

Environmental Sustainability Application for the Lower School Personal Project

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Abstract

For this semester's personal project, I created an iPad application that educates 4th-grade students at Shorecrest on topics including global warming, renewable energy, plastic pollution, and sustainable farming in accordance with their environmental sustainability unit. This application combines article-like pages that simplify these concepts into digestible pieces with interactive elements, such as categorizing activities and self-reflection. I chose this topic because I have always been passionate about environmental stewardship and promoting awareness regarding the importance of integrating sustainability into society. This project directly connects to the United Nations Sustainable Development Goals 11, 12, and 13, which are all related to global sustainability. My application promotes Goal #11, sustainable cities, through activities centered around renewable energy and sustainable agriculture. Likewise, Goal #12, responsible consumption, and Goal #13, the climate crisis, are tackled in my application across plastic pollution and global warming exercises to inform the next generation of citizens of the world's greatest challenges.

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Introduction

Overview of STEAM and the Personal Project

The Seminar in STEAM and Entrepreneurship course is the final class required to earn the STEAM certificate on our Shorecrest diplomas. In the first semester of this course, we studied why STEAM education is important, the engineering design process, the design thinking process, STEAM educational activities, and artificial intelligence. In the second semester, we are working on our cumulative personal project, which is the capstone project that highlights our skills in our chosen fields of computer science, engineering, medical engineering, and entrepreneurship. These projects must innovatively solve a major challenge and address some of the United Nations Sustainable Development Goals. Furthermore, these projects develop our independent work skills, allow us to specialize in a topic of interest, solve a problem of major concern, and interview experts to learn more about the field.

Brief Overview of the Final Project

My final project idea was to create an iPhone application for the 4th-grade students to use during their sustainability unit. This application contained articles and interactive activities where the students could learn about global warming, plastic pollution, renewable energy, and sustainable farming. A combination of paragraphs and interesting images was added to the application to give the students reading materials and helpful visuals.

Project Goals

One of my learning goals for the project was to become more knowledgeable about the global environmental crises that organizations like the UN are trying to solve. Another of my learning goals was to gain expertise in using Swift and Xcode to create an interactive iOS application, which I had little experience with beforehand. My primary project goal was to inform students of the importance of

sustainability, specifically targeting the 4th-grade sustainability unit. The application was meant to be widely available to have the greatest influence on the next generation of citizens and activists.

Why the Project Was Chosen

I chose this project because I have always been interested in sustainability and conserving the environment. After creating the Jamboard and listing out 80 problems, educating about sustainability was my greatest interest. Additionally, I have done volunteer work with both Keep Pinellas Beautiful and Tampa Bay Watch, teaching me extensively about the importance of reducing plastic pollution. Beyond my volunteering, I am passionate about sustainability and education, so this project has allowed me to leave a positive impact on the development of younger students.

Investigating

UN Sustainable Development Goals and Global Context

Throughout the world, there are excessive unsustainable practices that are causing immense damage to the planet, such as the global rise in temperature and 10 million tonnes of plastic pollution in the ocean annually. My app will encourage sustainable cities' renewable energy and sustainable farming to address UN Goal #11. Furthermore, the educational component targets UN Goal #12 by encouraging responsible consumption in terms of plastic pollution. Likewise, UN Goal #13 is addressed by urging the students to take climate action against the crisis of global warming. Promoting these environmental sustainable development goals makes the students more aware of pressing environmental crises among sustainability, conservation, and climate action. By engaging students with interactive elements regarding abstract topics, they can have a more concrete understanding of these problems and be inspired to find solutions.

Researching Sustainability and Selecting Sources

My project topic was researched by investigating the four central pillars of global warming, plastic pollution, renewable energy, and sustainable farming. For each category, peer-reviewed journal

articles as well as websites from nonprofit or government organizations were investigated to ensure I had high-quality sources. Additionally, some university reports written by faculty were examined to become more familiar with each topic to distill the information more simply for the 4th graders.

Important Resources

Bailenson and Queiroz have demonstrated the importance of educating the public about the pressing crisis of global warming and sea level rise. They have noted how more than 60% of people live further than 60 miles from a coast. Therefore, they noted how “Virtual reality (VR) simulations may offer a way to overcome some of these communication challenges... and increase their knowledge of climate change” (Bailenson et al., 2021). The application has incorporated similar visualizations of how rising sea levels pose a huge risk to coastal communities, motivating students to become part of the solution by being informed citizens.

According to Kurian (2012), the increase in energy demands has led to a pressing need for a more sustainable, economically viable, and need-oriented energy supply to power society. Furthermore, Kurian has noted how the public needs to frame legislation and urge their respective governments to focus on sustainable energy for economic growth without compromising the environment. This literature has demonstrated the importance of renewable energy, especially solar and wind, along with nuclear energy to meet all energy demands: “driving the renaissance of interest in nuclear power... to diversity fuel sources, reduce dependence on fossil fuel imports, greenhouse gas emissions, air pollution, and develop immunity” (Kurian, 2012). Therefore, nuclear energy has also been presented as a viable source of energy to students so long as the standards of operational safety remain high.

Maqueda (2010) has researched how plastic takes thousands of years to decompose into microplastics, which has led to the formation of the Great Pacific Garbage Patch: “Plastic pollution is not a problem created by improper disposal. It is a problem created by irresponsible design, paired with unsustainable throwaway habits” (Maqueda, 2010). Moreover, according to Maqueda (2010),

biodegradable alternatives to plastic must be adopted so that corporations no longer create products for profit and convenience over sustainability, which have elaborated on in my application. The literature has shown that single-use plastics have been a primary factor in the unprecedented levels of plastic pollution excreted into the ocean, illuminating the need for reusables.

Additionally, Risse and Faucette (2017) have explained what composting is, what materials are compostable, and the benefits of individuals and groups composting rather than discarding waste (Risse et al., 2017). They also elaborate on the agricultural benefits of composting in reducing reliance on fertilizers and chemical agents, simultaneously reducing the need for landfills. Likewise, they have examined the importance of reducing food waste through practical installations at locations like schools, which I have touched on in the sustainable farming section of my application.

Although not a research article, NASA's ClimateKids website was developed at the Jet Propulsion Laboratory as a method to both educate and engage students to learn more about climate change, global warming, and sea level rise (Earth Science Communications Team, 2022). Likewise, this literature similarly conveys the importance of sustainability to prevent further damage from climate change in a manner that younger students can understand through a combination of infographics, photographs, and videos.

4th-Grade Teachers Interview

I interviewed Mrs. Stoddard and Mrs. Husenitza, the 4th-grade teachers of the sustainability unit. They supported me by identifying the key features my application should contain. Furthermore, they guided me through the sustainability unit in general, the best teaching methods to utilize, the important takeaways the students should have, what features would appeal to them, important habits to create, and the types of energy I should talk about.

Some takeaways I received from the interview include how through sustainable farming, healthy foods can be produced at scale to ensure everyone has sufficient food sources. I have also learned to

focus my efforts on encouraging the students to pick up small habits, like composting at school or just being generally conscientious with their carbon and ecological footprint. They should be aware of the resources involved to produce goods like clothing or single-use plastics, and by reducing their consumption, they could minimize their footprint on the world. While these small habits are positive, they also need to be aware of the responsibility of large corporations to become more sustainable, which they can influence based on which companies they support financially. Industry conglomerates need to be held accountable for the waste their products inevitably produce.

Planning

Overall Project Completion

After researching the topics extensively and interviewing the 4th-grade teachers, I started my project by designing the activities and explanatory articles in Canva. After creating the designs on Canva, I used Xcode to replicate the designs but on the iOS application for iPad. Throughout this process, I utilized tutorials and web forms to solve the technical problems that arose throughout the app-design process. Before pasting the introductory materials into the app, I drafted the paragraphs in Google Docs, using my research to guide me. Simultaneously, I pulled images from the internet to support my explanations so that the 4th graders have a better understanding of these abstracts. I worked with Ms. Estremera to develop the code-heavy interactive elements, such as the global warming matching terms and definitions game.

Human-Centered Design Thinking

I used the human-centered design thinking process because I needed to connect with the 4th graders at a human level to best explain the importance of sustainability. While designing my application, I had the student's needs in mind, ensuring that there is a seamless experience navigating through each page. Furthermore, keeping their ages in mind, I wrote at a level that

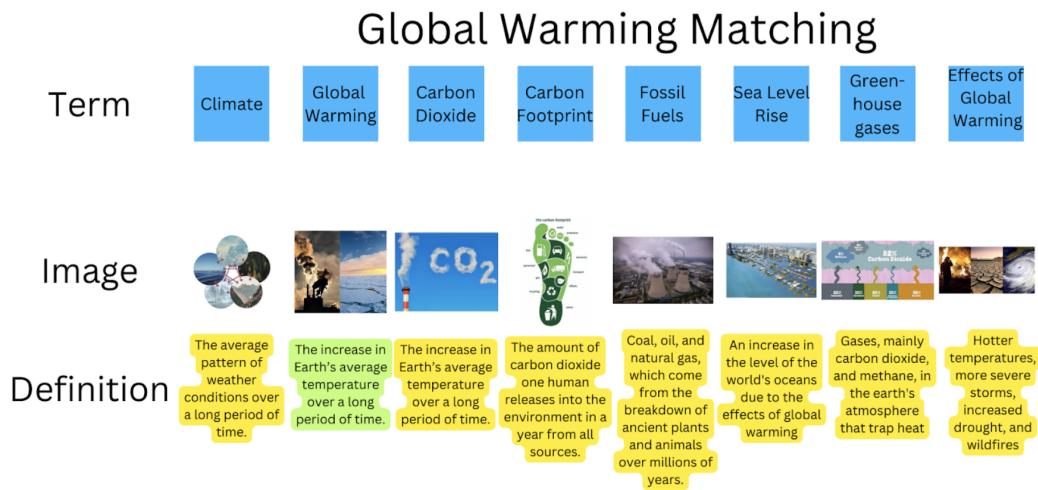
they could both understand and learn from, giving them a strong foundation for future studies in sustainability.

Project Evolution

Before starting on the iOS application, I looked into possibly creating a website using Python and Django or a Tkinter desktop application. However, after additional thinking, the project involved an iOS application that could be used at Shorecrest to help teach about sustainable topics. The project started as a collection of graphics and text initially sketched out in Canva, based on the research I conducted before.

Figure 1

Global Warming Matching Planning Created with Canva



Note. In this planned proposal, the students would drag the term onto the image, using the accompanying definitions based on the prior reading.

Figure 2

Plastic Pollution and Renewable Energy Categorizing Activity Created with Canva

Plastic Pollution & Renewable Energy Categorizing Activity		
Options to Match	Sustainable	Unsustainable
		
		
		
		

Note. In this iteration, the plastic pollution and renewable energy components were combined for time management. However, in the final application, this same activity has been used to address both topics.

Figure 3

Examples of Sustainable Farming and Reflection Created with Canva

Examples of Sustainable Farming



Sustainable Farming Reflection

In the box below, describe your experiences with Sustainable Farming. You can write about visiting the Lower School garden or learning about composting from individuals like Farmer Ray.

Note. The examples of Sustainable Farming expository information have been placed on a prior page to the reflection on the application.

After using Canva, I used Xcode's storyboard features to create multiple view controllers to contain the articles and interactive elements. Over time, I was consistently adding new pages and features to the application, ensuring that the students receive high-quality content to best process and internalize the messaging. After creating most of the educational content, I worked on the user-interactive elements for each activity to make the application more engaging.

Figure 4

Plastic Pollution Page on Sustainability Application Created with xCode



Note. This plastic pollution page explains the crisis of unsustainable plastic disposal habits on the left and the potential solutions to this problem on the right.

Figure 5

Global Warming Page on Sustainability Application Created with xCode



Note. This global warming page combines text explanations with photographs and illustrations to demonstrate the importance of understanding climate change and global warming.

There have been two types of pages on the sustainability application: the educational pages and the interactive activities. For the informational pages, I wrote articles based on the research I conducted with peer-reviewed articles and institutional reports. Furthermore, I have searched for accompanying images online that best match the content and help elucidate abstract, complex environmental topics. For the interactive components of the application, I first watched tutorials on how to create separate View Screens, utilize buttons to navigate through pages, insert labels for text, and upload images as assets. I watched a tutorial by Paul Hudson (2019) recommended by Ms. Estremera for the dragging and dropping of images, deploying a framework that has allowed for additional images to be uploaded later.

Sharing Project and Feedback

The project was initially shared with Dr. Baralt and Ms. Estremera, who looked over the application to help assist with debugging efforts. Likewise, I adjusted some of my phrasings to

remain at a reading level the 4th graders could understand. Additionally, their input was used to modify the design to ensure it best reached my target audience of 4th graders. For example, some of my text was initially too small, making the application difficult to read. Therefore, I enlarged the text around the application and put contrasting colors to make everything clearly visible. Furthermore, I received feedback regarding the functionality of the application, which I used to make the code more clear.

Taking Action

Project Final Outcome

I was able to complete my project and send it to Mrs. Stoddard and Mrs. Husenitz for their future use when teaching the sustainability unit. Although the application was not implemented while the 4th graders were in their sustainability unit between the months of October and January, it will be available for all future students. Based on the research, I found that there remains a lack of educational and interactive activities targeted specifically for younger students based on the four pillars covered by the 4th graders at Shorecrest. However, NASA's website for kids covers similar topics of global warming and rising sea levels for the general public.

Measuring Success

I measured success as completing my application's educational and interactive content in a manner that both educates and engages the students, causing them to become more environmentally conscious. Moreover, the success of the application has been defined by the quality of the content and interactiveness of the activities. Students have expected clear explanations and illustrative examples for their learning, which I have aimed to deliver. The greatest success of the application would be to save the application for the 4th grader's future use in their exploration of environmental sustainability.

Reaching Project Goals

I was able to reach both of my learning goals of becoming more familiar with environmental challenges and Swift iOS development. Through tutorials and practice, I became much more familiar with the iOS app development process, including navigating between pages, placing labels for text, uploading images as assets, accepting and saving user-generated input, and incorporating drag-and-drop style content for interactive learning.

Additionally, I reached the product goal of creating an iOS application with informative articles and interactive games to make learning about sustainability from a young age easier. Due to the prior literature review, I became acquainted with the four pillars of global warming, plastic pollution, renewable energy, and sustainable farming to a level such that I could disseminate that information to younger students.

Select Screenshots of Programming

Figure 6

Prototype Drag-and-Drop Game for Renewable Energy Created with xCode



Note. This prototype page has been created as a Mac application until it was converted to the iPad format, which was implemented in the renewable energy section of the application.

Figure 7

Part One of the Content View Programming File Created with xCode

```

8 import SwiftUI
9
10 struct ContentView: View {
11
12     //@State var private activeImages = [String](repeating: "Blank", count: 4)
13     //@State var tray = [String](repeating: "Blank", count: 4)
14     @State var buttonFrames = [CGRect](repeating: .zero, count: 4)
15     let names = ["solar", "coal", "gas", "wind"]
16
17
18
19     //var allowedImages = Bundle.main.words(from: "names.txt")
20     //var startImages = Bundle.main.words(from: "names.txt")
21
22     var body: some View {
23         VStack(spacing: 20) {
24
25             // Shorecrest logo on top
26             Image("logo").padding()
27             Spacer()
28
29             // Gray spaces to drag images to
30             HStack
31         }

```

Note. This Content View page controlled the layout and user-interaction capabilities of the app, which was crucial for the drag-and-drop functionality.

Figure 8

Part Two of the Content View Programming File Created with xCode

```

32         ForEach(0..<2)
33     {
34         number in Letter(empty: "gray", index: number)
35             .allowsHitTesting(false)
36             .overlay(
37                 GeometryReader { geo in
38                     Color.clear
39                     .onAppear{
40                         self.buttonFrames[number] = geo.frame(in:
41                             .global)
42                     }
43                 }
44             )
45     }
46 }
47 ForEach(0..<2)
48 {
49     number in Letter(empty: "gray", index: number)
50         .allowsHitTesting(false)
51         .overlay(
52             GeometryReader { geo in
53                 Color.clear
54                 .onAppear{

```

Note. In this section, the first two squares that are created are where the user drags the sustainable energy sources. The next two squares are designated for the fossil fuels.

Figure 9

Part Three of the Content View Programming File Created with xCode

```

55             self.buttonFrames[number] = geo.frame(in:
56                                         .global)
57         }
58     }
59   )
60 }
61 }
62 }
63 Spacer()
64
65 // Images of energy they are going to drag
66 HStack
67 {
68   ForEach(0..<4) { number in
69     //onChanged: self.letterMoved,
70     //onEnded: self.letterDropped
71     Letter(empty: names[number], index: number)
72   }
73 }
74
75 }
76
77
78 }
```

Note. This code creates the four initial energy squares including solar, coal, gas, and wind.

Figure 10

Part One of the Letter Class Programming File Created with xCode to Make Individual Tiles

```

8 import SwiftUI
9
10 enum DragState
11 {
12   case unknown
13   case good
14   case bad
15 }
16
17 struct Letter: View
18 {
19   @State private var dragAmount = CGSize.zero
20   @State private var dragState = DragState.unknown
21
22   var onChanged: ((CGPoint, String) -> DragState)?
23   var onEnded: ((CGPoint, Int, String) -> Void)?
24
25   var empty: String
26   var index: Int
27   var body: some View
```

Note. The Letter class allows for the creation of squares that can be dragged around by the user for the categorization of energy sources as sustainable or unsustainable.

Figure 11

Part Two of the Letter Class Programming File Created with xCode to Make Individual Tiles

```

28      {
29          Image(empty)
30              .frame(width: 130, height: 130)
31              .offset(dragAmount)
32              .zIndex(dragAmount == .zero ? 0 : 1)
33              .shadow(color: dragColor, radius: dragAmount == .zero ? 0 : 3)
34              .shadow(color: dragColor, radius: dragAmount == .zero ? 0 : 3)
35              .shadow(color: dragColor, radius: dragAmount == .zero ? 0 : 3)
36              .gesture(
37                  DragGesture(coordinateSpace: .global)
38                      .onChanged {
39                          self.dragAmount = CGSize(width:$0.translation.width,
40                                         height:$0.translation.height)
40                          self.dragState = self.onChanged?($0.location, self.empty) ??
41                                         .unknown
41                      }
42                      .onEnded {
43                          if self.dragState == .good {
44                              self.onEnded?($0.location, self.index, self.empty)
45                          }
46                          self.dragAmount = .zero
47                      }
48                  )
49  }
50

```

Note. The dragging accepted user input and checked whether the tile was correctly matched to the sustainable or unsustainable category.

Making Final Project Functional and Marketable

To make my final product functional and marketable, it would need to be uploaded to the App Store so that anyone could download it. There would also need to be a database created such that each student could create an account and track their progress over time. Without accounts, the students would still be able to complete all of the activities on the app, but tracking their progress over multiple visits would be challenging. To market the product beyond the scope of Shorecrest, funds would be necessary to spread awareness across teaching forums or websites so that other schools could incorporate the application into their curriculum.

Final Reflection

Evaluation of Project Quality

The final product quality has matched that of the criteria for my initial success because the articles have been well-researched to explain complex environmental topics in a manner that Lower and Middle Division students can still understand. Likewise, the accompanying images and general layout of the application have been intuitive and easy to understand, facilitating clear and concise learning. Likewise, I have been satisfied with the functionality of the interactive elements because initially receiving input in the form of text and finger movements was a significant challenge. Although early to tell, the application should have success in educating students of the importance of environmental sustainability, which they can carry for the remainder of their lives as global citizens.

Challenges Faced

The initial challenge that I faced in my project was narrowing down my project from environmentalism and sustainability into a more manageable workload. Therefore, Dr. Baralt's initial recommendation of tying my project to the 4th-grade curriculum was greatly helpful in focusing my projects on the four central pillars that they prioritized.

Another major challenge that I encountered was writing the educational articles at an appropriate level for the 4th-grade students. Abstract and complex topics like global warming and renewable energy are difficult for many adults to understand, so distilling these ideas into clear and grade-level appropriate writing was a challenge. I overcame this challenge by revising previous writing under the guidance of Dr. Baralt, who has much more experience communicating with younger students.

My largest challenges stemmed from working in xCode to create the iOS application because I had little prior experience. One large hurdle has been to accept the user's input for both the global warming term and definition activity as well as the sustainable farming reflection.

After reading many tutorials, I learned that the text input boxes must be treated as outlets for the data to be processed, but my xCode would only allow these boxes to act as functions.

The greatest challenge that I encountered was creating the drag-and-drop feature to pair images together in the various categorizing activities. I initially attempted to create a table layout with the images to then compare index values to ensure the correct items were matched. However, Ms. Estremera's recommended video tutorial explained how to create such a feature, which I followed along on a separate project and then copied over to both the plastic pollution and renewable energy matching activities.

Struggles and Modifications

After this learning process, if I were to do my personal project all over again, I would use my time more effectively during the research phase because I collected excess information that was not vital to the project. Additionally, I would focus more on the user-interface design to create a more modern and visually appealing application, which was limited in my final project due to time constraints and the prioritization of functionality.

Extending my Knowledge and Global Context

Creating this project has furthered my understanding of the global problems relating to global warming, plastic pollution, renewable energy, and sustainable farming that affects every nation on the planet. Although I have had some knowledge of the contemporary environmental crisis, doing additional research has made me aware of additional specifics and the urge at which these challenges must be addressed and solved. For example, I have learned how the planet is projected to heat by 8.6° Fahrenheit, which will have devastating consequences on the planet as demonstrated by melting glaciers, rising sea levels, fiercer hurricanes, and more severe droughts. Likewise, I have learned how plastic pollution has increased exponentially to 8 million tons of waste per year in the ocean, which takes thousands of years to decompose. Likewise, the

scientific literature has shown how there remains a dramatic need to incorporate renewable energy since only 10% of the world's energy comes from sustainable sources. My research into composting and sustainable farming introduced me to the benefits of sustainable agriculture for communities, farm laborers, and the environment.

It remains essential that the next generation of global citizens be aware of the pressing climate challenges that threaten the globe, and their autonomy to make informed decisions regarding environmental conservation.

Development as a Learner

Through this process, I gained the self-management skills to pace myself across the various aspects of the project from brainstorming to researching, planning, programming, writing, testing, and documenting. Each of these stages has required my self-management to stay focused and diligent in completing each subsequent task before advancing to the next one.

Likewise, my critical thinking and writing skills were improved by researching a broad array of environmentally-focused scientific literature and distilling them into clear materials understandable to 4th-grade students. Additionally, my programming skills were improved by re-learning the fundamentals of Swift programming, interacting with the Swift storyboard interface, and implementing app functionality based on tutorials for the drag and drop and user input features.

My communication and social skills were also improved in a variety of ways through this project. For example, I reached out to the 4th-grade teachers and conducted an interview to learn more about the 4th-grade's sustainability curriculum, requiring strong communication skills to convey my project goals. Moreover, communicating through each of the articles required consciousness to both stimulate their learning without confusing the younger students.

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Appendix A

Screenshots of Application Pages

I created pages in my application for the home screen, global warming, effects of global warming, global warming matching, plastic pollution and categorizing, sustainable farming and reflection, and renewable energy and categorizing.

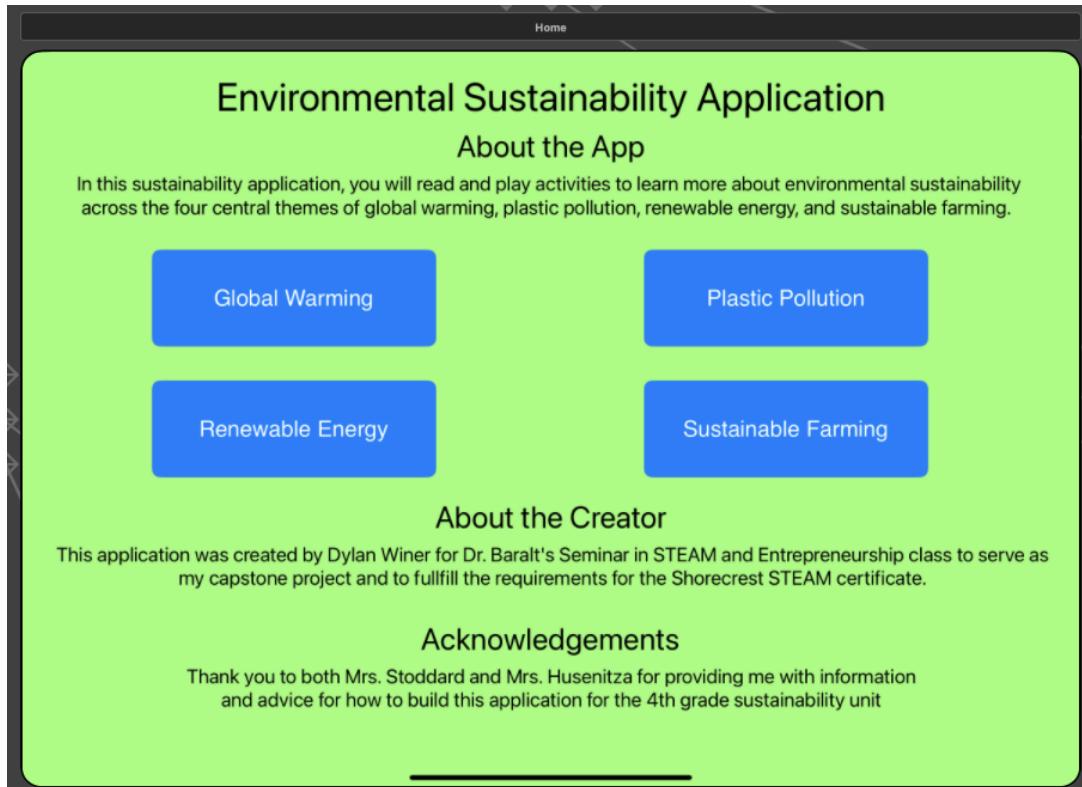
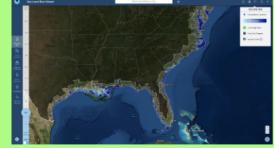


Figure A1. This screenshot shows the home page of the iPad application, which introduces the app, its creator, the acknowledgment, and the button links to each sub-section.

Effects of Global Warming

Due to rising temperatures, glaciers and the ice sheets on the Earth's poles melt. This melting has increased the average sea level around the world. The global sea level has risen 8-9 inches since 1880, which may not sound like much, but this can be very dangerous for countries around the world. Additionally, the average temperature of the ocean has increased by 1.5 degrees Fahrenheit. This warming makes hurricanes stronger and endangers sea life.




Other effects of global warming besides increasing temperatures and rising sea levels include more severe storms, increased drought, and wildfires. These storms can cause billions of dollars in damages around the world, displacing people from their homes. Droughts make life much more difficult for people without reliable access to water. Wildfires can also more easily grow out of control.



It is important to stay aware of our carbon footprint, which is the total amount of greenhouse gas emissions from our actions. For example, driving to school burns gasoline, and most electricity requires burning coal. To reduce your carbon footprint, you can do simple actions like turning off the lights when you are not using them and recycling.

[Global Warming Matching](#)

Figure A2. This screenshot shows the effects of global warming page, which explains the broad effects that global warming has had on the planet.

Global Warming Matching

In this matching activity, you will link the terms about global warming that you have learned about with their images and definitions. Match all the terms correctly to earn another badge!

Terms	Definitions
<p>A: Climate </p> <p>B: Sea Level Rise </p> <p>C: Fossil Fuels </p> <p>D: Carbon Dioxide </p> <p>E: Carbon Footprint </p> <p>F: Global Warming </p> <p>G: Effects of Global Warming </p> <p>H: Greenhouse Gases </p>	<p>The increase in Earth's average temperature over a long period of time. Letter Check</p> <p>The average pattern of weather conditions over a long period of time. Letter Check</p> <p>A gas that is made when burning materials like fossil fuels Letter Check</p> <p>An increase in the level of the world's oceans due to the effects of global warming Letter Check</p> <p>Gases, mainly carbon dioxide, and methane, in the earth's atmosphere that trap heat Letter Check</p> <p>Hotter temperatures, more severe storms, increased drought, and wild fires Letter Check</p> <p>Coal, oil, and natural gas, which come from plants and animals millions of years old Letter Check</p>

[Back to Home](#)

Figure A3. This screenshot shows the global warming matching game, so the students can match the terms with definitions to demonstrate their learning.

Renewable Energy vs. Non-Renewable Energy

Renewable energy does not use up and get rid of energy sources. For example, solar power is renewable because it does not use up the sun. However, non-renewable energy uses up resources like coal and natural gas that are gone forever. Today in the United States, 79% of energy comes from fossil fuels, 8.4% is nuclear power, and 12.5% are renewables.

Renewable Energy

Solar power uses the light from the sun to create electricity, which is then stored in batteries that can be used to power anything, from your iPad to your air conditioner. Wind turbines renewably generate (create) electricity by converting the wind's energy into electricity. Sustainable energy is important to protect our environment and prevent the pollution of fossil fuels into the atmosphere.



Solar Power



Wind Power

Non-Renewable Energy

Burning fossil fuels currently supplies 80% of the world's energy. Fossil fuel plants burn coal to boil water, which powers a generator to create electricity. Natural gas plants generate electricity by burning gases made millions of years ago. Nuclear power uses heat that is created during nuclear fission, the splitting of atoms apart, to create energy. Many people are afraid of nuclear power because of past accidents, but modern nuclear plants are much safer and more sustainable than fossil fuels.



Fossil Fuel Plant



Nuclear Plant

[Renewable Energy Activity](#)

Figure A4. This screenshot shows the renewable energy page, which differentiates sustainable energy sources from fossil fuels that harm the planet.

Sustainable Farming Examples



Composting is when organic matter, like old food, decomposes into soil that can be reused to grow new crops.

Sustainable agriculture uses methods that are less polluting (less damage to the environment) than what industrial farms can produce. They are meant to preserve soil fertility, prevent water pollution, and protect biodiversity.



[Sustainable Farming Reflection](#)

Figure A5. This screenshot shows the sustainable farming page, which introduces composting and primes the students before they are asked to reflect on sustainability.

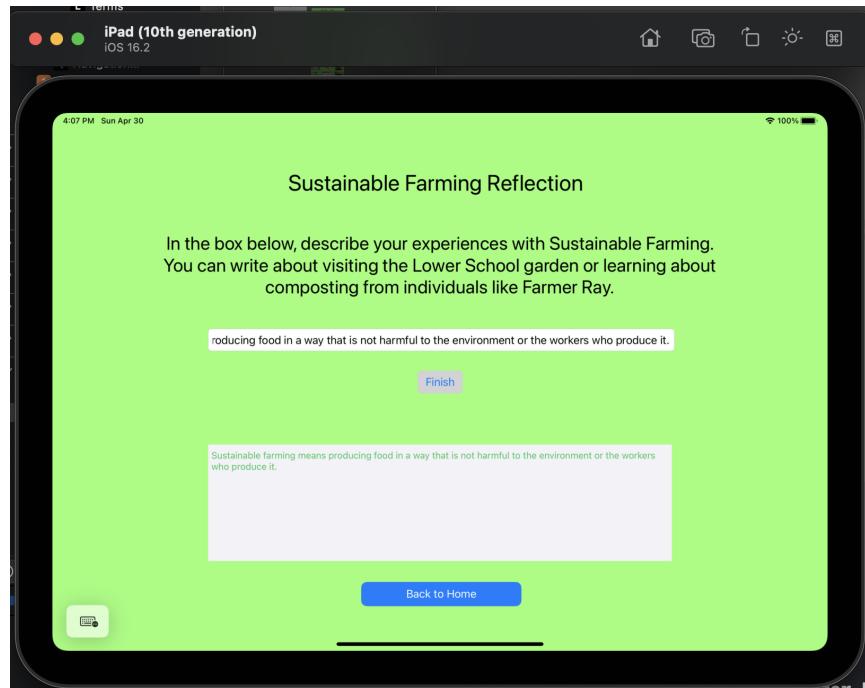


Figure A6. On the reflection page, the student can enter a paragraph and deeply reflect on how sustainable farming has touched their own life. After it is inputted, the reflection shows up in the box below.

Appendix B

Remaining Screenshots of Application Programming

The programming of the application's interactive elements required learning from tutorials to allow the user to navigate between pages, input text, and drag images for the matching activities.

```

8 import SwiftUI
9
10 struct ContentView: View {
11     var body: some View {
12         VStack(spacing: 20) {
13
14             Image("logo").padding()
15
16             // spaces to drag images to
17             Spacer()
18             HStack
19             {
20                 ForEach(0..<4){ number in Letter(empty: "gray") }
21             }
22         }
23
24         Spacer()
25         HStack
26         {
27             ForEach(0..<4){number in Letter(empty: "solar")}
28         }
29
30         // images they are dragging

```

Figure B1. This preliminary screenshot shows the beginning of the dragging and dropping categorizing activity, as modeled after the Switcharoo tutorial, which was further developed for the final product.



Figure B2. This screenshot of the interactive activity shows the beginning code's output onto the Mac display window, which was further evolved into the finished product.

```

10  class ViewController: UIViewController {
11
12
13  @IBOutlet weak var please: UITextField!
14
15  @IBOutlet weak var textView: UITextView!
16
17  override func viewDidLoad() {
18      super.viewDidLoad()
19
20      // Do any additional setup after loading the view.
21  }
22
23  override func didReceiveMemoryWarning() {
24      super.didReceiveMemoryWarning()
25  }
26
27  @IBAction func enterTapped(_ sender: UIButton) {
28      let mText = please.text
29      textView.text = mText
30
31  }
32

```

Figure B3. This screenshot demonstrates the functionality that allows the sustainable farming reflection inputted by the student to subsequently appear in the box below.

```

35
36  @IBOutlet weak var textA: UITextField!
37
38  @IBOutlet weak var textB: UITextField!
39
40  @IBOutlet weak var textC: UITextField!
41
42  @IBOutlet weak var textD: UITextField!
43  |
44  @IBOutlet weak var textE: UITextField!
45
46  @IBOutlet weak var textF: UITextField!
47
48  @IBOutlet weak var textG: UITextField!
49
50  @IBOutlet weak var textH: UITextField!

```

Figure B3. These outlets connected to the text fields on the global warming matching game.

```
①  @IBAction func checkA(_ sender: Any) {
52      if(textA.text == "A")
53      {
54          // Create new Alert
55          let dialogue = UIAlertController(title: "Correct", message: "Nice, you picked
56          // the right term!", preferredStyle: .alert)
57
58          //Add OK button to a dialog message
59          dialogue.addAction(UIAlertAction(title: "OK", style: .default, handler: nil))
60
61          // Present Alert to
62          present(dialogue, animated: true, completion: {
63              return
64          })
65      }
66      else
67      {
68          // Create new Alert
69          let dialogue = UIAlertController(title: "Wrong", message: "Try again!",
70          preferredStyle: .alert)
71
72          // dialogue.addAction(UIAlertAction(title: "OK", style: .default, handler: nil))
73
74          // Present Alert to
75          present(dialogue, animated: true, completion: {
76              return
77          })
78      }
79  }
```

Figure B4. For each of the eight terms, I created a function connected to the buttons that checks whether the letter inputted was correct. After, a dialogue is displayed that informs the student whether their answer was correct or incorrect.