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For People and Planet: Teachers' Evaluation of an Educational Mobile Game and Resource Pack

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Abstract: *For People and Planet: An SDG Adventure* refers to a freely available Android-based narrative adventure game and teacher resource pack that helps learners see the United Nations Sustainable Development Goals (SDGs) in their day-to-day lives. In this paper, we describe the results of an evaluation of both the game and the resource pack by eight (8) middle school teachers. After playing the game and reading the resource pack, teachers gave their feedback about what they liked best and least about the materials, how they could use these resources for their classes, and how these resources could be improved further. Overall, teachers' feedback was positive. They complemented the game's visuals and sound design and appreciated the game's contextualization. They affirmed the relevance of the game's contents to their lessons and the usefulness of the teacher resource pack as it provided them with notes, additional activities, and sample assessments. They gave some useful suggestions such as the need for more visual cues within the game and tutorials for the mini-games, and glossary of terms for the teacher resource pack. The game and resource pack underwent some revision following the feedback of the teachers. Performing the user test was essential to ensuring the quality of the game and the resource pack, and to increase the probability that the game will actually be used in schools.

Keywords: Sustainable Development Goals, mobile game, STEM education

1. Introduction

In 2015, the United Nations formulated the Sustainable Development Goals (SDGs) 2015 “to address urgent global challenges over the next 15 years” (UN, 2016). These goals represent global aspirations such as no poverty, zero hunger, quality education, clean water, sustainable cities, and so on. Unfortunately, general awareness of the SDGs is limited. There is a need therefore for sustainability education that not only explains what the SDGs are but also shows how systems—food systems, governments, community systems, and others—are interconnected. Moreover, sustainability education needs to show sustainability in the day-to-day choices we make as individuals.

At present, there are few materials available that fit these requirements. Sustainability education that is contextualized for Filipino learners specifically is even more rare. The broad purpose of the project presented in this paper is to address this lack of materials through the development of a mobile educational game and accompanying teaching guides. *For People and Planet: An SDG Adventure* refers to an Android-based narrative adventure game and teacher resource pack that helps learners see the SDGs in their day-to-day lives. In this paper, we discuss the game, the resource pack, and the user test process that the authors of this paper undertook to collect teacher feedback.

1.1 Overview of the Game

In the game, players assume the role of a middle school student in a rural community in the Philippines and embark on five (5) stories that can be played in any order. Each story tasks the player with

performing errands and other everyday activities while also being shown how the community encourages sustainability and maintains their environment. Each story covers an aspect of life and ties it to one or more SDGs. In *What's For Lunch?*, the player is asked to buy food for the family's lunch (See Figure 1). Afterwards, the player's grandmother asks for assistance with meal preparation and food waste disposal. In *Flood Fighters*, the player accompanies the grandmother and learns about disaster risk reduction and disaster risk management, both at the community and at the household levels. In *A Walk in the Park*, the player goes to a neighboring town with friends to learn about clean energy and wastewater treatment. On their way to visit the town park's bird sanctuary, the group also makes friends with another visitor who was bullied for her physical disability. In *Work, Work*, the player visits the community enterprise that the grandmother works in. Various employees of the enterprise tell the player about their work, which includes ecotourism in the nearby coastal area. In *Learning is for Everyone*, after attending a theater workshop in school, the player befriends a student with low vision. Together, they search the school for the whereabouts of their grandparents and engage in a variety of activities pertaining to the education system. The description of the game's design process is discussed in detail in Rodrigo et al (in press).

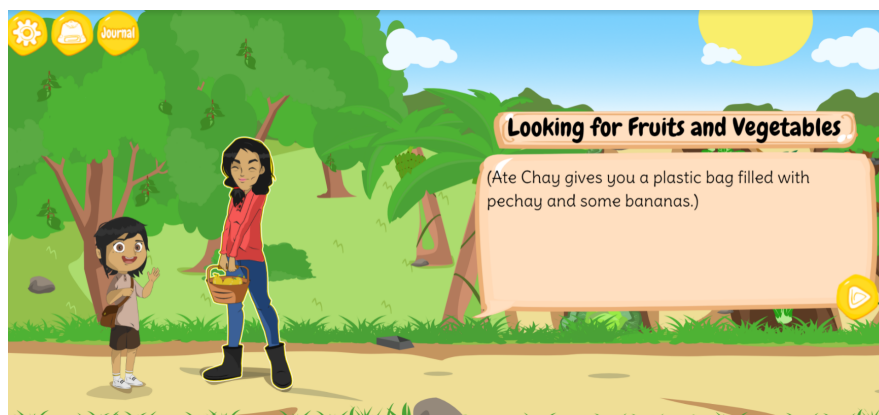


Figure 1. Ate Chay gives the player a basket of fruits and vegetables after the player completes the quest.

The game is intended as supplementary material to middle school lessons on SDGs. At present, there are several games in different formats that already address this need. These include card games (see Immacocollabo, 2018), board games (see UN, 2019), and mobile phone games (see We are Muesli, n.d.), and PC-based games (Ortega, Rodrigo, Favis, Mora, & Rubio, 2019). These games contextualize the SDGs in everyday contexts and engage players in activities in which players must allocate and manage resources sustainably. In the design of *For People and Planet*, we echo the themes of contextualization and activity-based tasks. All activities are grounded in the Philippine context by selecting situations that are typical of Philippines and are linked to the Philippine basic education curriculum's Most Essential Learning Competencies (MELCS).

1.2 Overview of the Teacher Resource Pack

The teacher resource pack is a critical companion of the game. In the Philippines, teachers do receive computer technology training, however this training tends to be limited to the use of productivity tools. Opportunities to learn how to use these technologies to support subject areas such as English, math, science, and others is less available (Torii, Kamidate-Yamaguchi, & Kubota, 2019). Furthermore, teachers lack access to subject-specific software (Alcantara, Verina, & Neim, 2020) and have no time to prepare lessons that integrate computer-based resources in their lessons (Torii, Kamidate-Yamaguchi, & Kubota, 2019). Hence, providing teachers with materials that can show how the game integrates with lessons increases the chances that the game will be adopted in class.

The teacher resource pack of *For People and Planet* contains one document and one slide deck. The document was a narrative guide intended for the teacher (See Figure 2 for an excerpt). It discusses the relationship between the story and the SDGs, a mapping between the story and the basic education curriculum's MELCS, learning objectives, process skills, values integration, learning tasks, background materials for the teacher, links to additional materials, references, a glossary, and a sample assessment.

The slides contained notes for the teacher teacher followed by explanatory slides that teachers can use in class (see Figure 3).

Story 1: What’s for Lunch

SDGs: 3, 12, 14, 15

Introduction

Food is an important part of our health, culture, and society. Food production provides livelihood not just for farmers and fisherfolk, but also for all the helping hands that bring the food from the farm to the markets, and from the markets to our homes. Food production relies on good soil, good weather, and clean water. While it is dependent on environmental quality, it is not without its impacts. Post-consumption food waste is also an issue, and proper management of this is essential in ensuring clean lands and water bodies.

The SDGs covered in this story include

SDG 3 which recognizes the importance of health and aims to "ensure healthy lives and promote well-being for all at all ages."

SDG 12 which focuses on managing our resources wisely, including reducing food waste and food losses along production and supply chains.

SDG 14 which aims to “conserve and sustainably use the oceans, seas, and marine resources for sustainable development.”

SDG 15 which strives to “protect, restore and promote sustainable use of terrestrial ecosystems ... and halt and reverse land degradation and halt biodiversity loss.”

In this story, students are invited to explore where food comes from and what it takes to put healthy and nutritious meals on the table. Through fun and thought-provoking mini-games, students are able to investigate how Zero Hunger, Good Health and Well-being, Responsible Production and Consumption, Life Below Water, and Life on Land are interconnected.

The MELCS related to Story 1

Subject	Grade 4	Grade 5	Grade 6
Health	Describes ways to keep food safe		Practices proper waste management at home, in schools, and in the community.
Science	Describes the effect of the environment on the life cycle of organisms.	Discuss the interactions among living things and nonliving things in estuaries and intertidal zones	[Describes the] interactions for survival among living and nonliving things that take place in tropical rainforests, coral reefs, and mangrove swamps

Learning Objectives

- Identify the components of a healthy meal.
- Identify the steps involved in food production and preparation
- Explain the importance of healthy soil and clean water in food production

Process Skills

- Discuss the causes of the decline in fish production
- Explain the effects of using pesticides in farming

Values Integration

- Cooperation and teamwork
- Caring for the environment

Figure 2a. Excerpt from the narrative guide for Story 1.

Learning Tasks

- Engagement Part I: Ask the students to give examples of nutritious food and why our bodies need these. Then, ask the students where they think the food comes from and what steps are involved in gathering raw materials for their meals.
- Exploration: Ask students to play Story 1: What's for Lunch?
- Explanation: Have a short discussion using the following guide questions:
 - What do you think happens to discarded food and food packaging materials?
 - How might these affect the health of our seas and the creatures that live in it?
- Engagement Part II: Food Diary – Ask students to keep track of the food they eat for breakfast, lunch, and dinner for one week. At the end of the week, students should look back and reflect on the nutrition quality of their meals and whether or not this should be improved. They should also reflect on how much waste (food and food packaging) was produced and how they can reduce this
- Extension: Meal Planning for the School Cafeteria - Ask the class to plan meals with their cafeteria. Each meal should have the right proportions of Go, Grow, and Glow food. You can also plan simple exercises that the class can practice during recess or lunch.

Background Information for the Teacher

What are examples of nutritious food? Why do our bodies need these? Proper diet and nutrition are important in keeping us healthy and strong. For children aged 10-12 years old, a healthy lunch consists of the right proportions of (Go) carbohydrates to provide energy (for example, one cup of cooked rice); (Grow) protein for the growth and repair of body tissues (for example, one medium-sized Mackerel Scad or Galunggong); (Glow) vitamins, minerals, fiber for regulation of bodily processes (for example, $\frac{3}{4}$ cup vegetables such as Pechay and one Lakatan banana); and at least eight glasses of water daily. This healthy diet should be complemented by adequate physical activity or exercise.

Where does our food come from? Before it reaches groceries and markets, all of the ingredients needed to make our healthy meals were tended and harvested by farmers and fisherfolk who rely on healthy soils, clean water, and good weather for food production. Unfortunately, fish catch has been declining steadily due to habitat destruction and destructive fishing practices, climate change, pollution from land-based activities, and overfishing/large-scale fishing (Muallil, et al, 2014).

Glossary

Biodegradable - materials that can be broken down through natural ways such as the action of living things (microorganisms)

Biodiversity - numbers of different species of plants and animals

Composting - the process of breaking down biodegradable materials such as food waste into compost, which can be used to improve the quality of the soil

Ecosystem - community of organisms and its environment

Sample Assessment

Question: Why is it important to eat GROW food?

- A. Because they give us vitamins, minerals, and fiber for the regulation of bodily processes
- B. Because they give us protein and calcium for the growth and repair of body tissues
- C. Because they give us carbohydrates for energy
- D. Because they give us oxygen so we can breathe and live

Answer: A

Question: In which trash bin do we put PET bottles, glass jars/bottles, metal cans, and dry paper?

- A. Recyclables
- B. Organic/Biodegradable
- C. Residuals
- D. Electronic Waste

Answer: A

Figure 2b. Excerpt from the narrative guide for Story 1.

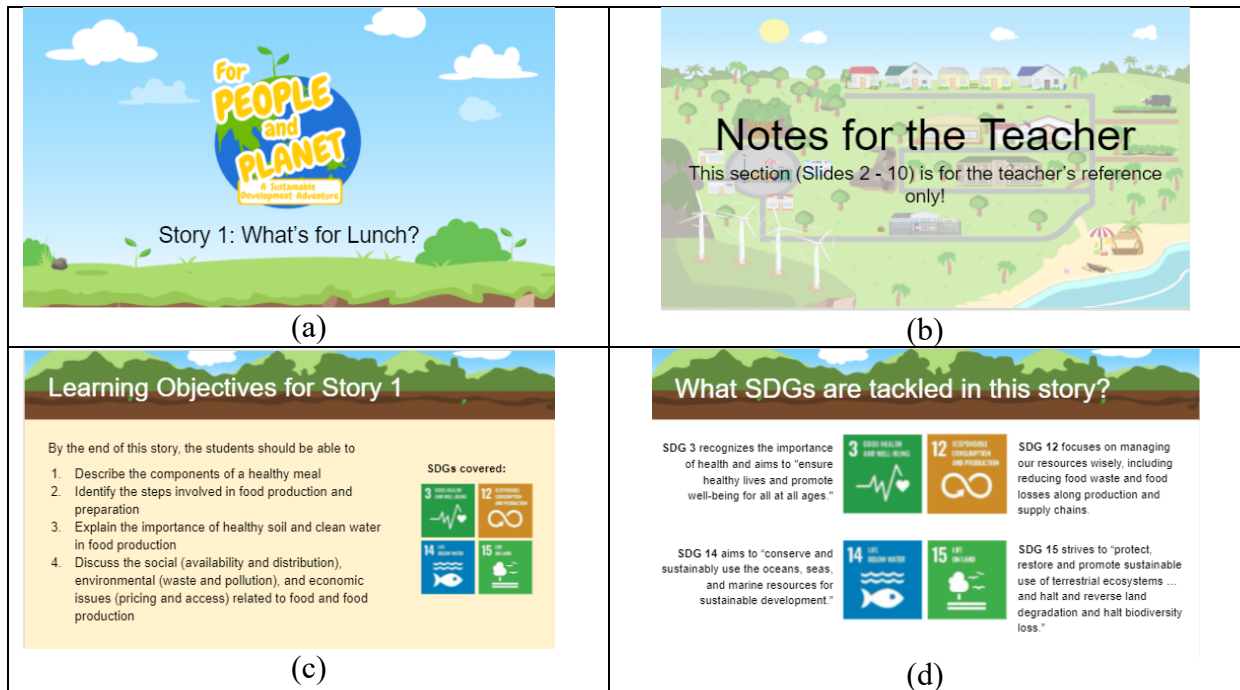


Figure 3. Excerpts from slides for Story 1: (a) Cover slide for Story 1; (b) Cover slide for notes for the teacher; (c) Articulation of learning objectives for the teacher's reference; (d) Explanation of related SDGs for the students.

2. User Testing

To maximize the usability of both the game and its support materials, it is necessary to obtain the feedback of its intended users. We therefore tested the game and its support materials with a group of teachers to determine whether and how these teachers could and would use the game when teaching their students about the SDGs. In this paper, we describe the testing process and its findings.

We recruited middle school teachers as game testers. To qualify as a tester, the teacher must be teaching a Science, Health or *Edukasyon sa Pagpapakatao* (EsP; Social Studies) to grades 4, 5, or 6 students. They must own or have access to an Android phone or tablet, must be able to download the game, and must have no prior knowledge of or experience with playing the game. Each test session was approximately 90 minutes long. The test protocols were submitted to and were cleared by the University Research Ethics Committee.

A total of eight (8) teachers joined the testing activity. Seven (7) were female and one (1) was male. Seven (7) were employed at private schools in Metro Manila, while one (1) taught in Bulacan, a province north of Manila.

Each test session had at most three (3) teachers. The test sessions were conducted by five (5) members of the research team who acted as facilitators, note takers, and technical support. The facilitators asked the teachers to download the game and play two (2) of the stories. We limited each testing session to two (2) stories because playing all five (5) would exceed the total time allocated for the test. After the teachers played the two stories, the facilitators walked the teachers through the teacher resource pack.

The facilitators then asked the teachers some questions about the game:

- What did you like best about the game? Why?
- What did you like least about the game? Why?
- Do you think this game would be relevant to your classes? Why or why not?
- How would you use it in your classes?
- What are the factors that might prevent you from using the game in your classes? Why?

Questions regarding the resource pack included the following:

- What other resources or assistance would you need in order to use the game effectively in class?

- What did you like best about the teaching materials? Why?
- What did you like least about the teaching materials? Why?
- Do you think these can be integrated well in your classes?
- How do you think we can improve the content of the teaching materials?

The teachers received a gift card worth P500 (approximately US\$12.00) for their participation in the test.

3. Findings

In this section, we summarize the teachers' feedback into four sections: most liked and least liked features of the game, most liked and least liked features of the teacher resource pack, potential usage in classes, and impediments to use. A fifth section summarizes the significance of these findings relative to broader educational mobile game design.

3.1 Most Liked and Least Liked Features of the Game

The teachers liked the fact that the SDGs were presented to students in the form of a game. One teacher said: *Students are immersed in games, so why not create good content in this format? Teachers try to create activities in school where they simulate real-life situations and ask students to think of solutions. The game takes this same approach.*

In terms of the design of the game, the teachers agreed that the game was child-friendly and age-appropriate. They enjoyed the visuals of the game and complemented the sound design. They appreciated that the game was situated in the Philippines.

The teachers were enthusiastic about the connection between the game and their lesson plans. One teacher said: *There is a second quarter Science lesson about ecosystems (mangroves and corals). I'll be able to apply the game there. The game connects with this lesson.*

The teachers did note the lack of prompts and, hence, they sometimes did not know what to do next. Some teachers said they did not know when a task was completed. They were looking for signifiers such as fireworks or stars to indicate that they could move on to the next task.

They also said that the mini-games needed tutorials because. Teachers (and therefore possibly their students) did not intuitively know how to play the games. One game on the Cranmar abacus (See Figure 4) was particularly challenging. One teacher admitted to not knowing what to do.

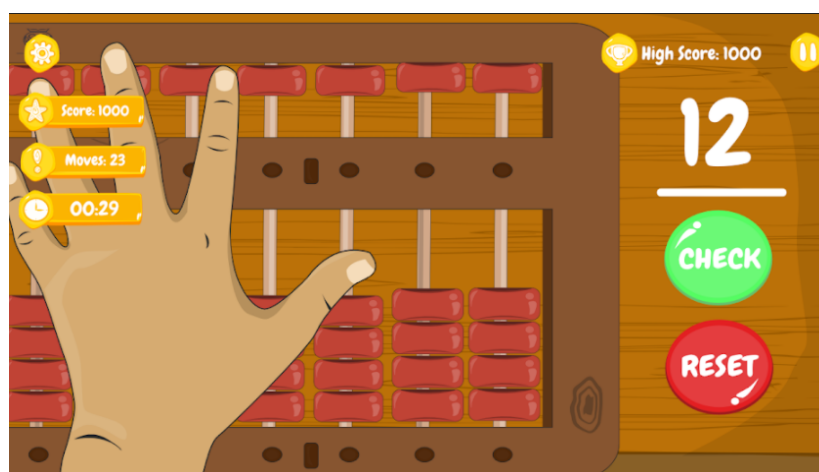


Figure 4. Cranmar abacus.

There was some disagreement among the teachers about the appropriateness of the vocabulary level of the game. One teacher said that the vocabulary was appropriate while the teacher from Bulacan worried that students there might struggle with the language. The grade 4 students in particular would be transitioning from mother-tongue based instruction, implemented from grades 1-3 in the Philippines, to English-based instruction in grade 4. Their English vocabulary, therefore, would not include some of

the words used in the game.

One of the drawbacks of the game format was that the narratives might be glossed over. One teacher admitted that there was a tendency to skip over narrations out of excitement. Another teacher suspected that the same would happen with the students.

3.2 Most Liked and Least Liked Features of the Resource Pack

The teachers affirmed the usefulness of the resource pack. Several of them said that if a teacher is him/herself unaware of the SDGs, reading the resource pack helps him/her prepare for the lesson. Furthermore, because the notes are editable, the teacher can pick and choose what he/she wants or needs. There is no pressure to use everything in the pack.

They did express concern that the slides in the pack were too long. Some slide decks were 72 slides long, far more than they can use in a class. They suggested that the writers of the teacher resource pack chop the slide decks into smaller modules but they also acknowledged that they were free to do so on their own.

3.3 Potential Usage in Classes

The teachers agreed that the game and the resource pack addressed a real need. One of them said: *I noticed that the SDGs are not integrated in lessons. When I tried to integrate them, I had a hard time finding appropriate materials, even for high school...There are no appropriate materials to integrate SDGs in the school lessons...that's why I find this game relevant. I think it's a useful material for teaching.*

One of the other teachers appreciated specific lessons: *It was great that the game included waste water as a topic (See Figure 5). I tried explaining waste water to my grade 6 students but all they could focus on was how gross it is. The game helps the students realize that this water has to go to waste water treatment. It is very relevant.*

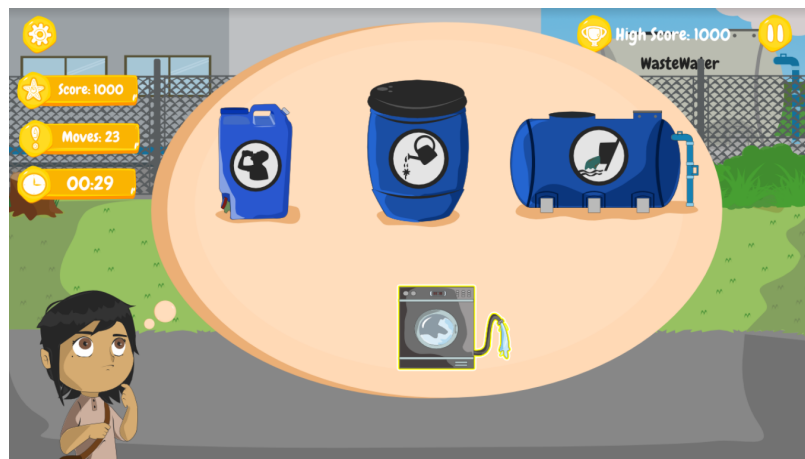


Figure 5. The minigame asks where waste water from a household, in this case a washing machine, should go. Should it go to drinking water, to grey water tank, or to waste water treatment.

Another teacher acknowledged that while the game was most useful for Science, the game would be useful not just for Science, it was also useful for language, reading, and vocabulary learning.

Teachers generally agreed that they would use the game for their classes. They would adapt the materials, possibly modularizing them further to fit the class format.

3.4 Impediments to Use

The teachers did point out several impediments that they will need to overcome in order to make full use of the game. They noted that the game takes a large amount of storage space—105 Mb. Some students might not have that much space available on their phones. They might have to delete other applications

in order to install the game.

Teachers also said they preferred a desktop version that they could play in class when face-to-face classes resume: *I think a desktop or laptop version would be better [for the students]. Better for the teacher as well because this can be used in class, with the teacher and students present in the same room.* Mobile phones are generally not allowed in class, so students would not be allowed to play on their phones.

Finally, some teachers expressed concern about the use of English as the language of the game. They suggested having a version of the game in Filipino.

3.5 Broader Implications on Mobile Game Design

The feedback of the teachers, while specific to *For People and Planet*, have some broader implications on educational mobile game design. In terms of content, teachers welcome well-designed, creatively conceptualized and implemented learning activities that include local contexts. They also welcome teachers manuals or guides that help them integrate these materials into their teaching.

Teachers have a keen sense of what their students will and will not understand. They are sensitive to language and vocabulary, as well as game mechanics. These are issues that game designers often take for granted. Hence, it is always important to elicit teacher feedback in order to improve the students' experience with any game.

Access to technology continues to be a concern. Teachers worry about whether their students will be able to download the game and play it on their devices. They also worry about how these materials can be used during in-person classes as students are not allowed to use their mobile phones while on campus. Hence, teachers expressed a preference to have materials that can be played in school, on school computers.

4. Responses to Findings

As of the time of this writing, the game development team and the resource pack authors have been able to address some of the concerns raised by the teachers. For example, we added the glossary to the narrative document of the teacher resource pack in response to the teachers' request for a glossary (See Figure 2b). The lack of signifiers or notifications was addressed by adding exclamation points to icons to indicate that the player earned new items (See Figure 6). We added a prompt to the map screen to ask the player where they wanted to go next (See Figure 7). We also added graphics to the mini-game tutorial screens to communicate the game mechanics to players more easily (See Figure 8).

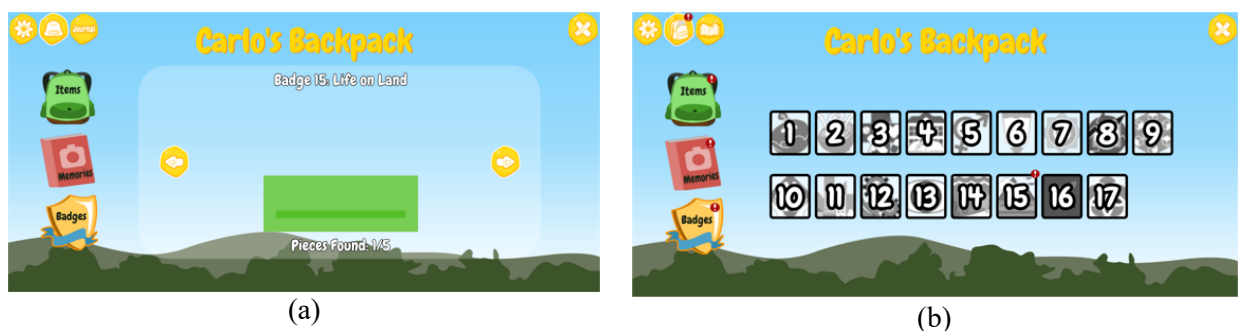


Figure 6. (a) Prior game progression screen with no signifiers; (b) Current game progression screen with exclamation points showing that the player earned new items and can find them in the backpack, the photos, the badges.



Figure 7. (a) Prior map with no prompt; (b) Current map with the question and the prompt.



Figure 8. (a) Prior tutorial screen with no graphics; (b) Current tutorial screen graphics.

Other teacher requests like multilanguage support, desktop version, and so on could not be accommodated at this time.

5. Conclusion and Future Work

For People and Planet: An SDG Adventure and its subsequent teacher testing contributes to STEM education in several ways. First, it contributes a mobile-based game that teaches the sustainable development goals. Aside from being attractive, age-appropriate, and child-friendly, the game is contextualized, activities-based, and curriculum-based.

Second, the teacher resource pack provides teachers with valuable guidance on how to make use of the game in their classes. It gives teachers a lesson flow, suggest activities, suggested assessments, additional resources, and classroom slides, all of which are editable. These materials conserve teacher time and effort. They can pick and choose what they would like to use for class instead of creating their own lesson plans from scratch.

The testing of both the game and the teacher resource pack validated some of the design choices that the game designers and resource pack authors made. It gave the designers and authors an opportunity to improve upon these materials. Finally, the teacher test underscored the importance of soliciting user feedback for both quality control and to increase the probability that these resources find their way to actual classroom use.

The project as a whole has several ways forward. It was mentioned earlier that various versions of the game need to be finalized, among these a desktop version and a version for iOS. It may also be possible to produce different versions of the game in different languages.

The teachers in the testing group said that they would actually use these resources in class. When they do, it would be valuable to monitor how the resources are actually used, measure their effects on student learning and the learning experience, and seek out opportunities for improvement.

Finally, some of the co-authors of this paper are undertaking a project to produce storybook versions of the game. Acknowledging the fact that some students do not have easy access to technology, they plan to take the existing game assets and storyline and convert them to hard copy format.

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