LMS. To accomplish the learning objectives, students first took a pre-assessment to test their knowledge on what they may already know about the bombing of Pearl Harbor during WW II. The embedded section of the modules taught students about additional content of Pearl Harbor. The post-assessment tested the students retention of overall knowledge after completing the modules. (Appendix D)

Canvas was selected as the learning management system, so that student data could be tracked to show their pre and post understanding of the content. The additional layer of affective domain research using John Keller’s ARCS Model of Motivational Design. The Attention, Relevance, Confidence, Satisfaction (ARCS) survey instrument (Appendix E) was administered to see how students responded to using Google Cardboard as a part of the learning process. Google Forms was used to create the ARCS survey instrument.

The Analysis, Design, Development, Implementation, Evaluation (ADDIE) model was used to develop the Pearl Harbor modules. The ADDIE model was the ideal instructional design technique used in the development process. The revision process outlined by ADDIE helped the curriculum developer with a logical creation, testing, and revision process till the product was finalized. ADDIE was key for developing and streamlining module development within a LMS.

The final piece to the project was to create VR content related to the attack on Pearl Harbor. Google Expeditions currently uses 360° still photos, and another experiment of this research project was to take content creation to the next level by creating 360° video content. The 360° video content retraced the flight path that some of the Japanese bomber aircraft used to sneak attack “ Battleship Row” on December 7th, 1941 (Figure 3). The purpose of the video was not to create a reenactment, but to visually show students the flight path at the approximate height and show an aerial perspective of flying from Kahuku Point, off of the North Shore of the island

O‘ahu, through the central plain, highlighting Wheeler Air Force base, and then on to Pearl Harbor itself. A commercial helicopter was chartered to fly the flight path. Custom rigging and safety gear was developed for the “doors off” flight. The researcher and a crew took 360° video and still photographs for the project.

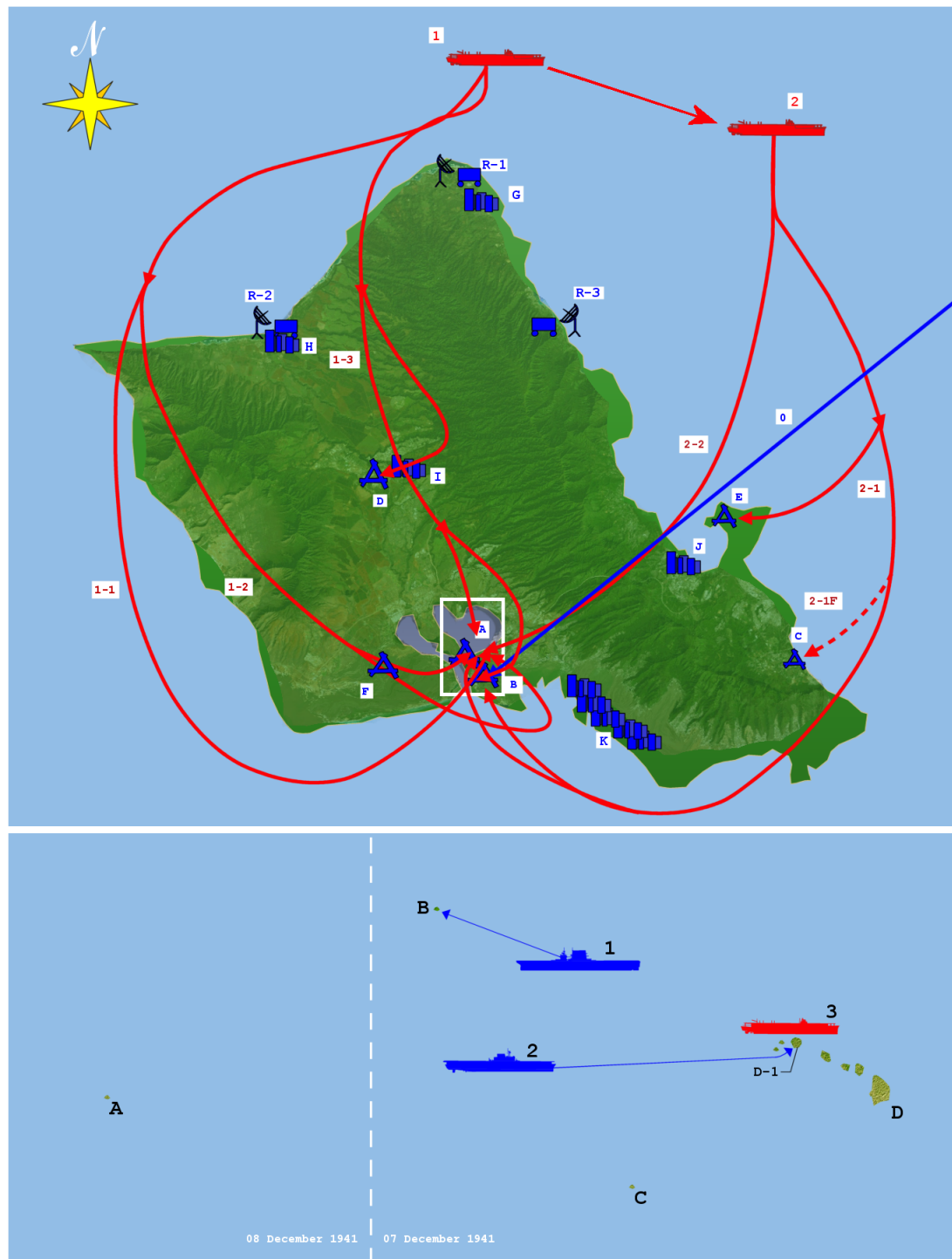


Figure 3. Diagram showing the multiple waves of attack on O‘ahu’s military targets

## Methods

The purpose of this study was to (1) determine student perceptions of Google Cardboard for technology enhanced curriculum, and (2) to determine if Google Cardboard could be used in conjunction with BYOD devices to provide a low cost VR solution for high school students. While the research in this project was just the tip of the iceberg, the thought was that the findings have the potential to further justify the use of Google Cardboard and BYOD devices in the classroom for academic purposes. In future iterations of Google Cardboard in conjunction with the final release of Google Expeditions for education, teachers and researchers will have a better understanding of the impact that Cardboard can have as a curriculum enhancement.

Participants were recruited from a grade 9 History of Hawai'i course at a local public charter school spent three, 45 minute periods over three weeks in doing a pre-assessment, construction of a VR device, and then did a post assessment. Students and legal guardians completed a consent/assent form (Appendix A). Participants were read a script (Appendix B) and given a short presentation about the research. Students had access to a one-to-one laptop, enabling learning to take place outside of the physical classroom. Students were able to access content via Canvas LMS. Testing was done ahead of time to make sure that content filters would not block the module or any of the associated components.

As a part of the learning process, students had the option to work individually or as a team to assemble their Cardboard device. The class that participated in the research contained 26 students. They were then grouped into seven teams. The research developed a classroom kit of contained seven Nexus 5 phones. The kit contained a USB charger designed to charge all of the phones at once. The classroom kit was designed to be easily portable, low cost, and the phones were off-contract so that only WIFI could be used on each of the devices.

Each team received a Nexus 5, Android smartphone to use with Cardboard device. While some students had their own smartphone, the research design used a single, provided Nexus 5 for consistency with the Cardboard experience. The Nexus 5 was deemed capable of running the Google Cardboard app without any issues. Using a student-owned smartphone could have created a variable Cardboard experience. Consistency was key as students may have then reported a different experience in the ARCS survey.

The instrument design was to ask sets of five questions in each section, for a total of five sections. Section one contained general questions, in the following sections, questions were arranged from a small scope to a larger scope. The rest of the survey contained four sections: two for attention, three for relevance, four for confidence, and five for satisfaction.

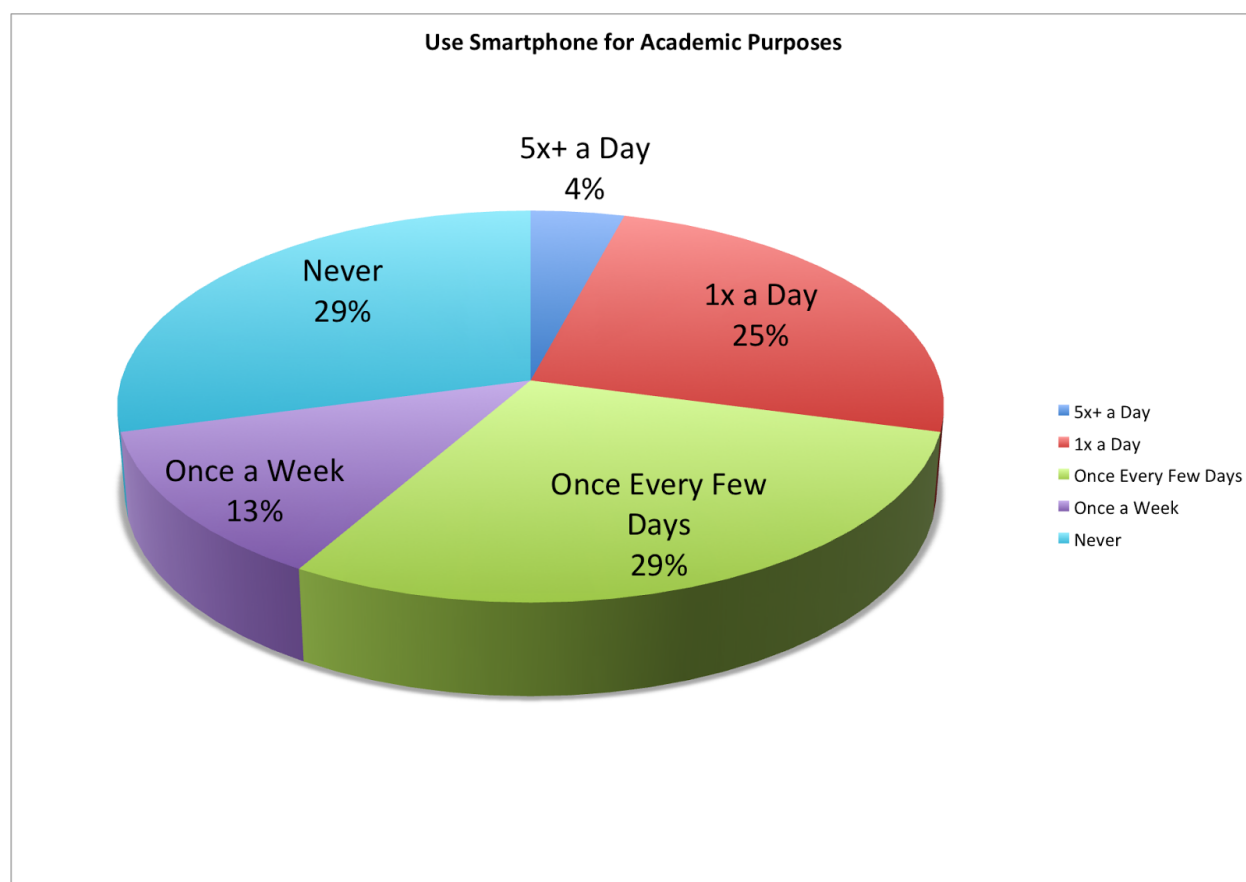
## Results

Data was collected over a three week period. This allowed for 26 students to participate in the project. Most of the classes at the selected charter school have a 50/50 mix of males and females. The school's composition of students reflects the ethnic composition of the State of Hawai'i. It also has a diverse sampling from across socio-economic status, making this an ideal

test site. Data collection involved students taking a pre and post test assessment, as well as being able to provide overall feedback in an evaluation of the project after it is completed. Most critically to this study was the feedback about VR as a part of the lesson.

The participants were evenly split 50/50, male and female. Of the participants who completed the survey, 100% of them owned a smartphone. 54 percent had an iPhone running iOS, while the other 46% had an Android device. This was further defined as a smartphone that they had in their possession that someone else may have purchased for them. As a part of this research study, unlocking the potential for student-owned smartphones to be used for academic purposes was one of the hopes.

Of the students surveyed, 71% of them did not use their smartphone for academic purposes on a daily basis (Figure 4.). In a follow up question, students reported a mixed perception of the need to have a smartphone for academic purposes in class. Nine of the 24 students were on the fence about having the requirement, while 10 students felt stronger about needed a smartphone for academic purposes, the remaining students felt it was less than necessary. While the survey design was not a deep dive to find out why, on the surface this is a good starting point to take a look at further research as to why this is the case.



*Figure 4. (n=24) Frequency of smartphone use for academic purposes*



In looking at the attention aspect of the instrument, students were asked to answer questions using a five point Likert scale. Only four of the 24 students had some previous experience with Google Cardboard. The low previous exposure to the product

In retrospect, the instrument should have allowed for “yes” and “no” for the options as opposed to sticking with the Likert scale for this question. However, the data can be interpreted as most of the students had no prior experience, as 13 of the 24 respondents stated they agreed that they had no prior experience. Four respondents stated that they had experience with Google Cardboard. Without further investigation, seven of the students may have had some experience with Google Cardboard. The majority of the participants or 92% reported they enjoyed learning about Google Cardboard.

The module was based upon existing classroom text and adapted for a learning management system. All the content presented in the module was supplementary to the existing curriculum and did not take away from traditional learning in the classroom. The learning management system consisted of a module with multiple sections. The pre and post assessment was comprised of multiple choice questions. The evaluation was also multiple choice questions using a Likert scale as well as open ended questions.

The pre-assessment, embedded, and post-assessment (Appendices D and E) was used to gauge how much students knew about World War II and Pearl Harbor, taught them through videos and images, and then re-tested their knowledge on the topic. Once the modules were completed, the survey tool (Appendix C) designed using the ARCS model, asked students their perceptions of the Cardboard device and experience.

As with most research studies in which volunteers are recruited, the participants do not always complete their tasks. While the total count of participants that consented to participate was 26 students, only 21 of them completed the pre-assessment, embedded questions, and post-assessment. In taking a look at the pre and post data (Figure 5.) the majority of the students did better on their post-assessment compared to the pre-assessment.

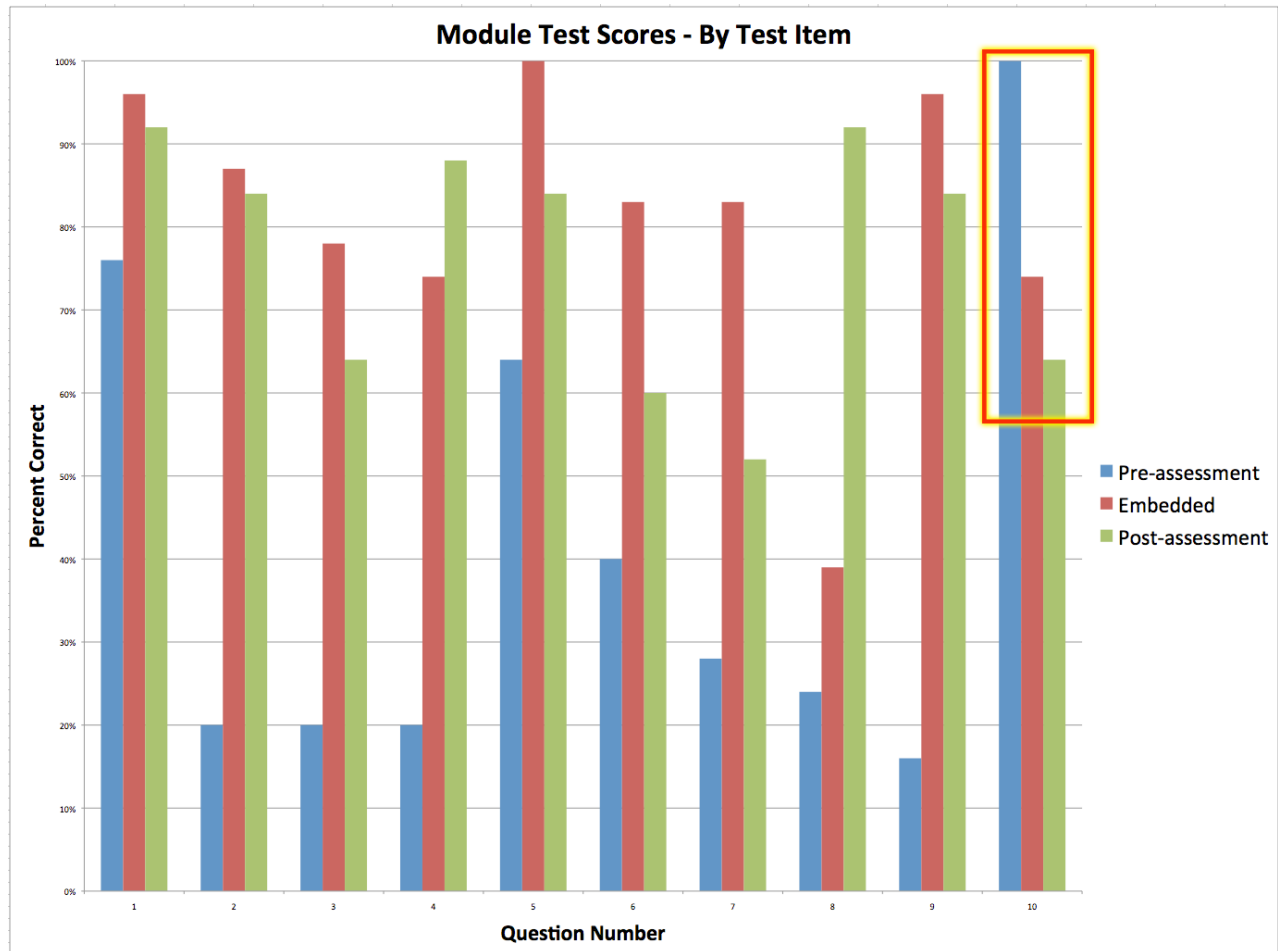


Figure 5. ( $n=21$ ) Pre-assessment vs. post-assessment scores

However, on the embedded and post-test, the last test item appeared to have stumped the students. In looking back at the final test item for the embedded instruction, students may have not had enough instruction or clear instruction. The post-test was by far worse than the embedded test score which could have been related to the students rushing to complete the assessment to be able to begin working with the Google Cardboard device.

The students provided valuable feedback through the ARCS survey. In the first section (A)ttention, students reported that 96% of them enjoyed learning about Google Cardboard and also had a 100% level of enjoyment using the product. The (R)elelevance section of the survey highlighted that 83% of them believed that Google Cardboard would help them better remember content because of the 3D factor. About 75% of the students felt that other classes such as English, Math, Science, and Social Studies should incorporate Google Cardboard. Students reported that 100% of them felt that Google Cardboard does meet its mark and potential for allowing them to explore somewhere that they could not ordinarily visit.

As as part of the ARCS survey, the remaining two sections were to determine deeper level understanding and the ability to pass on knowledge that they have acquired. In the (C)onfidence

section, 88% of the students felt comfortable that they could teach a friend or family member how to use Google Cardboard. This was a good indicator that the students felt comfortable enough with the product and had a good understanding of how it worked, with a short hands-on experience. After using Google Cardboard, 71% of the students reported that they could come up with their own use for the product on their own. A good majority of the students were using critical thinking and problem solving skills to dream up other possibilities. The concluding portion of the survey asked students about their (S)atisfaction with Google Cardboard. Students were curious to explore uses of Google Cardboard by downloading additional apps, represented by 87% of them indicating that they would do so. Lastly, 92% of the participants surveyed indicated that they were now going to tell one or more friends or family members about Google Cardboard, and 87% of those same students would show friends or family members how to use Google Cardboard.

## **Discussion and Conclusion**

The exploratory work to create a 21st century learning experience by incorporating instructional design to develop a social studies module for the K-12 environment, while using cutting edge technology such as Google Cardboard was a challenge. Without the direct assistance of a subject matter expert (SME), only a limited scope of breadth and knowledge could be applied to the World War II, bombing of Pearl Harbor could be created within the time constraints, limited resources, and time constraints. On a future, larger scope project, working on expanded content for the module and making it closely linked to the intended textbook would be highly advisable. Developing the modules within Canvas along with emerging technologies such as 360° video capture for creating a custom Cardboard VR experience was difficult. In this situation, being on the bleeding edge meant that not all of the tools necessary for creating well polished products was widely available at the time of the research.

Students that completed the ARCS survey had the opportunity to provide additional feedback with a single open ended question of, “Is there anything else we should know?”. Students wanted to know how long it would take to create their own video for Google Cardboard, and further wondered if this was possible. They thought the product was cool. While the best response was “I loved using Google Cardboard during class. If I were to rate it out of ten, I would give it a over 9000.” The participants of the research project did enjoy their experience and did provide good initial feedback to take this to the next level.

## **Conclusion**

The intent of the instructional design project was to design a well-constructed module in combination with the book *A History of Hawai‘i*, to devise a social studies lesson to have students assemble a VR device, learn about VR, and to learn a simple lesson on a moment in U.S. and Hawai‘i’s history. It is the hopes of the researcher that preliminary information on BYOD can help to future guide the development of a comprehensive program. The purpose of the study was to evaluate the effectiveness using the ARCS model of low cost VR products such as Google Cardboard as a viable curriculum enhancement technology for K-12 students. The

results from the ARCS survey will help to guide the expanded use of Google Cardboard, and has preliminarily determined that it is a viable option for low-cost VR curriculum enhancement.

The researcher intends to conduct further self-funded research on Cardboard and VR to further evaluate Google Cardboard and to further create additional content for testing. The create of modules to guide student driven content creation will also be apart of the immediate future plans. Other next steps is to expand the scope and collaboration of creating 360° video content and to disseminate the findings through further white papers, research papers, and conference presentations.

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## APPENDIX A

Google Cardboard Recruitment Script  
October 26, 2015

Aloha Class,

My name is Mark Yap. Besides being the IT manager for the Curriculum Research & Development Group here at UH Mānoa, I am also a student going for my master's degree in Learning Design and Technology. Today, I wanted to let you know about a research project I am working on for the University of Hawai'i at Mānoa under the direction of my professor and principal investigator, Dr. Catherine Fulford. Previous to my visit to your class today, I have met with Mr. Lush, Mrs. Tassil, Ms. Cottongim, and Mr. Jeremiah to discuss the research project. They have approved and I am here to ask for your consideration to participate in the research study.

As you know, there are multiple types of research being conducted here at the University Laboratory School. The research I am involved in is regarding Google Cardboard and Google Expeditions. Google Cardboard is a 3D, virtual reality viewer made of cardboard. Qualified smartphones are able to download apps to view 3D content. The purpose of the research is to have students assemble a Google Cardboard device, to learn a lesson related to what you are learning in this course, participate in a pre and post assessment (quizzes that do NOT affect your grade), and for you to complete a survey at the end about Google Cardboard.

You will have the right to decline participation in the research. However, we will all do the lesson as a class. The Google Cardboard device will be yours to keep. In no way will the outcomes of this research project affect your grade.

The requirements to participate is that you must be in Mr. Lush's grade 9 History of Hawai'i course, are willing to keep an open mind, and provide feedback. There are no wrong answers.

Does anyone have any questions?

Should you have questions that you did not have an opportunity to ask, you may e-mail me at [mark.yap@hawaii.edu](mailto:mark.yap@hawaii.edu).

Thank you for your time! I look forward to working with you.

## APPENDIX B

## Consent to Participate in a Google Cardboard for a K-12 Social Studies Module

Mark Yap  
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University of Hawai'i at Mānoa  
College of Education  
Learning Design and Technology Department  
Phone: 808-956-5194

The purpose of this project is to learn about students perceptions of Google Cardboard, Google Expeditions, and learning using virtual reality technology. We are asking your permission to participate in this study. With your help, we will learn more about the different ways smartphones impact learning. We will share this information to help all of the University Laboratory School (ULS), as well as other schools, as well as the greater education community.

Participation in the project will consist of taking two surveys describing your perceptions of the project before the technology is presented and after is completed. Your name will be replaced with a code to conceal identity; no personal information will be released in any way at any time. Completion of the survey will take no more than 30 minutes. More information on this project can be found at [it.crdg.hawaii.edu/research](http://it.crdg.hawaii.edu/research)

There is no risk in participating in this study. The results from this study could help support the continuation of the bring your own device (BYOD) program into other classes in our school, and beyond. Students are NOT required to have a smartphone in order to participate in the study.

The data we collect will be confidential to the extent allowed by law. However, agencies that oversee research, such as the University of Hawai'i Human Studies Program, can review the research data. We will store all research records in a file cabinet in a locked office for the duration of the project, and they will be destroyed in compliance after the proper retention period.

Participation in this project is voluntary. If you choose not to participate or if you want to stop participating after you started, please let us know. There is no penalty.

If you have any questions regarding the study, please contact Mark Yap at 956-5194 or [mark.yap@hawaii.edu](mailto:mark.yap@hawaii.edu). If you have any questions or concerns regarding this study, you may contact my master's advisor, Dr. Catherine Fulford, at 956-3906 or [fulford@hawaii.edu](mailto:fulford@hawaii.edu). If you have any questions about your rights as a participant in the research project, you may contact the University of Hawai'i Human Studies Program [uhirb@hawaii.edu](mailto:uhirb@hawaii.edu) or at 956-5007.



**Student**

I agree to participate in the Google Cardboard, Google Expeditions, and Virtual Reality study:

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Full Name (Please print)

---

---

Signature

Date

**Parent/Guardian**

I agree to have my child participate in the Google Cardboard, Google Expeditions, and Virtual Reality study:

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Full Name (Please print)

---

---


Signature

Date

*Please return this slip to your child's teacher.*

## APPENDIX C

Website portal for students. Linked to Canvas modules and post survey in Google Forms.


**cardboard**

[Home](#)
[Pretest + Module 1](#)
[Post](#)
[vr](#)
[survey](#)
[Sitemap](#)
[Recent Site Activity](#)

**Navigation**

[Home](#)

**Site owners**

CRDG IT


## Home

This is the portal for "Google Cardboard in a K-12 Social Studies Classroom".

There are (4) parts to this research activity:

Date Assigned	Unit	Due
Tue 2/16	<a href="#">Part 1 - Pretest + Module 1</a>	Wed 2/17
Wed 2/17	<a href="#">Part 2 - Posttest</a>	Thu 2/18
Fri 2/19	<a href="#">Part 3 - Virtual Reality (Google Cardboard)</a>	In class activity
Fri 2/19	<a href="#">Part 4 - Survey</a>	Fri 2/19

Students were also introduced to the technology component via the website portal. This was to separate the learning about the specific technology from the content in the module.


**cardboard**

[Home](#)
[Pretest + Module 1](#)
[Post](#)
[vr](#)
[survey](#)
[Sitemap](#)
[Recent Site Activity](#)


**Navigation**  
[Home](#)

**Site owners**  
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## VR


### Virtual Reality and Google Cardboard

Google Cardboard (Figure 1.) was conceptualized out of the 20% time that Google employees are afforded to vision a project and try to bring it to fruition.



Google Cardboard  
[G.CO/CARDBOARD](http://G.CO/CARDBOARD)



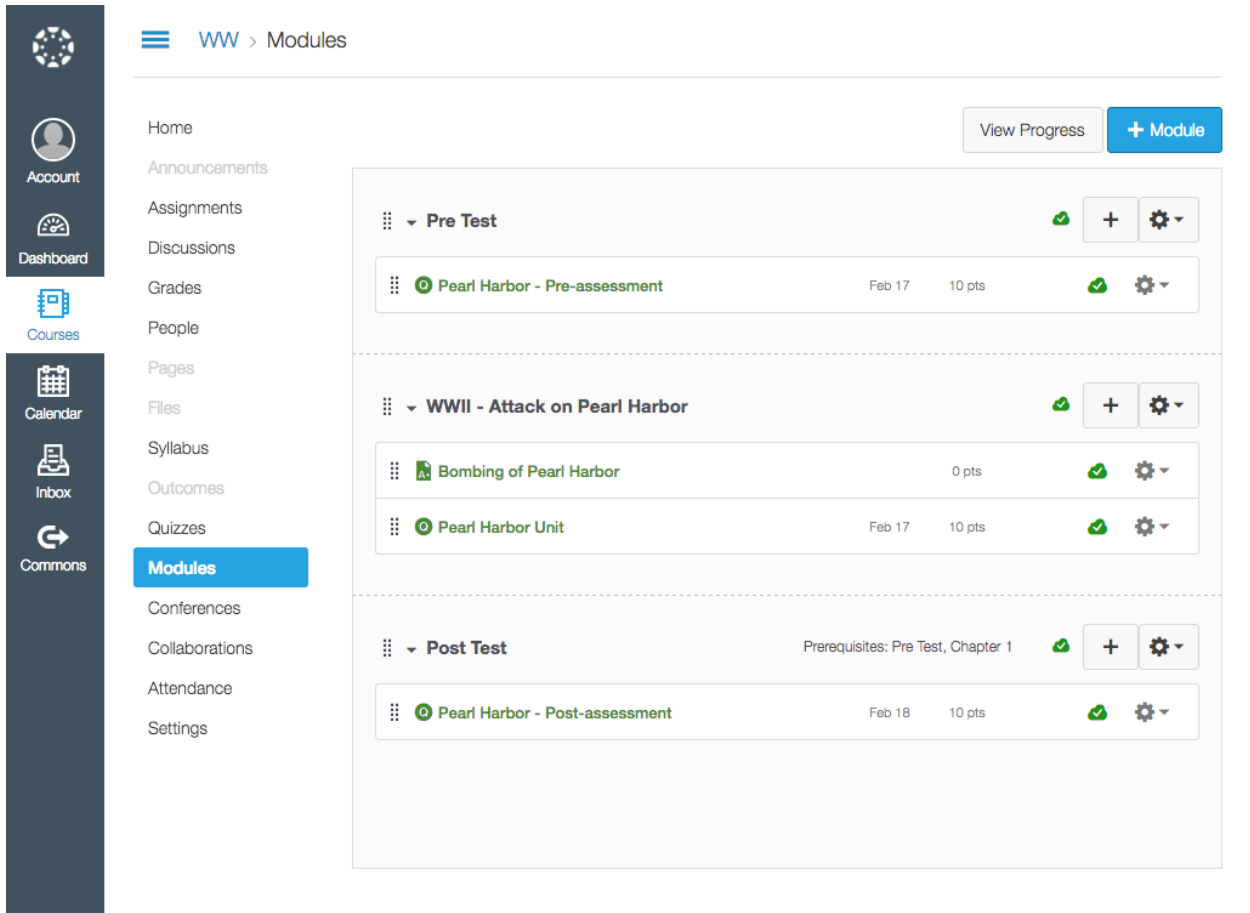


*Figure 1. Examples of various Google Cardboard models*  
Image credit: [http://googledevelopers.blogspot.com/2015\\_04\\_01\\_archive.html](http://googledevelopers.blogspot.com/2015_04_01_archive.html)

The hardware side of Google Cardboard uses low-cost viewers, with the reference design made of foldable cardboard (hence the name) 45mm plastic lenses, and a magnet or capacitive-taped lever to operate the screen. Once you get everything folded into the right configuration (most kits come pre folded and assembled) you slip your phone into the front of the viewer (Figure 2) (usually held in place by velcro or rubber bands) and run an app designed to work with Cardboard. (Hildenbrand, 2015)

APPENDIX D

Main module interface.



Example of the pre-assessment quiz on WW II - Pearl Harbor.

## Pearl Harbor - Pre-assessment

⚠ This is a preview of the published version of the quiz

Started: May 4 at 1:11am

### Quiz Instructions

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#### Question 1

1 pts

1) On what date was Pearl Harbor attacked?

- ☐ April 6, 1917
- ☐ September 1, 1939
- ☐ December 7, 1941
- ☐ September 2, 1945



#### Question 2

1 pts

2) About how many Japanese planes attacked Pearl Harbor on Dec. 7, 1941?

- ☐ 360
- ☐ 510
- ☐ 720
- ☐ 915

Example of the embedded content and testing.

## Pearl Harbor Unit

▲ This is a preview of the published version of the quiz

Started: May 4 at 1:15am

### Quiz Instructions

Watch the video below. Then answer the questions.

[Link](#)



↗



### Martial law

Martial law, in effect for the duration of America's involvement in World War II, was lifted by presidential order in October 1944. After the December 7, 1941 attack on Pearl Harbor, Governor Joseph Poindexter turned over many functions of the civilian government to Lieutenant General Walter Short who took over as military governor of the Islands. The new military government instituted many changes in the name of the war effort: new agencies and regulations were created, military judges replaced civilian courts, censors operated, blackouts and curfews were enforced. The military took over parks and schools (the Army Corps of Engineers took the entire Punahou campus for the duration of the war), plantations relinquished land, equipment and manpower, and more than 300,000 acres were occupied by the Army, Navy and Marine Corps. The Army alone controlled more than a third of the land on O'ahu. While some land was leased from the owners, other land was condemned and bought by the military. In 1946, the U.S. Supreme Court found the declaration of martial law in Hawai'i unconstitutional.

HawaiiHistory.org - Hawaii History - Home. (n.d.). Retrieved December 19, 2015, from [http://www.hawaiihistory.org/index.cfm?fuseaction=ig.page&PageID=35&returntoname=Short Stories&returntopageid=460](http://www.hawaiihistory.org/index.cfm?fuseaction=ig.page&PageID=35&returntoname=Short%20Stories&returntopageid=460)



#### Question 1

1 pts

1) On what date was Pearl Harbor attacked by the Japanese?

- ☐ December 8, 1941
- ☐ December 7, 1941
- ☐ November 11, 1941
- ☐ July 4, 1941

Example of the post-assessment quiz.

## Pearl Harbor - Post-assessment

⚠ This is a preview of the published version of the quiz

Started: May 4 at 1:16am

### Quiz Instructions

In thinking back on the unit on Pearl Harbor, please select the best answer.



#### Question 1

1 pts

1) What was the exact date and time Pearl Harbor was attacked?

- ☐ September 2, 1945 7:55 AM
- ☐ April 6, 1917 6:50 PM
- ☐ September 1, 1939 12:00 AM
- ☐ December 7, 1941 7:55 AM



#### Question 2

1 pts

2) Which of these United States battleships did not sink in the attack?

- ☐ USS Maryland
- ☐ USS Arizona
- ☐ USS California
- ☐ USS Utah

## APPENDIX E

## Attention, Relevance, Confidence, Satisfaction (ARCS) Survey Instrument

QUESTIONS

RESPONSES

24

Section 1 of 7

## Survey on Google Cardboard

Thank you for your participation our Google Cardboard modules. Your feedback is important to us as it will help to guide future development for enhancements to curriculum. Please answer all of the questions to the best of your ability. Please remember that there are no wrong answers. If at anytime you feel that you are no longer able to answer the questions, you have every right to end the survey.

For the follow survey questions, please select the appropriate response.

**Q1) What is your gender? \***

☐ Female  
☐ Male  
☐ Other...

**Q2) Do you own a smartphone? \***

(A smartphone that you have daily access to. Someone else may have purchased or gave it to you)

☐ Yes  
☐ No

**Q3) If you've answered yes to Q2, What operating system is it running? \***

☐ iOS (Apple iPhone)  
☐ Android (Google, Samsung, HTC, etc.)  
☐ Windows  
☐ I don't know

**Q4) I use my smartphone for school purposes, while in school... \***

(Select the statement that most applies to you)

☐ More than 5x a day  
☐ 1x a day  
☐ Once every few days  
☐ Once a week  
☐ Never

After section 1
 [Continue to next section](#)



## Section 2 of 7



## Smartphone Use

Please answer the following question whether you do OR do not have a smartphone for daily use.

Q5) How important do you think it is to have a smartphone for class purposes? \*

	1	2	3	4	5	
Not Needed at All	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Very Important

After section 2 **Continue to next section**



## Section 3 of 7



## Rate Your Experience With Google Cardboard

The follow series of questions are about your experience with Google Cardboard. Please think about your experience with the device in conjunction with use with a smartphone. For all of the questions, please select "strongly agree" if you feel that you are in 100% agreement with the statement. While selecting strongly disagree means that you are 100% in disagreement with the statement. Do not collaborate with other classmates to answer the questions

**Q6) Previously to this module, I have never used Google Cardboard. \***

(Module is defined as the learning experience you've completed about WWII, Pearl Harbor, along with Google Cardboard)

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q7) I enjoyed learning about Google Cardboard. \***

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q8) I enjoyed creating my very own Google Cardboard device. \***

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q9) I enjoyed using Google Cardboard. \***

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q10) I would like to see other social studies lessons incorporate the use of Google Cardboard. \***

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree



## Section 4 of 7



## What Do You Think?

The follow series of questions are about your experience with Google Cardboard. Please think about your experience with the device in conjunction with use with a smartphone. For all of the questions, please select "strongly agree" if you feel that you are in 100% agreement with the statement. While selecting strongly disagree means that you are 100% in disagreement with the statement. Do not collaborate with other classmates to answer the questions

**Q11) I believe that Google Cardboard will help me to better remember the lesson because of the 3D and virtual reality content.** \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q12) More classes (English, Math, Science, Social Studies, etc.) should incorporate Google Cardboard as a part of the class.** \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q13) Google Cardboard allowed me to explore somewhere that I cannot ordinarily go to or visit.** \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q14) Being able to visit other places in a 3D virtual reality environment are important to me.** \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

**Q15) If I were to be able to use Google Cardboard as a part of an exam, I feel that I would get a better grade on the exam (obtain a higher score).** \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree



## Section 5 of 7



## Tell Us About Your Use Of Cardboard

The follow series of questions are about your experience with Google Cardboard. Please think about your experience with the device in conjunction with use with a smartphone. For all of the questions, please select "strongly agree" if you feel that you are in 100% agreement with the statement. While selecting strongly disagree means that you are 100% in disagreement with the statement. Do not collaborate with other classmates to answer the questions

Q16) I did not have any difficulty using Google Cardboard. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q17) I can use Google Cardboard on my own without help from others. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q18) I feel comfortable that I can teach a friend or family member how to use Google Cardboard. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q19) I can use Google Cardboard for other classes besides social studies. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q20) After using Google Cardboard, I can come up with a new use for cardboard on my own. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree



## Section 6 of 7



## Google Cardboard & You

The follow series of questions are about your experience with Google Cardboard. Please think about your experience with the device in conjunction with use with a smartphone. For all of the questions, please select "strongly agree" if you feel that you are in 100% agreement with the statement. While selecting strongly disagree means that you are 100% in disagreement with the statement. Do not collaborate with other classmates to answer the questions

Q21) Google Cardboard is important to me. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q22) I am interested to know about Google Cardboard. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q23) After using Google Cardboard, I want to explore more uses of Google Cardboard by downloading additional apps. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q24) I intend to tell 1 or more friends or family members about Google Cardboard. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree

Q25) I intend to show 1 or more friends or family members how to use Google Cardboard. \*

	1	2	3	4	5	
Strongly Disagree	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Strongly Agree



## Section 7 of 7



## Is There Anything Else We Should Know?

Description (optional)

Here's your chance to provide any feedback that we did not ask about. Feel free to write any additional feedback using the space below. (optional)

Long answer text

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