

**De La Salle University - Manila**

**Ripple Effect**

The main focus of this project is to educate the audience/players about clean water and sanitation as it is one of the most important things that we need in our daily lives.

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A Term Project

Presented to Mr. Ramon Stephen L. Ruiz

In Partial Fulfillment of the Requirements for  
Object-Oriented Programming Laboratory (LBYCPEI)  
Section EQ5

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## I. Introduction

Water is one of the most important resources for life, the environment, and environmental development. In recent years, population increase, urbanization, industrialization, climate change, and pollution have all posed threats to water. SDG 6 emphasizes worldwide water resource quality, sustainability, drinking water, sanitation, and hygiene (WASH) issues. Nutrition, education, and health also require improvements in drinking water, sanitation, and hygiene (UNICEF, 2021; ISO, 2022).

**Clean Water and Sanitation** (SDG 6) is the most important area of development and objectives deemed by the United Nations for 2030. This SDG focuses to ensure that clean and safe water for both drinking and sanitation purposes is available and there is proper management for these. It mainly addresses the current global water crisis, which is also essential in improving other sectors covered by other SDGs, such as but not limited to health and well-being, education, and economic productivity (Wikipedia, n.d.).

The importance of this is often underestimated leading to a significant problem that we are not aware of. Even though there has been significant breakthrough and improvements over the recent years, there are currently over 2.2 billion people worldwide affected without proper access to drinkable water while half of the global population has access to proper sanitation facilities. (UNICEF, 2021). The biggest problem is not just only the lack of clean water and sanitation but that young children are in danger since WASH-related infections are among the major causes of death for children under the age of 5 years old while also including malnutrition and stunting (NEDA, 2022).

**Ripple Effect** is an interactive Java game that aims to educate players about the importance of water conservation and sustainable management of water resources. It includes challenges and games related to water usage and sanitation practices, players are encouraged to make sustainable choices and learn about the impact of their actions on the environment. The game includes difficulty levels to make it more challenging, and players are rewarded with in-game achievements for making sustainable choices and penalized for wasteful behavior. By promoting awareness and encouraging responsible behavior, **Ripple Effect** contributes to the global effort to achieve SDG Goal 6: Clean Water and Sanitation.

## **A. Background of the Study**

SDG 6 aspires to guarantee the availability and sustainable management of water and sanitation for all. Water and sanitation are essential for human and environmental health. SDG 6 targets not just drinking water, sanitation, and hygiene (WASH), but also the quality and sustainability of water resources globally (Wikipedia, n.d.).

According to National Geographic (n.d.), the lack of water affects around 40% of the global population. This amount is expected to increase as the global temperature over recent years has been rising. Droughts have been causing starvation and malnutrition around the world and approximately 1.7 billion people live in a watershed, where water is utilized faster than it can be restored.

The United Nations adopted SDG 6 in an effort to provide appropriate sanitation and water services to all people by 2030. To achieve its vision, the UN established a set of goals. These goals include repairing and maintaining river ecosystems across the world, decreasing water pollution sources, and boosting international collaboration to offer services to people everywhere (National Geographic, n.d.).

Clean Water and Sanitation for All (SDG 6) is one of the 17 Sustainable Development Goals that the United Nations General Assembly set in 2015. The main purpose of this SDG is a response to the fact that many people throughout the world lack access to these fundamental services. Despite advances in drinking water availability, an estimated 663 million people relied on unimproved water sources or surface water in 2015 (United Nations, n.d.).

## **B. Problem Statement**

SDG 6 aims to provide universal access to and long-term management of water and sanitation. Water and sanitation are critical components of both human and environmental health. Goal 6 addresses not just drinking water, sanitation, and hygiene (WASH) issues, but also the global quality and sustainability of water resources (UNEP, n.d.).

UNESCO thinks that education is critical to ensuring that water and sanitation are available, sustainable, and universal by 2030. Effective water education must be recognized and encouraged as part of the larger strategy to address the water challenges

highlighted in SDG 6. Education is critical to ensuring that water and sanitation are available, sustainable, and universal by 2030 (UNICEF, 2021).

Education is also essential for building a peaceful and prosperous planet. Education gives people the knowledge and skills they need to be healthy, obtain jobs, and promote tolerance (Martin, 2022). People can be taught on the importance of safe drinking water and sanitation to their health and well-being. It can also help people understand the environmental impact of their actions and how they can contribute to sustainable water management.

### **C. Objectives**

#### **B.1. General Objectives**

The general objective of this project is to develop an interactive Java game that educates players about the importance of water conservation and sustainable management of water resources by showing facts and letting them answer questions that would broaden their knowledge of SDG 6.

#### **B.2. Specific Objectives**

1. To educate players about the importance of water conservation and sustainable management of water resources and promote awareness and encourage responsible behavior towards this issue.
2. To design and develop a user-friendly interface so that players would be able to enjoy the game while learning new things about SDG 6.
3. To include challenges and games related to water usage and sanitation practices in order to broaden their knowledge and spread the word about the importance of making sustainable choices and learn about the impact of their actions on the environment.
4. To develop a system that rewards players with in-game achievements for making sustainable choices and penalized for wasteful behavior as this is effective in helping the players learn faster since no one likes to get penalized on anything.

5. To evaluate the effectiveness of the game by checking on whether each part of the game is fun and informative by comparing different perspectives and implementing useful advice.

### **D. Significance of the Project**

The creation of the interactive Java game Ripple Effect is a big step in addressing the urgent issue of water conservation and sustainable water resource management. The significance of fulfilling Sustainable Development Goal 6 (SDG 6) cannot be understated, as it underlines the critical need for clean water and sanitation for everyone by 2030, affecting not just human health and well-being but also other SDG-covered sectors.

The significance of the project lies in its ability to contribute to the worldwide effort to achieve SDG 6 by raising awareness, encouraging responsible conduct, and disseminating information about water conservation and sustainable water resource management. Ripple Effect immerses users in an instructive and engaging experience that encourages responsible water consumption and demonstrates the influence of their decisions on the virtual world. The game effectively supports sustainable behavior by including challenges, games, and in-game achievements, building a sense of accountability and empowerment among players.

## II. Related Works

Clean water and sanitation are vital because they assist to maintain a sanitary environment that prevents illnesses from spreading through tainted food and contaminated water. Furthermore, it aids in the conservation of resources such as water by decreasing waste. Clean water and sanitation are also critical building blocks for attaining the SDGs, which include excellent health and gender equality. It aids in the sustainable management of water, which aids in the management of food and energy production and contributes to decent labor and economic progress (UNICEF, 2021; United Nations, n.d.).

In the paper by Sandoff et. al. (2020), the authors stress the urgency of rethinking water policies and management paradigms to achieve SDG 6 successfully. They call for increased ingenuity, research, and innovation to sustainably safeguard and utilize water resources for a more equitable and sustainable water future. However, they also acknowledge that progress towards SDG 6 has been insufficient to date and emphasize the need for intensified efforts to attain this critical global goal.

The paper by Mushota et al. (2021) provides valuable insights into the effectiveness of school-based WASH interventions in improving knowledge related to diarrhea management and prevention among adolescents in a resource-constrained setting. It highlights the importance of targeting adolescents as knowledge carriers and calls for further research to assess the long-term impact of such interventions on community health outcomes.

The paper by Ngure et al. (2014) discusses the link between water, sanitation, and hygiene (WASH) and early child development (ECD) in low- and middle-income countries. It proposes the concept of "baby WASH" to address gaps in current interventions and emphasizes the importance of newborns' environmental hygiene for their health and development. Further research and innovation are encouraged to create effective baby WASH treatments.

### ***A. Rethinking water for SDG6***

This article authored by Claudia W. Sadof, Edoardo Borgomeo, and Stefan Uhlenbrook discusses the challenges of achieving Sustainable Development Goal 6 (SDG 6) on clean water and sanitation by 2030. The SDG 6 focuses not only on drinking water supply and sanitation but also includes aspects of water quality, water use efficiency, integrated water resources management, ecosystems, and an enabling environment. The authors highlight that the previous global water targets, such as the Millennium Development Goals (MDGs), mainly concentrated on access to water supply and sanitation, overlooking other crucial elements like water quality and equitable water resource management.

The authors acknowledge that the transition from the MDGs to the broader SDGs poses various challenges, including definitional and monitoring issues, financing, capacity, and governance barriers. Furthermore, they emphasize the need for ambitious actions to match the increased ambition of SDG 6. While technological advancements offer opportunities, achieving the SDG requires changing underlying paradigms of water policy. The authors discuss three main paradigms that need revision: economics, engineering, and management.

The traditional water economics paradigm treated water as an abundant resource, neglecting its scarcity value and externalities. The focus was on minimizing costs rather than recognizing water as a scarce resource. The authors argue for policies that reflect water scarcity, address non-economic trade-offs, and prioritize equitable access and sustainable water management.

Lastly, water management should adopt adaptive and integrated approaches to deal with complexity and trade-offs. Such approaches involve considering interconnections, involving various stakeholders, and utilizing new data sources and tools to make informed decisions.



***B. Effect of school-based educational water, sanitation, and hygiene intervention on student's knowledge in a resource-limited setting***

In the Ujjain district of India, Mushota et al. (2021) performed a research to evaluate the efficiency of a school-based educational water, sanitation, and hygiene (WASH) intervention in enhancing students' understanding of diarrhea prevention and management. The majority of children fatalities worldwide are still related to diarrhea, with India having the largest number of these deaths. The study highlighted the significance of adopting WASH-related interventions in communities and schools to reduce morbidity and mortality caused by diarrhea in settings with low resources.

The research employed a pre-post intervention study design with a two-stage cluster sampling, involving 1,781 students aged 14-19 years, studying in grades 8th-12th, in schools located in Ujjain, Madhya Pradesh. The intervention consisted of an educational training session using a WASH training module. A structured WASH-knowledge questionnaire was used to assess the students' knowledge on diarrhea management and prevention before and after the intervention.

The findings revealed that prior to the intervention, a small percentage of students had awareness of the symptoms and indications of severe pediatric diarrhea, the usage of zinc tablets during an episode of diarrhea, and the therapy for diarrhea. The proportion of students who had this information increased by more than a factor of two following the educational intervention, however. The WASH educational intervention was successful in raising students' knowledge levels as evidenced by the fact that the mean post-intervention knowledge score was considerably higher than the mean pre-intervention score.

The study concluded that WASH- and diarrhea-related knowledge among higher secondary school students increased after the educational intervention. Adolescents were identified as key knowledge carriers who could disseminate health information to their communities effectively. The study emphasized the significance of investing in adolescents as change drivers to fight against poverty and inequalities.

***C. Water, sanitation, and hygiene (WASH), environmental enteropathy, nutrition, and early child development: making the links***

This paper discusses the link between water, sanitation, and hygiene (WASH) and early child development (ECD) in low- and middle-income countries. It reviews the evidence on how poor WASH conditions affect child growth, anemia, and cognitive, sensorimotor, and socio-emotional development. It also highlights the gaps in current WASH and ECD interventions and proposes a concept of baby WASH as an additional component of ECD programs. The paper is based on a literature review of studies on WASH, nutrition, and ECD, as well as the authors' own research and experience in this field.

The paper presents a hypothesis that microbial ingestion from poor hygiene is a risk factor for poor ECD, mediated in part through environmental enteropathy (EE), a subclinical condition of the gut that impairs nutrient absorption and causes inflammation. The paper also suggests that poor hygiene may affect ECD through other pathways, such as anemia of inflammation, reduced physical activity and exploration, and altered caregiver-child interactions. The paper reviews the evidence linking WASH to stunting and anemia, which are known risk factors for child developmental deficits, and examines the potential role of EE as a key mediating pathway.

The next section of the paper covers the effects of inadequate cleanliness on the environment for children to play and eat in low-income families. According to this argument, the first three years of life, when gut health and linear development are established, are not protected by existing WASH efforts. It promotes the creation of treatments geared for this age group as well as a more comprehensive view of WASH focused on infants in their early years of life. The simultaneous issues of EE and infectious illnesses inspire the paper's proposal of the infant WASH concept as an extra focus element of ECD initiatives.

The paper's conclusion emphasizes the significance of treating newborns' environmental hygiene. It implies that the cleanliness of the immediate surroundings in which the newborn begins to discover the world has an impact on the health, nutrition, growth, and development of children. It makes the case that WASH should be defined holistically to include all components of the physical and behavioral environment that affect children's hygiene. In order to create baby WASH treatments that can safeguard, stimulate, and advance learning for infants in the context of their culture and family structure, further research and innovation are urged.

### III. Methodology

#### A. Proposed Application

We would be utilizing **IntelliJ IDEA** as our integrated development environment (IDE) which allows us to work simultaneously using the **Git** function with **GitHub** access to the repository implemented into the IDE. We would then be using **Java Platform Standard Edition** (Java SE) as our development platform kit in order to compile and run our source code. We would also be utilizing **JavaFX** as our library/program dependencies as it includes important libraries such as Scanner, ArrayList, Application, and so on. We would be utilizing what we have learned in class and the **Java Doc** as a guide for us just in case we would get lost in how we would implement a method. We would be utilizing **SketchIt!** to generate the **PlantUML** class diagram.

The game includes questions that are all related to water usage and sanitation practices and their importance. Players are rewarded with in-game achievements for making sustainable choices and penalized for wasteful behavior. There are also **additional features** that were implemented in the game:

- The customizability of player names
- Allows players to compare their scores with previous ones
- Allows players to reset their scores
- Allows players to view their game statistics and show the unlocked and locked achievements they have
- Incorporate real-world data and statistics to emphasize the global water crisis and the impact of individual actions
- Educational quizzes or trivia questions about water-related facts and statistics to further enhance players' knowledge on the subject

## B. Implementation/OOP Aspects

So that we are able to be successful and organized in addressing the problem, implementing the functionality, and accomplishing the project, we would be utilizing the

### **Four Pillars of Java:**

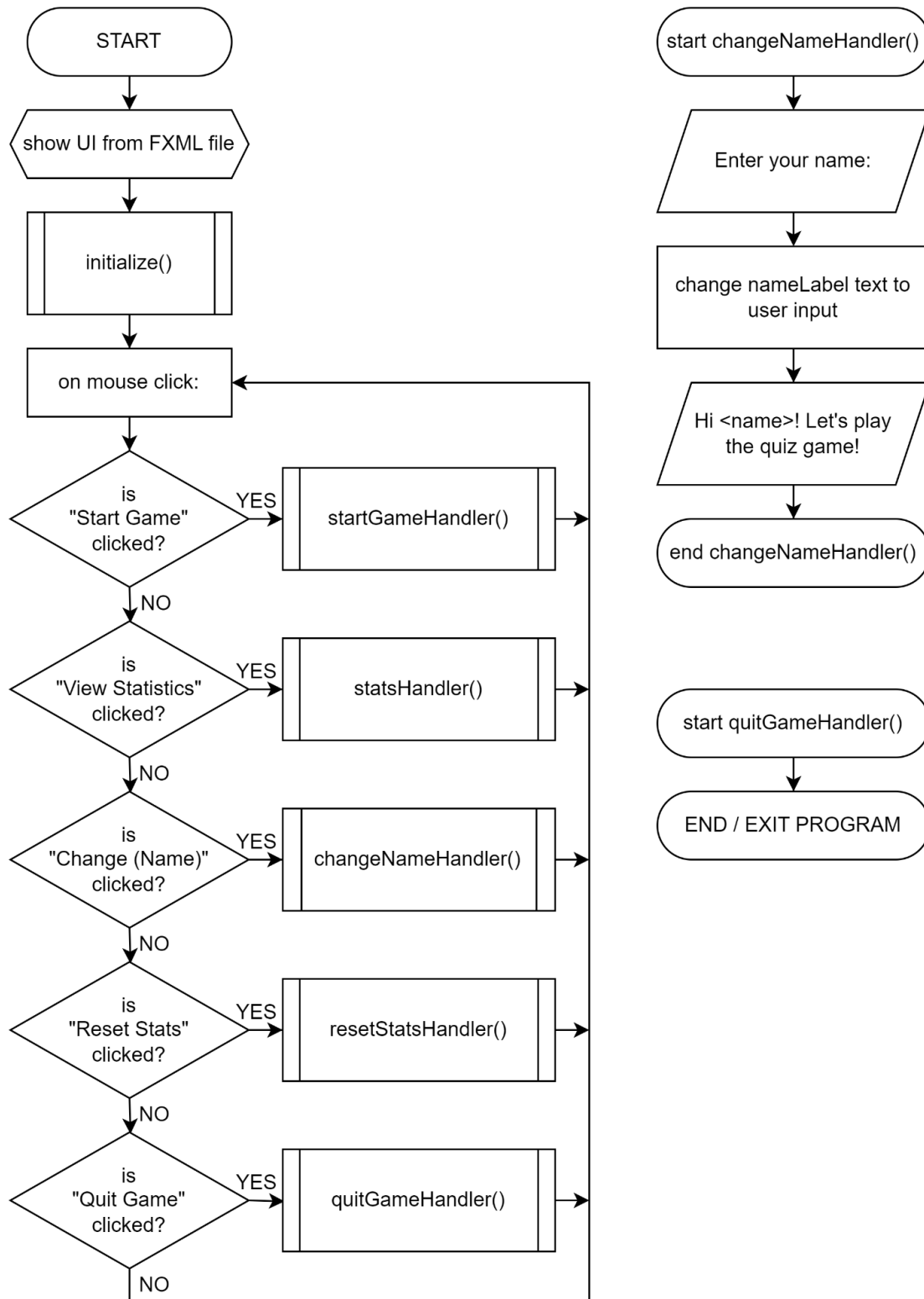
- **Abstraction:** Start by identifying the key components and features of the game, such as the gameplay mechanics, user interface, and educational content. Define abstract classes or interfaces to represent these components and their behaviors.
- **Encapsulation:** Organize the game's code into classes and packages that encapsulate related functionality. Use access modifiers such as private and protected to control access to the class's internal state and behavior.
- **Inheritance:** Use inheritance to create a hierarchy of classes that share common attributes and behaviors. For example, you could create a base GameEntity class that defines common properties and methods for all game entities, such as their position and size. Then, you could create subclasses such as Player and Obstacle that inherit from GameEntity and add additional properties and behaviors specific to those entities.
- **Polymorphism:** Use polymorphism to create flexible and reusable code. For example, you could define an Interactable interface with an interact() method that is implemented by all game entities that can be interacted with by the player. Then, you could use a single interact() method in your game logic to handle interactions with different types of entities, without having to write separate code for each entity type.

**C. Input-Process-Output (IPO)**

<b>Input</b>	<b>Process</b>	<b>Output</b>
<p>Player interaction with the game.</p> <p>Button in the application for different functions (e.g. Change, Start Game, etc.).</p> <p>The player answers (A, B, C, or D) to the educational quizzes or trivia questions.</p> <p>Player's customization of username</p> <p>Real-world data and statistics on the global water crisis.</p> <p>Player's request to reset game data</p> <p>Player's request to quit the game</p>	<p>Game mechanics calculate player choices and actions.</p> <p>The game checks answers for correctness.</p> <p>Game stores the player's name.</p> <p>The game changes the player's name.</p> <p>The game resets the player's data.</p> <p>The game incorporates data into the gameplay and educational content.</p> <p>The game compares current data and previous data (if current data exists else it asks the user to play a round).</p> <p>The game reads the files containing facts, achievements, game data, questions and answers, and previous game data.</p> <p>The application reads from the FXML files for the main menu GUI.</p> <p>The game assigns values (previous game data, current game data) to save in a file.</p>	<p>Graphical User Interface and Experience (UI/UX)</p> <p>Game Mechanics</p> <p>Display the player's username</p> <p>Display the player's game data</p> <p>Display the player's previous round of data</p> <p>Display questions for the user to answer</p> <p>Display a comparison between the player's current round data and previous round data</p> <p>In-game achievements and penalties</p> <p>Feedback on player's knowledge of water-related facts and statistics</p> <p>Enhanced player understanding of the impact of individual actions on the global water crisis</p> <p>Displays Did You Know? with random facts when the application starts</p>

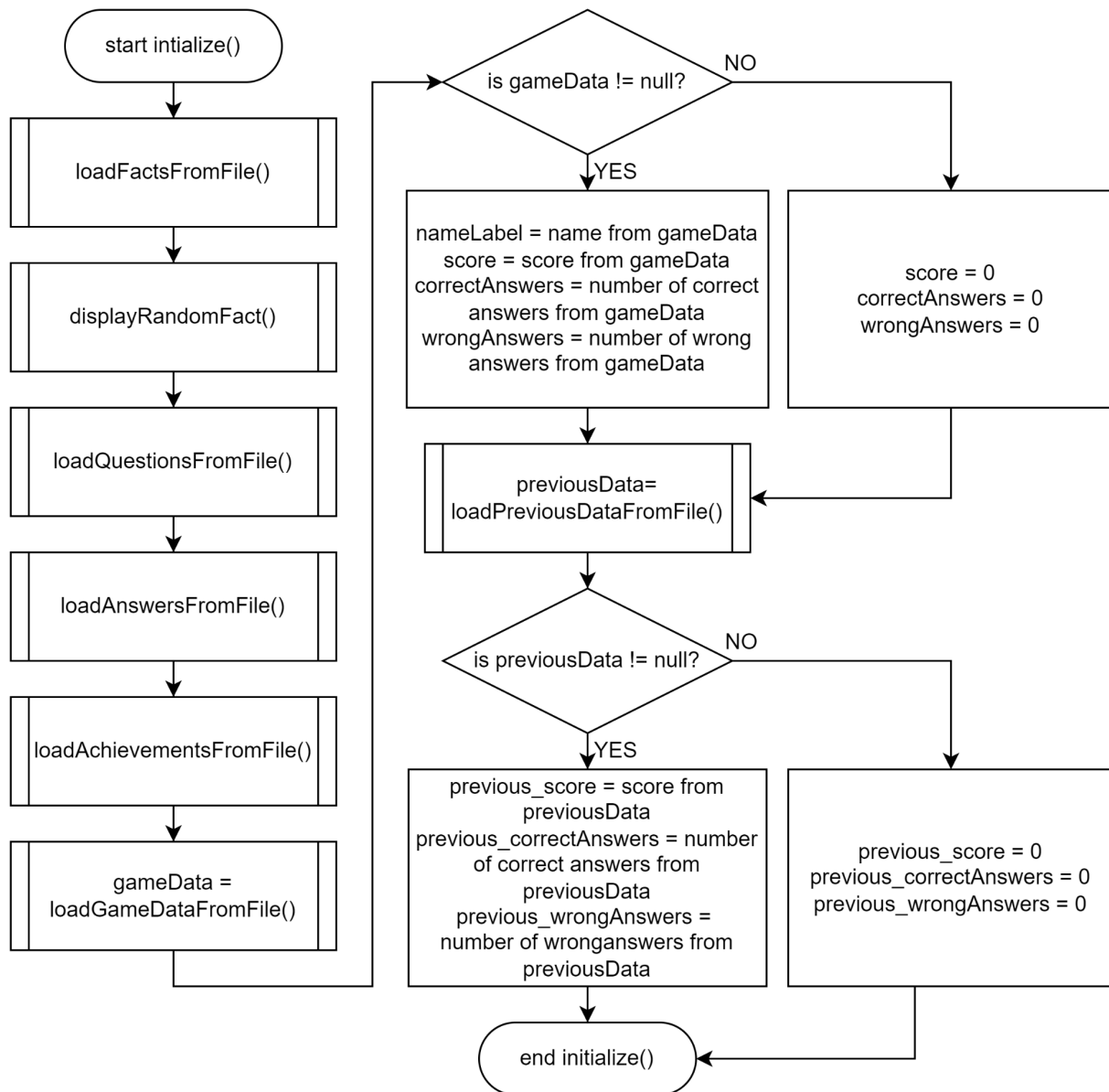
Table 1.1 - IPO Table

## D. Flowchart

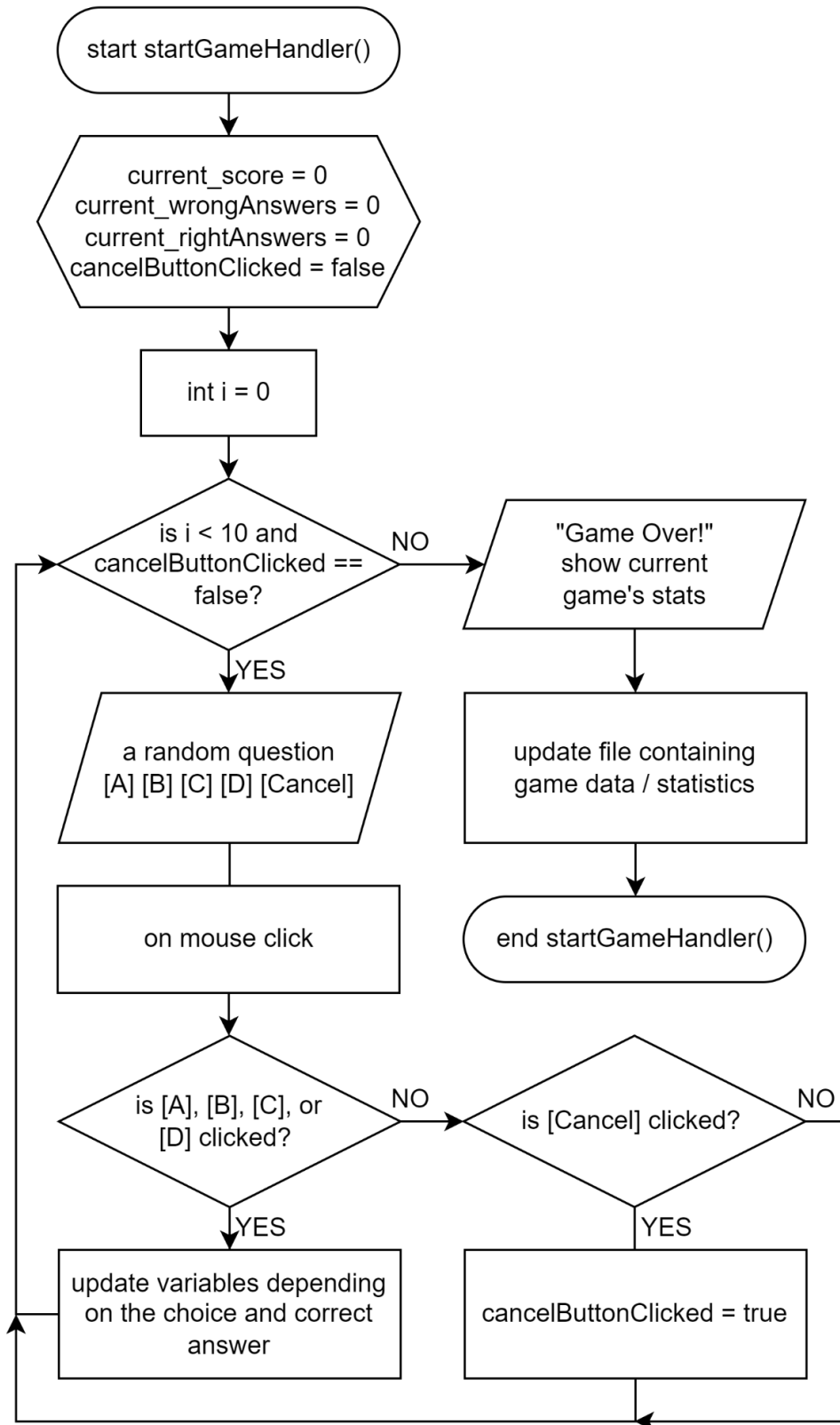


Flowchart 1.1 - Starting Flowchart and changeNameHandler

## Ripple Effect

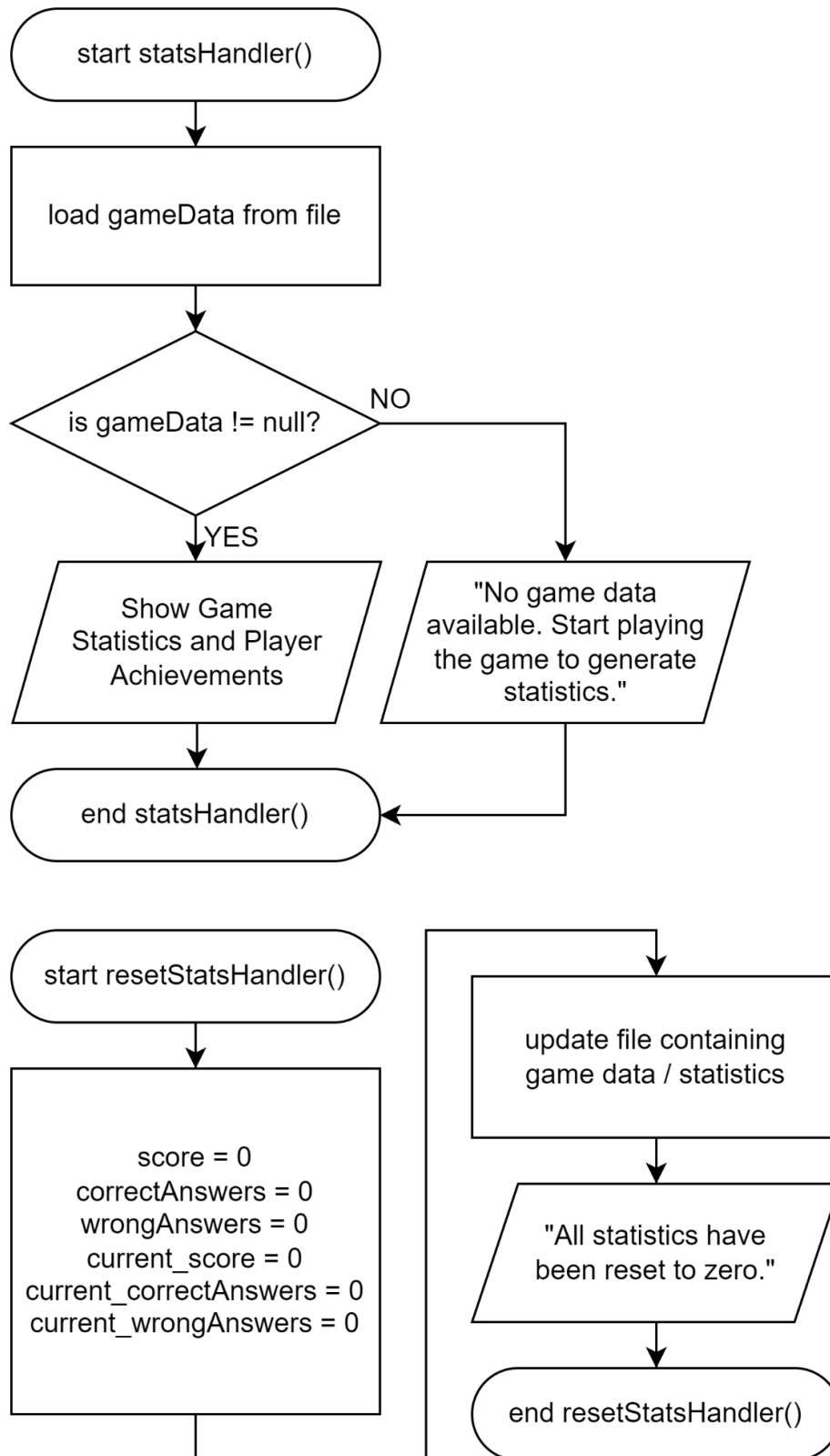


Flowchart 1.2 - Initialization of Variables and Values



Flowchart 1.3 - startGameHandler





Flowchart 1.4 - statsHandler

## E. Class Diagram (PlantUML)

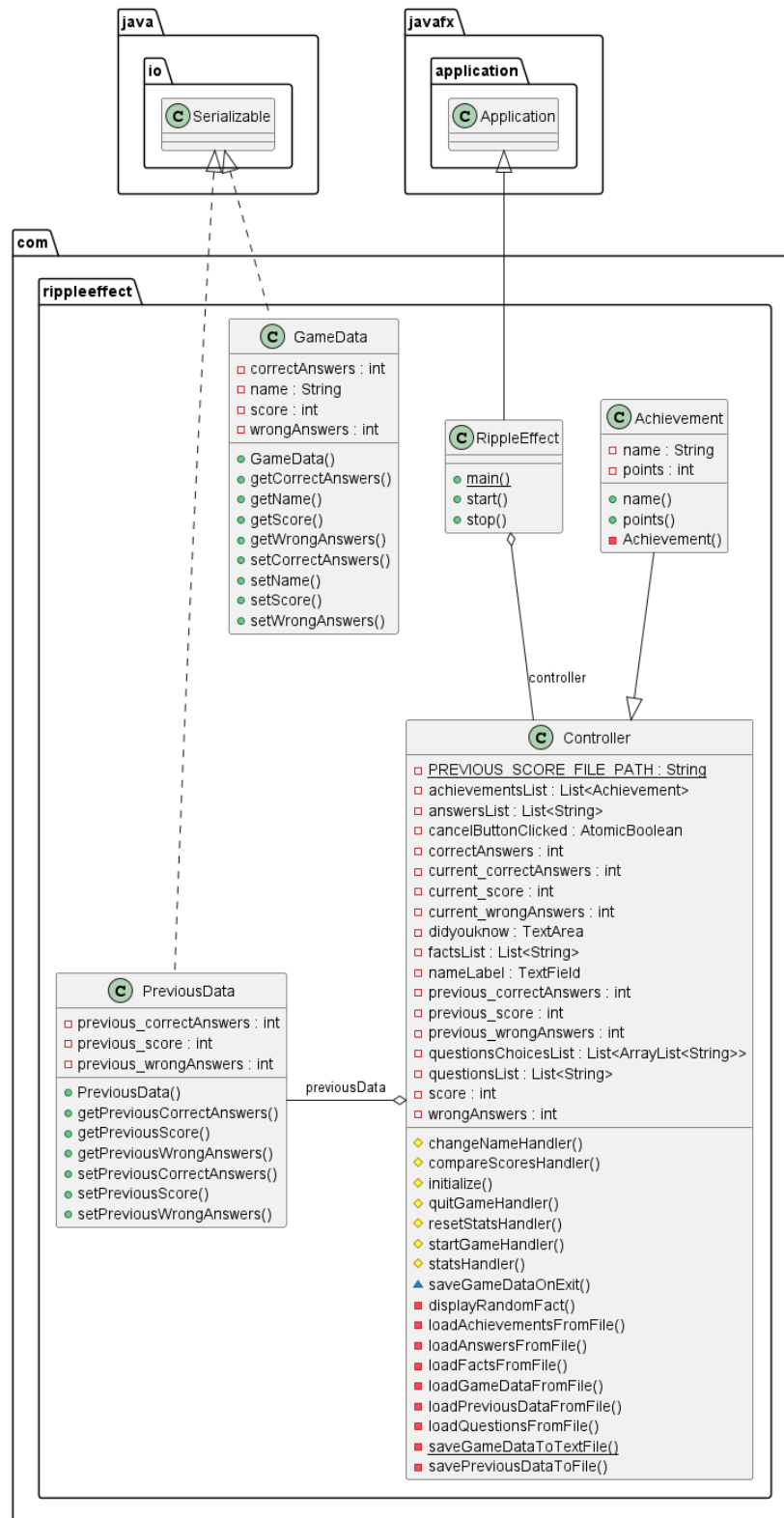


Diagram 1.2 - Class Diagram for the Program

## **IV. Discussion**

### **A. Results**

Coming to the results, we were able to achieve the objectives of creating a game that would broaden the ideas and perspectives of players toward Clean Water and Sanitation For All (SDG 6). From implementing the load and save game data to files while also being able to customize their profile names to adding facts and questions about SDG 6, players would surely have a personalized experience after reaching a certain number of scores, they would unlock achievements. We are also able to implement the Four Pillars of Java and it made coding the program simpler and better. We were also able to add Java Doc and comments to guide developers on how our source code works. We were able to add a Did You Know? in the main menu and would be different each time a player starts the game. The questions have 4 choices, which are A, B, C, and D, for the player to choose and the question and choices are shown. Players are able to cancel the question answering anytime when they feel like they don't want to continue and each round would have 10 sets of random questions since it is the best balance for learning more while not consuming so much time. Even though it might no longer be relevant in the future, we are sure that it would contribute to the present time which will help make the future better for everyone. Players would be able to reset their score when they want to share the program with their peers but the source code comes with the empty scores so they don't have to reset the scores before sharing meaning that they can just download the source code from our GitHub repository. Players are also able to compare their current scores with their previous ones to show their progress in learning as it will give them a competitive vibe to achieve a higher score which will encourage them to learn more about the facts and questions while understanding the right answer. After playing this game, the player would surely be curious about SDG 6 and they would research it through sites like Google and YouTube where they would learn more about the importance of this topic and possibly spread the word to their friends and family.

## B. Walkthrough

### ---- Main Menu ----

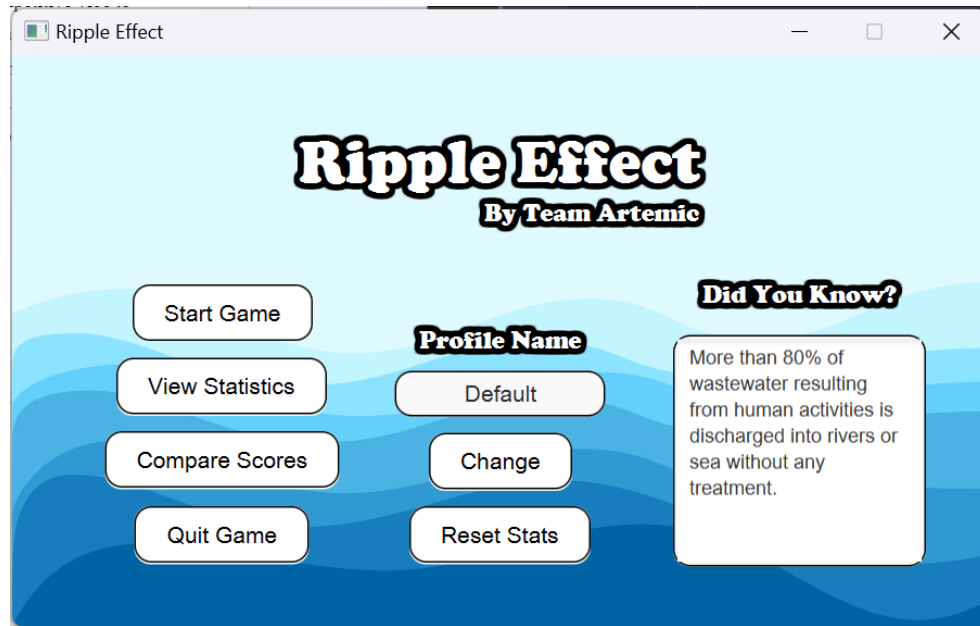


Image 1.1 - Main Menu

When the application is launched, the user would be greeted with the title and the menu. On the **left side**, it is in charge of starting the game, showing the statistics and the achievements unlocked by the player, comparing the current score and the previous score, and quit game. In the **middle**, we would see the profile name, change the profile, and reset stats to reset game data back to default. On the **right side**, we can see Did You Know? with facts and there are currently a total of 38 facts the program would rotate at every start of the application and the user can add more in the **facts.txt** file. Some example facts that the user would stumble into are shown below.



Image 1.2 - Examples of Did You Know? Facts

## --- Change Username ---

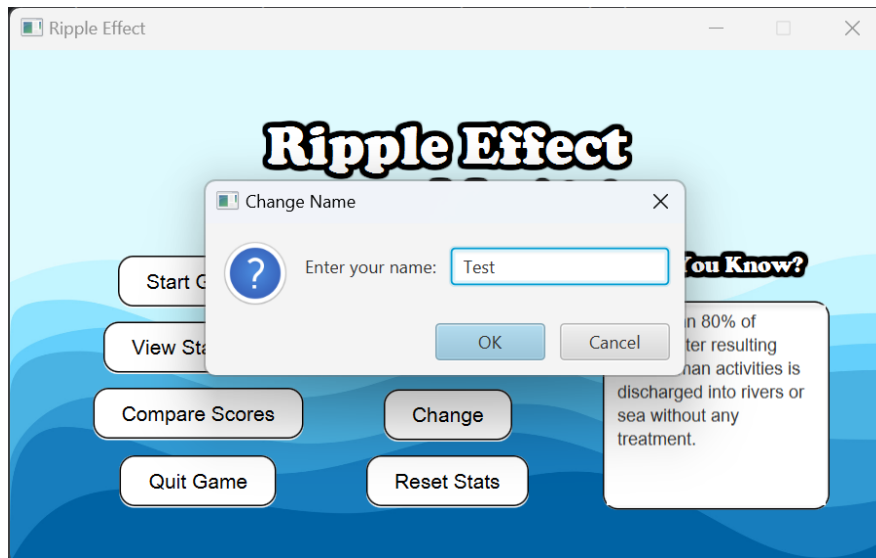


Image 2.1 - Change Name Dialog

When the user presses the **Change** button, the program would show a dialog pop-up where the user would input his/her new username and press OK or Cancel to not change.

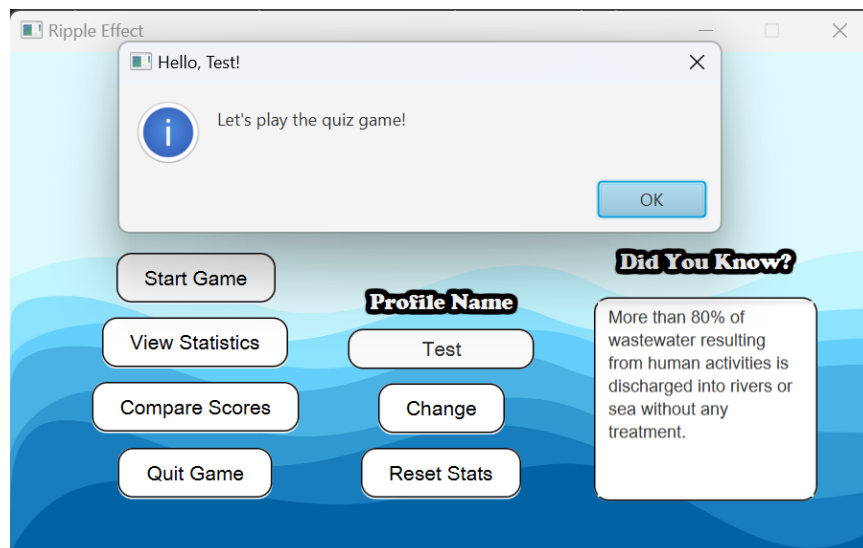


Image 2.2 - Successful Change Dialog

After the user presses OK it would greet the player with his/her new username and display “Let’s play the quiz game!” and we can see that after pressing the OK on the previous dialog. The Profile Name has changed to the new one.

---- Reset Statistics ----

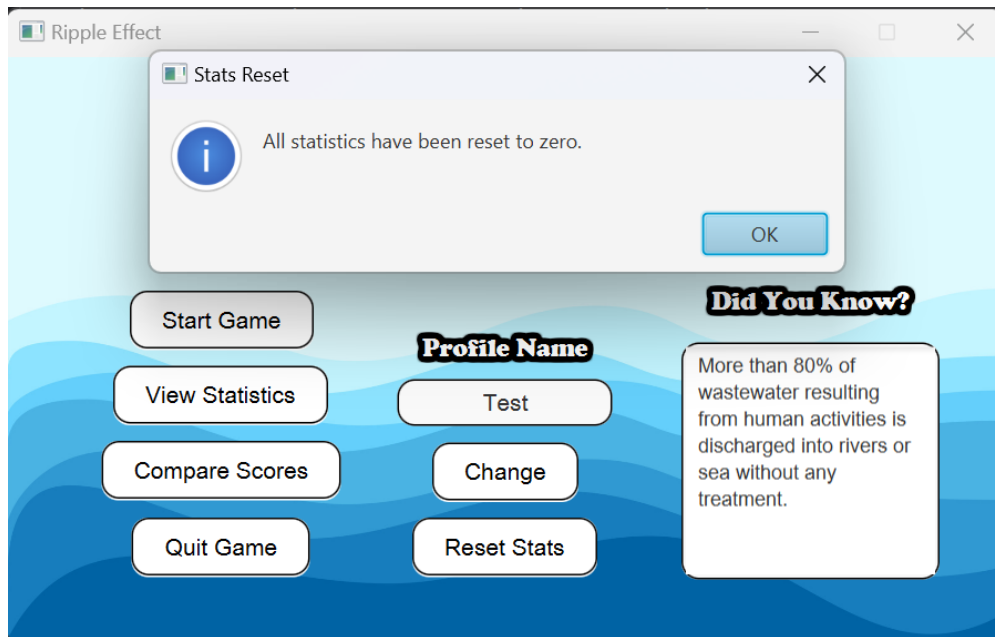


Image 3.1 - Reset Statistics Dialog

When the user presses the Reset Stats button, there would be a dialog pop-up window saying that “All statistics have been reset to zero” and all of the executions happen in the background so the user just has to press OK to return back to the main program

— Start Game —

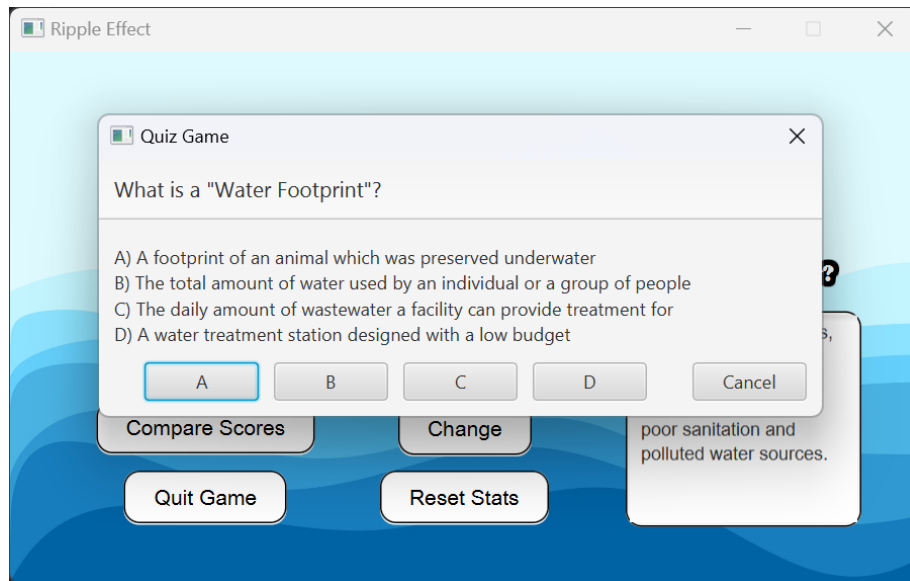


Image 4.1 - Question Dialog

When the user press the Start Game Button, the program would display a random question from the **questions.txt** file with a total of 21 questions, and the answers would be checked from the **answers.txt** file. Each round contains 10 random questions and the user can cancel the round anytime but there would be a penalty that all discarded questions left would be considered as minus points.

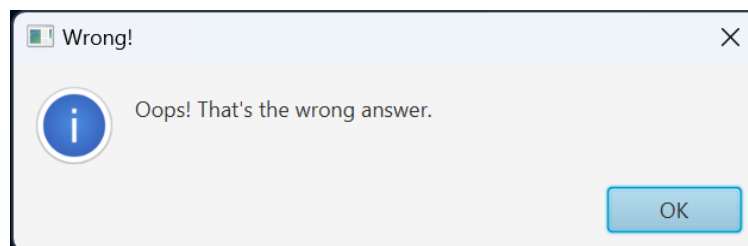


Image 4.2 - Wrong Answer Dialog

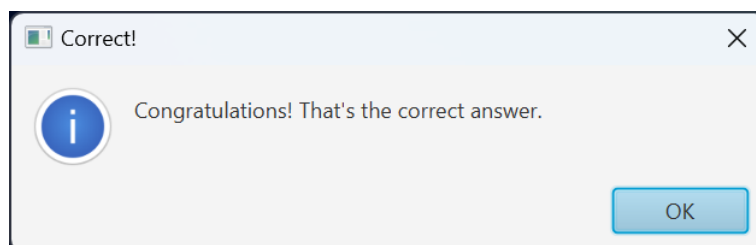


Image 4.3 - Correct Answer Dialog

As we can see from Images 4.2 and 4.3 above, if the user gets the correct answer then the game would display “Congratulations! That’s the correct answer.” and the player gets plus 1 point meanwhile if the user gets the wrong answer then the game would display “Oops! That’s the wrong answer.” and the player gets minus 1 point.

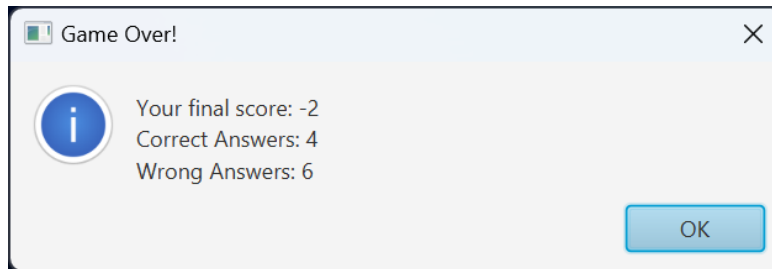


Image 4.4 - Game Over! Dialog without Previous Statistics

The dialog from Image 4.4 would show up after each round with details such as the final score and the number of correct answers and wrong answers.

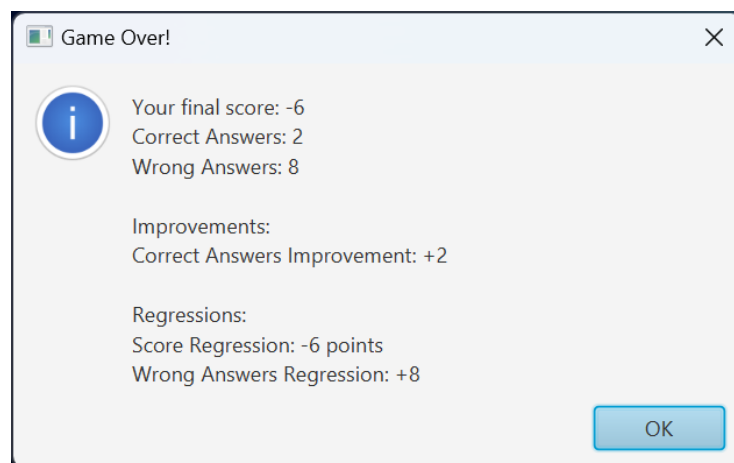


Image 4.5 - Game Over! Dialog with Previous Statistics and Comparison

Comparing Images 4.4 and 4.5, we can see that if there is previous round data detected by the game then it would show the list of improvements and regressions from the previous round data while if there are no previous game data then the program would just show the statistics of the current round.



---- **Game Statistics and Achievements** ----

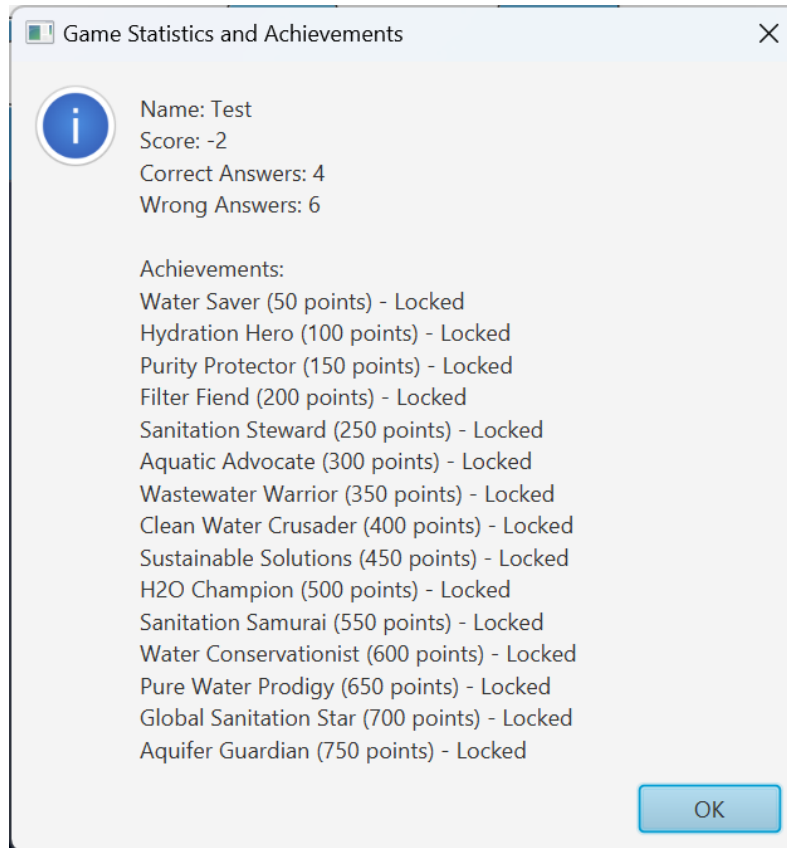


Image 5.1 - Game Statistics and Achievements Dialog

We can see from Image 5.1 that when the player presses the View Statistics button in the main menu then it would lead them to this dialog that shows their username, total score, total numbers of correct answers and wrong answers, and the achievements locked and unlocked by the user.

## ---- Compare Scores ----

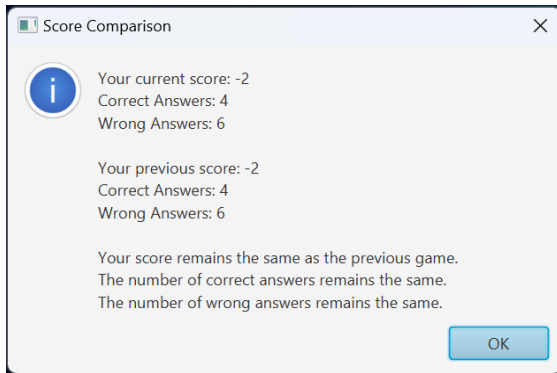


Image 6.1 - Score Comparison

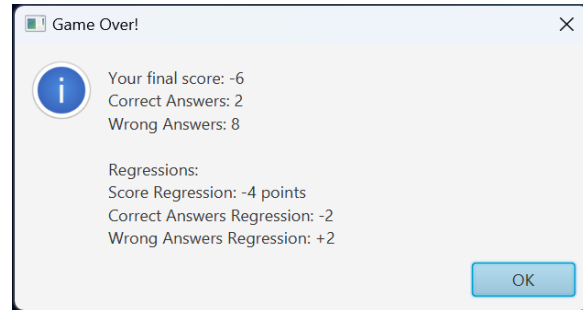


Image 6.2 - Score Comparison

When the user presses the Compare Scores button in the main menu then it would show the comparison of their latest round score and a previous round score while also showing whether there are improvements or the score remains the same as we can see from Images 6.1 and 6.2.

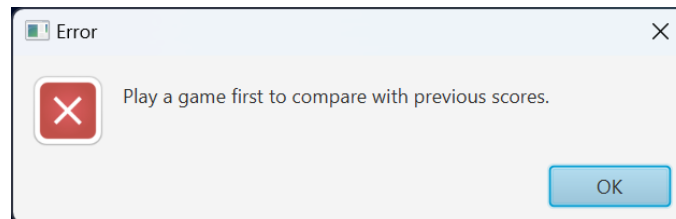


Image 6.3 - Error (No Current Score Found)

From Image 6.3, we can see that this error dialog pops up when the user hasn't played a round yet as the game is launched. The user would be asked to play one round in order to compare with the previous round score.

### C. Evaluation

<i>Criteria</i>	<i>Description</i>
Graphical User Interface (GUI)	We will assess how aesthetically pleasing the visual assets are for the GUI in addition to how easy it is to understand the game mechanics through user experience and/or the included tutorial/s. We may also seek the opinions of other students for this criterion.
Program/Code Structure	We will evaluate the organization and readability of the code, as well as its efficiency and use of appropriate data structures and algorithms.
Educational Content	We will assess how well the game teaches its intended subject matter and how effectively it conveys information to the player.
Game Difficulty	We will evaluate whether the game provides an appropriate level of challenge for its intended audience and whether it offers a good balance between difficulty and accessibility.
Player Engagement	We will assess how engaging and enjoyable the game is to play, taking into account factors such as its pacing, replayability, and overall fun factor.

Table 1.2 - Evaluation Criteria for the Game

From Table 1.2, we were able to evaluate our game while making the necessary adjustments when needed. For the **Graphical User Interface (GUI)**, we put our efforts into making the simplest and most user-friendly interface possible so that it is suitable for children to play. For the **program and code structure**, we are able to utilize the Four Pillars of Java while separating the main Controller from the Main Program. We were also able to add Java Doc and comments to the code so that developers who would like to view the code will be able to catch up easily on how we implemented the code and what are their functions. For the **educational content**, we made sure to fact-check all of the questions and facts from the web and made sure that they are relevant to the user. For the **game difficulty**, we made sure to make it easy for children to be able to understand the questions and learn from them. For **player engagement**, we tested the game many times to make sure that it is fun such as adding Did You Know? which will interest the younger audience on the topic and we also added statistics to be viewed and achievements for the player to unlock after reaching a specific amount of points.

## V. Conclusion, Limitations, and Future Directives

In **conclusion**, the creation of the interactive Java game **Ripple Effect** has successfully achieved its objectives in educating players about the importance of water conservation and sustainable water resource management, with a specific focus on Sustainable Development Goal 6 (SDG 6) - Clean Water and Sanitation for All. The game's user-friendly interface and engaging challenges have effectively raised awareness and encouraged responsible behavior toward this critical issue.

The **significance** of this project lies in its contribution to the global effort to achieve SDG 6 by promoting awareness and understanding of water conservation and sustainable water management practices. By immersing players in a virtual environment that demonstrates the impact of their decisions on the world, Ripple Effect fosters a sense of accountability and empowerment among players, encouraging them to make sustainable choices.

Through a rigorous evaluation process, the game has been refined to ensure educational content accuracy, simplicity for younger audiences, and overall player engagement. With in-game achievements, progress tracking, and interactive elements like "Did You Know?" facts, players are motivated to learn more about SDG 6 and share their newfound knowledge with others.

Projects like **Ripple Effect** are crucial in empowering people with the knowledge and awareness necessary to contribute to sustainable water resource management as the globe continues to face problems with water availability and quality. It is believed that by enabling gamers to engage responsibly in their virtual world, this awareness would convert into actual conduct, further achieving the goals of **SDG 6** and guaranteeing access to clean water and sanitation for all by **2030**.

## Ripple Effect

The objective of this project was to create a game that would educate players on the importance of **Clean Water and Sanitation For All (SDG 6)**. However, there are still some constraints that we have encountered while developing the "Ripple Effect" game which includes the following:

- **Design constraints:** The game's design, including its visual style, user interface, and gameplay mechanics, may be constrained as we are not that advanced in UI development which means that we could only perform simple interfaces for this project.
- **Time and Resources:** Although we were able to finish the task, there are definitely many improvements that can be added to future projects. There are quite a few limitations such as our knowledge of creating complex methods which would lead us to only utilize the skills we learned from this course and the time allotment for further research and study.
- **Target audience:** The game's target audience (e.g. age range, educational background) may affect the design and implementation of certain features, such as the difficulty levels or educational content.
- **Testing and feedback:** Playtesting the game and gathering feedback from players is an important part of the development process. However, the process may be time-consuming and may require additional resources which leads us to only give feedback to each other as we develop the project since it would be the most efficient way to finish the task.

For **future directives**, developers who are going to engage in a project similar to ours should improve on the game's design such as making it a standalone game without needing to have the source code while also making it available across several OS platforms. If they were to use our program as a basis, they should update the educational content to fit in their timeline as the situation of our climate and environment would be different several years from now. They should utilize more time and resources as this would significantly improve the project. Additionally, expanding to a larger target audience of older people would further improve our data range as this project mainly focuses on the youth since we believe that they would be able to learn and play the games faster. Developers should broadly test their program and gather more feedback as there are definitely additional resources from different educational backgrounds that will benefit the education on SDG 6.

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[https://en.wikipedia.org/wiki/Sustainable\\_Development\\_Goal\\_6](https://en.wikipedia.org/wiki/Sustainable_Development_Goal_6)

## VII. Contributions

Tasks/Deliverables	Contributor
Program Structuring	Leigh Tabanao
Final Proposal	Win Sy Leigh Tabanao Timothy Tiu
Introduction	Win Sy
Related Works	Timothy Tiu
Proposed Application	Leigh Tabanao
Implementation/OOP Aspects	Win Sy Leigh Tabanao Timothy Tiu
Program Coding	Leigh Tabanao Win Sy
Walkthrough/Data/Results	Win Sy Leigh Tabanao Timothy Tiu
Conclusion and Future Work	Timothy Tiu
Project Review	Win Sy
Presentation and Demonstration (Including Video Presentation)	Win Sy Leigh Tabanao Timothy Tiu