



ΠΡΟΓΡΑΜΜΑ
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Developing Gamified Gardening Resources for Schools in Thessaloniki

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May 7, 2026

Submitted to Melissa Butler and Robert Kinicki

Developing Gamified Gardening Resources for Schools in Thessaloniki

An Interactive Qualifying Project submitted to the Faculty of

WORCESTER POLYTECHNIC INSTITUTE

in partial fulfilment of the requirements for the degree of Bachelor of Science/Arts.

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Abstract

Greek primary and secondary schools struggle to teach environmental education(EE), limiting students' awareness of sustainable practices and environmental literacy. To address this learning gap, Treli Rhodia, a farming cooperative, launched school gardening initiatives to foster community through EE across Thessaloniki, Greece. The team set out to create a supplementary tool, a gamified gardening app about permaculture and plant care, to continue EE past the garden. Through collaboration with Treli Rhodia staff, student playtesting, and observed student engagement, the application was designed to reflect student needs and desires. With quizzes, plant-tracking features, and rewards, the app reinforces EE while extending student engagement with sustainability past Treli Rhodia's initiatives.

Executive Summary

Introduction

Integrating environmental education (EE) into formal schooling remains a global challenge despite widespread recognition of its importance (AlAli et al., 2025). In many curricula, instruction is inconsistently delivered, limiting student engagement and understanding of environmental issues. In Greece, early governmental efforts in the 1990s to introduce environmental education were not mandated in the national curriculum. As a result, schools and teachers implement EE based on available time, resources, and motivation, leading to fragmented delivery across schools and classrooms. (Anastasopoulou et al., 2025)

In 2021, the Self-Help Promotion Program (SHPP), which supports individuals recovering from substance addiction, extended its mission by establishing Trelī Rhodia. This farming cooperative provides a safe work environment for rehabilitated individuals. In 2025, the cooperative began gardening initiatives in private schools around Thessaloniki to address gaps in EE. Trelī Rhodia visits schools to teach students about sustainability and organic farming and collaborates with schools to develop gardens where students can cultivate gardening knowledge.

Since launching these initiatives, Trelī Rhodia has aimed to increase engagement and create a longer-lasting educational impact on students. Our team collaborated with Trelī Rhodia to design a gamified gardening application for primary and secondary students. The application complements gardening initiatives by combining hands-on learning with gamified digital activities to enhance engagement and reduce reliance on lecture-based instruction. This approach has four objectives: evaluating EE curricular integration,

assessing student engagement in current initiatives, gathering design insights from Trelī Rhodia staff, and developing an accessible application.

Background

School gardening is a form of experiential learning that functions as a “living classroom,” allowing students to engage directly with ecological systems. (Green & Somerville, 2015; Lee et al., 2022) Such hands-on approaches improve environmental literacy, strengthen knowledge retention, and encourage sustainable behaviors by shifting learning from abstract instruction to active participation. Beyond environmental outcomes, gardening supports student well-being by reducing anxiety, increasing physical activity, promoting healthier eating habits, and fostering collaboration and inclusivity across diverse student groups (Papadopoulou et al., 2020).

To extend the impact of these practices, Information and Communication Technology (ICT) in Greek schools offers a pathway for reinforcing learning beyond the classroom. While national and European initiatives have expanded digital infrastructure, including internet access and online resources, integration in Greece remains uneven due to fragmented platforms, varying teacher digital literacy, and unequal student access to devices and reliable connectivity, especially outside school. Increasing restrictions on smartphone use during instructional hours further limit the use of mobile technology in formal learning, underscoring the need for cross-platform (mobile-to-desktop) educational resources.

Within this context, gamification has emerged as an effective approach for improving student motivation and engagement (Koivisto &

Hamari, 2019). By incorporating elements such as challenges, progress tracking, feedback, and rewards, gamified systems activate both intrinsic and extrinsic motivation. Research indicates that combining multiple game mechanics and varying interactive tasks sustains engagement more effectively than static or lecture-based instruction (Rosenfelder, 2023; Sailer & Homner, 2020).

Methods

To develop a gamified gardening application, the team collaborated with Treli Rhodia staff, using observations, greenhouse visits, surveys, and focus groups to inform the design.



Figure 0.1 - *Team Learning about Annual Plants and Pollinators* (Tringos, 2026)

The team began by touring the Treli Rhodia greenhouse to gain insight into organic gardening practices, beginner cultivation methods, and the plant species used in school initiatives (see Figure 0.1). Their staff guided organic farming, heirloom seeds, soil health, seasonal cycles, and plant uses. The team then met weekly with staff to gather and compile content for the application.



Figure 0.2 - *Arsakeio Students Planting Herbs During a Treli Rhodia Initiative* (Tringos, 2026)

The team also visited Arsakeio Private School (see Figure 0.2), where Treli Rhodia led a gardening initiative in two fifth-grade English classes, divided into a lecture portion and a gardening portion. This enabled the team to examine student engagement with EE and compare experiential learning with traditional instructional approaches. The team observed 62 students in the two classes, focusing on attentiveness, participation, collaboration, and use of gardening tools. In parallel, we spoke with teachers and distributed surveys to examine their experiences with EE and technology integration.



Figure 0.3 - *Student Playtesting Focus Group* (Butler, 2026)

During preliminary application development, the team conducted a playtesting focus group (see Figure 0.3) with students from private schools in Thessaloniki, who interacted with the initial prototype and provided feedback on navigation, functionality, and content. A parallel guided discussion with Treli Rhodia staff offered further practitioner input and design feedback.

Collectively, these sources informed the iterative development of our gamified gardening application.

Results

Although the team distributed surveys to teachers at Arsakeio during their school visit, a three-week delay of the visit prevented completion within the project timeframe. As a result, the team failed to obtain survey responses from Arsakeio, limiting the team's ability to

assess current EE curricula from an educator's perspective.

Observations at Arsakeio School reinforced these findings, with engagement significantly higher during hands-on gardening activities compared to lecture-based instruction. Students worked collaboratively in small groups, though moderate disengagement occurred when physical space in the garden limited participation. Teachers and Treli Rhodia staff more actively redirected students during lecture segments than during outdoor activities.

Greenhouse visits and a staff focus group further informed our design decisions. Treli Rhodia staff noted that beginners often struggle with advanced practices such as pruning and long-term plant care, which short school-based initiatives typically do not cover due to their limited duration. Staff also emphasized the importance of collaborative learning, drawing on their shared journey in cooperative learning at Treli Rhodia. These insights directly inspired proposed app features, including team quizzes, shared progression mechanics, and group-based rewards.

These findings indicate that experiential learning generates higher engagement than lecture-based instruction within EE and suggest that gamified learning can extend the educational impact of Treli Rhodia's gardening initiatives beyond the initial planting phase.

Design

The team built the application on Flutter, a multi-platform framework supporting Android, iOS, MacOS, Windows, and web deployment – maximizing accessibility for Treli Rhodia's diverse school audience. A Firebase backend handles user data, including accounts, gardens, virtual classrooms, and quiz assignments. The app follows a Model-View-ViewModel (MVVM) architecture to keep the codebase

organized and maintainable for any future developers the sponsor engages.

The app centers on two primary screens: the Home Screen (see Figure 0.4) and the Info Screen (see Figure 0.5), connected by a bottom navigation bar.

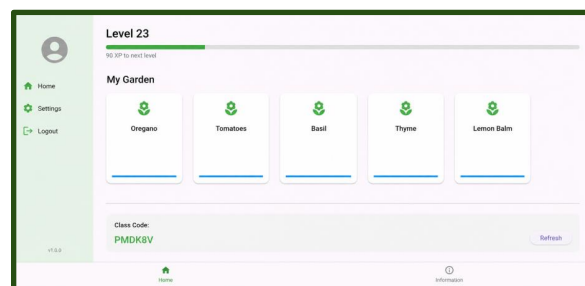


Figure 0.4 - Home Screen

The home screen (see Figure 0.4) greets users with a progress bar at the top that shows their current XP and progress toward the next level. There is no level cap, giving students a persistent incentive to keep engaging. The center of the screen displays the student's virtual garden, populated by plants they added through the Info Screen. Teachers see a class code generator at the bottom of the home screen. In contrast, students see a field to join a class, enabling teachers to push quizzes directly to enrolled students rather than relying on students to seek them out independently.

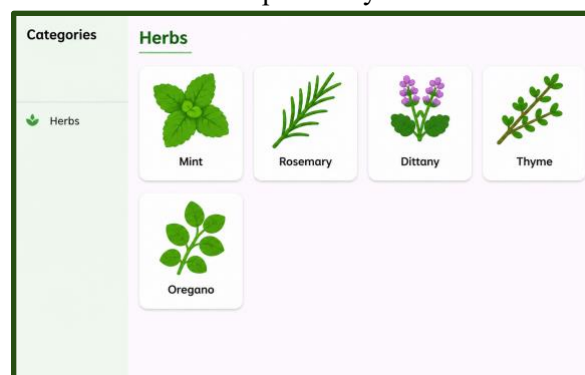


Figure 0.5 – Info Screen

The Info Screen (Figure 0.5) presents a browsable library of plant cards organized by type. Each card uses a unique illustrated icon designed to be easily distinguishable at a glance.

Selecting a card opens up a pop-up with a description, care instructions, and an option to add the plant to the student's virtual garden. Once added, the plant appears on the Home Screen with a water meter that notifies the student when watering is needed.

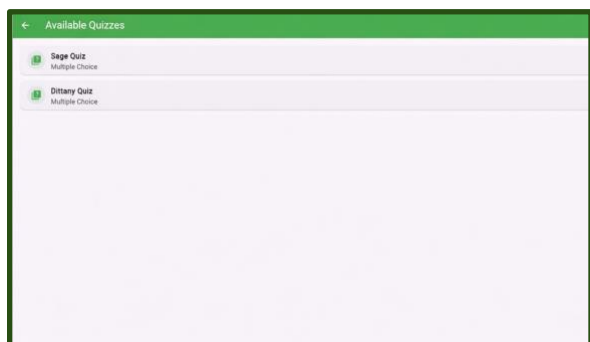


Figure 0.6 – *Quiz Screen*

The Quiz Screen (see Figure 0.6) forms the core of the app's educational experience. It remains empty until a teacher assigns a quiz from the quiz bank, keeping the content teacher-directed and curriculum-aligned. Each quiz presents seven to eight questions with a progress bar tracking completion. When a student selects a wrong answer, the screen flashes red – providing immediate visual feedback that reinforces the learning loop. Upon finishing, a results pop-up displays the number of correct answers and XP earned, which carry over to the level bar on the Home Screen.

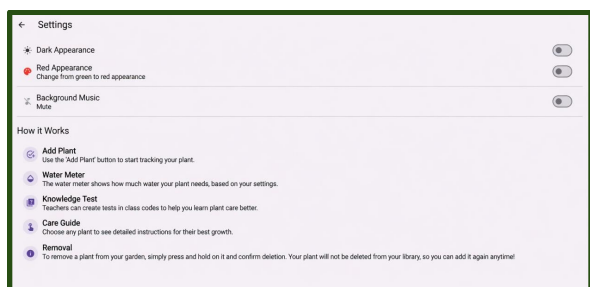


Figure 0.7 – *Settings and How-To Guide*

The Settings screen (Figure 0.7) gives users control over theme and audio. Users can toggle between light and dark mode, and switch to a red color scheme that reflects Treli Rhodia's branding. A background music toggle allows users to mute in-app audio. The screen also houses the how-to guide, which walks first-time users through core app features using illustrated

tiles – each showing an icon, title, and brief description

After developing the initial app prototype, student playtesting helped validate that the application was intuitive and accessible. Students provided feedback on motivational elements, educational content, and navigation, reporting positive responses to the experience bar and overall usability. They also identified areas for improvement, including a feature indicating incorrect answers, more extensive informational menus, and a potential tutorial for younger students.

Given the team's tight timeframe, we were unable to implement all planned features; the recommendations section outlines the features we were unable to implement. The features the team successfully delivered include:

Online Classroom - Teachers can create a class code for students to join, and once the app generates the learning space, the teacher can send out quizzes to their virtual classroom.

Similar to other gamified applications, the team added a virtual classroom to give teachers control over the content presented to students.

Level Progress Bar - A persistent experience tracker that displays a student's current level, encouraging continued engagement. The application awards experience points upon quiz completion, proportional to the student's performance. There is no level cap, meaning students always have an incentive to keep learning.

The team added the level bar as a gamification feature; during our background research, the team found it to be a common way to gamify any activity.

Info Screen - A user can navigate to the information screen to view a list of plant cards. Users can click the cards to display a pop-up menu that includes a brief description and care

instructions for the plant. This pop-up also has an ‘add plant’ button to track a plant.

During our visits to the greenhouse, the team realized that we needed a way to display information on a plant so users could effectively use the quizzes.

Plant Tracking - The students and teachers can ‘add a plant’ through the info screen, and when they do, it will save the plant card to the main home screen, allowing them ease of access to the info on that plant, as well as a water meter to tell the user when they need to water their plant.

The team's time with Treli Rodia showed us that it would be helpful to have plant info readily available.

Alternating Appearance - The application features 2 distinct appearance toggles, a red/green and a dark/light appearance, see Figure 0.8

The app is for young students, and after our team visited the greenhouse, it became clear that features focused on user enjoyment would be critical to maintain engagement.

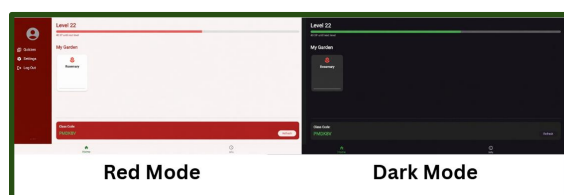


Figure 0.8 - Appearance Changer

Application Recommendations for Treli Rhodia

Given the limited on-site time and the much-appreciated feedback from students and Treli Rhodia staff, the team has outlined three recommendations for future work on the application.

Integrating students' artwork into the application will foster community-building practices and increase engagement by allowing students to create art about their experiences and see their work and their peers' reflected in the application.

Integrating more collaborative features for students, such as group quizzes or shared rewards, in the future will reinforce students' need to rely on one another and further Treli Rhodia's goal of increasing community among students.

In its current form, most of the plant care information is short-term because the gardening initiatives are short-term; however, to accommodate gardens lasting longer than the program itself, adding long-term care information will benefit many students to come and increase the longevity of the gardening initiatives past Treli Rhodia's influence.

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Acknowledgements

We would like to thank our sponsor, the Self Help Promotion Program (SHPP), and its representatives, Katerina Kallergi and Anastasia Hamalidou. This project would not have been possible without their guidance, support, and the resources provided by SHPP.

We would also like to thank the staff and workers at Treli Rhodia for their time and participation in our focus groups, and the teachers and students at the partner schools in Thessaloniki for welcoming us into their classrooms and gardens.

We also want to thank our advisors, Professors Robert Kinicki and Melissa Butler, for their dedication and support throughout this project. Their feedback and direction were vital to the completion of this work.

Authorship

The introduction, background, and methodology of this report were written collaboratively by Ciera St.Pierre, Nikolai Margolin, and Ryan Orris, with each section divided into parts and assigned to individual members, and feedback and revisions contributed by all three. The results, design, and conclusion sections were similarly distributed, with each member taking primary authorship over specific subsections. The appendices, references, table of contents, and supplementary materials were also collaboratively written and edited by the team. Joseph Tully served as the team's sole developer, taking primary responsibility for designing and building the application in its entirety, and authored the design summary section of this report.

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2.3 Gamification	Ryan Orris	Nikolai Margolin
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1.0 Introduction

The integration of environmental education (EE) into primary and secondary schooling has become increasingly important as global communities confront mounting environmental challenges (UNESCO, 2021). However, many educational institutions struggle to provide engaging resources that transmute environmental awareness into meaningful activity and ecologically responsible behavior (Ludin et al., 2025). In 1990 and 1991, the Greek Ministry of Education introduced EE into primary and secondary curricula through interdisciplinary projects designed to promote critical thinking and environmental responsibility (Moschopoulou & Karakatsani, 2020). Despite these efforts and the Greek government's disinclination to make EE mandatory, its implementation depends entirely on teachers' initiative and flexibility, leading to inconsistent and inequitable programming in schools and classrooms (Ntona et al., 2023; Moshou & Drinia, 2025).

To address these challenges, educators have begun incorporating school gardens into their curricula to teach sustainability through hands-on learning. These initiatives increase environmental literacy, student engagement, and healthy habits such as responsibility and self-reliance (Christian et al., 2014; Howarth et al., 2020). Similarly, research on gamified e-learning shows that features such as challenges and goal-oriented progression can enhance students' motivation within and beyond the classroom (John et al., 2023; Nam, 2021).

Treli Rhodia is a Thessaloniki-based farming cooperative and a subsidiary of the Self-Help Promotion Program (SHPP), which supports individuals recovering from substance addiction by providing a safe work environment and opportunities to build meaningful post-recovery habits. Beyond its rehabilitative role, the cooperative engages the local community

through greenhouse visits and events to promote the importance of permaculture practices, including organic farming and ecological sustainability. In response to the limited integration of EE in local schools, Treli Rhodia began leading school gardening programs in 2025. These initiatives aim to equip students with practical skills in cultivating and maintaining organic gardens, while promoting healthier dietary habits and reducing dependence on unsustainably produced commercial goods. That same year, SHPP collaborated with WPI students to develop a digital crop database to supplement these permaculture education efforts beyond annual visits (Rooney et al., 2025). Building on this work, SHPP and Treli Rhodia aim to develop an application that integrates hands-on gardening with gamified learning, enabling students to learn at their own pace and to better understand the plants they are growing in their school gardening initiatives.

The goal of this project was to develop a gamified educational app supporting school gardening initiatives in Thessaloniki held by Treli Rhodia. To achieve this goal, we have identified four objectives:

1. Evaluate the integration of sustainability and gardening materials within school curricula.
2. Assess student engagement in Treli Rhodia gardening initiatives.
3. Gather perspectives from Treli Rhodia workers for gamification and app design.
4. Develop an accessible prototype of the application.

By addressing these objectives, the team found that hands-on, collaborative learning drives stronger engagement than lecture-based instruction, that students require continued guidance beyond introductory gardening tasks, and that technology can bridge gaps in beginner learning by reinforcing foundational gardening skills often underdeveloped in short-term school initiatives. In response, the team developed a gardening and permaculture education app

synthesizing SHPP-selected resources from initiative lesson plans and a public database. The app includes gamified quizzes, plant-tracking tools, and notifications. The team designed the app for accessibility across iOS, Android, and desktop platforms, with customizable settings and a visually engaging art style to support diverse learners, including those with sensory learning disabilities. Student playtesting guided iterative refinements to navigation, feedback, and instructional content, aligning the team's deliverable with user needs and learning outcomes.

2.0 Background

This chapter examines school gardening as a means of bolstering sustainability practices and developing positive habits in students. It explores the history of environmental education (EE) and current practices and discusses the strengths and limitations of hands-on or experiential learning. Section 2.2 provides an overview of the integration of information and communication technology in Greek schools and of students' access to technology in primary and secondary schools. Finally, Section 2.3 discusses gamification practices, including student motivation and game mechanics.

2.1 Environmental Education Through School Gardening

Gardening provides a range of educational benefits, but within EE, school gardening serves as a targeted tool for teaching sustainability concepts through experiential learning. Functioning as living classrooms, school gardens enable students to engage directly with ecological systems, helping develop environmental literacy and an understanding of the relationship between human activity and natural processes (Green & Somerville, 2015; Lee et al., 2022). By moving learning beyond abstract instruction, garden-based education encourages students to apply sustainability principles through observation, participation, and problem-solving.

Research shows that hands-on gardening experiences strengthen students' environmental identity, fostering both knowledge acquisition and sustainable behaviors rather than awareness alone (AlAli et al., 2025). This approach supports interdisciplinary learning by integrating science, ecology, and social responsibility into practical activities, allowing schools to teach sustainability as an interconnected system rather than an isolated topic (Benatti, 2024). Active garden education models further emphasize collaboration and real-world decision-making that reinforce long-term interest with sustainability practices (Lee et al., 2022).

2.1.1 Experiential Learning

Experiential learning is a pedagogy that derives knowledge from hands-on experiences. Across the globe, primary (ages 6-12) and secondary schools (ages 12-18) have utilized gardens to promote experiential learning. Some teachers have adopted experiential learning as an educational pedagogy that emphasizes a student-led, hands-on approach (Institute of Experiential Learning, 2025). In school gardening, educators use gardening practices to increase engagement with agricultural and environmental content, foster cooperation among students, promote inclusivity in education, and offer other personal benefits associated with gardening (Papadopoulou et al., 2020).

Studies worldwide show that school gardens benefit students' mental and physical well-being, environmental literacy, and learning. Gardening reduces anxiety, boosts self-esteem, and promotes physical activity and healthier eating (Papadopoulou et al., 2020). Hands-on learning increases engagement and retention: practical learning yields higher knowledge absorption rates than lectures. In addition, experiential gardening cultivates awareness of local and global sustainability (Dahl & Cushing, 2022).

2.1.2 Healthy Eating

The role of school gardening has expanded beyond environmental pedagogy to address issues such as childhood obesity and nutrient deficiency. Research shows that integrating school gardening with nutrition education through experiential, hands-on learning and engagement with family and educators strengthens student participation and learning outcomes (Cristian et al., 2014; Holloway et al., 2023). These combined educational approaches produce measurable health outcomes, including increased fruit and vegetable consumption, higher intake of dietary fiber and vitamins A and C, and improved body mass index (Holloway et al., 2023). This demonstrates that combining practical gardening experiences with structured nutrition education yields educational and health benefits beyond those of traditional classroom instruction.

Across these studies, researchers identified consistent benefits of gardening-based interventions and examined how schools implemented such practices across different settings. These interventions range in duration from six weeks to three years and include activities such as cooking lessons, classroom instruction, and greenhouse visits (Ohly et al., 2016). Despite this variation, a common fact emerged: the use of experiential, hands-on learning approaches that engage students in growing, maintaining, harvesting, and preparing the food they produce reinforces both nutritional knowledge and active participation (Ohly et al., 2016).

Experiential education complements in-class learning and benefits a broader range of students due to its inclusivity. Experiential learning through school gardens not only increases environmental literacy but also fosters students' interpersonal and personal well-being. Working outside fosters teamwork and promotes equity, helping to address classroom divisions by leveling the playing field for learning opportunities (Johnson, 2012). Increasing the adoption of school gardening in curricula has the potential to teach future generations about environmentally friendly methods and cooperation, unlike current EE methods, which promote individual learning separate from cooperation, and decrease accessibility among students based on skill level (Burt et al., 2018).

2.1.2 Potential Drawbacks to Implementation of Experiential Learning

Despite the many benefits of experiential learning, teachers often struggle to implement this approach effectively in the classroom due to limited training in experiential pedagogy, difficulty aligning hands-on activities with existing curricula, and challenges in assessing student learning within traditional grading systems (Johnson, 2012). Each teacher's pedagogy must align with students' experiential activities, requiring educators to understand experiential learning to serve as effective guides. As traditional grading measures cannot adequately assess gardening practices, teachers must also adopt different evaluation methods that emphasize qualitative growth rather than the quantitative measurements common in many grading systems (Klemmer, Waliczek, & Zajicek, 2005). Teachers can better engage

students by implementing information and communication technologies (ICT), which provide alternative methods for tracking student progress in both traditional and hands-on learning (Duda, 2024).

In Thessaloniki, the Self-Help Promotion Program (SHPP), through its subsidiary farming cooperative, Treli Rhodia, is actively implementing these approaches through their school gardening initiative. Treli Rhodia delivers EE programs to local schools by facilitating student participation in gardening activities and promoting sustainability practices such as organic farming and healthy eating. Through annual school visits and the development of student-maintained gardens, the cooperative applies experiential learning principles in real educational settings. However, like many hands-on educational initiatives, these efforts struggle to maintain continuity beyond in-person instruction and lack the scalable tools to sustain student engagement over time. Consequently, SHPP has identified a need for solutions that can extend the reach and impact of its programs while maintaining the interactive and experiential qualities that define their success.

2.2 ICT in Greek Primary Schools

Information and Communication Technology (ICT) integration has been present in Greek primary schools since the late 1980s. Beginning as limited computer installations and pilot programs, with European Union (EU) support in the early 2000s, Greece launched a digitization initiative, funding computer labs and providing basic internet access to schools nationwide (Anastasopoulou et al., 2025).

The outcome of this technocratic jubilee was the establishment of digital education infrastructure such as the *Panhellenic School Network*, which provides schools with email services and internet connectivity (Anastasopoulou et al., 2025). In the 2010s, the *Digital School* and *New School* programs provided over 7,500 open educational resources and more than 100 interactive e-textbooks in repositories such as *Photodentro* and introduced a weekly ICT course for upper-primary students across much of the country (Anastasopoulou et al., 2025; Nikolakopoulou & Pierri, 2024).

Today, Greek primary schools have a more robust digital environment than ever before. In 2024, the European Center for the Development of Vocational Training reported that nearly all Greek primary schools had basic internet connectivity and on-site computing facilities, with many classrooms equipped with interactive whiteboards and projectors (Anastasopoulou et al., 2025; CEDEFOP, 2024).

2.2.1 Limitations of ICT Integration

However, despite recent progress, several barriers continue to slow the integration of ICT into Greek primary education. For instance, although Greece maintains a broad ecosystem of digital platforms, limited coordination among them creates logistical burdens for teachers and reduces effective adoption (Anastasopoulou et al., 2025; Lavranos, 2025). Moreover, weak alignment between digital tools and traditional curricula and assessment practices leads many educators to treat online activities as supplementary, relying primarily on board-and-paper-based instruction for core subjects (Roussinos & Jimoyiannis, 2019). Additionally, although many teachers have completed state-led A-level and B-level ICT certifications to improve their digital competence, older teachers often still lack the confidence or proficiency to integrate digital tools effectively into their curricula (Aivazidi & Michalakelis, 2023; Anastasopoulou et al., 2025; Tzafilkou et al., 2023).

2.2.2 ICT and Mobile Device Access in Thessaloniki

Despite systemic and generational barriers, a case study in Thessaloniki suggests that successful digital education is possible in urban Greek municipalities. For example, an *eTwinning* project—an EU initiative connecting schools across countries via online platforms—titled *Our Culture, Our Future* enabled a Thessaloniki primary school to collaborate with schools in Italy and Finland, using web-based tools to co-create digital presentations and quiz games on cultural heritage (Anastasopoulou et al., 2025).

However, broader social dynamics complicate the scalability of digital education in Greece, as pandemic-era screen fatigue and persistent inequalities in household technology access—including

disparities in internet connectivity and computer and mobile device availability—contribute to unequal digital education outcomes beyond the classroom (Anastasopoulou et al., 2025; Psani et al., 2022). Additionally, with smartphone use increasingly restricted during instructional hours across schools in Thessaloniki, combined with uneven access to devices and reliable internet at home, these constraints limit how students engage with technology inside and beyond the classroom, resulting in a rigid framework for aspirational smartphone integration into future lesson plans—namely, gamified educational apps (Daskalaki et al., 2020; OECD, 2023).

These limitations highlight the importance of designing digital tools that are both accessible and adaptable to existing school structures. For organizations like SHPP, which aim to expand EE through digital applications, these constraints underscore the need for deliverables that function effectively within limited and even prohibited instructional time

2.3 Gamification

While access to technology enables users to access learning resources, gamification can facilitate sustained engagement and deeper learning. Gamification is the integration of game design elements into non-game contexts to enhance user engagement and retention (Koivisto & Hamari, 2019). Gamification has seen a significant increase in use, especially in education. As schools and society continue to digitize, the methods educators use to teach must evolve (Nam, 2021, p. 287). Gamification has emerged as a particularly effective training modality.

2.3.1 Intrinsic and Extrinsic Motivation

Gamification relies on two primary forms of motivation: extrinsic and intrinsic. Extrinsic motivators provide external rewards such as points, badges, or leaderboard rankings, offering immediate

feedback and visible recognition (John et al., 2023). In contrast, intrinsic motivators stem from internal drivers such as personal interest, satisfaction, autonomy, and a sense of mastery (John et al., 2023).

In the past, developers relied heavily on extrinsic motivators, often resulting in reduced novelty and diminished long-term motivation (John et al., 2023). Designing an effective gamified experience, therefore, requires a careful balance between intrinsic and extrinsic forms of motivation. Research suggests that a structure that emphasizes roughly two-thirds extrinsic and one-third intrinsic motivators can help sustain both short-term engagement and long-term commitment (see Figure 2.1) (John et al., 2023).

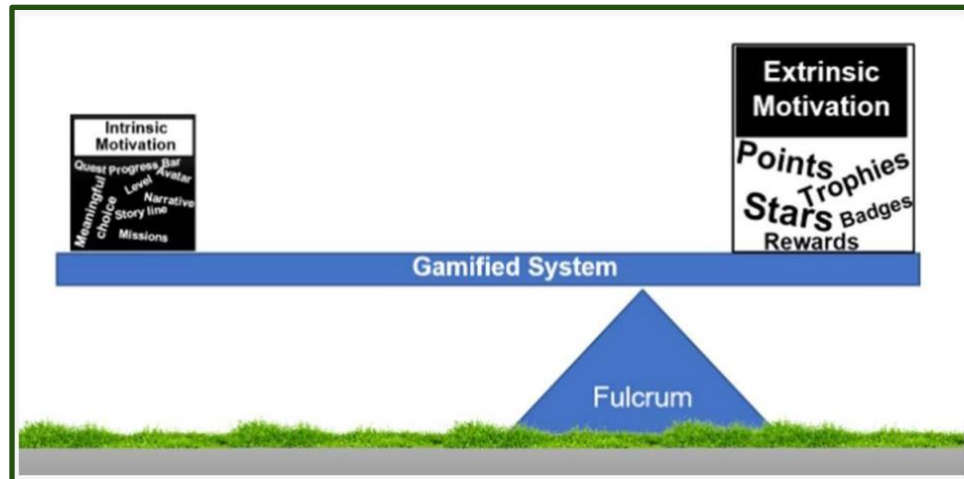


Figure 2.1: Fulcrum representation of balancing extrinsic and intrinsic motivation. (John et al., 2023)

2.3.2 Game Mechanics

Research shows that gamification systems that incorporate multiple mechanics—such as progress tracking, challenges, social interaction, and feedback—are more effective than single-mechanic approaches, such as leaderboards alone (Rosenfelder, 2023; Pappas, 2025). Combined gamification elements produce stronger motivational and learning outcomes because they target different aspects of engagement (Siler & Homner, 2020). For instance, progress tracking and structured challenges strengthen

learners' sense of competence, while technology-assisted feedback supports knowledge and skill acquisition through timely guidance (Huang et al., 2025). Social interaction further enhances engagement by fostering relationships and shared accountability. These findings align with Self-Determination Theory, which emphasizes competence, autonomy, and relatedness as drivers of motivation (Deci & Ryan, 2000). Overall, layered gamification systems are more effective because they activate multiple motivational pathways simultaneously, leading to more sustained engagement.

In addition to incorporating multiple mechanics, varying game modes and activity types can further strengthen sustained engagement. Research shows that gamified systems are more effective when they remain dynamic rather than static, as variation reduces motivational fatigue and supports long-term participation (Sailer & Homner, 2020; Gini et al., 2025). Providing options such as collaborative challenges, individual practice, and exploratory tasks allows users to engage with content in ways that match their preferences while also fostering autonomy (Deci & Ryan, 2000). By rotating or combining activity modes, gamified systems can reduce monotony and maintain interest, creating a more adaptable learning experience (Nam, 2021).

2.3.3 Personalization

In gamification, personalization is central to the user experience. Examples of personalization are common in video games; character creation, unique choices, and tailoring the experience to the user are just a few mechanics that add personalization. Users tend to differ in learning styles; some excel with auditory lessons, while others learn more from writing out answers. A learning game should support a wide range of learning styles, enabling more students to engage, excel, and learn through the app. Ensuring accessibility is therefore essential to the app's success, as it allows individuals with varying educational backgrounds, ages, and levels of digital literacy to engage with the experience equally effectively (Nam, 2021).

2.3.4 Student Impact

Research consistently reinforces that gamification has a strong positive effect on learning outcomes and engagement across diverse educational settings. A recent meta-analysis of 41 studies involving over 5,000 students found that gamified interventions produced significantly higher learning outcomes, including improved knowledge retention, enhanced conceptual understanding, and increased task completion rates, compared to traditional approaches (Gini et al., 2025). This suggests that gamification can measurably boost participation and academic performance in educational contexts.

This evidence is especially relevant for mobile learning environments. Mobile devices offer distinct advantages over computer or paper-based learning in terms of accessibility, portability, and immediacy. Unlike desktop tools, smartphones and tablets allow learners to engage with content at any time and from any location, making them particularly well-suited for informal, self-directed learning (Dede, 2014). Research further suggests that mobile-first design, where developers structure content around the constraints and affordances of handheld devices, provides stronger learning engagement than simply adapting existing computer-based materials (Pappas, 2025). Because users typically engage with mobile applications in short, intermittent sessions, these apps must capture attention quickly and provide immediate reinforcement. Gamification supports this structure by breaking larger learning objectives into smaller, achievable tasks or quests and providing clear feedback to reinforce continued use (Pappas, 2025). For example, Duolingo (<https://www.duolingo.com>) is a successful app structured around brief one- to five-minute activities that encourage habitual engagement through rapid rewards and visible progress.

Gamification plays a critical role in improving engagement and learning across a wide range of educational contexts. By designing systems that thoughtfully balance intrinsic and extrinsic motivation, vary game mechanics, and accommodate diverse learning styles, developers can create effective gamified

experiences (Nam, 2021). When these elements work together, they sustain engagement and support meaningful learning outcomes (Gini et al., 2025).

For initiatives like SHPP sponsors, gamification offers a promising approach to sustaining student engagement beyond hands-on activities by reinforcing learning through interactive and accessible digital experiences.

2.4 Background Summary

This chapter highlights the potential of school gardening and experiential learning as effective approaches for promoting environmental education, particularly through their ability to foster engagement, practical skills, and sustainable behaviors. However, it also identifies key limitations, including challenges in implementation, assessment, and long-term student engagement. While ICT infrastructure in Greek schools has improved, barriers related to accessibility, curriculum alignment, teacher readiness, and increasing attitudes and policies opposing in-class technology use continue to constrain its effectiveness. At the same time, gamification has emerged as a powerful tool for enhancing motivation and sustaining participation, particularly in mobile learning environments.

Together, these findings suggest that effective environmental education in Thessaloniki must integrate hands-on learning with accessible digital tools that reinforce engagement over time. Within this context, initiatives such as those that SHPP and Treli Rhodia support present an opportunity to extend the impact of existing gardening programs by combining experiential education with gamified digital learning that students can access on school computers during instructional hours and on personal mobile devices outside the classroom, addressing both pedagogical and practical limitations the literature has identified.

3.0 Methodology

The goal of this IQP was to develop a gamified educational app supporting school gardening initiatives in Thessaloniki held by Treli Rhodia. We addressed this goal through the following objectives:

1. Evaluate the integration of sustainability and gardening materials within school curricula.
2. Assess student engagement in Treli Rhodia education initiatives.
3. Gather perspectives from Treli Rhodia workers for gamification and app design.
4. Develop an accessible prototype of the application.

Our team conducted onsite research from March 16, 2026, to May 6, 2026. During this period, we analyzed student data from past Treli Rhodia surveys and conducted teacher surveys to evaluate how schools integrate gardening and environmental education practices into primary and secondary curricula across the city. Additionally, we conducted a non-participant observation of students during a Treli Rhodia gardening initiative to assess student engagement and evaluate school gardening infrastructure. Furthermore, we visited the Treli Rhodia greenhouse seven times to familiarize ourselves with organic gardening practices through hands-on participation and to facilitate a focus group with employees. The team used this focus group to workshop permaculture-informed ideas for gamification and app design, facilitating a functional, accessible, and inclusive final application.

3.1 Evaluate the Integration of Sustainability and Gardening Materials within School Curricula

Our first objective was to evaluate how gardening and environmental education practices integrate into the curricula of primary and secondary schools across Thessaloniki, while the team remained mindful of keeping app development within culturally sensitive and feasible classroom contexts. To pursue this objective, the team worked with our sponsor to visit the Arsakeio School of Thessaloniki during a Treli Rhodia gardening initiative and distributed digital surveys to the English teachers who oversaw the two participating classes. The team originally planned the school visit for March 31, 2026, but Treli Rhodia canceled it at short notice due to workers becoming ill. The school's two-week Easter break required us to reschedule the visit for April 21, 2026. This scheduling issue drastically delayed our primary data collection for this directive, as our team planned not only to supply the surveys to the teachers at Arsakeio but also to ask staff whether they knew teachers at surrounding schools who could provide input on EE integration within their curricula. As a result, our team contacted only one school, which did not provide enough data to conduct a broader review of EE integration throughout Thessaloniki. Furthermore, we sent surveys to teachers at Arsakeio school, but the late rescheduling of the initiative prevented us from receiving any responses. These two issues meant our team could not collect data that fit the objective's scope or yield any additional insights, leaving the objective incomplete.

3.2 Assess Student Engagement with Pilot Gardening Initiatives

Our second objective aimed to explore how primary and secondary students participate and behave during Treli Rhodi education initiatives in school gardens across Thessaloniki, with particular attention to gaps in their gardening performance that the app could address. To support this objective, we first reviewed student feedback surveys from previous Treli Rhodia initiatives. By analyzing data from previous collectives, our team set a baseline for student engagement, understood gardening initiatives from a student perspective, and identified which aspects of gardening students enjoy most. This survey data guided us in shaping our observational guides for the next method for this objective. Building on these insights, we took field notes by conducting structured non-participant observation of Treli Rhodia-led gardening and classroom activities at Arsakeio School in Thessaloniki on April 21, 2026.

3.2.1 Reviewing Previous Student Feedback

In 2025, Treli Rhodia administered surveys to pupils participating in their initiative at the Big Bang School to assess their overall satisfaction with the gardening content. To capture student perspectives on the activities, the team first reviewed the data collected by Treli Rhodia. The questionnaires included easy-to-interpret images depicting feelings and gardening activities that students could check off multiple-choice styles, along with a small section of open-ended questions to illuminate students' favorite aspects of the initiative (Favorite plant or favorite fact). The team initially reviewed the quantitative data by summarizing percentages for the whole class or by counting the number of responses per question. Next, we examined the open-ended responses to identify common themes. Finally, they compiled their findings into a list of graphs and key takeaways that reflect students' self-reported engagement with the initiatives.

3.2.2 Observing Students

The team used observation to examine how schools organize gardening activities and how pupils interact with peers, educators, and gardening practices during initiative instruction. The team acted as known non-participant observers during a Treli Rhodia education initiative with fifth-grade students at the Arsakeio School on April 21, 2026. The initiative lasted 90 minutes, consisting of 45 minutes of outdoor planting of herb seedlings and 45 minutes of an in-class slideshow on the environmental and social benefits of organic farming. The two classes, with 29 and 33 students respectively, completed these components in alternating order, meaning that one group completed the in-class session prior to the gardening activity and the other completed the gardening activity before completing the in-class session. To maximize data collection depth, our team split into pairs, with each pair observing one class for the full duration of the initiative. At all times, we were under the supervision of two Arsakeio English teachers to ensure team compliance with school procedures and student safety.

The team followed a structured observation guide to record field notes during the visit. The guide included predefined categories of observable behaviors, such as student participation in gardening tasks, collaboration and communication, responsiveness to teacher instructions, use of tools and materials, and transitions between activities (see Appendix E). Observations focused on group-level interactions rather than on individual performance, and field notes on the garden's structure and condition, including its scale, layout, maintenance, and supporting resources and infrastructure. To maintain consistency in documentation, the team recorded field notes using standardized templates. The school administration also permitted the team and Treli Rhodia to take photos of the grounds and staff, provided students' faces were not visible.

As this study involved minors in school settings, the team gave careful attention to ethical considerations and informed consent. Before conducting observations, the team completed a volunteer declaration form to obtain permission from school administrators to comply with school policies, while respecting student privacy where appropriate. The team conducted observations only in public or instructional settings, recorded data anonymously, and reported data in aggregate form to protect student identities.

3.3 Gather Perspectives from Treli Rhodia Workers for Gamification and App Design

Our third objective was to gather perspectives from Treli Rhodia workers and use their insights to inform app development. The project team made weekly visits to the Treli Rhodia greenhouse to become familiar with staff and daily greenhouse operations. The team also facilitated a focus group on April 22 with seven workers to draw on their practical experience in brainstorming game features and guiding content and usability decisions.

3.3.1 Visiting the Treli Rhodia Greenhouse

Weekly visits to the greenhouse in Themi, Thessaloniki, immersed the team in the daily labor and processes of organic gardening, while providing insight into the permaculture principles and inclusive practices that SHPP desired to guide the development of the gardening app. Each visit lasted approximately 120 minutes, during which the team participated in and observed the workflow, garden layout, plant-care routines, and tool use. The team held visits every Wednesday from 12:00 to 14:00 to avoid disrupting the 14:30 Treli Rhodia staff meetings.

3.3.2 Focus Group with Trelia Rhodia Staff

The team hosted a 60-minute focus group at the Trelia Rhodia greenhouse, held at 13:00 on April 22, 2026, in coordination with the facility manager to minimize disruption to daily operations and maximize participant availability. To support communication, the team worked with a Greek graduate student research advisor who facilitated the session, as several workers were not comfortable communicating in English.

The focus group generated ideas for game mechanics and app features based on workers' experiences learning to garden and the challenges they faced as beginners. The greenhouse manager recruited seven staff (including herself) who were available and willing to participate, and permitted the team to hold the session in the greenhouse's front porch, providing a separate space for uninterrupted discussion. A project team moderator led the session using a structured guide to ensure consistency, equitable participation, and thorough documentation of actionable recommendations in topics such as early gardening challenges, collaborative gardening, and plant symptom protocols (see Appendix F). The team recorded feedback as written notes and transcribed the conversation in real time using OtterAI (see Appendix Q). The team ensured all employee identities were deleted, and if references, students were referred to anonymously in the focus group transcription to maintain confidentiality. This process enabled the team to ground app features in the practical, hands-on experiences of the Trelia Rhodia employees.

3.4 Develop an Accessible Prototype of the Application

Our fourth objective was to develop an accessible prototype of the application. To align the app’s design and educational features with the learning styles and ergonomic needs of students in Thessaloniki, the team—working with the project site coordinator and an IQP advisor—organized a joint focus group with primary and secondary students to test the prototype and provide feedback during its primordial development stage.

3.4.1 Joint Focus Group with Primary and Secondary Students

The team conducted a focus group on April 16, 2026, at Estrella World Street Food in Thessaloniki. Participants included two members of the research team, six students between the ages of 9 and 15—reflecting both primary (up to age 11) and secondary (ages 12–18) education levels—an IQP advisor, and three parents. The parents were present to provide consent for participation and data collection, and to guarantee that the team members present conducted the session with full respect for student privacy and safety throughout the play-testing and guided discussion.

After obtaining written consent from the three parents (see Appendix D & N) and informing the six students of the focus group’s purpose and procedures, participants engaged with the application and provided semi-structured feedback across four domains: navigation and ease of use, learning content, gamification and motivation, and visual design. Two team members co-moderated the session, while recording and transcribing responses in real time using OtterAI (see Appendix P) for later analysis. As an additional ethical measure, the team kept all student identities anonymous in the focus group transcription, and photos the team took at the meeting kept their faces blurred or omitted.

4.0 Findings

The goal of this project was to develop a gamified educational app to support sustainability and gardening initiatives held by Treli Rhodia. To inform its development, the team evaluated environmental education in school curricula, assessed student engagement in gardening initiatives, and gathered insights from Treli Rhodia workers. This chapter presents the key findings and their implications for the app's design, including patterns of student engagement in experiential versus lecture-based learning, the effects of collaboration structures on student participation, and insights into organic gardening from conversations with Treli Rhodia staff and greenhouse visits.

4.1 Evaluation of Environmental Education Content Within School Curricula

4.1.1 Teacher Survey Findings

The objective of the team's teacher survey was to assess how schools integrate gardening and environmental education into school curricula and to better understand how students engage with these subjects within and beyond the classroom. However, due to the delayed distribution of the survey following the rescheduling of the Arsakeio initiative, the team received no responses within the project's on-site timeframe. As a result, this section does not include teacher-derived findings, and this objective remains unfulfilled within the scope of this project.

4.2 Assessment of Student Engagement in Pilot Gardening Initiatives

4.2.1 Observations of Student Engagement

Team observations of the Treli Rhodia gardening initiative at the Arsakeio School involved two classes of 29 and 33 students, each completing both an outdoor gardening activity and an in-class lecture in alternating order. Across both groups, students engaged in hands-on tasks such as planting, soil

preparation, and watering, as well as classroom-based notetaking during an organic farming presentation. Student engagement varied notably between experiential and lecture-based learning and depended on classroom behavioral dynamics and physical constraints within the garden space.

Gardening Participation

Figure 4.1 displays Arsakeio's school garden, which is located in a courtyard behind the main campus building and consists of an approximately 3-meter by 5-meter soil plot with a central walking path. Figure 4.2 illustrates that the school has equipped the space with basic gardening resources, including three watering cans of varying sizes, a bag of organic fertilizer, and zeolite, a natural mineral added to the soil to improve water retention, nutrient absorption, and aeration. In the foreground of this figure (along the rear wall) are two sink stations along the rear wall each equipped with two faucets. For the gardening initiative, Treli Rhodia supplemented these materials with two additional watering cans, two buckets of dried poultry fecal pellets for the students to use as natural fertilizer, and four plastic crates of potted herb seedlings. Students planted the following herbs during the initiative: dittany, hyssop, lemon thyme, mountain savory, oregano, rosemary, sage, and thyme.



Figure 4.1 - *Arsakeio School Garden with Planted Seedlings at the End of the Educational Initiative*

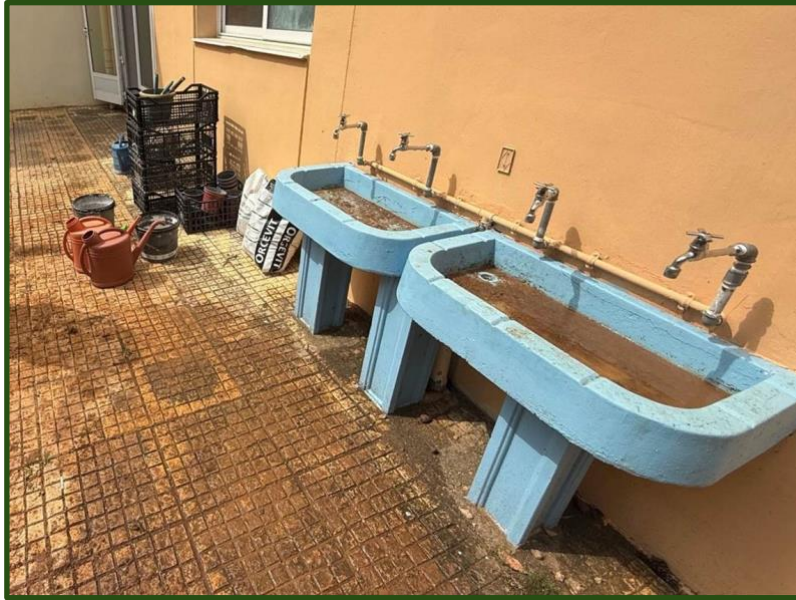


Figure 4.2 - *Arsakeio School Gardening Supplies*

Because student cohort sizes (29–33) exceeded the garden’s physical capacity and the number of available seedlings, Treli Rhodia mentors rotated small groups of students through specific stages of the planting process. Such tasks included measuring soil pH, mixing fertilizer, digging holes, planting herbs, and watering. While this rotational scheme allowed all students to participate in hands-on tasks, it limited sustained, continuous engagement.

In the smaller class, collaboration tended to occur within social groups that completed the same stage of the planting process together (see Figure 4.3) before dispersing to the courtyard perimeter while the next group approached the garden. This structure led to intermittent participation, as students disengaged once their group completed its task, rather than remaining involved in subsequent stages. As a result, participation declined noticeably, with approximately half of the class disengaging at times and, once, requiring verbal redirection from the lead Treli Rhodia staff member. This pattern suggests that when collaboration does not extend beyond a single task, students are more likely to become passive observers or disengage entirely, limiting their exposure to the full sequence of gardening activities.



Figure 4.3 - *Arsakeio Students Working Together to Plant Oregano* (Tringos, 2026)

In contrast, the larger class demonstrated a more task-differentiated form of collaboration, with students self-organizing into small teams of approximately three and assuming distinct roles such as digging, fertilizing, or watering. This structure supported more sustained engagement, as students often remained involved after completing their assigned task by observing and assisting peers through subsequent stages of the process. As a result, in the larger class of 33 students, disengagement was lower than in the smaller class of 29—affecting up to one-third of students, compared to approximately half, with a small subset of approximately 4–5 students exhibiting disruptive behavior requiring teacher intervention and temporary class separation. Overall, distributing interdependent roles extended student involvement across multiple stages of the activity, reducing the likelihood and extent of disengagement observed in the smaller class.

Together, these findings indicate that while rotational structures can contribute to disengagement when participation is brief and isolated, structuring collaboration around complementary roles can extend engagement across multiple stages of the gardening process. This also underscores the value of a gardening app that explicitly teaches the full planting process step by step, allowing students to revisit and learn tasks they neither performed nor observed during the activity.

The team observed both similarities and differences in how students handled gardening tools across the two cohorts. During the digging phase, approximately five of the nine participating students in the smaller class approached the task with less control, moving soil quickly and at times without regard for nearby peers or the quality of the planting holes. In contrast, twelve out of the fifteen engaged students in the larger class generally demonstrated more careful technique, shaping holes with greater precision and awareness of their surroundings.

However, during later stages of the process—particularly fertilization, planting, and watering—students in both groups who chose to participate tended to work with greater care and attention. Those applying poultry manure did so thoroughly, while students involved in planting and watering carefully secured seedlings and adequately nourished the surrounding soil. These patterns suggest variation in initial task engagement, with more consistent attentiveness emerging during later, more structured stages of the activity. Therefore, the application should provide clear, step-by-step guidance for each stage of the planting process, including how techniques vary across plant types, to reduce gaps in proper handling and ongoing garden maintenance and to improve the likelihood of long-term plant health and survival. This need becomes more apparent given the imbalance between the number of students and instructors during initiatives, as the app can deliver individualized, on-demand guidance when direct instructor support is limited.

Lecture Participation

The team also observed the in-class lecture portion of the gardening initiative and discovered a noticeable decline in student focus compared to the outdoor experiential segment. Among the 29 students who participated in the hands-on activity first, two-thirds engaged in side conversations or appeared disengaged, often staring off or losing attention during the lecture. The final third of students remained engaged by taking notes on colored paper, following the slides on the whiteboard, and raising their hands to answer questions about permaculture and sustainability when the Treli Rhodia instructor posed them. However, when the period bell rang, many students left their seats before the lesson concluded, and some

who had taken notes discarded or pocketed their work, suggesting limited sustained interest in the lecture content.

In the smaller group, who took part in the lecture before the hands-on activity, disengagement was similarly prevalent. Side conversations were frequent and at times disruptive, requiring a total of six verbal interventions from both teachers and Treli Rhodia instructors to restore attention. However, the same pattern of partial engagement emerged, with a smaller subset of the group attentive and interacting with the material in similar ways to those observed in the larger group. This consistency across both sequences suggests that disengagement was not a result of activity order, but rather of the lecture format itself, which offered limited opportunities for active participation and sustained attention. In both cases, students were more responsive when prompted to actively problem-solve—whether through hands-on planting or answering questions—whereas lecture-based delivery led to reduced focus regardless of when it occurred.

These findings indicate that app development should prioritize interactive and participatory learning mechanisms over static content delivery. Features such as short, responsive activities or quizzes supported by an extrinsic digital reward system—complementing the intrinsic satisfaction derived from gardening—may better align with student attention patterns, helping to sustain engagement and reinforce learning in a manner that traditional lecture formats do not.

Taken together, the team's observations from the garden and classroom show that students were most engaged when they actively participated in hands-on tasks and least when they waited or shifted to lecture-based instruction. Limited garden space and a step-based task structure left many students without a role at certain points, resulting in consistent disengagement across both groups. Collaboration style also shaped engagement, as task-based teamwork sustained participation and supported more successful planting than loosely organized social groupings. However, the team also noted brief spikes in engagement when instructors posed interactive questions, which elicited enthusiastic student responses.

4.3 Gardening Insights from Treli Rhodia Staff

4.3.1 Treli Rhodia Visits

Greenhouse Tour

Our team went on a tour of the Treli Rhodia greenhouse in Thermi, Thessaloniki on March 26, 2026, with a staff member to better understand the collective's inner workings and identify the unique gardening practices of organic farming to include in the educational resources of the application. This included a tour of the greenhouse's office spaces and the main growing section of the grounds.

The office spaces are for company management, employee collaboration, and planning of school gardening initiatives or environmental outreach events. The main workspace is a small, home-like area that supports close collaboration among employees. The second workspace includes the greenhouse "shop" area, a compact section where our team worked and where some employees complete individual tasks in a quieter environment.

After touring the office space, we moved over to a small storage area located in the first room of the facility. This space stores soil and minerals they use in the adjacent nursery sections and occasionally serves as a gathering area for greenhouse events. The guide then led the team through the nursery sections, which consist of three stages: an initial nursery for sprouting plants, a middle section for more mature plants, and an outdoor section for summer crops.

The first section of the nursery contains all the plants that have just begun to sprout, as well as some herbs and flowering plants. These plants include different types of mint, rosemary, cappuccino leaf, small strawberry bushes, and cherry tomato plants. This section is the main area for growing plants until they are large enough for Treli Rhodia to sell them to farmers. The

second nursery section, shown in Figure 4.4, contains more mature plants intended for purchase by farmers and small-scale gardeners, and staff also stock it with the remaining plants and herbs grown in the greenhouse. This area has tables of aloe, thyme, lemon thyme, basil, chives, and marigolds. The final section is the outdoor garden area, which contains plants that require high sun exposure and access to pollinators. Employees also produce ash fertilizer in this space and grow crops such as peach trees that benefit from exposure to natural elements.



Figure 4.4 - *Second Room Within the Greenhouse*

During the greenhouse tour, a staff guide introduced the team to non-genetically modified (GMO) organic gardening practices, including the use of soils with varying acidity and mineral content to manage pests and support plant growth, as well as the use of organic seeds, which produce plants that grow more slowly than GMO varieties but promote soil health and produce seeds that staff can use, which reduces reliance on annual seed purchases. In addition, during the tour, the team also engaged directly with the herbs through hands-on interaction and tasting. This experience served as an initial step in identifying relevant app content and engaging with beginner gardening practices, informing the design of potential app features to support student learning.

Porch Conversations with the Staff

Following the tour, the team met with the guide on the porch of the greenhouse's main building, where he shared the founding story of Treli Rhodia. The initiative began as a digital program that SHPP developed during the COVID-19 lockdown, when the organization suspended its in-person rehabilitative services. Through this program, SHPP taught members how to grow organic vegetables and herbs at home and encouraged reduced reliance on commercially produced goods. This effort provided participants with a sense of purpose and therapeutic engagement. The initiative later evolved into a formal farming collective after the acquisition of the greenhouse site in Thermi.

The team held a similar porch discussion with another Treli Rhodia staff member during the greenhouse visit on April 1, 2026. She emphasized the personal fulfillment she and other staff members derived from working at the greenhouse and provided guidance on aligning app development with Treli Rhodia's expectations. In particular, she shared with the team a list of vegetables and herbs they currently use in school initiatives, and she recommended consolidating information on closely related plant varieties—such as assorted mint species—into single, unified entries. This approach would allow the app to present all relevant planting and care information while avoiding unnecessary complexity and overextension of the project scope.

Spring Festival

On April 5, 2026, the team visited the greenhouse to attend Treli Rhodia's spring festival, which brought together members of the Thermi and Thessaloniki communities, including customers and organizations with similar commitments to solidarity and environmental justice. At the festival, attendees shared meals, staff led greenhouse tours, artists performed Greek

music, and children engaged in activities such as painting floral murals on future planting surfaces and interacting with the greenhouse's dog, Max.

The strong engagement the team observed during the mural-painting activity, where subjects showed sustained focus, creativity, and enthusiasm while contributing to a shared visual environment, highlighted how artistic participation can deepen emotional connection to environmental spaces. This observation suggests that incorporating student-made art into the gardening app, such as customizable background visuals or plant icons, could similarly foster a feeling of ownership and motivation by allowing students to actively shape their learning environment rather than exclusively consume the app's content. Overall, this visit provided the team with a direct, experiential understanding of Treli Rhodia's role not only as a workspace for SHPP program participants but also as a community hub that fosters education, social connection, and local engagement.

Erasmus

The team also participated in the Erasmus conference, a joint gathering of Treli Rhodia and SHPP staff along with social scientists from rehabilitation organizations in Italy and Romania, who had convened in Greece to learn about Treli Rhodia's rehabilitative care strategies and educational mission in Thessaloniki. Treli Rhodia hosted a conference at the greenhouse on April 22, 2026. Through attending the conference, the team presented their research strategy, individual project motivations, and a demonstration of the app as it stood on April 22 to an international audience. In addition, the team gained a deeper understanding of the principles and learning objectives guiding Treli Rhodia's educational initiatives, as well as the varying structures and outcomes of the school programs they conducted over the past year.

During presentations to the team and visiting peers from Italy and Romania, Treli Rhodia emphasized the importance of transferring responsibility for garden upkeep to student groups after initial instruction. This approach aims to foster a sense of ownership over the seedlings students help plant—an experience that may be unfamiliar or entirely new to many young participants—and to reinforce values such as responsibility, diligence, and tender care through continued student-led maintenance of the gardens. The presenting staff members additionally highlighted that beginning instruction from a shared, basic level of organic gardening promotes a more egalitarian and democratic dynamic among students, reducing the influence of perceived hierarchies and challenging social divisions shaped by power, wealth, and gender binaries.

Focusing on the specific content covered in past initiatives, Treli Rhodia staff explained that, beyond the fundamentals of organic gardening, they introduce students to the mythological significance of various vegetables and herbs, including their connections to the Greek Olympian pantheon and their roles in folklore and religious narratives from non-Hellenic origins. This practice adds a layer of multicultural insight that students may carry with them as they continue to care for their seedlings and learn about other plants after the initiative's end. The teaching of Greek myths proved particularly useful during Treli Rhodia's visit to a youth refugee center outside Thessaloniki (see Figure 4.5).

The presenter explained that the youth, who came from diverse linguistic and cultural backgrounds across the Middle East and Africa, often had limited proficiency in Greek. However, they gained useful exposure to Greek vocabulary through plant-related mythological narratives, which supports more contextual language learning.



Figure 4.5 - *Refugee Planting Initiative* (ARSIS, 2025)

Furthermore, the presenter also noted that language barriers between Treli Rhodia staff and the refugee participants led to adaptations in the curriculum, with greater emphasis placed on visual demonstrations and graphic imagery. In addition, staff encouraged the youth to select which plants they wanted to grow. According to the conference summary, many participants chose vegetables and herbs commonly used in their home countries, as the refugee facility used the garden's produce to support meal preparation. To support Treli Rhodia's mission of multicultural inclusivity, the app could include plant descriptions and quiz sections highlighting how the same plants appear across different cultures in cuisine, mythology, and medicinal practices.

4.3.2 Focus Group Findings

The team held a focus group with seven Treli Rhodia workers on April 21, 2026, to help the team gather insights into the gardening practices and experiences of the greenhouse's staff, to

learn how they have informed the structure of their educational initiatives, and to provide a list of app features that could enhance the longevity and community impact of our deliverables.

As part of this guided discussion, participants reflected on early-stage challenges in becoming career organic gardeners. Among these challenges, the most recurring difficulties mentioned were the safe handling of cutting tools and pruning, and the selective removal of plant material—such as stems, leaves, or branches—to promote healthy growth. Participants emphasized that pruning requires more than simple cutting; it involves understanding plant structure, growth patterns, and timing while making irreversible, decisive actions that directly affect future plant development. Treli Rhodia’s gardening initiatives do not address these skills, as they focus primarily on initial planting rather than long-term herb care, which may limit students’ ability to independently sustain and manage their gardens after the initiative concludes.

A majority of staff vocalized initial difficulties beyond plant care, including team coordination—collaboration, and communication—and greenhouse organization. Notably, participants highlighted challenges in consistently returning tools and materials to their proper locations and following safe storage procedures after task completion, and further indicating that workflow discipline and collaborative habits required time to develop alongside technical skills. However, participants disclosed that as they became more familiar with their peers’ skillsets, they redistributed tasks (e.g., plant maintenance, customer service, and student teaching) by leaning into their individual strengths to improve overall greenhouse productivity and instill each staff member with a sense of purpose and contribution to the common good.

Building on this shift toward more structured collaboration, workers described how they improved their planting skills over time through observation and repeated practice rather than formal instruction. Many of the staff members noted they learned by watching more experienced

workers and gradually refining their techniques through hands-on involvement. Staff shared knowledge informally, with peers demonstrating methods and offering guidance during daily tasks. Additionally, workers emphasized that closely observing plant behavior—such as changes in growth, color, or condition—was more effective than relying on general instructions, as this approach allowed them to respond to specific plant needs with targeted and effective procedures. This process required patience, which staff emphasized as essential for developing competence in planting and long-term plant care.

These focus group findings highlight several considerations that informed the team's design strategy for the application. First, the complexity of tasks such as pruning and tool handling underscores the need for a learning resource that extends beyond initial planting, providing accessible, step-by-step guidance for long-term plant care. Second, the importance of collaboration and task delegation suggests that learning tools should encourage peer interaction and shared learning goals rather than facilitating solely individual educational fulfillment. Finally, the staff's reliance on observation, repetition, and informal knowledge exchange indicates that effective learning occurs through experience-based engagement, reinforcing the value of interactive, visually descriptive, and practice-oriented app features. Collectively, these insights demonstrate how the application can address common learning gaps that gardening beginners encounter, which Treli Rhodia doesn't fully cover in their school initiatives.

In our guided educational initiative conversation, the staff indicated that many initiatives are time-constrained, often limiting instruction to initial planting activities while omitting critical information on long-term care. This gap underscores the app's potential as a supplementary tool of continuous access to essential knowledge, supporting students beyond the initial stages of gardening and enabling more sustained learning and engagement.

Staff emphasized the importance of collaboration in both gardening work and classroom environments. They described how students at gardening initiatives already thrive from working together, sharing knowledge, and seeking help from peers rather than approaching tasks individually. Two workers proposed structuring the app around cooperative learning mechanics and designing progress to depend on group participation rather than isolated completion. For example, quiz-based activities could require collective input, encouraging students to communicate and contribute to shared outcomes.

Additionally, one worker suggested incorporating unlockable rewards tied to group and potentially class achievement. They suggested a puzzle-based approach where students could each contribute pieces of a “mystery” plant’s qualities—such as care techniques, uses, or observations. These shared milestones would reinforce teamwork and distribute responsibility across the group, mirroring the collaborative dynamics observed at the educational initiatives and emphasized by the greenhouse work ethic.

4.4 Findings Summary

Overall, the findings from student observations, Treli Rhodia staff input, and greenhouse visits and celebrations demonstrate that students engage most when actively involved in hands-on activities and disengage during lecture-based instruction or when instructors do not assign them an active role in the gardening process, unless tasks are distributed via a systematic team structure. This highlights the need for an app that prioritizes interactive, task-based learning and cooperative mechanics, such as individual or team quizzes and shared progression systems, to replicate effective role-based teamwork observed in the garden and emphasized during Treli Rhodia’s Erasmus presentation. Evidence that rotational task structures prevent students from

experiencing the full planting process also supports step-by-step instructional features and replayable modules that allow users to revisit missed stages. Insights from Trelia Rhodia further emphasize the importance of providing resources that teach long-term plant care and responsibility, as well as the multicultural significance of initiative plants. Collectively, these insights indicate the need for an application that sustains engagement, reinforces understanding of the full planting process, and supports continuous learning beyond in-person instruction. The following chapter translates these findings into the concrete development of the gardening app and describes how the team playtested and refined the app prior to its final publication.

5.0 Design

5.1 Design Summary

Students participating in Treli Rhodia’s gardening initiative learn about plant care and basic gardening practices at their schools. Once Treli Rhodia facilitators depart, school staff and students uphold the responsibility for ongoing garden maintenance and continued student education. To support this transition, Treli Rhodia commissioned this application to provide students with an accessible and engaging platform for continued learning. The application is in Greek, but the team translated it into English for this report. To see untranslated versions of our screenshots, see Appendix R.

The design process forms the foundation of effective software development. During the initial design phase, several key components were defined that made development possible, including features such as interactive quizzes, screens, and interface elements, based on findings that show students learn best through hands-on activities, structured collaboration, and visual, step-by-step instruction, which together improve engagement and understanding compared to passive learning. The team designed the initial **User Interface (UI)** with a **Navigation Bar (Navbar)** at the bottom of the screen, providing access to the **Info Screen** where users can browse plants, view information about each species, and learn proper planting techniques. The **Info Screen** also enables users to track the plants they are currently cultivating, allowing the application to schedule watering reminders to support proper plant care.

Development Framework and Development Tools

Our application runs on Flutter, a multi-platform development framework that integrates with Visual Studio Code (VSCode), Microsoft's free code editor. Flutter utilizes a widget-based architecture to design and construct application interfaces. By adopting Flutter, the team can deploy the application across Android, iOS, MacOS, Windows, and web platforms, maximizing versatility for the project sponsor. In addition, this framework shifts UI design from a drag-and-drop approach to a code-driven methodology, resulting in a more professional and maintainable UI. The application follows a **Model-View-ViewModel (MVVM)** architectural pattern, which keeps the codebase organized and accessible to any future developer the sponsor may engage. To incorporate the ‘virtual classroom’, all user data, including email, passwords, garden, virtual class, assigned role, and quizzes, needed to be securely stored in a Firebase database. The design encompasses two primary screens: the **Home Screen** and the **Info Screen**.

Figure 5.1 shows the **Teacher’s Home Screen**; the class code section at the bottom allows a teacher to generate a ‘virtual classroom’. Teachers then use the classroom to send quizzes to students in their class.

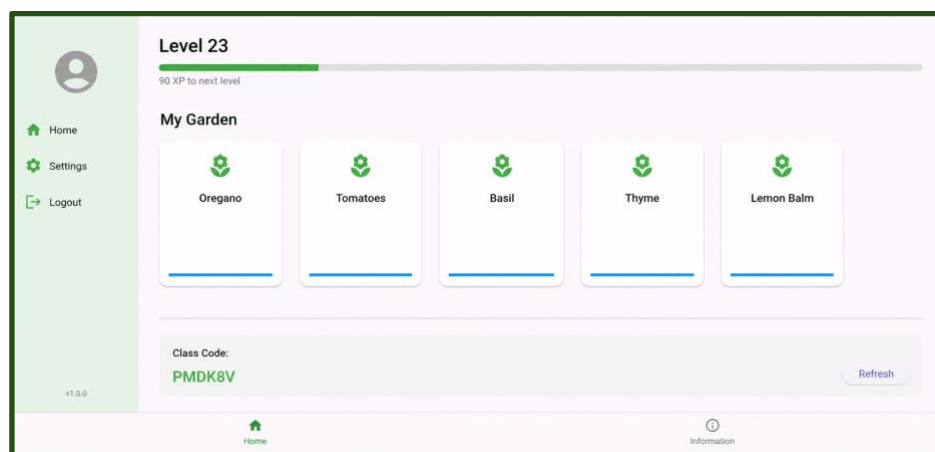


Figure 5.1 – *Teacher’s Home Screen*

Figure 5.2 depicts the level bar at the top of all **Home Screens**, an element designed to promote engagement through extrinsic gamification of the educational experience. As mentioned, the team found that multiple-choice quizzes were the most effective way for users to learn and retain the educational material in the app. By completing quizzes, users gain experience—with higher scores awarding more experience and contributing to greater progression. The amount of experience required to reach the next level appears below the progress bar, while the “Level 22” indicator above the bar shows the user’s current level. The system has an open ceiling, meaning it includes no level cap and allows users to continue progressing and accumulating experience indefinitely.

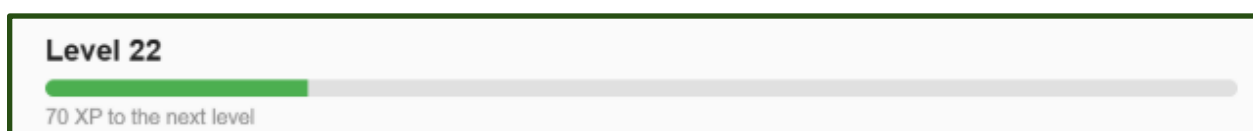


Figure 5.2 - *Level Progress Bar*

If a student logs in, the class code section shown in Figure 5.1 changes to the text box in Figure 5.3, where the user enters a class code to join a “virtual classroom”. The team designed this feature to support structured classroom collaboration by integrating students into a shared learning environment. The virtual classroom also streamlines quiz distribution, allowing teachers to assign quizzes aligned with their curriculum so students can complete them within the instructional flow rather than independently and outside the teacher’s planned sequence.

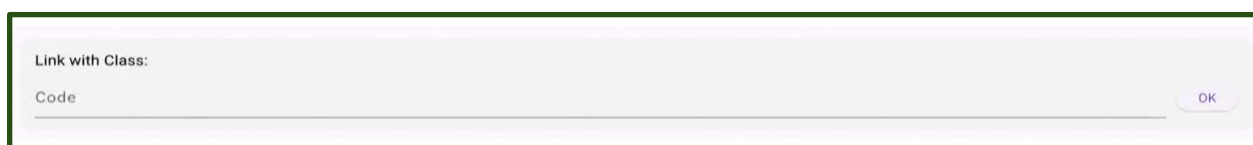


Figure 5.3 - *Join Class Section*

Moving towards the **Info Screen**, you can navigate to it using the Info button—the icon circled in red—in the **NavBar** as seen in Figure 5.4. This screen serves as the first point of reference for any student using the application. Moving towards the **Info Screen**, you can navigate to it using the Info button—the icon circled in red—in the **NavBar**. This is the first stop for any student using the application. The **Info Screen** will provide plant information and help students understand the caretaking procedures they must follow for each plant.

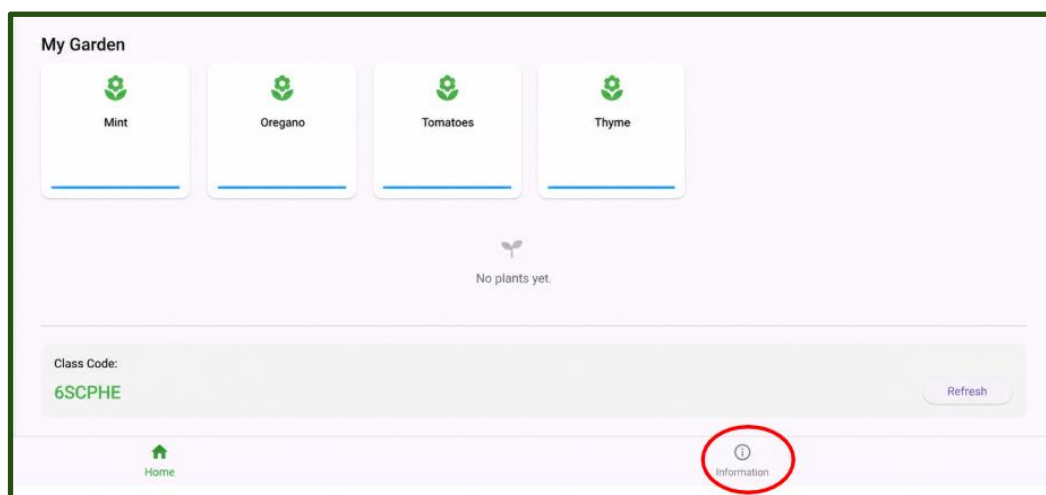


Figure 5.4 - *Navigation to the Info Screen*

Figure 5.5 depicts the **Info Screen**, displaying a set of plant cards categorized by type. The current selection contains herbs. Future plant sections, like fruits and vegetables, may be added by Treli Rhodia in the future. The team designed these icons to appeal to our younger user base, rather than more photorealistic ones.

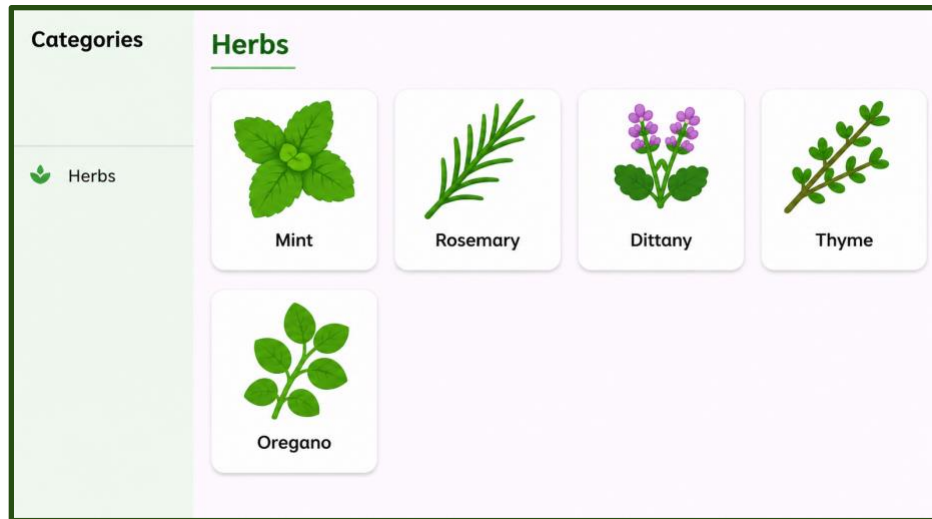


Figure 5.5 - Info Screen

Once a user selects a plant card, a "pop-up" appears containing the plant's title, description, and care instructions. Figure 5.6 depicts the Dittany plant card as an example. This feature helps students learn information about each plant, although teachers also have access to these pop-ups. At the bottom of the "pop-up" are two buttons: a **select plant** button and a **close** button, as shown in Figure 5.6.

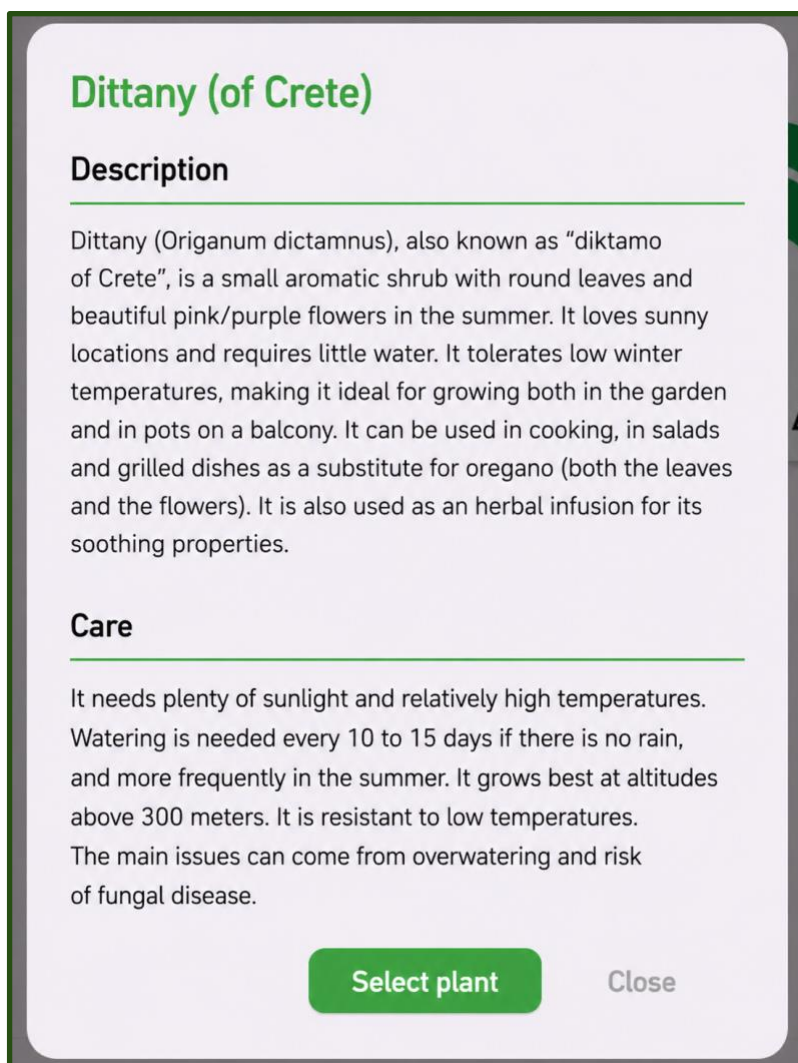


Figure 5.6 - *Dittany Plant Info Card*

When a user clicks the **select plant** button, the plant (in this case, Dittany, as shown in Figure 5.6) will be added to their “virtual garden”, which sits in the middle space of their **Home Screen**. Alternatively, when a user clicks the **close** button, the plant card “pop-up” will disappear.

You can see a “virtual garden” with five plants in Figure 5.1. A closer view is depicted in Figure 5.7. The user can also open the “pop-up” menu (Figure 5.6) by clicking the plant card in their **Home Screen**.

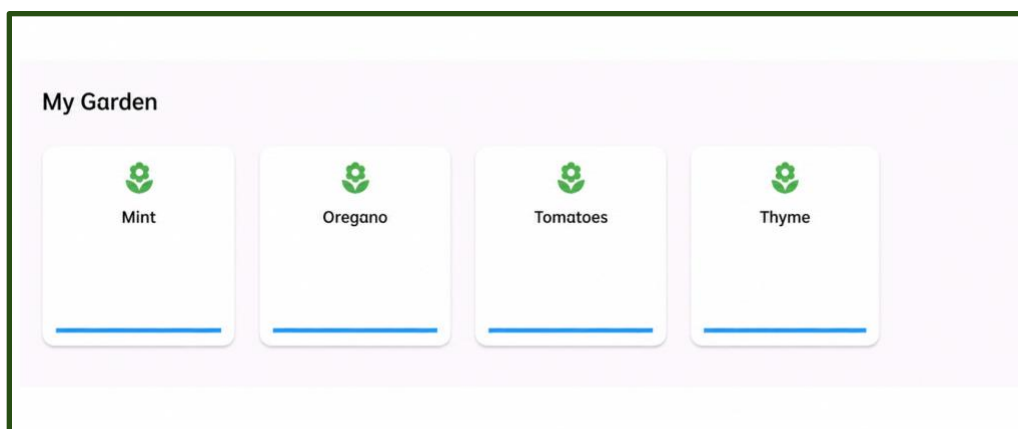


Figure 5.7 - *My Garden*

The **Quiz Screen** forms a core component of the application’s educational structure, designed to reinforce material reviewed in the **Info Screen** by allowing students to consolidate their knowledge through assigned quizzes. Teachers create and assign quizzes by selecting the green “+” button in the bottom-left corner of the **Teacher Quiz Screen** (Figure 5.8), which opens the **Quiz Bank tab** (Figure 5.9). The top half of this screen displays the **Active Quizzes** tab, where teachers can view quizzes currently assigned to their “virtual classroom”; Figure 5.8 shows a Sage Quiz as active. By selecting **Tap for details**, the teacher will see a list of the questions being asked in the quiz they sent out to their “virtual classroom”. The bottom half contains the **Student Progress** tab, which tracks student completion and performance. As shown in Figure 5.8, this section remains empty until students begin submitting quiz responses.

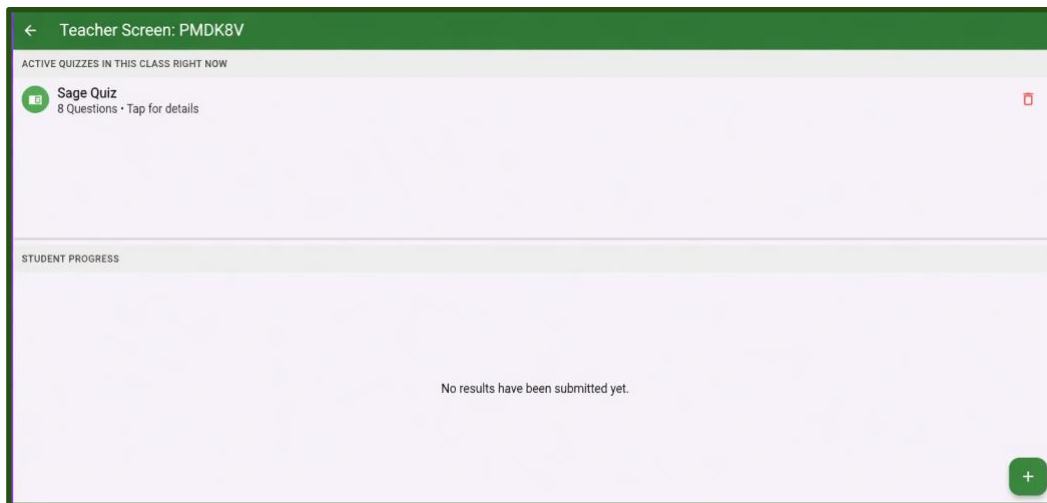


Figure 5.8 - *Teacher Quiz Screen*

After the teacher selects the green “+” button shown in Figure 5.8, the **Quiz Bank Tab** opens as a “pop-up” window (Figure 5.9). Each quiz appears as an individual widget with a green arrow on the right-hand side. To assign a quiz to students in the virtual classroom, the teacher selects the green arrow corresponding to the desired quiz.

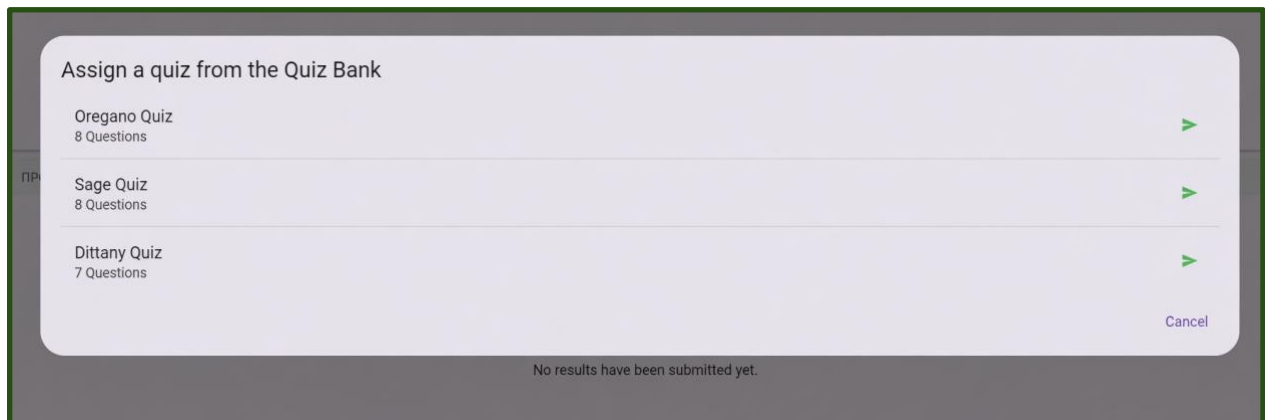


Figure 5.9 - *Quiz Bank*

Once assigned by a teacher, quizzes become visible to students on the **Student Quiz Screen**, where they can access and complete them. In Figure 5.8b, a **Student Quiz Screen** is depicted with an active Sage Quiz and Dittany Quiz.

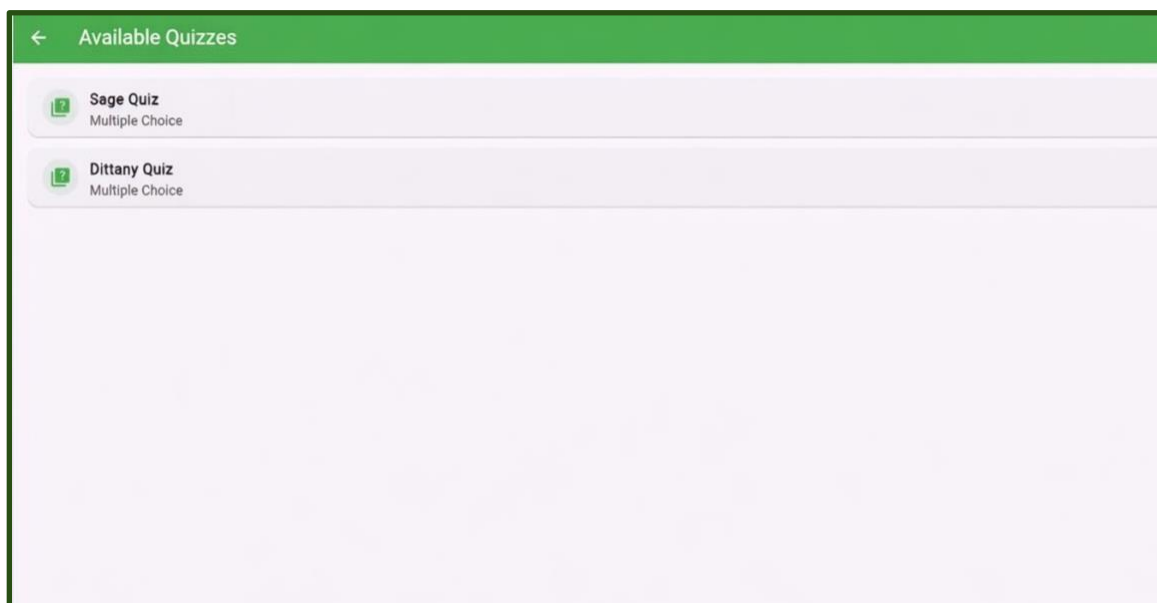


Figure 5.10 - *Student Quiz Screen*

Figure 5.11 depicts the first multiple-choice question of a Sage Quiz on a student's screen. When a student begins a quiz, the application presents a series of typically seven to eight questions, displaying the total question count and a progress bar above each question to show the student's progress through the quiz. Students may exit the quiz at any time by clicking the exit arrow in the top-left corner of the screen.

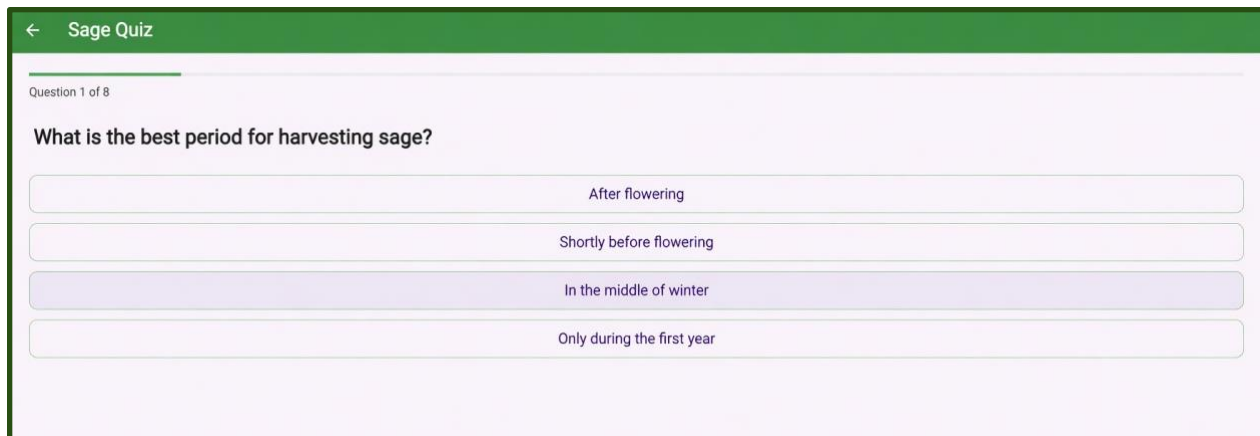


Figure 5.11 - *Sage Quiz on a Student Screen*

As shown in Figure 5.12, when a user selects an incorrect answer to a quiz question, the screen briefly flashes red to indicate that the response is incorrect.

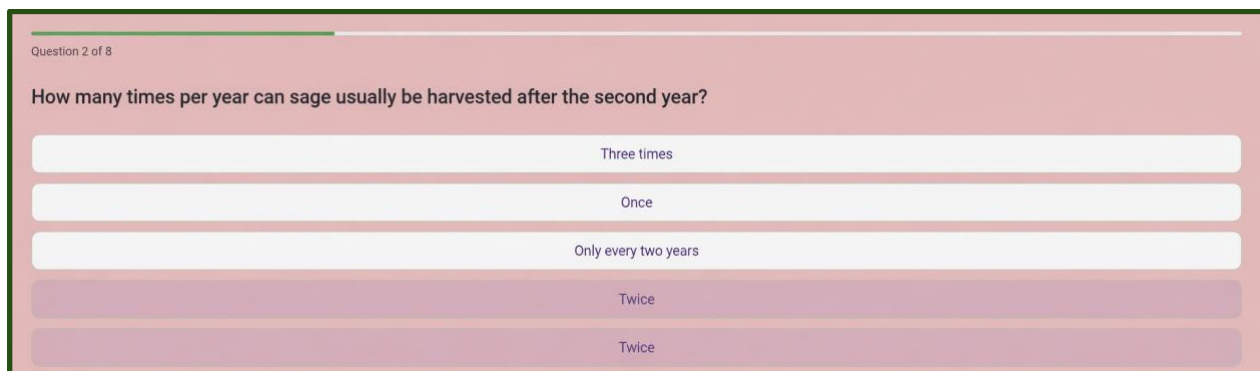


Figure 5.12 - *Wrong Answer Flash Function*

Upon completion of a quiz, a “pop-up” window displays the number of correct answers alongside the experience points earned (e.g., +20 XP), as shown in Figure 5.13. To return to the **Home Screen**, the user selects the **Finish** button in the bottom-right corner. The application then updates the Experience Level Bar at the top of the **Home Screen** (Figure 5.4) to reflect the newly accumulated points, reinforcing continued engagement.

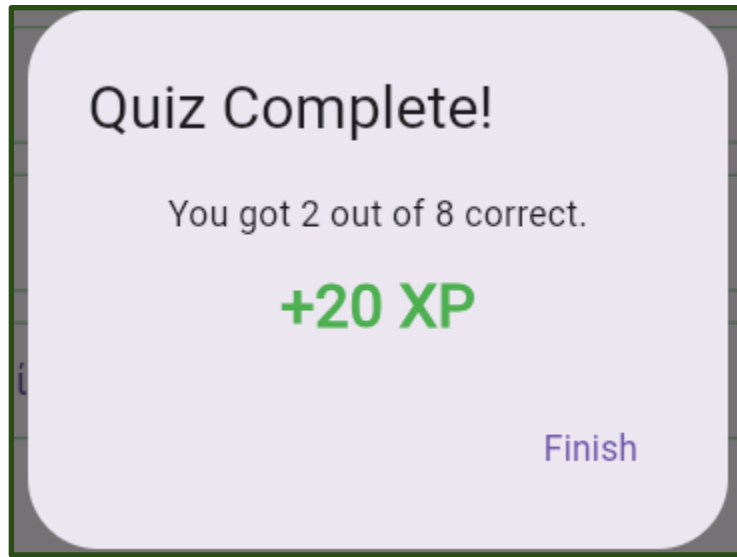
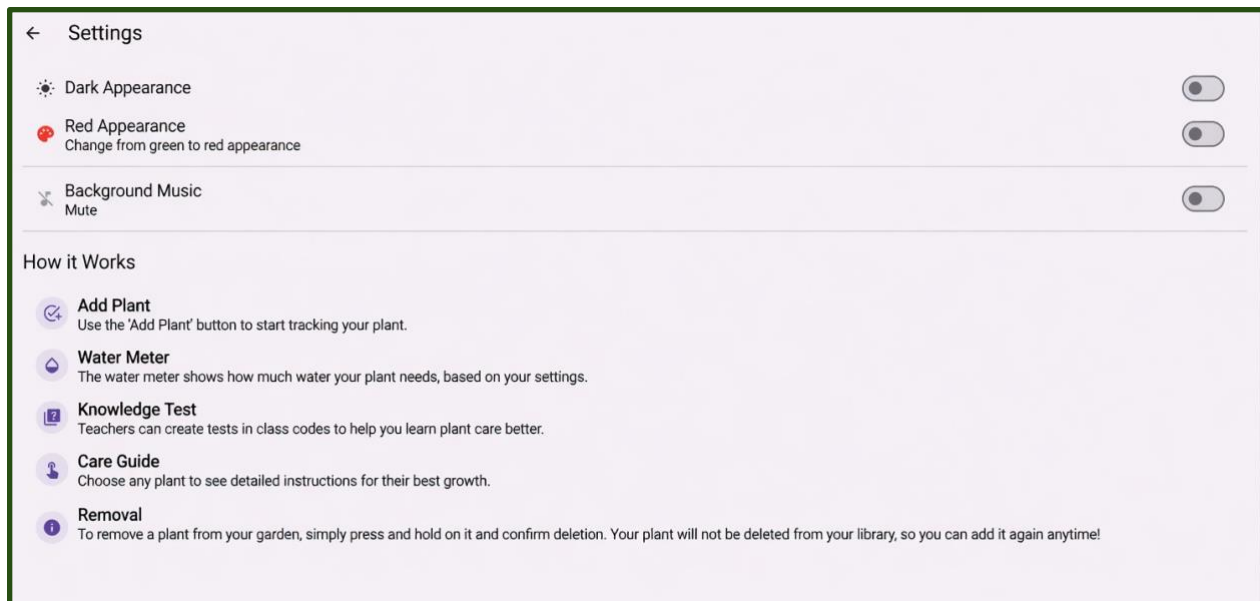
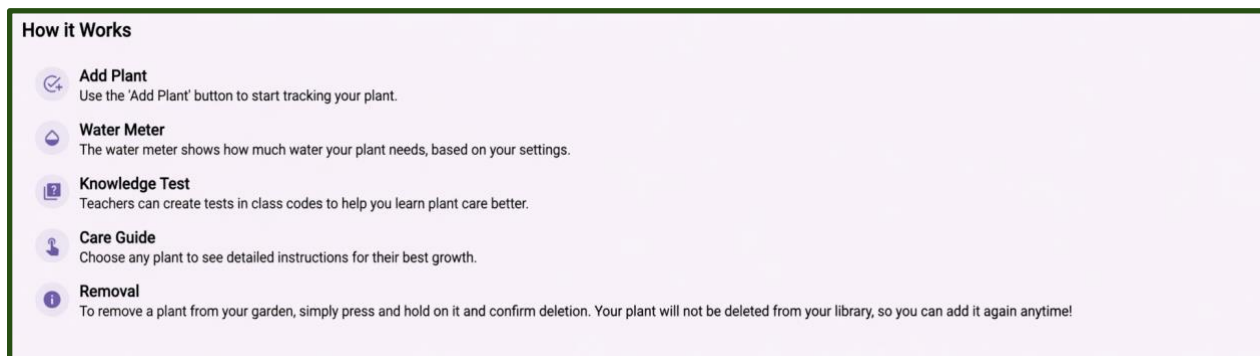
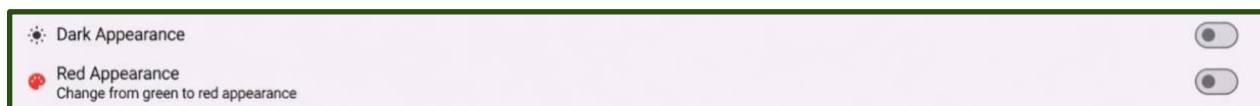


Figure 5.13 - *Finished Quiz Pop-Up*

As shown in Figure 5.14, the **Settings Screen** includes three main sections: theme customization, background music, and a “How It Works” guide. Theme customization is controlled by the two toggles on the right—labeled “Dark Appearance” and “Red Appearance” (also shown in Figure 5.16). In total, the app has four color themes: light and green, light and red, dark and green, and dark and red. The informational section of the **Settings Screen**, also depicted in Figure 5.14 and expanded in Figure 5.15, introduces users to the application’s core features through a series of tiles, each containing an icon suited to the app’s young audience, a title, and a brief description.

Figure 5.14 - *Settings Screen*Figure 5.15 - *Informational Screen Options*Figure 5.16 - *Theme Options*

As shown in Figure 5.16, users toggle between light and dark appearance using a switch at the top of the screen. When the app runs in light mode, a second option becomes available, allowing the user to switch between the default green color scheme and a red color scheme that

reflects the sponsor's brand colors. During the design period, the team encountered a challenge in ensuring that text colors remained distinguishable from the background across all theme combinations. Thus, this implied the app design needed to include the ability to adjust the theme system to update text color alongside the background when users switch themes. As Figure 5.17 illustrates, while both red and dark modes function correctly, the team determined that the combined red-and-black color scheme clashed with both the garden aesthetic and the sponsor's red floral palette.

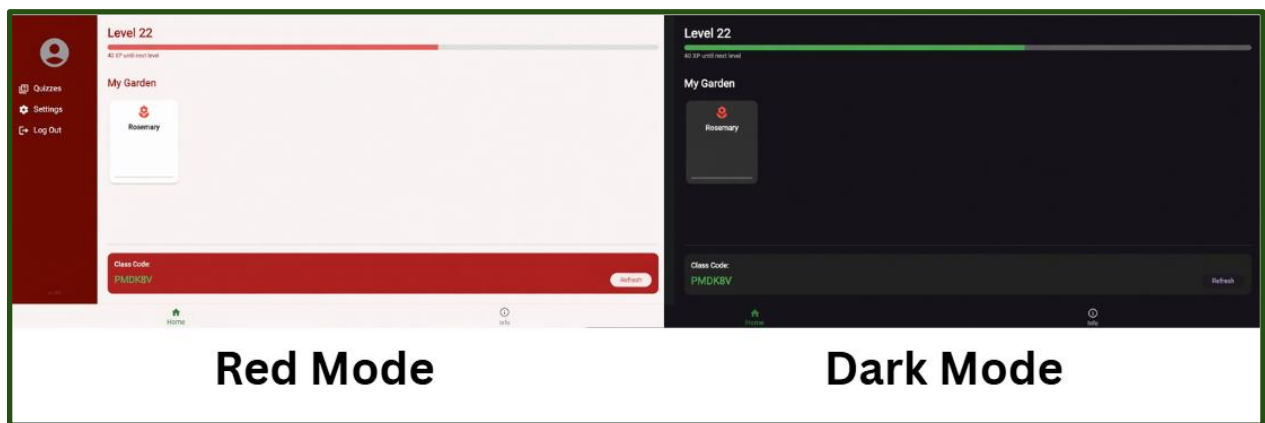


Figure 5.17 - *Red Vs. Dark Modes Examples*

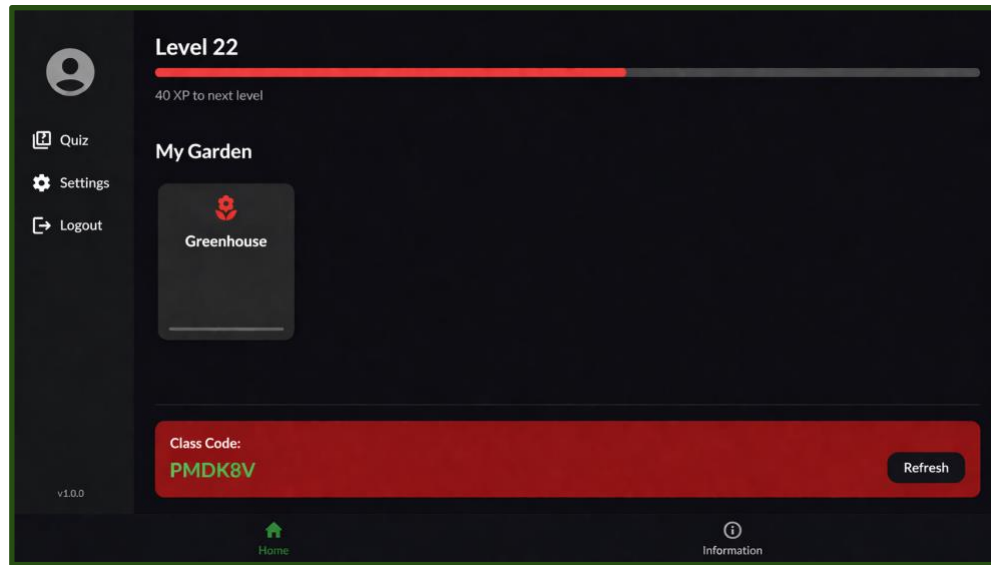


Figure 5.18 - *Red Mode and Dark Mode*

The last section of the settings screen, in order of importance, is the Background music. The toggle switch depicted in Figure 5.18 allows the user to mute the background music.



Figure 5.19 - *Background Music Mute*

5.2 App Prototype Testing and Student Feedback

The team conducted a focus group with six students on April 16, 2026, to test the preliminary app prototype. Findings suggest the app is generally intuitive and engaging, with strong responses to its quiz-based learning and visual design. However, recurring issues in feature clarity, content alignment, and translation indicate key areas for refinement.

5.2.1 Navigation and Ease of Use

All six participants found the app navigable, with two participants (33%) describing the overall experience as "fairly easy" and "simple." However, a recurring point of confusion emerged around the information screen button, which two users initially mistook for a general app description rather than plant-specific information. This suggested that the labeling or iconography in the information section lacked sufficient clarity for first-time users. One participant also noted a lack of clarity in the plant tracking and humidity functions, which the team designed to notify users when their plants need watering. Although the feature's purpose became clear after explanation, the need for external clarification indicates a gap between intended and perceived affordance. This suggests the need for clearer in-app labeling, improved visual cues, or a brief onboarding tutorial for first-time users.

5.2.2 Learning Content and Quiz Feedback

Participants responded positively to the quiz component of the application. Four of the six (67%) expressed that it helped them retain information from the plant information screens. One participant explicitly stated that the quiz format aided memorization. However, another participant said that one quiz question covered content absent from the information screens, which contributed to confusion and unnecessary difficulty. This inconsistency between the quiz and informational content represents a meaningful gap in the application's current library of resources—if the app aims to teach users through the read-then-quiz flow, the two content layers must match closely.

Participants also responded enthusiastically to culturally resonant content, most notably the oregano quiz questions, with one noting that oregano runs deep in Greek culinary culture.

Although outside this project's scope, this finding suggests that anchoring educational content to cultural context meaningfully enhances student engagement. Conversely, two participants and an assisting parent flagged several instances of awkward phrasing, which participants attributed to poor translation, as well as a confusing information page for Dittany. While this event was premature for our app's full development and not all of our design was yet complete, the team should prioritize revisions before wider deployment.

5.2.3 Gamification and Motivation

All six participants expressed genuine motivation to use the app, with one describing it as “an interesting way to learn.” Participants reacted positively to the leveling and XP system, although participants offered several suggestions for expanding its reward structure. Two of the six participants (33%) proposed additions, including unlockable profile pictures, a collectible digital garden feature, and a competitive point-based quiz mode resembling Kahoot™. Additionally, two participants noted that in the quiz section, there was no feedback when a user answered a question incorrectly. This left the participants uncertain which question they had answered incorrectly. The enthusiasm around competitive and collectible mechanics is consistent with research on extrinsic motivation in game-based learning environments, and suggests that the current gamification layer, while functional, can deepen engagement. All six participants responded positively to the digital garden concept, a feature in which correctly completed quizzes enable students to grow and collect virtual plants, supporting consideration for future development by either the current team or a subsequent project team.

5.2.4 Visual Design and Overall Impression

Participants provided mixed feedback on visual design. All participants appreciated the dark mode and red color scheme adopted at the sponsor's request, but they raised substantive concerns about the phone version's layout. Specifically, they described the proportions as imbalanced, with approximately half the screen occupied by the menu and the remaining half displaying very small text, making it difficult to read. They also described the tracked plants page as visually sparse. These issues indicate a need for responsive design adjustments to better accommodate mobile screen dimensions, which is particularly important given that the app's target users—middle and elementary school students—are most likely to access it on personal devices.

Participants also noted inconsistency in icon style within the information section, observing that some plant entries used illustrated leaflet icons while others used photographs. Finally, several participants and an observing adult suggested that younger users, particularly at the elementary level, would benefit from an avatar or guided tutorial character—similar to Duolingo's owl—to help them navigate the app independently. This recommendation is especially relevant given that the app is intended for use across both elementary and middle school settings.

5.2.5 Design Changes Following Focus Group

The team implemented several targeted changes in response to focus group feedback. First, a how-to guide was added to the app, in the settings tab, to address the navigation confusion identified in section 5.2.1, giving first-time users a clear walkthrough of core features without requiring external explanation. Second, the quiz screen now displays a red flash when a user answers incorrectly, directly resolving the lack of feedback that participants noted. This change reinforces the read-then-quiz learning

flow by making incorrect responses immediately visible. Third, the team replaced inconsistent plant icons with a new set of unique illustrated icons, allowing users to distinguish between plants at a glance and resolving the icon style inconsistency flagged in section 5.2.4. Finally, the team made broader UI improvements to address the layout and proportion concerns raised about the mobile view, prioritizing readability and visual balance on smaller screens.

6.0 Discussion

6.1 Limitations

During the term, we encountered several limitations that affected our project. One major limitation of this study relates to the context in which SHPP implemented its gardening initiatives. Due to financial issues within the Greek educational system and limited funding allocated to environmental education, the program has been conducted exclusively in private schools. Because the program was conducted exclusively in private schools, the team's findings are limited to student engagement in private schools. The extent to which engagement might differ in public school settings, where financial and social dynamics vary, remains unknown. The initiative would likely differ in content and scope, and students' engagement and willingness to complete it would differ as well. Therefore, the team's findings cannot be generalized to all primary schools in Thessaloniki, Greece, and are applicable only to private institutions around the city.

Another important limitation of this study was the inability to obtain direct student feedback from students involved in the Treli Rhodia gardening initiatives. Due to practical and ethical constraints, data collection relied on indirect measures, such as student observations. This mainly limited the depth of our understanding of student engagement, which we would've gained if we could have collected direct student feedback.

The final limitation was the limited amount of data our team collected over the course of the term. Our team was only able to attend one on-site gardening initiative, resulting in one set of observational data at Arsakeio School. This data was also collected in two groups (though it is one class), with the team split, and the two classes had drastically different experiences, leading

to discrepancies in data interpretation across the initiative as a whole. Different observers and different classes made comparing the data from the two classes difficult, given all the variables included; however, this limitation moderately impeded the research, but it also allowed the team to isolate two subsections of what would be one whole data point. As mentioned in section 4.1, the team attempted to survey teachers for the same initiative; no submissions were received. The small amount of data, on top of the data set's divisiveness, significantly limits the number of solid conclusions the team can draw about student engagement from gardening initiatives and from both positive and negative student feedback about the application itself.

6.2 Recommendations

Through both our research and field experience, we present the following recommendations for consideration by Treli Rhodia:

Integrate Student Artwork to Enhance App Aesthetic and Foster Community Ownership

The team recommends incorporating student-created artwork into the app to enhance its visual appeal and instill a sense of community ownership amongst its users. During classroom implementation, Treli Rhodia staff could present the app's limited visual design as an intentional gap, inviting students to contribute drawings that reflect their gardening experiences—an approach that aligns with Treli Rhodia's prior use of student artwork in feedback collection. Framing this as a shared effort encourages students to see themselves as agents in the app's development, reinforcing the emphasis on responsibility and self-reliance embedded in existing gardening initiatives.

This approach also engages students from earlier Treli Rhodia initiatives, as the call for artwork provides a natural entry point into the app, even for those who were not previously

exposed to it. Encouraging students to work together on shared pieces—such as class murals or group designs, similar to those observed during the spring festival—would further reinforce Treli Rhodia’s emphasis on shared responsibility, mutual support, and community-building, allowing students to experience how collaborative effort can translate into tangible contributions to a shared space. Given Treli Rhodia’s existing relationships with partner schools, gathering and organizing student artwork would be a feasible extension of current programming. Integrating these materials into the app, however, may require additional technical and design support, which could be addressed by future development teams.

Expand Collaborative Learning Features in the App

In the team’s focus group with Treli Rhodia, a recurring theme was collaborative learning. When prompted to suggest potential app features, staff largely focused on designing quizzes that could be completed collectively rather than individually, as well as mechanisms to reward group participation. Based on these insights, the team recommends that future work focus on researching collaborative quiz structures and other group-based learning strategies within ICT-supported primary and secondary education. This research could inform the development of a clearly defined design concept that can be integrated into the app’s quiz system, enabling students to engage with content through shared problem-solving rather than isolated completion. Due to the seven-week time constraint and late data collection, we were unable to implement these features, but would like to see them implemented in future versions of the application.

Incorporate Long-Term Plant Care Information into the Plant Tracking Function of the App

Another recurring theme from the focus group centered on the long-term sustainability of student gardens, particularly the limited exposure students receive to plant care beyond the initial planting phase. Staff noted that students are likely to forget key information regarding long-term plant maintenance by the time it becomes relevant, creating a gap between initial learning and practical application later in the plant's lifecycle.

In response, the team recommends expanding the app's plant-tracking feature to include a clearly identifiable and easily navigable component dedicated to long-term plant care. This feature would provide short, digestible guidance tailored to each plant, focusing on common issues that may arise throughout its lifecycle—particularly those arising from its organic cultivation. Emphasis should be placed on helping students visually identify problems, such as signs of pests, disease, or environmental stress, and on providing simple, actionable steps to address them. By equipping students with this knowledge, the app can support independent problem-solving and enable users to sustain and harvest their plants without continuous, direct guidance from Treli Rhodia staff.

6.3 Conclusion

Throughout this experience, our team came to understand that gardening is much more than simply planting, watering, and harvesting. Gardening can be used for a variety of purposes, but we came to see it as a way to foster community and share knowledge with others. Our gamified gardening app combines hands-on learning with technological education to foster student engagement with environmental education and literacy. In doing so, the application reflects Treli Rhodia's organizational goals to emphasize community building, as nature's growth is similar to that of a community. Overall, the application aims to be functional as a supplement to Treli Rhodia's gardening initiatives and to expand as the organization expands its gardening programs in schools.

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Appendices

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Appendix A: Teacher Survey Consent Form and Preliminary Teacher Survey Questions

We are a group of four students from Worcester Polytechnic Institute, Massachusetts, USA, working on a collaborative project with the Self-help Promotion Program (SHPP) to develop a gamified educational app that supports sustainability and gardening initiatives in primary and secondary schools. The purpose of this survey is to assess curricular integration of sustainability and gardening material within the classroom and to inform feasible app integration within these classroom realities. We will ask questions about your teaching experience, how sustainability and gardening fit into your classroom, how students participate in and learn from these activities, the role technology plays in learning, and any practical factors that shape what is possible in your teaching environment. This survey will take approximately 10 minutes to complete. Your participation is completely voluntary, and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires, in any project reports, or in publications. Your participation is greatly appreciated. Should you have any questions or concerns, we can be reached at gr-SHPP-D26@wpi.edu or through our advisors Melissa Butler (mbutler@wpi.edu) and Robert Kinicki (rek@wpi.edu). For more information about this research or about the rights of research participants, please contact irb@wpi.edu.

Section A: Teacher Background

Q1. What grade level(s) do you currently teach?

☐ Primary (Grades ____)

☐ Secondary (Grades ____)

Q2. How many years of teaching experience do you have?

☐ 0–3 years

☐ 4–7 years

☐ 8–15 years

☐ 16+ years

Q3. What subject(s) do you primarily teach?

(Short answer) _____

Section B: Gardening & Sustainability Teaching Context

Q4. What environmental or sustainability topics are currently included in your teaching?

(Short answer) _____

Q5. How is gardening or sustainability incorporated into your classroom or school activities?

(Short answer) _____

Q6. What learning goals do you hope students achieve through gardening activities?

(Short answer) _____

Q7. How often do you incorporate garden-based or experiential learning into your curriculum?

☐ Every day

☐ 3–4 times per week

☐ 1–2 times per week

☐ Monthly

☐ Rarely

☐ Never

Section C: Student Engagement

Q8. Which aspects of gardening activities do students seem most engaged in?

(Short answer) _____

Q9. Which aspects appear most challenging for students?

(Short answer) _____

Q10. How do students typically interact during gardening lessons?

☐ Mostly collaborative group work

☐ Mix of group and individual work

☐ Mostly individual work

Section D: Technology & Learning Practices

Q11. What digital tools or technologies do students currently use for learning?

(Short answer) _____

Q12. In your experience, students respond best to:

☐ Technology-based learning

☐ Hands-on / experiential learning

☐ Lecture-style learning

☐ A combination of methods

Q13. Have you used gamified learning strategies (e.g., points, rewards, challenges, competition)?

☐ Often

☐ Sometimes

☐ Rarely

☐ Never

Section E: Home–School Learning Context

Q14. To your knowledge, do students continue gardening or sustainability activities outside of school (e.g., at home or in the community)?

☐ Often

☐ Sometimes

☐ Rarely

☐ Not sure

Section F: Classroom Constraints

Q15. What challenges limit your ability to implement gardening or sustainability activities?

(Check all that apply)

☐ Limited time

☐ Curriculum requirements

☐ Lack of resources

☐ Limited outdoor space

☐ Technology access

☐ Training/support

☐ Other: _____

Q16. Please share any additional comments about sustainability education or gardening in your classroom.

(Short answer) _____

Appendix B: Gamified App Testing Consent Form

Project Title: Developing a Gamified Educational App for Sustainability and Gardening

Investigators: WPI Student Team, gr-SHPP-D26@wpi.edu

Project Purpose:

The purpose of this project is to test a prototype of a gamified educational app designed to support sustainability and gardening initiatives. Your feedback will help improve the app's content, usability, and design for beginner-level learners.

Procedure:

You will be invited to interact with the app at the Treli Rhodia greenhouse. During the session, you will follow guided tasks in the app and share your thoughts and observations with the team. Field notes will be taken to document your feedback. No audio or video recordings will be collected unless you explicitly consent. The session will last approximately 60 minutes.

Risks and Benefits:

There are no known risks or direct benefits to participation. Your involvement will contribute to the improvement of an educational tool designed for local schools.

Use of Data:

Your input will be used by the project team to refine app features, content, and usability. All information will remain anonymous, and no identifying information will be included in reports, publications, or presentations.

Voluntary Participation:

Participation is entirely voluntary, and you may withdraw at any time without any penalty. If you have questions or would like more information about this project, please contact the team at gr-SHPP-D26@wpi.edu or our advisors, Melissa Butler (mbutler@wpi.edu) and Robert Kinicki (rek@wpi.edu). For information about your rights as a research participant, you may contact irb@wpi.edu

Appendix C: Focus Group Consent Form

Project Title: Developing a Gamified Educational App for Sustainability and Gardening

Investigators: WPI Student Team, gr-SHPP-D26@wpi.edu

Project Purpose:

The purpose of this project is to gather feedback from Treli Rhodia greenhouse workers to inform the development of a gamified educational app focused on sustainability and gardening. Your insights and experiences will help shape the app's content, usability, and overall design for beginner-level learners.

Procedure:

You are invited to participate in a focus group discussion at the Treli Rhodia greenhouse. During the session, a small group of participants will engage in a guided conversation about gardening practices, sustainability concepts, and ideas for app features. The research team will facilitate the discussion and take written notes to document key points.

No audio or video recordings will be collected unless you explicitly consent. The focus group will last approximately 60–90 minutes.

Risks and Benefits:

There are no known risks associated with participating in this focus group. While there are no direct benefits, your participation will contribute to the development of an educational tool designed to support sustainability learning in local schools.

Use of Data:

Information shared during the focus group will be used to guide the design and improvement of the application. All responses will remain anonymous, and no identifying information will be included in any reports, publications, or presentations.

Voluntary Participation:

Participation is entirely voluntary. You may choose not to answer any question and may withdraw from the focus group at any time without penalty.

Contact Information:

If you have questions or would like more information about this project, please contact the team at **gr-SHPP-D26@wpi.edu** or our advisors:

Melissa Butler (mbutler@wpi.edu)

Robert Kinicki (rek@wpi.edu)

For information about your rights as a research participant, you may contact irb@wpi.edu.

Appendix D: Parent Survey Consent Form

Survey Consent Form

We are a group of four students from Worcester Polytechnic Institute, Massachusetts, USA, and are working on a collaborative project with the Self Help Promotion Program (SHPP) to develop a gamified educational app supporting primary and secondary school sustainability and gardening initiatives. The purpose of this survey is to assess student engagement with sustainability and gardening material from the utilization of a gamified gardening application to inform feasible app integration within these classroom realities. We will ask questions about ease of use with the application, visual intuitiveness of the UI, any application components that need adjustment, and whether or not the student enjoyed using the app. This survey will take approximately 10 minutes to complete. Your participation, and your students', is completely voluntary, and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires, in any project reports, or in publications. Your participation is greatly appreciated. Should you have any questions or concerns, we can be reached at gr-SHPP-D26@wpi.edu or through our advisors Melissa Butler (mbutler@wpi.edu) and Robert Kinicki (rek@wpi.edu). For more information about this research or about the rights of research participants, please contact irb@wpi.edu.

Appendix E: Student Observation Field Guide

Observer _____

Date: _____

School: _____

Grade Level: _____

Number of Students: _____

Location

☐ Outdoor Garden

☐ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☐ Planting

☐ Harvesting

☐ Watering

☐ Maintenance

☐ Instruction

☐ Other: _____

Duration of Observation: _____ **minutes**

Engagement Indicators

A. Student Participation

- ☐ Majority actively engaged
- ☐ Some disengagement observed
- ☐ Frequent redirection needed

Notes:

B. Collaboration and Peer Interaction

- ☐ Strong teamwork
- ☐ Moderate collaboration
- ☐ Mostly individual work
- ☐ Conflict or disengagement observed

Notes:

C. Responsiveness to Teacher Instructions

- ☐ Immediate response
- ☐ Occasional clarification needed
- ☐ Frequent repetition required

Notes:

D. Use of Tools and Materials

- ☐ Confident and appropriate use
- ☐ Some uncertainty
- ☐ Limited access to materials
- ☐ Safety reminders needed

Notes:

E. Transitions Between Activities

- ☐ Smooth and efficient
- ☐ Minor downtime
- ☐ Noticeable disengagement

Notes:

Environmental Factors

Space layout effective? ☐ Yes ☐ No

Materials sufficient? ☐ Yes ☐ No

Weather: _____

Time of day: _____

Notes:

Reflections

Key Drivers of Engagement:

Barriers Observed:

Ideas for Gamification Integration:

Appendix F: Treli Rhodia Worker Focus Group Guide

Project: Gamified Sustainability Education Application Development

Location: Treli Rhodia Greenhouse

Session Duration: Approximately 60 minutes

Moderator: _____

Note Taker(s): _____

Date: _____

Number of Participants: _____

Purpose of the Focus Group

The purpose of this session is to gather insights from Treli Rhodia workers about their experiences learning gardening from a beginner perspective and to brainstorm ideas for realistic and educational game features for the sustainability learning application.

Participants are encouraged to share experiences, opinions, and suggestions openly. There are no right or wrong answers.

Opening Script (Moderator)

- Thank participants for attending.
- Explain project purpose and how feedback will inform app design.
- Remind participants:

- Participation is voluntary.
- Responses will remain anonymous.
- No identifying information will be recorded.
- The session will be documented through written notes only.
- Encourage respectful discussion and equal participation.

Section A: Gardening Learning Experience (10–15 minutes)

1. When you first began gardening here, what was most difficult to learn?
2. What skills or knowledge took the longest to understand?
3. What helped you learn gardening most effectively?
 - Watching others
 - Hands-on practice
 - Instructions or explanations
 - Trial and error
4. What mistakes do beginners commonly make?

Notes:

Section B: Beginner Challenges & Motivation (10–15 minutes)

5. What makes gardening enjoyable or motivating for beginners?
6. What causes frustration or confusion when learning gardening?

What helped you stay interested while learning?

Notes:

Section C: Brainstorming Game Features (15–20 minutes)

8. If gardening were turned into a game, what activities would work well as challenges or levels?
9. What kinds of rewards or achievements would motivate learners?
10. What should a gardening game teach first?
11. What real greenhouse tasks should definitely be included?
12. Is there anything important about learning gardening that we did not discuss?

Prompt ideas (if discussion slows):

- Progress levels

- Skill-building challenges
- Cooperative tasks
- Problem-solving scenarios

Notes:

Closing Questions (5 minutes)

13. Is there anything important about learning gardening that we did not discuss?
14. What advice would you give someone designing a gardening learning app?

Final Notes:

Moderator Reflection (Completed After Session)

Key Themes Identified:

Promising Game Ideas:

Observed Points of Agreement or Disagreement:

Implications for App Design:

Filled Out Appendices:

Appendix G: Ciera Indoor Student Observation Field Guide

Observer: Ciera St.Pierre

Date: 4/21/2026

School: Arsakeio Private School

Grade Level: 5th Grade

Number of Students: 33

Location

☐ Outdoor Garden

☒ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☐ Planting

☐ Harvesting

☐ Watering

☐ Maintenance

☒ Instruction

☐ Other: _____

Duration of Observation: 60 minutes

Engagement Indicators

A. Student Participation

- ☐ Majority actively engaged
- ☐ Some disengagement observed
- ☒ Frequent redirection needed

Notes:

Students did not engage in the lecture portion of the lesson. Students had conversations among themselves and did not pay attention to Treli Rhodia or Arsakeio staff. Students fidgeted with objects and in their chairs, and teachers and Treli Rhodia staff persuaded them to stay on task multiple times throughout the lesson.

B. Collaboration and Peer Interaction

- ☐ Strong teamwork
- ☐ Moderate collaboration
- ☐ Mostly individual work
- ☒ Conflict or disengagement observed

Notes:

Peer interaction in the classroom consisted mainly of personal conversations during the lesson. Only a few students talked to each other about answers to lesson-related questions. The same students answered nearly all the questions Treli Rhodia staff asked about plant utilization and names, while others remained disengaged with the lesson.

C. Responsiveness to Teacher Instructions

- ☐ Immediate response
- ☐ Occasional clarification needed
- ☐ Frequent repetition required

Notes:

Treli Rhodia staff had to play listening games with the students multiple times, and even then, students could not stay engaged. The teacher had to intervene multiple times as well, disciplining the students into staying focused.

D. Transitions Between Activities

- ☐ Smooth and efficient
- ☐ Minor downtime
- ☐ Noticeable disengagement

Notes:

As the class transitioned from lecture to individual on-paper work, students immediately began loud conversations and ignored the initiative. During the shift back to lecture style, students became very rowdy and loud, nearly halting the session.

Reflections

Key Drivers of Engagement:

The activity that kept students most engaged was short listening games that required them to engage with the lesson. The other aspects that kept them focused were talking among themselves to complete the tasks on paper. Students talked about their gardens back home, instead of focusing on the one they were building outside.

Barriers Observed:

Students seemed unable to stay focused during a lecture-style lesson. Many students barely paid attention to the initiative and were left in the dark when planting came around.

Appendix H: Ryan Indoor Student Observation Field Guide

Observer: Ryan Orris

Date: 21/04/2026

School: Arsekeio

Grade Level: 5th

Number of Students: 29

Location

☐ Outdoor Garden started here

☒ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☐ Planting

☐ Harvesting

☐ Watering

☐ Maintenance

☒ Instruction

☐ Other: _____

Duration of Observation: 45 minutes

Engagement Indicators

A. Student Participation

- ☒ Majority actively engaged
- ☐ Some disengagement observed
- ☐ Frequent redirection needed

Notes:

The majority of the students were actively engaged, with only several students having side conversations for the entirety of the indoor lesson.

B. Collaboration and Peer Interaction

- ☐ Strong teamwork
- ☐ Moderate collaboration
- ☒ Mostly individual work
- ☐ Conflict or disengagement observed

Notes:

Due to it be a lecture format, there was very little collaboration between students. I observed several students chatting about what I assume was what they were learning, but the majority were taking individual notes and listening to the instructor.

C. Responsiveness to Teacher Instructions

- ☒ Immediate response

☐ Occasional clarification needed

☐ Frequent repetition required

Notes:

Students were very responsive during the lecture, whenever a question was proposed typically half or more of the class raised their hands. If background conversations were getting too loud the teacher had an easy time getting the volume back to manageable levels.

E. Transitions Between Activities

☐ Smooth and efficient

☐ Minor downtime

☐ Noticeable disengagement

Notes:

As stated in the outdoor report the transition from outdoor to inside was a little bit rough, with inefficient usage of time and a lack of structure. Other than that though the transition between topics and questions was smooth.

Environmental Factors

Space layout effective? ☒ Yes ☐ No

Materials sufficient? ☒ Yes ☐ No

Weather: Indoors _____

Time of day: morning _____

Notes:

We entered into a decent sized classroom, with desks and chairs arranged around the room.

There was enough space to sit our entire group along with our two team members, and the two teachers assisting.

Reflections

Key Drivers of Engagement:

Engagement was driven by Teachers having a decent amount of control, and the kids being respectful and listening intently to the topics presented.

Barriers Observed:

No major barriers, I think they could've given out handouts to create a more engaging lecture.

Appendix I: Nikolai Indoor Student Observation Field Guide

Observer: Nikolai Margolin

Date: 4/21/2026

School: Arsakeio Private School

Grade Level: 5th Grade

Number of Students: 29

Location

☐ Outdoor Garden

☒ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☐ Planting

☐ Harvesting

☐ Watering

☐ Maintenance

☒ Instruction

☐ Other: _____

Duration of Observation: 60 minutes

Engagement Indicators

A. Student Participation

- ☐ Majority actively engaged
- ☒ Some disengagement observed
- ☐ Frequent redirection needed

Notes:

Two thirds of the students visibly disengaged from the in-class lecture. They were either having side conversations with their peers, or staring off into space. However, no redirection was ever imposed by the English teachers or the Treli Rhodia instructor. The third of students who were engaged either did so by watching the presentation, recording notes on colored paper, or raising their hand when questions were asked by the Treli Rhodia instructor.

B. Collaboration and Peer Interaction

- ☐ Strong teamwork
- ☐ Moderate collaboration
- ☐ Mostly individual work
- ☒ Conflict or disengagement observed

Notes:

Peer interaction in the classroom emerged in the form of side conversations unrelated to the presentation and braiding each other's hair.

C. Responsiveness to Teacher Instructions

- ☐ Immediate response

☐ Occasional clarification needed

☐ Frequent repetition required

Notes:

Responsiveness to teacher instructions was never observed because teacher instructions were never given.

D. Transitions Between Activities

☐ Smooth and efficient

☐ Minor downtime

☐ Noticeable disengagement

Notes:

The students who disengaged from the lesson were also disengaged in the transitions between the different segments of the lesson.

Reflections

Key Drivers of Engagement:

Students were engaged by the visual elements of the presentation and by questions prompted by the instructor.

Barriers Observed:

The majority of students were not paying attention to the presentation and even students who were engaged with the presentation and taking notes were observed crumpling up and throwing away the notes they took after the lesson ended.

Appendix J: Joe Indoor & Outdoor Student Observation Field Guide

Observer Joe Tully

Date: 4/22/2026

School: Arsakeio

Grade Level: 5th Grade

Number of Students: 33

Location

☒ Outdoor Garden

☒ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☒ Planting

☐ Harvesting

☒ Watering

☐ Maintenance

☒ Instruction

☐ Other: _____

Duration of Observation: 90 minutes

Engagement Indicators

A. Student Participation

- ☐ Majority actively engaged
- ☒ Some disengagement observed
- ☐ Frequent redirection needed

Notes:

The students were mostly engaged but often disengaged. We were told our group was the less well-behaved group, which means the teachers were expecting the students to have a hard time staying focused. At one point, there were roughly 4 to 5 students were consistently put into a timeout corner for misbehaving.

B. Collaboration and Peer Interaction

- ☒ Strong teamwork
- ☐ Moderate collaboration
- ☐ Mostly individual work
- ☐ Conflict or disengagement observed

Notes:

The students worked well together. There were a few students who were not very engaged for the whole duration of the initiative. Although the students who were engaged showed good collaborative skills while planting and watering.

C. Responsiveness to Teacher Instructions

- ☐ Immediate response

☐ Occasional clarification needed

☒ Frequent repetition required

Notes:

The students were very disruptive. They did not listen to either Katerina, the representative from Treli Rhodia, or their teacher. The students were repetitively being asked to focus, listen, and quiet down.

D. Use of Tools and Materials

☐ Confident and appropriate use

☒ Some uncertainty

☐ Limited access to materials

☐ Safety reminders needed

Notes:

Not all students were happy with the use of chicken poop for fertilizer. They were very good at watering. The only split came with fertilizing the plants; some of them did not want to touch the fertilizer, while others seemed enthusiastic about the process as a whole.

E. Transitions Between Activities

☐ Smooth and efficient

☒ Minor downtime

☐ Noticeable disengagement

Notes:

My observation group went from the classroom to the garden, which is where they wanted to be. This led them to be quick out the door, although when they were transitioning, a few groups, roughly 4-7 students, broke off and socialized in the hallways.

Environmental Factors

Space layout effective? ☒ Yes ☐ No

Materials sufficient? ☒ Yes ☐ No

Weather: Sunny with slight drizzle towards the end of the initiative

Time of day: Noon

Notes:

There was a light drizzle towards the end of the initiative, but throughout the initiative, the weather was sunny with few clouds.

Reflections

Key Drivers of Engagement:

The students were most engaged during the hands-on portion, but the biggest driver of engagement would be physically doing something. This was hard to maintain due to the smaller size of the garden.

Barriers Observed:

The garden was small. This made it difficult to allow all the students to be actively engaged in the planting process. The classroom had students sitting together and chatting, making it more of a social environment than a learning space.

Appendix K: Ciera Outdoor Student Observation Field Guide

Observer: Ciera St.Pierre

Date: 4/21/2026

School: Arsakeio Private School

Grade Level: 5th Grade

Number of Students: 33

Location

☒ Outdoor Garden

☐ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☒ Planting

☐ Harvesting

☒ Watering

☐ Maintenance

☒ Instruction

☐ Other: _____

Duration of Observation: 45 minutes

Engagement Indicators

A. Student Participation

- ☐ Majority actively engaged
- ☒ Some disengagement observed
- ☐ Frequent redirection needed

Notes:

Students in the garden seemed intensely engaged when within the actual plot of the garden, due to the garden being a small area, students had to wait their turn to actually participate. Those who were not able to physically be within the space were disengaged and playing amongst each other in the areas around the garden, but groups of engaged students and disengaged students rotated over the time the students were outside. Nearing the end of the time outside, 30 minutes after students exited the classroom, there were only 10 students left actively working in the garden.

B. Collaboration and Peer Interaction

- ☐ Strong teamwork
- ☒ Moderate collaboration
- ☐ Mostly individual work
- ☐ Conflict or disengagement observed

Notes:

Some students worked in small groups of two or three within the garden, where each student had a specific task for an individual plant. Multiple small groups were observed delegating tasks, where one student dug the hole, another replanted the herb, and another watered the plant.

Though collaboration was limited due to interpersonal student relationships (noticeable cliques/separation by gender) as well as the size of the garden limiting the number of students and how many plants could be transferred at any given time.

C. Responsiveness to Teacher Instructions

☐ Immediate response

☒ Occasional clarification needed

☐ Frequent repetition required

Notes:

Students became distracted by other tools, and some of the aspects of the garden when there was a lack of space in the plot itself. There were two teachers present, as well as Treli Rhodia staff to steer students back on track, and with most students, it took only a comment or two to steer them back into focus on the garden.

D. Use of Tools and Materials

☐ Confident and appropriate use

☒ Some uncertainty

☐ Limited access to materials

☐ Safety reminders needed

Notes:

Students only engaged with hand trowels, potted plants, fertilizer, and watering cans. Students were most confident when transferring plants from the small pots to the gardening plot and when

utilizing watering cans. Students were mostly confident with the trowels, but needed some staff instructions on how much to dig, and sometimes needed intervention to avoid being careless with the trowel and the soil. Students were least certain about the fertilizer, with only some willing to take on that task due to its contents.

E. Transitions Between Activities

☐ Smooth and efficient

☒ Minor downtime

☒ Noticeable disengagement

Notes:

The activities were done row by row in the garden, where students had the opportunity to rotate through completing tasks. Due to the plot size, many of the students had to wait their turn for space, leading to some downtime for individual groups between students. Towards the end of the gardening portion, the students were actively disengaged due to the lack of planting that was left to do in the garden.

Environmental Factors

Space layout effective? ☐ Yes ☒ No

Materials sufficient? ☒ Yes ☐ No

Weather: Slightly cloudy, moderately warm, with some sprinkling of rain at the end.

Time of day: 11:00 AM - 11:45 AM

Notes:

Students were seemingly very excited to transition from the lecture portion to the outdoor gardening portion of the initiative. Once outside, students examined the garden, and a majority lined up to begin working in it immediately. Students formed small friend groups to talk about the garden and work on tasks, and some began asking questions about the gardening tasks to the staff and teachers. Roughly halfway through the gardening portion, when most of the plot had been replanted, students began to spread out and play with each other. Many of the conversations were off topic from the initiative, but some conversations consisted of students being excited about watching the garden grow, and some about telling their families and other friends in the school.

Reflections

Key Drivers of Engagement:

The observed key drivers of engagement were students being able to participate in the garden in groups of friends, having fun with repotting the plants, and spending time outside.

Barriers Observed:

The plot itself was small, only allowing a few students at a time. Students would likely be more engaged overall if the plot were larger and more students could participate at once.

Appendix L: Ryan Outdoor Student Observation Field Guide

Observer Ryan Orris

Date: 21/04/2026

School: Arsekeio

Grade Level: 5th

Number of Students: 29

Location

☒ Outdoor Garden

☐ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☒ Planting

☐ Harvesting

☒ Watering

☐ Maintenance

☐ Instruction

☒ Other: _____

Applying fertilizer, taking the pH and moisture of the soil, and talking about plant needs

Duration of Observation: 60 minutes

Engagement Indicators

A. Student Participation☐ Majority actively engaged☒ Some disengagement observed☐ Frequent redirection needed**Notes:**

All students were very excited to start, with all students listening intently to the Treli Rhodia worker leading our group. Around half the students, while waiting their turn to participate, were walking around chatting with other students. Six boys were disengaged and goofing off in the surrounding courtyard for most of the outdoor portion.

B. Collaboration and Peer Interaction☐ Strong teamwork☐ Moderate collaboration☒ Mostly individual work☐ Conflict or disengagement observed**Notes:**

Before starting, students cliqued up into boys and girls. Once they started planting, it was mostly individual work, digging holes, watering plants, applying fertilizer

C. Responsiveness to Teacher Instructions

☐ Immediate response

☒ Occasional clarification needed

☐ Frequent repetition required

Notes:

At the start the kids were super responsive to instruction, once they started digging it got a little more rowdy but they still were responding diligently when directly addressed by a teacher or adult.

D. Use of Tools and Materials

☐ Confident and appropriate use

☒ Some uncertainty

☐ Limited access to materials

☐ Safety reminders needed

Notes:

Five students looked confident using tools, but the majority didn't know how to use spades properly. All students were adept at using a watering can and spreading fertilizer.

E. Transitions Between Activities☐ Smooth and efficient☐ Minor downtime☐ Noticeable disengagement**Notes:**

Transitioning between the different stages of planting to watering was done very well and efficient, but when it came time to transition inside after the outdoor portion this time was very inefficient and slow, with students walking around disengaged.

Environmental FactorsSpace layout effective? ☐ Yes ☐ NoMaterials sufficient? ☐ Yes ☐ No

Weather: sunny_____

Time of day: morning_____

Notes:

The plant plot was much too small for the amount of students working in it, and there were not nearly enough materials for all the students to be able to be actively involved.

Reflections**Key Drivers of Engagement:**

Students were very interested in participating in the activity, and were extremely engaged.

Barriers Observed:

My perceived reason for disengagement was the inability to directly participate in the activities,
due to the lack of tools and gardening space.

Appendix M: Nikolai Outdoor Student Observation Field Guide

Observer Nikolai Margolin

Date: 21/04/2026

School: Arsekeio

Grade Level: 5th

Number of Students: 29

Location

☒ Outdoor Garden

☐ Classroom-Based Gardening

☐ Other: _____

Type of Activity

☒ Planting

☐ Harvesting

☒ Watering

☐ Maintenance

☐ Instruction

☒ Other: _____

Applying fertilizer, taking the pH and moisture of the soil, and talking about plant needs

Duration of Observation: 45 minutes

Engagement Indicators

A. Student Participation

- ☐ Majority actively engaged
- ☒ Some disengagement observed
- ☐ Frequent redirection needed

Notes:

Before beginning three students were very excited to hold water pitchers and acted out pouring water into the soil. The students were very happy to see the Treli Rhodia staff with one student hugging the leading staff member and the rest lining up at attention for the lesson. About half the students were disengaged from the activity at any given time. They were seen crouching and standing at the perimeter of the courtyard having side conversations and kicking pine cones. They were called back one time by the leading Treli Rhodia staff member.

B. Collaboration and Peer Interaction

- ☐ Strong teamwork
- ☐ Moderate collaboration
- ☒ Mostly individual work
- ☐ Conflict or disengagement observed

Notes:

Different tasks in the gardening process were generally completed by members of the same friend group, but when engaging in the actual gardening activities they completed them mostly independently with embedding the herbs in the soil being the exception.

C. Responsiveness to Teacher Instructions☐ Immediate response☒ Occasional clarification needed☐ Frequent repetition required**Notes:**

Students were responsive to Treli Rhodia instruction at the very start of the activity but quickly began to disperse from the gardening plot, but returned when instructed to by the Treli Rhodi instructor.

D. Use of Tools and Materials☐ Confident and appropriate use☒ Some uncertainty☐ Limited access to materials☐ Safety reminders needed**Notes:**

Students were very gentle when it came to using watering cans but students who used spade were seen scooping dirt all over the place.

E. Transitions Between Activities☐ Smooth and efficient

☐ Minor downtime

☐ Noticeable disengagement

Notes:

Students transitioned between activities by disengaging when they could no longer conduct work on the gardening plot.

Environmental Factors

Space layout effective? ☐ Yes ☐ No

Materials sufficient? ☐ Yes ☐ No

Weather: Clear and Sunny

Time of day: Morning (10 AM)

Notes:

There was insufficient space, saplings, and gardening tools for students to be physically involved with the gardening process at all times.

Reflections

Key Drivers of Engagement:

Hands-on activities were the key driver of student engagement.

Barriers Observed:

Not being able to engage in every step of the gardening process caused students to be disengaged for the majority of the activity.

Appendix N: Parent-Signed Student Survey Consent Form

Survey Consent Form

We are a group of four students from Worcester Polytechnic Institute, Massachusetts, USA, and are working on a collaborative project with the Self Help Promotion Program (SHPP) to develop a gamified educational app supporting primary and secondary school sustainability and gardening initiatives. The purpose of this survey is to assess student engagement with sustainability and gardening material from the utilization of a gamified gardening application to inform feasible app integration within these classroom realities. We will ask questions about ease of use with the application, visual intuitiveness of the UI, any application components that need adjustment, and whether or not the student enjoyed using the app. This survey will take approximately 10 minutes to complete. Your participation, and your students', is completely voluntary, and you may withdraw at any time. Please remember that your answers will remain anonymous. No names or identifying information will appear on the questionnaires, in any project reports, or in publications. Your participation is greatly appreciated. Should you have any questions or concerns, we can be reached at gr-SHPP-D26@wpi.edu or through our advisors Melissa Butler (mbutler@wpi.edu) and Robert Kinicki (rek@wpi.edu). For more information about this research or about the rights of research participants, please contact irb@wpi.edu.

Three handwritten signatures in black ink. The first signature on the left is a stylized, cursive 'HJ'. The second signature below it is a more complex, cursive signature. The third signature on the right is a bold, cursive signature.

Appendix O: Treli Rhodia Signed Worker Focus Group Consent Form

Focus Group Consent Form

Project Title: Developing a Gamified Educational App for Sustainability and Gardening

Investigators: WPI Student Team, gr-SHPP-D26@wpi.edu

Project Purpose:

The purpose of this project is to gather feedback from Treli Rhodia greenhouse workers to inform the development of a gamified educational app focused on sustainability and gardening. Your insights and experiences will help shape the app's content, usability, and overall design for beginner-level learners.

Procedure:

You are invited to participate in a focus group discussion at the Treli Rhodia greenhouse. During the session, a small group of participants will engage in a guided conversation about gardening practices, sustainability concepts, and ideas for app features. The research team will facilitate the discussion and take written notes to document key points.

No audio or video recordings will be collected unless you explicitly consent. The focus group will last approximately 60–90 minutes.

Risks and Benefits:

There are no known risks associated with participating in this focus group. While there are no direct benefits, your participation will contribute to the development of an educational tool designed to support sustainability learning in local schools.

Use of Data:

Information shared during the focus group will be used to guide the design and improvement of the application. All responses will remain anonymous, and no identifying information will be included in any reports, publications, or presentations.

Voluntary Participation:

Participation is entirely voluntary. You may choose not to answer any question and may withdraw from the focus group at any time without penalty.

Contact Information:

If you have questions or would like more information about this project, please contact the team at **gr-SHPP-D26@wpi.edu** or our advisors:

Melissa Butler (mbutler@wpi.edu)

Robert Kinicki (rek@wpi.edu)

For information about your rights as a research participant, you may contact **irb@wpi.edu**.


Ajay





Chama Gidou
Huaqiao









Transcripts:

Appendix P: Student App Testing Focus Group Transcript

Unknown 0:00

All right

Speaker 1 0:10

were there any buttons that felt hard to understand what it did good

Unknown 0:22

no good, I suppose this

Unknown 0:29

button on the home

Unknown 0:33

screen with the humidity it's going to be connected to some kind of sensor, I suppose.

Speaker 1 0:43

So which one is over here? Oh, so those are your track plants. So while, while you're playing, while you have a let's say you planted a new plant, it's gonna track and it's gonna tell you when the water yeah,

Speaker 2 1:04

That was the money.

Speaker 3 1:11

Also, there was a battle on the opposite info, and at first I was a little confused, because I thought it was info about. what the app is about, like some sort of description,

Speaker 4 1:46

yeah, I mean, what do you guys think about, like, the quizzes, like you think the questions were like too easy, or like too difficult.

Unknown 1:54

There were some of them weren't mentioned on the info text. A

Speaker 5 2:17

positive thing about it was that it helped me memorize the

Unknown 2:22

information the quiz after reading

Speaker 5 2:44

here, maybe it would also help if The Information screen about the plants was in bullet points.

Speaker 4 3:13

Was there, like, a specific question in the quizzes that you guys like, particularly like, like, you found it like, super interesting.

Speaker 2 3:30

On specific question that we found interesting,

Unknown 3:40

if not, then not just say that

Speaker 3 3:45

I like the ones about dehydrating the plants. Yes,

Unknown 4:08

after the oregano. One was also interesting.

Speaker 5 4:12

The whole quiz, because oregano is generally engraved in the culture. In the Greek culture used very often. I also found that interesting. So was

Speaker 4 4:32

there anything like that was strangely in the quizzes like it,

Speaker 5 4:36

like, didn't make sense. Like, yes, there were a few sentences that were worded kind of weird,

Speaker 6 4:46

but it could be because of portrait translation. So

Speaker 7 5:05

for not. So which ones were the chocolate mint is again, stuck to mine.

Speaker 1 5:16

I might just remove that completely. Explain it well, they just wanted to have mint, and all the mint is treated the same, because they're all have the same and stuff. So I might just

Speaker 5 5:27

remember, yeah, also the information page of the detainee was that part where it was you.

Speaker 1 6:01

So? Were you guys? Like, did you guys feel like you wanted to use the app. So, like, what made you want to use

Speaker 5 6:08

the app? It was kind of motivating. It was an interesting way to learn. Awesome.

Speaker 1 6:17

Did you like the leveling system? I think I'm gonna, I'm gonna try and add some features where, once you get a certain level, you unlock, Like a profile picture or something,

Unknown 6:32

some sort of reward.

Unknown 6:44

Of luck

Unknown 6:50

animations, I guess we. the graphics, some

Speaker 5 6:56

kind of, I don't know, I felt like a picture of white. I guess,

Speaker 1 7:14

like, so you want, you're thinking like having something in the background, doing something or something we can add, like moving plants. That'd be great. Cool with a little garden in the background. Yes, I um, what do you think would make Okay, actually, that answers that question. Any of you taken a gardening class before? Yeah, so if they gave you an app like this after the class, do you think you'd use it? Do you think be.

Unknown 8:03

it would be helpful? I don't see. The question. You

Speaker 7 8:26

may see, old 13 year olds will

Speaker 7 8:44

be the 12 year olds, 13 year olds will be fine with them, whether younger children something a simpler, simpler version, or something. Yeah. Okay.

Speaker 7 9:05

Okay, look, you caught. He says that some of the words are terminology, terminology related to plants, so they're not that commonly used. I mean, when you get to order like this, okay, yeah, it's easy to understand. But

for gag and children, it may be it might need some clarification. For just some of the of the terms used, not the general text, but some of the terms might be actually, might actually need some clarification. You can discuss that in the sponsor or if you read school. I mean, if this, will the school you be elementary or middle school? Do you know

Unknown 9:54

what was the primary and secondary?

Speaker 7 10:01

Thank you. I think it has both Elementary. Okay, so if you reach a class on the elementary school, you can ask that as well, just to make sure that's awesome for younger people, maybe only they

Unknown 10:17

have the most common plan.

Unknown 10:24

Have the most common plants. No, it's not a matter of things.

Speaker 1 10:49

If you guys got to pick a reward you got for reaching new levels completing quizzes, what would you want?

Unknown 11:04

Breaks.

Unknown 11:17

Ah. You think

Speaker 8 11:23

he says that you could do like a point system, like a hood. So it's like many people in the same quiz, and they answer the questions, and there is really

Unknown 11:35

the place simultaneously, and they can

Speaker 7 11:40

something of a competition, or something like that you are familiar with,

Unknown 11:45

you have to answer quickly

Speaker 7 11:49

and correctly at the same time. It depends on the platform.

Unknown 11:53

Probably used, yeah, I gotta, I gotta figure out,

Unknown 11:58

okay, that does.

Speaker 1 12:01

I'm, this is all my stuff. So this is like you've got my brain thinking now. So all I could do great notes,

Speaker 9 12:06

even if they just become recommendations for

Speaker 3 12:14

future to my it might be cute if there was a digital garden, so if you got a quiz completely correct,

Speaker 1 12:26

I bathe one of those in a different engine, but I we didn't end up adding it. Remember? I told Bob about it. He was like, that's a simulation, not

Speaker 9 12:35

a game. Yeah, that's a great but you can put that down. But now we have, we have students who are suggesting that

Speaker 1 12:41

what might be the easiest thing to do is you can collect it, and then instead of doing Have you ever played like, those 2d shelf games where you have like levels and you have like, the little icons that you could Yeah, yes, so something like that. Okay, yeah,

Unknown 13:00

that would be if you got it grows.

Unknown 13:12

Look, give me another three months regarding

Unknown 13:30

the UI. Yeah, it was

Speaker 5 13:35

it was kind of fall off in the phone version

Speaker 5 13:54

proportions. Half of the screen was the settings and the other half was text, yeah, and the text was very the words were super small, so it was kind of hard to read, I guess. Okay,

Unknown 14:22
yeah, and then resign,

Speaker 4 14:39
as well the colors, like images and kind of the layout of the app.

Unknown 14:46
Overall, I like the red, like red

Speaker 1 14:50
switch, yeah, it was nice. I added that this morning, it took like two hours.

Speaker 1 15:00
Our sponsor, their colors are red, okay, so they asked me to put a switch in. Okay.

Speaker 7 15:14
Speaking, any part

Speaker 1 15:21
of the screen. Computer version that seemed crowded,

Unknown 15:25
that seemed empty, like there should have been something.

Unknown 15:34
Something

Unknown 15:38
tracked plants

Speaker 1 15:47
are I think we're gonna have To add some sort of animation in The background, you

Speaker 2 16:25
like I said before, get this is

Speaker 7 16:52
is another suggestion, it was referenced that perhaps you could also use some kind of Avatar, or something like that for younger children to guide them through the app, Just like, I don't know, Duolingo or something like Another that will explain the basics,

Unknown 17:18

like a tutorial. Yeah,

Speaker 1 17:48

know that because you had mentioned who was it? Who mentioned was it? One of you had mentioned about not knowing to go to the info section first. Yeah, so I think that. I think that might solve that. Yeah. What was

Unknown 18:12

your favorite part of the app Like, overall?

Unknown 18:18

What was your favorite part?

Unknown 18:22

Yes, okay,

Unknown 18:33

entrepreneur.

Speaker 7 18:40

What does XP mean? Experience, experience, okay.

Speaker 1 18:47

What do you okay, if you're Have you guys played in many video games, yeah. Okay. What would you call experience,

Speaker 3 18:58

being being comfortable moving around the game well, like what to do, okay,

Speaker 1 19:07

when, when, when we in the US. Video games give you experience, but they label

Unknown 19:22

It, XP, something like that same

Unknown 19:32

thing. So translated.

Speaker 5 19:41

I remember being younger and trying to play video games on the computer, and I had to ask my mom to translate for me.

Speaker 10 19:54

No, oh, last part,

Unknown 20:03

what's your least favorite part?

Unknown 20:07

Sorry, what was your least favorite butter?

Unknown 20:10

I shut down.

Unknown 20:15

Yep, that dies really quickly.

Unknown 20:22

Maybe the icons in the some

Unknown 20:25

of them are just some of them are in a photo.

Unknown 20:30

Yeah, we gotta go. We gotta go to go to the greenhouse and collect more photos.

Speaker 5 20:48

Also, it was, it's, I get that it's under it's in the process, but I really like the Dark mode, the dark part of it, where it worked.

Speaker 4 21:19

One way street, like anything that you didn't really like about it, I

Speaker 1 21:34

don't like it, but I don't know what to put there. So it's like, yeah, yeah. I'm thinking of texture, like a plant or like a crazy pomegranate that just sits at the bottom of the list of tracking. It just kind of sits there and goes I don't

Unknown 22:05

think we need this one, but I one.

Unknown 22:19

If you guys could describe the app in one word, what would it be?

Unknown 22:26

It can be a bad it can be a negative word,

Speaker 1 22:30

yeah, if you didn't like it. You can say bad, not great. Yeah, no, but I want to know if they didn't like it. I'd rather know that than have to

Unknown 22:44

smart, smart

Unknown 22:48

like that one.

Unknown 22:52

I want to get one for each of you. Yeah, give me a word

Unknown 22:57

I want to think about.

Unknown 22:59

Okay, the first

Unknown 23:02

one that came to my mind is green, but that's good. Yeah?

Unknown 23:16

Didn't experience what appealed to me the most.

Unknown 23:33

Yes, yes,

Speaker 6 23:45

no, oh, maybe trivia.

Speaker 8 24:13

Maybe you could, instead of the XP, or along with XP, you could have, like, so not stats, but like a loading thing, where, like, when you read the text, or you play a quiz, and you go, Well, it's

Unknown 24:31

you gain, like, some

Unknown 24:39

tracks in progress. I

Unknown 24:57

Is there a way to identify your mistakes?

Unknown 25:03

Oh yes, yeah, we have that. Yeah.

Unknown 25:12

Just stomp.

Unknown 25:27

If you want to walk, he skips, skips.

Unknown 25:35

Games, thank you so much for your help.

Unknown 25:45

Thank you. Thank you Now we celebrate. Yeah.

Transcribed by <https://otter.ai>

Appendix Q: Treli Rhodia Worker Focus Group Transcript

Unknown 0:00

Um,

Unknown 0:15

yeah, so basically, like, this will be a photo script to talk about, like, the design of the app

Unknown 0:24

that we're making, super helpful for us making the app

Unknown 0:34

registration is voluntary, so anything like you don't have to contribute anything respond, all the responses will remain, like, anonymous, so we won't, like be giving your name out to anybody.

Unknown 0:46

No identifying information will be recorded. So like, no names or anything will be in this and then, yeah, the session will be documented through just written notes, through, like, the transcript here, and also just with me, like typing and then taking notes, yeah, getting Okay, perfect.

Unknown 1:08

So, yeah, we'll just start off with, like, you're like, the gardening learning experience that you guys went through. So like, when you first began gardening here, what was, like the most difficult thing to learn about, like, Gardening in the greenhouse?

Unknown 1:22

Oh, no.

Unknown 1:30

Energy House. Let's have

Unknown 1:33

some time for her to translate

Unknown 1:42

the say the

Unknown 1:46

question gardening, when you first began gardening, what was like? The most difficult thing to learn? Okay, you

Unknown 2:10

of I think everything was difficult the start with the same

Unknown 2:21
heat.

Unknown 2:25
Because it was new. We are not we were not farmers, so everything new is difficult the start.

Unknown 2:42
Let cutting and like

Unknown 2:49
learning how to do the cutting score gate, the second is, like the beginning, the beginning of plants without disturbing them. Or like cutting where you're not supposed to. And the third thing is learning how, because you have this machinery that does the soil

Unknown 3:13
that we have, like zeolite, etc, so learning how to do this machinery and remembering what you should use in the

Unknown 3:31
soil we will need To chair two more

Unknown 3:38
chairs.

Unknown 3:41
It's not Bob or Melissa. It's one of the students from Aristotle who's been working with us. Okay,

Unknown 3:52
anything else about the gardening?

Unknown 3:58
Okay, yeah, definitely.

Unknown 4:01
Okay. Do you want me to do?

Unknown 4:05
Actually, okay, because I'm not working in this question about the all in the pomegranate fog to think overall. Just kidding,

Unknown 4:22
the lack of tools and the lack of experience.

Unknown 4:33

And I think one of the difficulties that you had it was when we what if, when we plant, when we have to start the planting?

Unknown 4:51

Yes, when we collect the seeds,

Unknown 4:55

conserve the seeds, things like this. That very specific, a lack of technical knowledge,

Unknown 5:06

and they used to do a lot of experiments

Unknown 5:13

in

Unknown 5:20

sea burn. It's.

Unknown 5:29

See

Unknown 5:35

specifically which skills were most difficult to learn.

Unknown 5:41

Yes, it Yeah,

Unknown 5:50

to collaborate and to work syndrome is many, synchronous, coordinated to work coordinated,

Unknown 6:09

to be responsible about the tools that we use. Not let it, not let the tools all over the nursery and about our Colleagues, yes, the communication,

Unknown 6:31

it's

Unknown 6:38

too tidy. Tidy. The tools.

Unknown 6:50

Okay?

Unknown 7:00

Way.

Unknown 7:09

Okay, other skills that like, what skills or knowledge took like the longest to understand or like were the most difficult to

Unknown 7:22

learn. You're gonna skills,

Unknown 7:27

right? Yeah, I think every new skill wanted from us the same amount of energy to learn or to but the.

Unknown 7:36

Amount of energy to learn or to but the difficult, I think the most difficult, was the was the most dangerous tools? Okay? Because they are dangerous. Yeah, really dangerous.

Unknown 7:52

What tools are dangerous? We have a lot of cutting tools, wheels, cutting wheels, motors that we do the pruning, or knives we do the pruning, or motors with blades that cut the grass. I

Unknown 8:32

My professionals,

Unknown 8:34

all easy,

Unknown 8:52

God it

Unknown 8:57

is

Unknown 9:02

okay,

Unknown 9:09

Doxy to Scale.

Unknown 9:16

Na,

Unknown 9:30

Orris telecast,

Unknown 9:43
guy to the

Unknown 9:44
It to

Unknown 9:44
point, but again.

Unknown 9:45
the point it's weird to get stuff organized and have it at the same place
that you left it. And she's very perfectionist about that.

Unknown 9:59
I think it's more complicated, because in a nursery like this, you have to
do a lot of jobs different between them. So maybe I'm very good at the
prunings, but I'm not good at the organizing things, or I'm not good
talking with the customers. We you have. We are always on a so you have
different people for different qualities, yes and customer

Unknown 10:36
asked me,

Unknown 10:46
we are talking about the skills continue.

Unknown 10:56
So while you were learning, like, how to garden out of I have a couple
like options like, but I guess what allowed you to learn like the most was
it like watching others hands on practice instructions or explanations
from somebody, or just trial and error, or just Just what, or trial and
error. So

Unknown 11:22
like, leopards now he must wait for the either me to

Unknown 11:36
bring the activity.

Unknown 11:39
My

Unknown 11:43
fellow does.

Unknown 11:44

Club you believe. So they started

Unknown 11:47

Give you the.

Unknown 11:52

by watching other people do it, and then they got into it themselves, and they watched other videos or read a lot, and then the experience came, and

Unknown 12:05

with the hands on.

Unknown 12:12

Also, we do a lot of like observing.

Unknown 12:17

That I think has been really helpful to like learn more about gardening. We observe what works and what does not like you were saying about the ash out back in the trees taller than the others, yeah, yeah.

Unknown 12:37

And then

Unknown 12:39

they were sharing the information.

Unknown 12:43

Someone was studying something, and we we had groups that we communicate, we communicate knowledge, the knowledge, yes, we had the group, like self paced the reading studying group, like a study group, basically. But we didn't have, like someone expert. We had a text or a book, some of us against some chapters and to the others, yes,

Unknown 13:21

and by asking some experts, yeah, like contacting the

Unknown 13:32

come.

Unknown 13:36

Last

Unknown 13:39

Yes, she.

Unknown 13:39

Yes.

Unknown 13:42

So while you're like, teaching people how to garden, what's like, what are the common mistakes that people make when they're gardening, or, like, when they're starting

Unknown 13:57

to garden here in the

Unknown 14:01

up.

Unknown 14:12

All the economy.

Unknown 14:15

Pure key, no problem. A beginner, see,

Unknown 14:44

I

Unknown 14:48

love

Unknown 15:02

it, basically, if you love it,

Unknown 15:16

so you're saying that, basically, if you hold it, you observe it more, and you'll get better at it easier.

Unknown 15:24

People want tips, specific tips, but there, what he wants to say is that there are not specific tips. You have to observe the the plant because, as he said, as he usually, usually says, that a plant is like a human person.

Unknown 15:44

Plant is like a human person. If the temperature is like this, we are okay, not very cold, but very warm. Yes,

Unknown 15:56

they have to observe the plant the weather.

Unknown 16:00

I

Unknown 16:04
the water

Unknown 16:09
and people are not so patient.

Unknown 16:15
That's a big problem. They teach them generation to be patient.

Unknown 16:26
We're fantastic, especially at schools, I have noticed that that they really confuse even simple plants between them. So basically, like organic with Ghost Magi, they tend to like they don't even know what simple plants look like, what the tomato look like, or that or that, not all the Plants have. They have the same needs. Yeah, yeah.

Unknown 16:59
I

Unknown 17:22
Know God, what makes

Unknown 17:46
garlic? Gardening enjoyable or like motivating for beginner gardeners

Unknown 18:04
and the best.

Unknown 18:05
The best thing that first someone notices about gardening is a growth of the of the plant, the whole procedure from the seed to the little baby plan that goes on. This is something like an everyday miracle,

Unknown 18:32
congratulations myself and to the plant, something like that.

Unknown 18:40
I think also it's a bit like occupational therapy, like I remember for myself when I started here not doing even doing something, and having to be really careful with what you do, or like dealing, because plants are really delicate. So this attention that you give for me, can be like, really rewarding, like taking your mind off of things, you know,

Unknown 19:10
Singapore, it's a healing procedure. You like it or don't, because you have to be patient. If I'm not patient in my life, I have to be patient. So this procedure changes, okay, this is very, very nice, very

Unknown 19:29
relaxing procedure. It's

Unknown 19:31
also all about nature. So yes, and we are connected,

Unknown 19:38
also without, like realizing the changes of nature. For me like that, you start to notice, and that becomes really rewarding. You start like paying attention to little things that they suddenly become really important, you know, things that you would both pass by, the weather, the temperature. I wouldn't check the temperature every day, because I would go out on the balcony, but now I have to check.

Unknown 20:00
Don't check the temperature every day, because I would go out on the balcony, but now I have to check the temperature every day, or like noticing when the first three blooms, when the first flower, like wild flower blooms, because it's a message that you have to like. And starting to understand this message can be really rewarding and motivating positive, feeling responsibility.

Unknown 20:24
You have to be responsible for this living thing so you want it or you don't. You have to be there for this plan.

Unknown 20:41
You

Unknown 20:48
small

Unknown 20:53
movements, like small elements and

Unknown 21:00
small movements, like small elements. And no one can decide it depends on exactly what you do, because you

Unknown 21:08
either you'll be outside and do like more pleasure and like work out a lot more, or you'll do inside

Unknown 21:19
work, which is more delicate. Inside

Unknown 21:23

work which is more delicate,

Unknown 21:30

and like the context that we said, it is a really

Unknown 21:35

delicate process in a category you have, like a job office.

Unknown 21:46

Okay, so this one's more about the gardening initiatives and the people involved in those what made you guys want to start the gardening initiatives with the schools who.

Unknown 21:52

What made you guys want to start the gardening

Unknown 21:58

initiatives

Unknown 22:04

with the schools?

Unknown 22:08

It was milondas, my

Unknown 22:14

economy. Extra Orris

Unknown 22:21

that I see. First of all, it's a valid income

Unknown 22:30

checking out the poly.

Unknown 22:33

On

Unknown 22:39

the gas

Unknown 22:44

and opera all you can already touch. It's details and enough talk as I'm economical, or in audionica Thomas that ignosima Lady of the mass America's massive a need test, yet my seat was the applause This man and trouble the lady party is the ethicacies. So it's also a cultural thing without

Unknown 23:28

Sharing knowledge and getting the young people into more nature stuff.
We're very like digital wise, not

Unknown 23:28

sharing.

Unknown 23:45

there, like nurseries, they grow people. So also, what amasses said is that when we sell plants, we have two seasons to sell plants, one and a half seasons sell plants. And we were trying to, like, find ideas on what we can do that will help us be financial, sustainable,

Unknown 24:12

sustainable. Sorry, in

Unknown 24:14

other seasons too, and that's how the idea started. But if I can continue, have you finished? If I had to continue like I remember when we started writing the educational like proposition that we have, that we send to schools. Yeah, I personally, at least, I realized how amazing this will be. Like, I remember a guy thing with a girl. Look, she's not here. I mean, she's not at the level again currently, but we were guiding together with her. And I would get like, excited of the idea of, like, on how many ways we can connect what we do about nature, what we do about gardening, with other things, with like making the kids responsible for something, because I believe this is a real problem that we have, that our

Unknown 25:02

society is a Forget of responsibility.

Unknown 25:07

Make them understand, like being patient, achieving soft skills while gardening, and also, like even connecting it. We haven't done this yet, but with like older people, like adults and like older teenagers, connecting it, even with social issues, what it means to have a hearing variety and not to have to buy seeds every year. Yeah, it's a type of freedom, and for me, at least like it's what motivates me also like to to be able to teach people how they can be forgiven regarding their food and have they like this knowledge not

Unknown 25:51

to be addicted. You know, in all these big companies that sell seeds and sell food and all this thing, yeah, and also, the last thing for me is, like creating community, which was also, like, really motivating to see that you can you got use gardening as a community.

Unknown 26:00

For me is like creating community, which was also, like, really motivating to see that you can you got use gardening as a community tool. Community

Unknown 26:14

is important, and it's also a culture about community. Our whole idea is about community and learning together. And yeah, our sport, my sports team, is the exact same way. It's about teaching each other and helping everyone grow to be a better person. Yeah,

Unknown 26:33

awesome. And then, sorry. One more question for me.

Unknown 26:40

This is more on the app, application side of things. So what we're working on,

Unknown 26:45

would you say, Yeah, okay,

Unknown 26:49

sorry, what would be helpful for us to put into the app that you guys would be helpful to you Guys during your gardening initiatives, what you're teaching students.

Unknown 27:19

What about you mean information wise. Information wise features, like things they

Unknown 27:31

want this, I say lemonade stuff for Yeah,

Unknown 27:46

for me, one strategy that I have is that a lot of time, many times, we have a lot of information that, as you see, it's not always easy to pass this Information, because a class might be how do maybe

Unknown 28:03

or maybe they have other questions, so like, having a full identity of the plan how to care for it and how to use it after, like, when to harvest it, when, how to like, dry out and etc, it would be really helpful, because now every time we finish, very often, not every time we have to send to teach sex, okay, we planted these plants and like we have to guide them.

Unknown 28:24

Game. We have to send to teachers. Okay, we planted these plants, and you can like, we have to write an image every time with this information so it doesn't get lost. So I think it will be really useful, not how to guide and be like, Okay, now you take the app and you have everything here, and if you need something, you call it, but you have the basic information of and usage.

Unknown 28:48

And we can also mention a feedback procedure

Unknown 28:53

after the educational program so the students could

Unknown 29:05

me. Sorry your feedback

Unknown 29:12

writing, and they would prefer it if it was on the

Unknown 29:24

same handwriting, yeah, and they would prefer it if it was on the app, it would be easier not to bug in. Yeah. Have to hand them all out and get them all back then scan all of them. Yep.

Unknown 29:40

To all this paper, I answer

Unknown 29:49

pieces in a voice article. No mean exactly monoto motivates.

Unknown 29:52

Okay, so she

Unknown 30:01

said to

Unknown 30:12

for more healing. Okay, so she said it will be really helpful if you could find a way to make it more motivational for people to like use the app and actually gain some knowledge on everything that was the need to end up was in a semantic co after Gunn Yeti body cup is a boy my Spotify. I didn't get to tell you.

Unknown 30:53

I told Kara, told Katerina. We had a study group with six students. Yes, she told me, and they

Unknown 31:00

all said it was, it was easier to learn from the app than it was, yeah, yes,

Unknown 31:05

because what they were from, private school, public public school. Okay, so a little bit different. But no, we want to go just anything that's proof of proof that they will learn from it. Yes, because they we can give them the first input that is an input that they are used to. This because all children plays with apps, with games. So for them, it would be more attractive to start with something that is very familiar, familiar to them, yes, or games to start with question, Orris games

Unknown 31:58

mini tests.

Unknown 32:00

Right now, we just have a level system, but a lot of the input was they want collectibles, like they want to unlock certain things within the app. Oh, nice that maybe they could unlock next? Yes, it's nice for me too. It's nice if I have a game that I have to to reach another level or there is a challenge children might get addicted.

Unknown 32:38

We have told that it will be something that they have to collaborate to to achieve, to the process, to the process. For example, I get, I get this information, I can share it with other, with the other so I can help others to unlock my classmates. Yes, my classmates, you can have it so that the whole class has to reach a certain threshold for all of the students to get a certain prize within that class. Yes, because maybe someone is more motivated and has more time or is more interested in what we are doing, but we have to find the way that this person we want to advance has to help other people and they can the whole person.

Unknown 33:39

Success is to reach the same target altogether, teamwork. Go collaborate more if they have a shared goal. Exactly, yes, if, because I used to teach in sisolia in high schools, and I used to do competitions or games like this. I realized that some people, for example, I'm a Spanish teacher, like Spanish more than other, or they want they study more, or they have more time. So after some time, I changed my way to teach, and I said, you will reach this target if you help

Unknown 34:32

the other. It was like the millionaire. I was doing a game like the millionaire,

Unknown 34:40

you have to ask the opinion of the expert. I was the expert. You have to ask to collaborate with two of the classmates. Or you have, you have five minutes to open the book, but only five minutes to because you have to know where the information is, so open the book is also important. And or we have, you have to check there the information, the information, the information.

Unknown 35:23

It's kind of the same way that we work here, sharing the knowledge and helping each other do.

Unknown 35:28

It and helping each other.

Unknown 35:31

Yeah, the community that we were talking about, basically, and so what student that is more? It was egocentric.

Unknown 35:44

Egocentric.

Unknown 35:47

Have to change this. This feature, feature, it

Unknown 35:54

has to collaborate to success.

Unknown 36:00

It is a way to promote different values on children. Yeah, this, this kind of education, not just to to give knowledge, but to give a new way for them to learn, to communicate and to share and to live their their life with these values. It is, it's a good way, a nice example that is, that is good enough to play my legal history.

Unknown 36:35

And then he says in me, Oh, mother, classical is a sin after a London age of officially, no mother in a synthetic para polymer, yeah. Anthropy must the better. So she's saying that it's the same thing. They always say that you you might want to get somewhere on your own, but you might not be able to. So, you know, the background other kids in this specific subject? It's a way we work in rehabilitation and like Battle addiction, we speak a lot that, like, you cannot battle addiction alone. You cannot stop using a lot. You need the group. You need the team. For that, it's the same like culture, like type of

Unknown 37:26

teaching how to reach out for help when you need it. Exactly, exactly. And I didn't know who was with me when I was in the school. You too. Okay, I told children,

Unknown 37:45

reach out for help. Don't do it on your own. If you cannot dig,

Unknown 37:52

ask for help. That is very important, and it is connected to the prior.

Unknown 38:00

It's not pushing a dynamic. It's not

Unknown 38:06

a

Unknown 38:10

weakness. It's 20 the different

Unknown 38:17

schools, I think

Unknown 38:22

it's very like, maybe they can do it, but they they have to complete an exercise. They have to ask someone else help,

Unknown 38:37

yes, to complete and to achieve something. Yeah, what if, like in the quizzes, if they get problems wrong, at the end of the quiz, there's just a message, just encouraging, hey, ask your friends for help for the problems you got wrong. And we also see a lot of times that someone is more in pure egos. We could faster, quicker, and he stomach. I He stops. He finished.

Unknown 39:10

He finishes what He and then he lose the motivation. The motivation starts to bother other children, so the whole exercise has to finish when everyone and if they want to finish earlier. They have to to help each other.

Unknown 39:35

They get it or not. They can get motivated to other people either help them, where, like, where, like, you can only move on from one question to the next after everyone's answered it. Yes, yes. So they have, they have to help the other since they want to finish, or we have, like, a, did you all play gym kit?

Unknown 39:56

Because they have this, this game where your entire class is answering questions from a certain set of questions, but you all have a shared money bank, and so certain students, if they purchase too many, like, power ups for themselves, it like,

Unknown 40:17

yeah. It makes other kids like, yeah. It like, negatively affects the other students. So you can't win the game if all the students aren't, like, alive at the end, or like, all the money is spent, but like, half the students are in the pit of lava because you have to, you're buying survival things, like bricks to help you build up. So you have to, like, work as a group for all of the students to not get in the lava. And if other students get greedy, then you just kill off your other classmates in the lava, and then no one wins, or we have to.

Unknown 40:56

We can think that the one of one step is like, we combine, we collect information that everyone has to put something to be complete.

Unknown 41:15

The like a secret, like a puzzle, like I have, like I have a piece, someone has another piece, and Katrina has another piece. So the three pieces can

Unknown 41:33

exactly could be, I have the name of the plant, but Nico has the way to care for it, and guyan has the usage, and he knows like, like to get the beat, like to get the guys, both three of us have to match the yes they care.

Unknown 41:50

Unlock,

Unknown 41:58

connect the puzzle and unlock the next stage? Yeah, yes, I don't know if it's

Unknown 42:07

we give ideas you

Unknown 42:10

guys,

Unknown 42:25

what if

Unknown 42:26

you do the quizzes and come off and questions wrong. And then when you take a quiz again, you

Unknown 42:35

can talk to your friend and get help, and then you get the answer right at the end of the quiz will be like, Wow, I did better. Did you get any help? And then you just put in the name of, like, the account that helped you, and they get a medal. I don't know how, like, Okay,

Unknown 42:50

I so when I

Unknown 42:56

was teaching the most difficult thing was the children that were that weren't motivated, and they used to to bother to they want to parent, to take their attention. So I used to give them a specific role, A role of role of another. To,

Unknown 43:48

okay mini break.

Unknown 43:52

Two minute break.

Unknown 43:56

Let's do you want to know anything else

Unknown 44:03

we can continue?

Unknown 44:09

Yeah, I have like, one more question before, like,

Unknown 44:12

Maybe so, like, when you're doing your programs, what information that is, like, critical to the gardening tends to get, like, left out because you don't have enough time with the students. So you'd be super good to have, like, in the

Unknown 44:30

political

Unknown 44:44

like for their with their programs, like In the schools, like what gets locked up, deep Jack,

Unknown 44:55

after care, after care and the usage of the plant, the

Unknown 45:03

usage of the plant, the

Unknown 45:28

really

Unknown 45:39

helpful, I Think

Unknown 45:46

so.

Unknown 45:48

It

Unknown 46:18

Irishman

Unknown 46:41

if

Unknown 46:56

They

Unknown 47:01

get

Unknown 47:19

was

Unknown 47:23

like the mistake

Unknown 47:26

during The quiz.

Unknown 47:29

It's public. Anyone can access,

Unknown 47:36

I'm telling

Unknown 47:41

you, like,

Unknown 47:48

okay, proud of myself. He lived in Africa

Unknown 48:06

for a year.

Unknown 48:12

Be

Unknown 48:22

you get finished, but I finished?

Unknown 48:30

Is there any other things that we can see on the up? So there's a couple of quizzes.

Unknown 48:38

Give give them Vasilis, who is the expert here, the original farmer, awesome. So there's one on Disney, and then there's also one on. And then

Unknown 48:53

you can also oregano, okay, go here and you can look at the different plants.

Unknown 48:57

Okay,

Unknown 49:01

we have a very normal class.

Unknown 49:18

I was doing my job. I was doing my job too.

Unknown 49:28

It was pretty bad. And

Unknown 49:32

then he called me a big, giant walrus.

Unknown 49:42

Actually, he has no friends.

Unknown 49:45

He has he has six friends, and you're five,

Unknown 49:51

teacher, the teacher, like, I was like talking. It

Unknown 49:58

was like, Oh, my God, he's

Unknown 50:03

such, if you guys want to use it to.

Unknown 50:03

Such. If you guys want to use it, put that link into a search bar. It'll take you to a page. If you hit Enter, there was a script of boys that

Unknown 50:19

like left and they were like, all should load if it's not already signed in they love

Unknown 50:27

Kim Jong Un over

Unknown 50:32

there. I

Unknown 50:33

need

Unknown 50:47

that

Unknown 50:52

okay.

Unknown 50:57

The only problem would be, we would have needed a bunch

Unknown 51:02

of gonna get into my

Unknown 51:17

phone.

Unknown 51:32

Google.

Unknown 51:37

To

Unknown 51:42

you,

Unknown 52:03
oh, eight out of eight.

Unknown 52:07
Oregano,

Unknown 52:10
The the Oregon of wins,

Unknown 52:31
are

Unknown 52:35
use it here.

Unknown 52:42
Maybe

Unknown 52:47
I just, I just looked

Unknown 53:02
it

Unknown 53:06
up.

Unknown 53:08
Here, go. Movie,

Unknown 53:41
completely First,

Unknown 53:57
decent,

Unknown 54:10
Things

Unknown 54:21
You

Unknown 54:28
victim.

Unknown 54:49

You Playing

Unknown 55:05

to

Unknown 55:18

solid each edge around the

Unknown 55:25

edges I can

Unknown 55:37

or my mom,

Unknown 55:42

like My hair is like puffed down.

Unknown 55:48

Look at any Oh, my God. A little bit

Unknown 56:21

more information.

Unknown 56:23

Lift

Unknown 56:30

up.

Transcribed by <https://otter.ai>

Screenshots:

Appendix R: Untranslated Design Screenshots

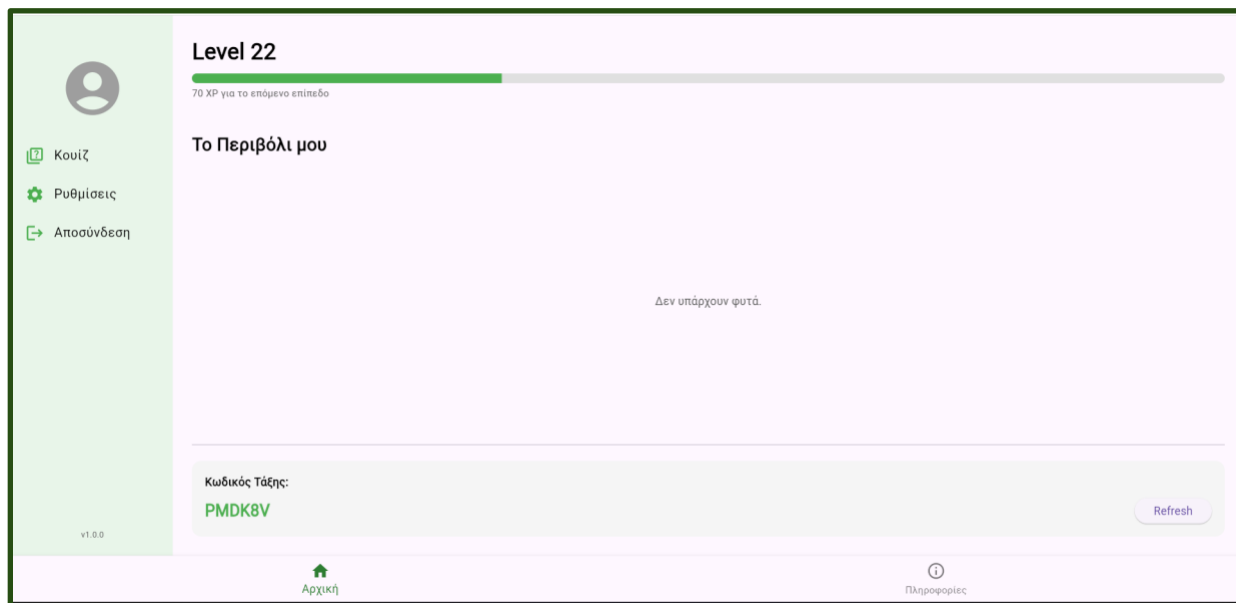


Figure 5.1 - Home Page

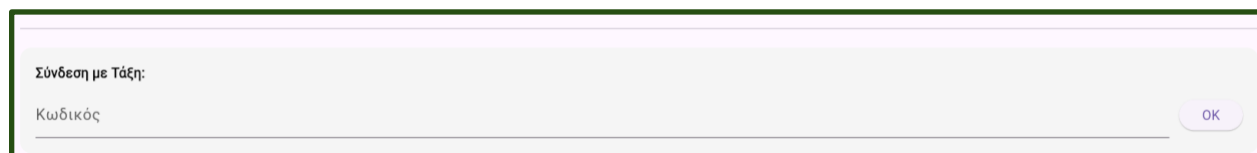


Figure 5.2 - Student Class Join Section

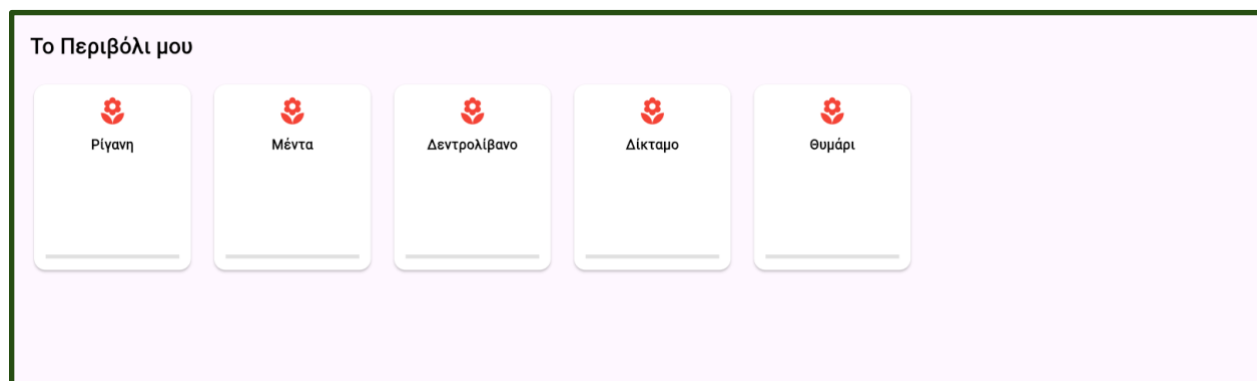


Figure 5.4 - Plant Tracking Function on Home Screen

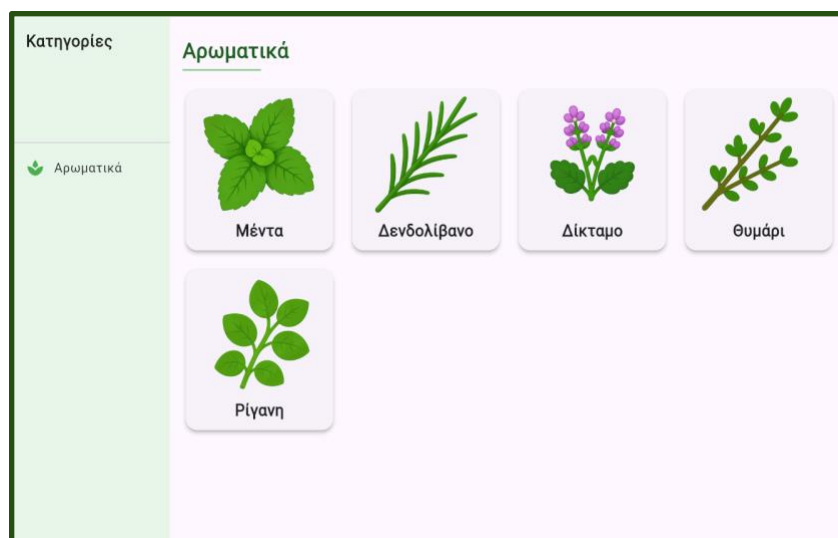


Figure 5.5 - Info Screen

Δεντρολίβανο

Περιγραφή

Το έρπον δενδρολίβανο (*Rosmarinus officinalis prostratus*) είναι ένα αειθαλές, πολυετές φυτό, το οποίο εξελίσσεται σε έναν μεγάλο, πυκνό θάμνο που απλώνει τα κλαδιά του πλευρικά. Είναι ένα από τα πιο ανθεκτικά αρωματικά φυτά, τόσο σε γλάστρα όσο και στο έδαφος. Την άνοιξη και το φθινόπωρο παράγει μικρά λευκά άνθη. Προτιμά ηλιόλουστα, ξηρά περιβάλλοντα και, αν φυτευτεί στο έδαφος μπορεί να ποτίζεται αποκλειστικά από την βροχή. Καθ' όλη την διάρκεια του έτους μπορείτε να συλλέξετε τα φύλλα για την μαγειρική. Τα άνθη του προσελκύουν τις μέλισσες και γι' αυτό χρησιμοποιούνται ευρέως στην μελισσοκομία. Έχει περιγραφεί ως παραδοσιακό φαρμακευτικό πρώτο γι' τη αντιμετώπιση της δυσρεψίας, δυστηγόρροιας και του πονοκεφάλου.

Φροντίδα

Προτιμά ηλιόλουστο, ξηρό και ζεστό περιβάλλον. Είναι ανθεκτικό στον παγετό και τις χαμηλές θερμοκρασίες. Έχει χαμηλές έως ελάχιστες απαιτήσεις σε πότισμα. Τα ωριμα φυτά μπορούν να βασιστούν μόνο στη βροχόπτωση, εφόσον η ετήσια βροχή υπερβαίνει τα 400 χιλιοστά.

Επιλογή φυτού
Κλείσιμο

Figure 5.6 - Plant Info Card

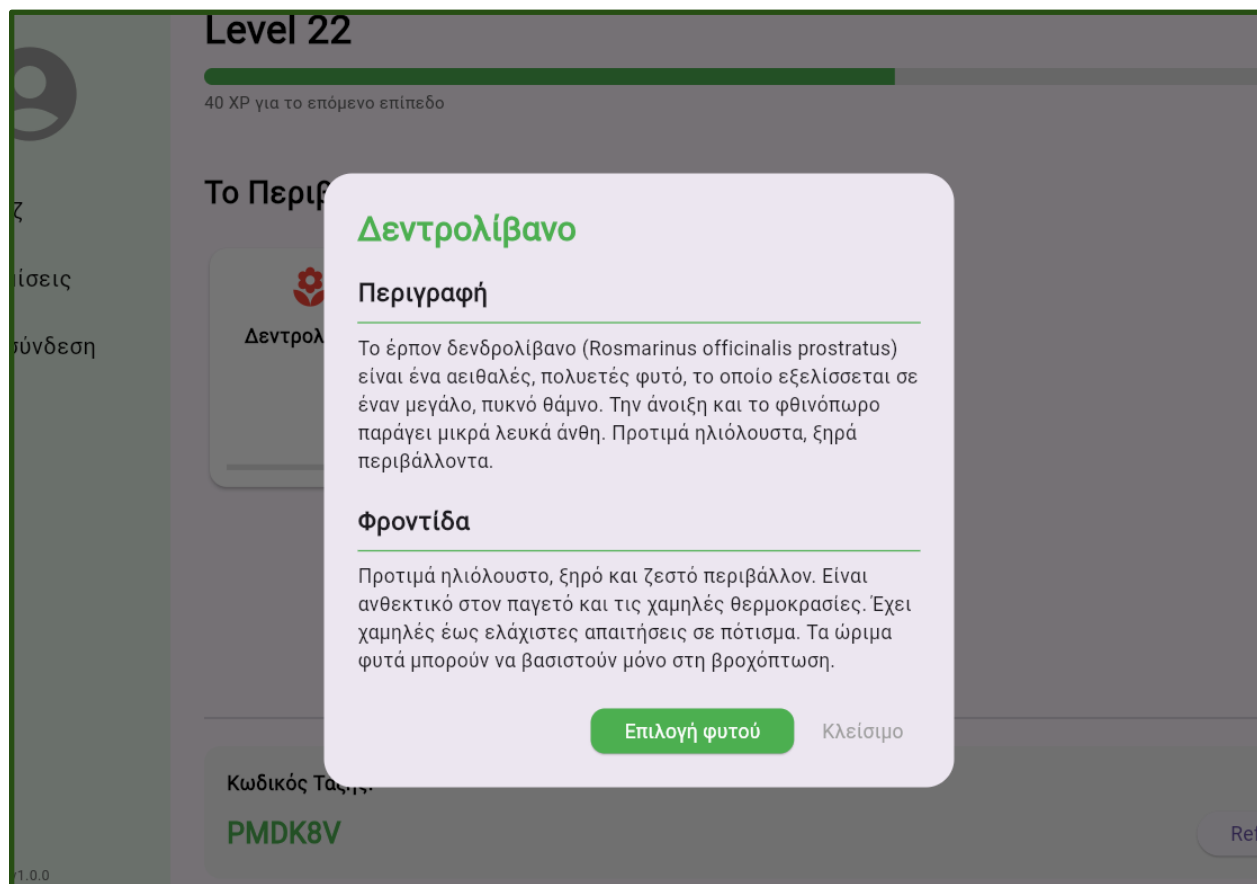


Figure 5.7 - Info Card on Main Screen

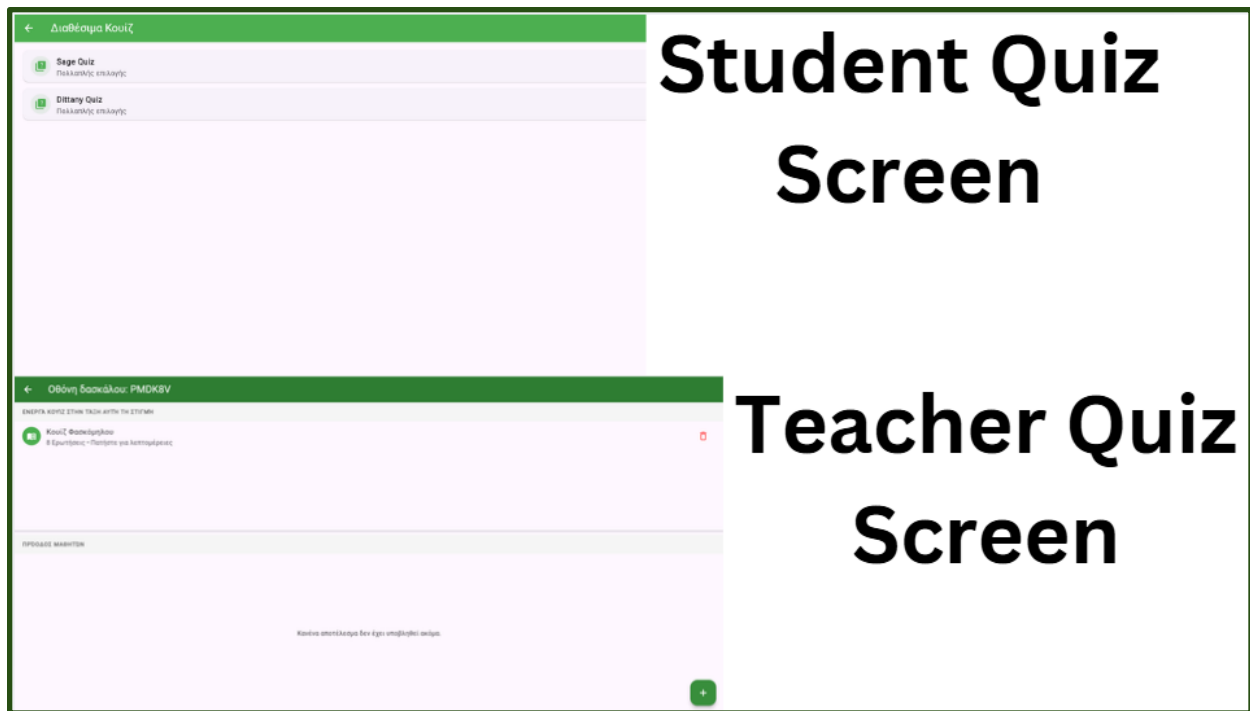


Figure 5.8 - Quiz Screen



Figure 5.9 - Quiz Bank

← Κουίζ Φασκόμηλου

Question 1 of 8

Πότε είναι η καλύτερη περίοδος για τη συγκομιδή του φασκόμηλου;

Μετά την ανθοφορία

Λίγο πριν την ανθοφορία

Στα μέσα του χειμώνα

Μόνο κατά τον πρώτο χρόνο

Figure 5.10 - Quiz Layout

Question 2 of 8

Πόσες φορές το χρόνο μπορεί, συνήθως, να γίνει η συγκομιδή του φασκόμηλου, μετά το δεύτερο χρόνο;

Τρεις φορές

Μία φορά

Μόνο κάθε δύο χρόνια

Δύο φορές

Figure 5.11 - Wrong Answer Flash Function

← Ρυθμίσεις

☀ Σκούρα εμφάνιση

🔴 Κόκκινη εμφάνιση
Αλλαγή από πράσινη σε κόκκινη εμφάνιση

🔊 Μουσική υπόκρουση
Σίγαση

Τρόπος λειτουργίας

➕ Προσθήκη φυτού
Χρησιμοποιήστε το κουμπί 'Προσθήκη φυτού' για να ξεκινήσετε την παρακολούθηση του φυτού σας.

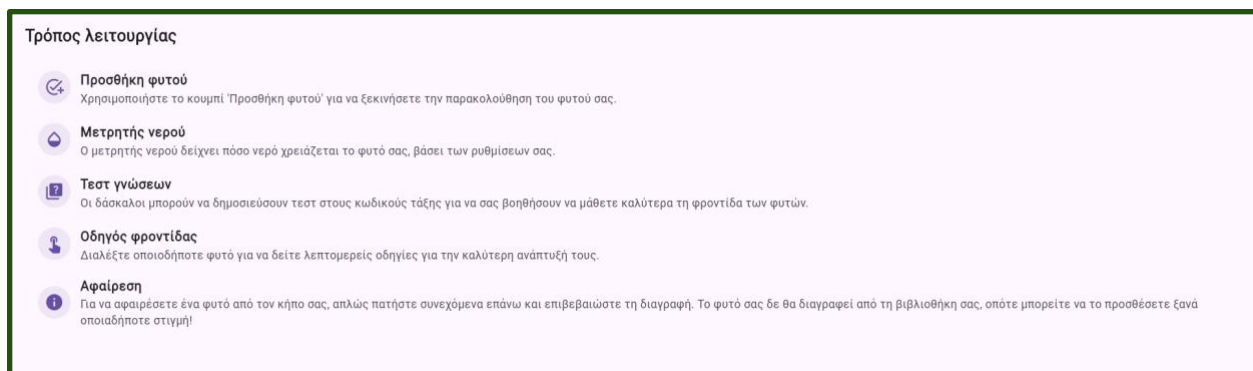
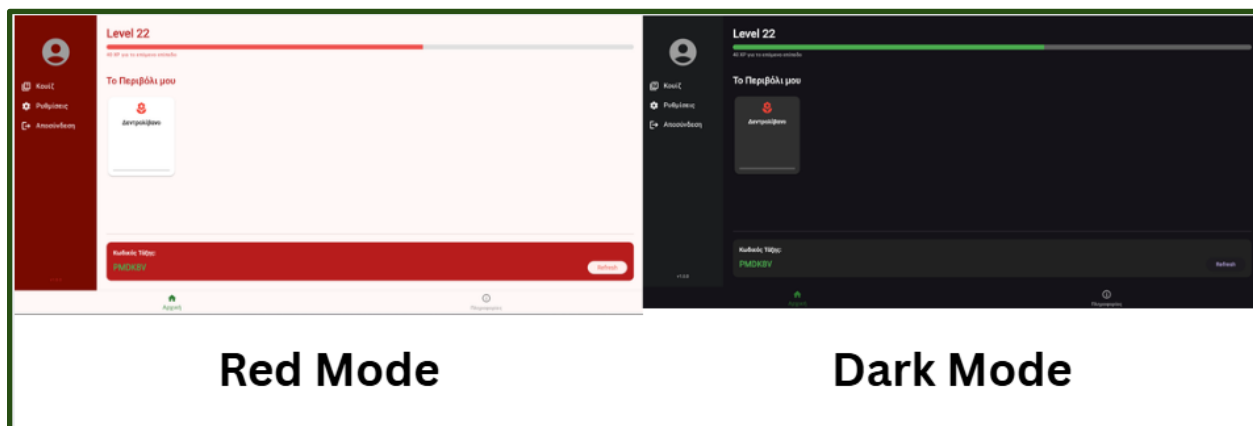
📊 Μετρητής νερού
Ο μετρητής νερού δείχνει πόσο νερό χρειάζεται το φυτό σας, βάσει των ρυθμίσεων σας.

📖 Τεστ γνώσεων
Οι δάσκαλοι μπορούν να δημοσιεύσουν τεστ στους κωδικούς τάξης για να σας βοηθήσουν να μάθετε καλύτερα τη φροντίδα των φυτών.

📍 Οδηγός φροντίδας
Διαλέξτε οποιοδήποτε φυτό για να δείτε λεπτομερείς οδηγίες για την καλύτερη ανάπτυξη τους.

🗑 Αφαίρεση
Για να αφαιρέσετε ένα φυτό από τον κήπο σας, απλώς πατήστε συνεχόμενα επάνω και επιβεβαιώστε τη διαγραφή. Το φυτό σας δε θα διαγραφεί από τη βιβλιοθήκη σας, οπότε μπορείτε να το προσθέσετε ξανά οποιαδήποτε στιγμή!

Figure 5.13 - Settings Screen

Figure 5.14 - *Informational Screen Options*Figure 5.15 - *Theme Toggle Buttons*Figure 5.16 - *Red Vs. Dark Modes Examples*