

# Towards Development of an Interactive Mobile Application for Teaching The UNSDG

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## Abstract

In aim of a better, inclusive, accessible, and safer future, educational institutions are committed to integrating the United Nations' 17 Sustainable Development Goals (SDG) into their curriculum design and course delivery. Traditionally, a plain literary review of these goals has been adopted by educators. This tends to leave students wondering what a realistic scenario would look like, and how they would approach an urgent call to action. To encourage thrive to learn and delve into action, a gamified reflective and immersive process would be more sought by learners instead of reviewing the definition of goals and their description without any tangible practice. To do so, The York University SDG Uphold (YU-SDG-UP) app was designed to immerse students into a world of those scenarios, where their responses are recorded and graded on an impact scale. This provides an interactive approach which is certain to influence the user's understanding of the SDG, and their attitude towards a sustainable, inclusive, diverse, and equitable future. This is accomplished through developing a mobile application hosting a virtual world with a global health score, where the user interacts with a scenario-based problem-solving framework. Scenarios are presented in text-based descriptions, and followed by a multiple-choice list of actions, all of which hold a weighted impact on the user's global health score. The user is intended to explore these scenarios with the objective of claiming the best possible score through their chosen actions, embracing practical education through trial and error. This activity is anticipated to surpass the traditional means of teaching sustainable development through slideshow presentations, or at least reinforce that knowledge through a virtual decision-making experience. Students can practice their problem-solving skills under realistic conditions and constraints, while understanding the significance of their decisions towards sustainable living.

## 1. Introduction

### 1.1. The Need for Sustainable Development Education

Education for sustainable development (ESD) in today's world has become a crucial tool in tackling the issues that we currently face globally. As we grapple with the increasing challenges around climate change, loss of biodiversity, the use of unsustainable resources, and social inequity, educating people of all ages has become paramount to equip them with the knowledge, skills,

values, and agency to address these issues [1][2]. ESD empowers learners to make better informed decisions, both on an individual level as well as a larger global collective, to help transform society and the way we care for our planet [1]. ESD is a lifelong learning process that aims to enhance individuals on their cognitive, social-emotional, and behavioral dimensions. It also encompasses the entire learning process such as the content, teaching method, and the learning environment itself [1]. Traditional teaching methods often focus on passive learning, memorization, and/or verbatim regurgitation of information. This leaves students with a limited understanding and implication of the United Nations Sustainable Development Goals (UNSDG). The current curriculum emphasizes the need for innovative teaching approaches and mode of deliveries that create an immersive and realistic environment for learning and engaging with the UNSDG [1]. To include the UNSDG in the curriculum educational institutions are making an effort to integrate them into their curriculums, hoping to communicate the urgency of each cause. Universities are particularly invested in introducing undergraduate students to these goals to prepare the graduating workforce for a sustainable future. Unfortunately, these goals are often delivered through traditional means of education, such as lecture slides and bullet-form presentations. Besides the typical project which might ask students to consider some factors of sustainability in their solution, they are rarely required to immerse themselves in a realistic situation where decision-making is crucial, conditional, and constrained. Students are allowed, and oftentimes encouraged, to make assumptions surrounding the viability of their solutions. For a project in the Engineering field, the ease of which a material can be sourced or produced could be exaggerated or brushed off as viable, whereas in reality, it is in fact harmful and unsustainable for the environment. This is mainly because sustainable development is not the key learning outcome of that particular course, which minimizes its presence in that curriculum. As a result, students graduate with little to no knowledge of modern sustainable practices, limiting their contribution to any breakthroughs in that capacity. To overcome this need, The York University SDG Uphold (YU-SDG-UP) app was designed to immerse students into a world of those scenarios, where their responses are recorded and graded on an impact scale. This provides an interactive approach which is certain to influence the user's understanding of the SDG, and their attitude towards a sustainable, inclusive, diverse, and equitable future. This is accomplished through developing a mobile application hosting a virtual world with a global health score, where the user interacts with a scenario-based problem-solving framework.

## **1.2. The United Nations' 17 Sustainable Development Goals (SDGs)**

The 17 sustainable development goals are an urgent call for action by all countries - developed and developing - in a global partnership [3]. They serve as an internationally recognized blueprint for sustainable living through innovation, peace, and prosperity as presented in Figure 1. The following list holds a brief overview of each goal:

1. **No Poverty:** End poverty in all its forms everywhere.

2. **Zero Hunger:** End hunger, achieve food security and improved nutrition, and promote sustainable agriculture.
3. **Good Health and Well-being:** Ensure healthy lives and promote well-being for all at all ages.
4. **Quality Education:** Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all.
5. **Gender Equality:** Achieve gender equality and empower all women and girls.
6. **Clean Water and Sanitation:** Ensure availability and sustainable management of water and sanitation for all.
7. **Affordable and Clean Energy:** Ensure access to affordable, reliable, sustainable, and modern energy for all.
8. **Decent Work and Economic Growth:** Promote sustained, inclusive, and sustainable economic growth, full and productive employment, and decent work for all.
9. **Industry, Innovation, and Infrastructure:** Build resilient infrastructure, promote inclusive and sustainable industrialization, and foster innovation.
10. **Reduced Inequalities:** Reduce income inequality within and among countries.
11. **Sustainable Cities and Communities:** Make cities and human settlements inclusive, safe, resilient, and sustainable.
12. **Responsible Consumption and Production:** Ensure sustainable consumption and production patterns.
13. **Climate Action:** Take urgent action to combat climate change and its impacts.
14. **Life Below Water:** Conserve and sustainably use the oceans, seas, and marine resources for sustainable development.
15. **Life on Land:** Protect, restore, and promote sustainable use of terrestrial ecosystems, sustainably manage forests, combat desertification, and halt and reverse land degradation and halt biodiversity loss.
16. **Peace, Justice, and Strong Institutions:** Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable, and inclusive institutions at all levels.
17. **Partnerships for the Goals:** Strengthen the means of implementation and revitalize the global partnership for sustainable development.



**1.3. Experier** *Figure 1: UN Sustainable Development Goals (Extracted from [United Nation Page](#))*

Experiential learning is a form of active engagement which encourages the user to adapt to the conditions they are presented with and reflect on their actions [4]. In other words, this philosophy involves “learning by doing” despite one’s minimum theoretical background in the topic at hand [4]. In fact, studies have shown that experiential learning directly contributes to the retention of 70% more knowledge when compared to traditional means of education, suggesting that it promotes a much deeper understanding of course content to students [4]. Kolb’s experiential learning model perceives learning as an integrated cycle of concrete experience (CE), reflective observation (RO), abstract conceptualization (AC), and active experimentation (AE). For instance, a student attending a prepared lecture, or a slideshow presentation may fall under the AC category, but it is often not reinforced with a strong AE phase [4]. Thankfully, virtual tools can be used to complete Kolb’s learning cycle, particularly those which offer an interactive interface and an open world setting that can be designed to meet the learning outcomes of the course. Studies also showed that the focus and planning required to play a video game translates well to the education field [5]. The player often finds contentment and validation in observing the progress they have made in a video game setting, as it not only represents their self-development, but the degree to which they are familiar with the game. Educational video games are proven to stimulate visual learning through concentration and creativity through the goals that are either set by the game or the users themselves. Further, a virtual video game setting is easily reset to its original conditions, allowing the user to safely practice trial and error with no precautions. This encourages them to return to the game for as many attempts as necessary to grasp the concepts at hand, in hand improving their attitude towards content which they may have previously deemed frustrating. With an estimated

worth of \$24 billion in 2024, the world is quickly catching up to the benefits of the educational video game market [6].

## **2.0 YU-SDG-UP App Design, Development and User Experience**

### **2.1 Scenario-Based Experiential Learning**

The York University Sustainable Development Goals Uphold (YU-SDG-UP) app aims to transform the delivery of the United Nations' 17 Sustainable Development Goals to students of all disciplines. Experiential learning lies at the heart of the app, as users are asked to interact with various scenarios related to the 17 goals. To illustrate, each goal is explored through 4 unique scenarios, and a set of 6 actions with impacts ranging from very positive (+3 points) to very negative (-3 points). To resolve the scenario at hand, the user is prompted to briefly judge the actions and select the one they deem most appropriate. The user's world health score directly reflects the nature of their choices, as it is instantaneously affected by the points collected and deduced throughout their journey. After choosing an action, the user is offered a paragraph of feedback so that they may reflect on the implications of their decision and plan their next action accordingly. The world health score is visualized to the user with an animated globe which reflects the numeric value of their health score through coloured animations, shades, and textures. For example, an overall positive world health score is portrayed by a brightly shaded rotating globe with an emphasis on oceans and vegetations. In contrast, a poor positive world health score may be portrayed by a slower globe rotation (suggesting slow sustainable development) and a dimmer shading to portray darker times. This hybrid of a numeric and visual score is intended to allow the user to observe the consequences of their actions, serving as an effective knowledge retention tool. Through the application of theoretical knowledge in a simulated practical context, the user should find the real-world problems that they encounter quite similar to their virtual experience.

### **2.2 Use of Prompt Engineering to Develop Real-World Scenario**

To provide tangible, real-world challenges, and realistic scenario, a comprehensive literature review was needed with extensive expert surveys, following a traditional approach, such as the Delphi method. This may take multiple months to conduct the literature review, identify case studies, prepare questionnaires, conduct survey, and compile the results. Though a scenario may be well thought out and revised, coming up with four unique scenarios for each of the 17 goals is not only time consuming, but also tedious. In addition, preparing and writing each scenario and their corresponding actions may increase the likelihood for human errors, with a total of 68 scenarios and 408 actions. Keep in mind that, the app is intended to stimulate the user's judgement, reasoning, and emotions into attempting to resolve the scenario at hand. To avoid such tedious tasks and with rise of Open AI and prompt engineering, we selected Microsoft Copilot in Bing as the primary chatbot to automate this process, as this would later serve as a cooperative tool that

eliminates human error. Each scenario presents a unique and creative situation with a set of related actions. Following a few trial runs, it was noted that the chatbot would require a detailed set of instructions for it to respond within the boundaries of each scenario. To illustrate, for a particular scenario, it would often suggest a set of six actions which may initially seem to contrast, but upon further inspection, are in fact too similar. At times, a full set of six actions would only allude to three relevant factors, where each factor is either increased or decreased as an approach to that scenario. To cooperate with the chatbot's tendencies, a detailed prompt was engineered in stages, where the scope of the project was first explained to the chatbot, followed by a list of requirements expected from each scenario it produces. More specifically, it was asked to return a realistic scenario for the specific goal mentioned in the prompt, whilst embracing its creativity to keep the actions unique and engaging. After Microsoft Copilot laid out a set of scenarios and actions, we manually revised and validated the scenario against their reference list and critiqued for accuracy. This particularly applied to the feedback and impact score, as it was important that they simultaneously reflected each other (i.e. a -2 score is explained with two negative implications). Figure 2 demonstrates a sample scenario paired with its list of actions, the impact attributed to each action, the block of feedback presented upon choosing it, and the assigned impact score.

Goal 05	Scenario 03	Actions	Impact (P/N/NU)	Feedback	Impact Score
<b>Gender Equality</b>	In your world the roles of parents within a household have been becoming progressively more rigid over the past few years. Fathers have been expected to handle all driving and maintenance tasks while mothers are expected to handle cooking and taking care of the children. What will you do?	Encourage female participation in STEM at a young age through presentations and workshops.	P	By encouraging women in science, technology, engineering, and mathematics, we harness diverse perspectives, break gender barriers, and drive advancements that benefit society as a whole. However, this does not address men's roles in the household.	+2
		Fund men's domestic violence charity organizations.	P	Rigid gender roles introduce dangerous presumptions about the typical household, particularly that men do not experience domestic violence. Funding these charity organizations gives them a voice to raise awareness and take action, but this does not address women's roles in the household.	+2
		Force all men and women to switch chores for 1 day.	P	Swapping duties is a fun activity to ease rigid gender roles in the household, but a partner who is employed may not find the time to try this out. The effects of this experiment may not be long-lasting either.	+1
		Encourage households to create a rotating chores list.	P	Rotating chores around the household is the best way to approach rigid gender roles. It helps both partners appreciate each other's responsibilities and communicates the need for cooperation.	+3
		Keep things traditional, the way they have always been.	N	Traditional responsibilities do not necessarily suit all men and women, nor should they become an expectation.	-2
		Increases taxes to encourage both partners to find a job.	N	Constraining a household financially is not a solution.	-2

Figure 2 Sample Scenario for Clean Water and Sanitation Goal with its Related Actions

### 2.3 YU-SDG-UP App User Interface & Navigation Instruction

Upon launching the app, the user is introduced to a virtual world where they are asked to create a profile to begin their journey (Figure 3). This allows multiple users to share one device and continue where they left off by simply signing into their personal profile. Once that user has entered their profile (secured with a username and a password), they are welcomed to a dashboard which prompts them to do one of the following: (1) continue their experiential learning journey, (2) review their progress and statistics, or (3) configure their profile settings, as shown in Figure 4. The user is encouraged to regularly review their statistics tab, which not only demonstrates the numeric and visual world health score detailed under section 2.1 (Figure 5 and 6) but provides the user with a breakdown of their goal-specific performance (Figure 7). This is intended to guide the user through their experiential learning journey by identifying their strengths and weaknesses which collectively determine that individual's world health score. Clicking on the minimized profile icon seen on the top right corner will return the user to the dashboard in Figure 4. The settings tab allows the user to customize their profile, with personalization options ranging from themes, colours, and notification preferences. When the user proceeds to the game, the banner at the top of the screen will headline the sustainable development goal (randomly chosen by the system) to which the presented scenario is attributed (Figure 8). On the same screen lies the presented scenario and a list of actions (labeled actions 1-6 for simplicity) from which the user is allowed to select. Once an action is tapped, it is locked in and highlighted, and only at this point will the score be revealed to the user (Figure 9). After carefully reviewing these scores, the user can proceed to the feedback page, where they are given the chance to reflect on the implications of their action (Figure 10). From this point onwards, the user is free to proceed with the next scenario, and the procedure becomes repetitive until each of the 68 scenarios have been attempted. Figures 3 through 10 are merely depictions of the intended final product, and therefore subject to change during the development of the app. Layouts, colour schemes, and animations may be modified to optimize the user's experience with the interface.

Before proceeding, it is worth taking a moment to re-iterate the random nature of the game, and the effects it can have. When playing the game users will be presented with various scenarios that have occurred within their world, each of these scenarios will be related to one of the UNSDG. However, the scenario is randomly chosen from the list, meaning there is no way to predict what the next scenario will be nor what UNSDG it would be related to. The actions that then appear for each scenario appear in random order, meaning there is no correlation between the order of actions and their respective "correctness". The random nature of the scenario selection allows for no two users to experience the same path throughout the game, as each user will be shown randomly selected scenarios. This greatly enhances the re-playability of the game and creates unique user experiences.



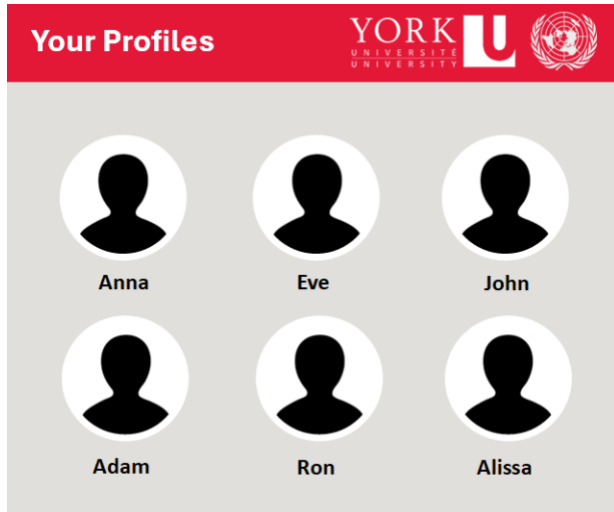


Figure 3 Welcome Page with User Profiles

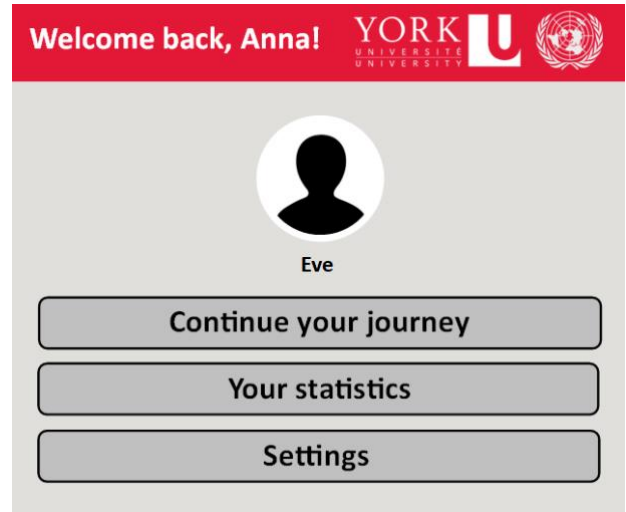


Figure 4 User Dashboard

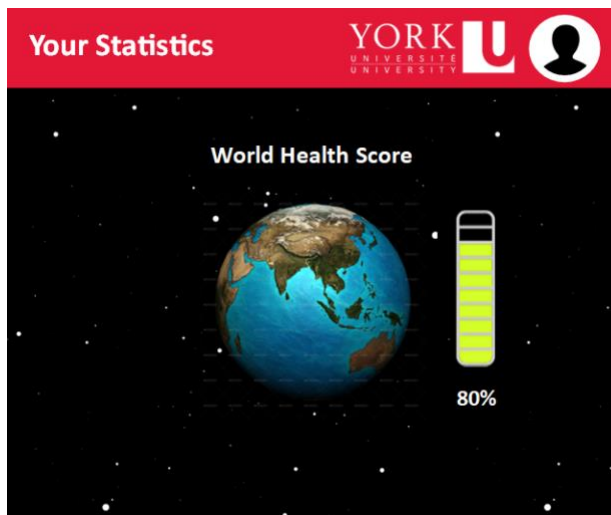


Figure 5 Poor World Health Score (Statistics Page)

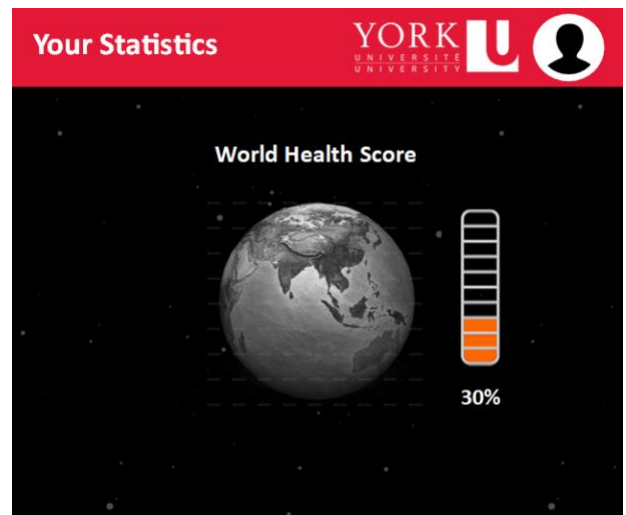


Figure 6 Positive World Health Score (Statistics Page)



Figure 7 Goal-Specific Performance (Statistics Page)

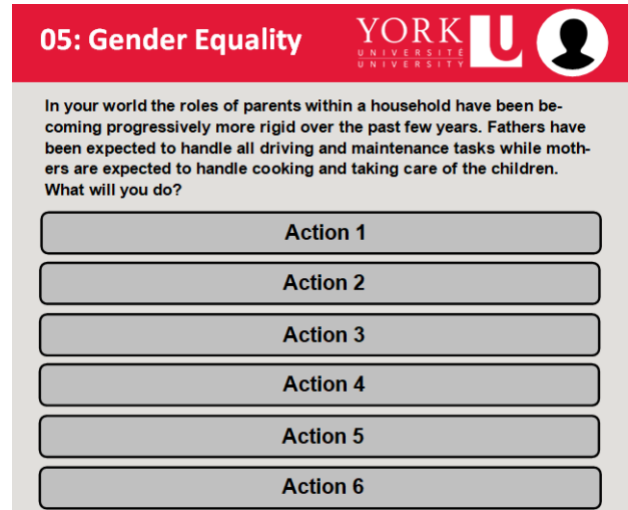


Figure 8 Sample Scenario with List of Actions

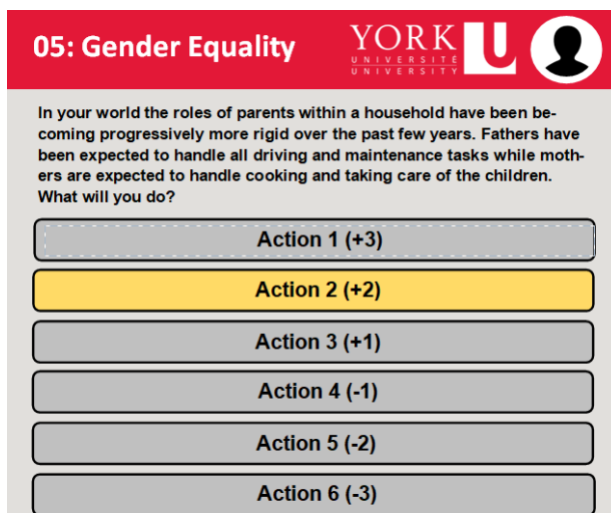


Figure 9 Chosen Action with Revealed Scores

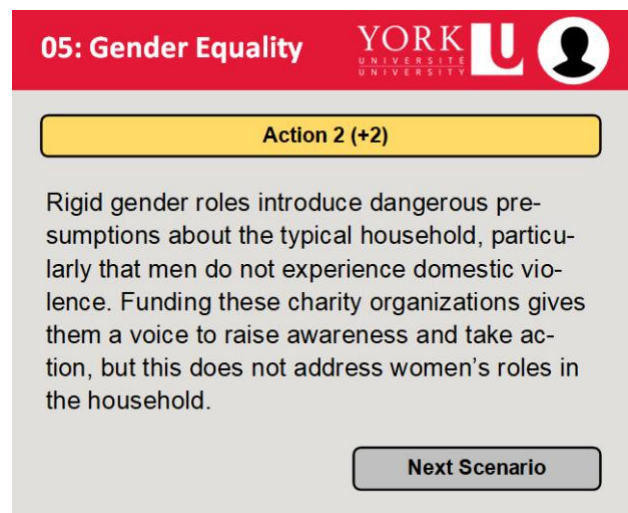


Figure 10 Feedback for a Chosen Action

### **3.0 Discussion**

The YU-SDG-UP app attempts to resolve the challenge of fusing the UNSDG notion to the curriculums through experiential learning, where students are required to navigate a virtual world which only allows them to progress forward when a scenario is resolved with an action. Whether or not the best action is chosen, a score is graded to the user, after which they can either maintain their score or learn from their previous mistakes to build a better one. In the next version of the app, feedback and data will be collected from students to gauge their learning level, and the degree to which they understood the sustainable development goals. Overall, this modern approach of delivering the notion of SDG is anticipated to help students retain their virtual experience and prepare them to make decisions under realistic conditions. This novel approach embraces the countless advantages of virtual and experiential learning, with the goal of preparing users to take charge in promoting sustainability, diversity, equality, and innovation. Future work will look at optimizing and refining the app into a valuable learning tool not only for classrooms, but individuals of all ages and occupations.

Once the Beta version for the YU-SDG-UP app is launched, the team intends to collect valuable user feedback that will go towards updating the app in stages. Once the user successfully resolves a scenario (or a select number of scenarios), they will be prompted to provide their written feedback with their first impressions of the presented scenario(s). At that point, the scenario library may be expanded and refined with the quality that users are anticipating. Users might also be asked to comment on the interface chosen to host the app and the ease in which it is navigated. In the future, the team is planning on incorporating a Large Language Model (LLM) that uses machine learning to record user tendencies and present scenarios accordingly. This would ideally transform the app into an adaptive learning tool which cooperates with the user's background knowledge on sustainable development, and minimizes the frustration associated with learning advanced content.

### **4.0 Conclusion**

This paper described the design, development, and functionality of the YU-SDG-UP app; an interactive mobile app which teaches the United Nation's 17 Sustainable Development Goals through experiential learning. Using Microsoft Copilot, a scenario-based problem-solving framework was developed at the heart of the app to successfully deliver the United Nations' urgent call to action. By exploring a virtual world with real-world scenarios, the user will build a strong understanding of the positive and negative approaches to sustainable development, while retaining much more knowledge than their prior efforts in the classroom. The user's weighted actions are directly reflected in their world health score, encouraging them to carefully think about their responses if they wish to experience the sense of fulfillment that comes with a near perfect (or gradually improving) performance. This is demonstrated with the aid of dynamic visual feedback, which was incorporated alongside the numeric world health score for the user to observe the graphic implications of their actions on a rotating globe. In summary, the YU-SDG-UP app is anticipated to broaden the user's knowledge and understanding of sustainable development, in

addition to leveraging their critical-thinking and problem-solving skills in that context. We plan on launching a Beta version of the app to send it through a rapid development phase with the help of user feedback surrounding the quality of the scenarios, as well as the functionality of the interface itself. The Beta version may then be updated with a wider scenario library, paired with an advanced Large Language Model (LLM) that uses machine learning to present the user with a more diverse range of challenges appropriate to their knowledge level. Our focus is on meeting the overarching goal of maximizing the educational impact of the app through user-centric functionalities and experiential learning to ensure a bright and sustainable future for our planet.

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