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GALA 2025 Games Competition & Exhibition

– Book of Abstracts

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Preface

Welcome to the 2025 collection of abstracts for the Games and Learning Alliance (GALA) Conference's annual Serious Games Competition and Exhibition. This volume is dedicated to showcasing the innovative and significant work featured in this year's competition.

We proudly present creative and research-driven contributions spanning domains such as healthcare, education, virtual simulations and collaborative learning. Reflecting the 2025 theme "Games for Good," this year's entries demonstrate how serious games can drive positive change, fostering learning, inclusion, and social awareness across the Student, Academic, and Business categories.

Serious games continue to prove their power to educate, inspire, and empower players across fields and communities. This collection celebrates the diversity and creativity of the GALA community while reaffirming our commitment to advancing game-based learning and socially responsible design.

We extend our heartfelt thanks to the authors for their dedication and imagination, to our expert jury for their careful evaluation and insightful feedback, and to the organizing committee for enabling this vibrant exchange of ideas.

As editors, we hope this collection captures the spirit of "Games for Good", showcasing how games can make a difference, and it inspires future creators, researchers, and innovators in the field.

November 2025

René Röpke
Kristina Risley

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Table of Contents

Adaptive Dichoptic Therapy for Amblyopia

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Abstract

SURV-EYE-VE addresses amblyopia therapy through accessible gaming. Traditional eye-patching treatments suffer from 50-70% abandonment rates due to discomfort and social stigma. The game uses dichoptic therapy with red-cyan anaglyph glasses, presenting different visual stimuli to each eye. The core innovation is a performance-based dynamic contrast modulation engine that automatically adjusts therapeutic difficulty based on real-time player performance. Built as simple 2D games requiring only standard computers and inexpensive glasses, the system makes therapy accessible for home use. The adaptive approach personalizes treatment while maintaining patient engagement. Initial testing confirmed functionality, with eye-tracking validation planned.

Keywords: amblyopia therapy; dichoptic training; adaptive contrast modulation; accessible healthcare; performance-based adaptation

Game Overview

Amblyopia affects 2-3% of the population as the leading cause of monocular vision impairment. Despite effective conventional treatments, poor patient compliance remains the primary barrier, with abandonment rates often exceeding 50% due to discomfort and social stigma associated with eye-patching (Hess, Mansouri & Thompson, 2011).

SURV-EYE-VE transforms repetitive therapeutic exercises into engaging gaming experiences. The game targets patients aged 6-16 who traditionally struggle with conventional therapy, while also serving healthcare providers seeking accessible therapeutic tools. Players embark on therapeutic gameplay using red-cyan anaglyph glasses that create the dichoptic visual experience essential for treatment.

Gameplay and Mechanics

SURV-EYE-VE consists of two engaging game modules: a side-scrolling platformer and a Flappy Bird variant, both featuring intuitive keyboard controls. Players navigate challenges while critical game elements appear at different contrast levels for each eye, forcing binocular fusion.

The game's primary innovation lies in its dynamic contrast modulation system that continuously monitors player performance through success rates, reaction times, and completion accuracy. When players perform well, the system automatically increases contrast differences to create greater therapeutic challenges. During

difficulties, contrast adjusts downward to maintain engagement and prevent frustration. This real time adaptation ensures each therapy session operates at optimal challenge levels.

Figure 1a. SURV-EYE-VE Platformer gameplay with adaptive contrast modulation.

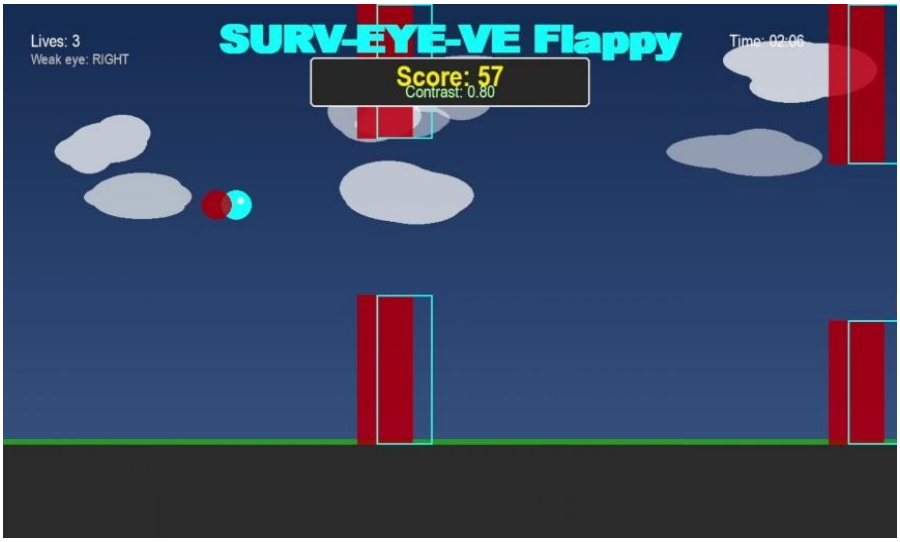

Figure 1b. SURV-EYE-VE Flappy variant showing dichoptic visual presentation.

Innovation and Accessibility

The performance-based adaptation moves beyond static dichoptic treatments to provide truly personalized therapeutic experiences. Unlike existing therapies with predetermined contrast levels, SURV-EYE-VE responds dynamically to individual patient capabilities throughout each session (Žiak, Holm, Halička, Mojžiš, & Piñero, 2017).

The approach prioritizes accessibility through low-cost implementation using inexpensive red-cyan glasses instead of expensive VR alternatives. Simple keyboard

controls accommodate diverse age groups while home-based deployment eliminates geographical and economic treatment barriers. The system requires only standard computing hardware with built-in calibration for display variations.

Initial testing validated core therapeutic logic and adaptive mechanisms, confirming appropriate challenge maintenance and sustained engagement. Future development includes comprehensive eye-tracking validation for physiological assessment (Loudon & Simonsz, 2005) and co-design methodologies enabling customizable game elements for enhanced motivation.

SURV-EYE-VE demonstrates how innovative game design can transform traditional medical treatments, making amblyopia therapy more engaging, accessible, and effective for patients worldwide.

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Ashiyan: An Educational Journey into the World of Iran's Native Vertebrates

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Abstract

"Ashiyan" (the Persian word for "Nest") is an educational board game designed to address the challenge of theoretical and disconnected environmental education in Iranian primary schools. The game creates an engaging, interdisciplinary experience that bridges Iran's third-grade Science and fourth-grade Social Studies curricula by focusing on the nation's native vertebrate animals. Its primary objective is to familiarize students with the five main vertebrate groups—fish, amphibians, reptiles, birds, and mammals—and their key characteristics, such as habitat, diet, and reproduction. Through a unique gameplay mechanic of guessing animal traits based on limited information, players are cast as "zoologists" on a scientific journey across Iran. This culturally grounded, low-cost tool fosters ecological literacy, intrinsic motivation, and a deeper connection to nature, offering a scalable solution for resource-constrained educational settings.

Keywords: Educational Board Game; Environmental Education; Serious Games; Ecological Literacy

1. Introduction

In the Iranian primary education system, environmental and ecological concepts are often taught through traditional, abstract methods that fail to connect with students' daily lives. This can lead to a lack of engagement and difficulty in understanding fundamental scientific principles. The "Ashiyan" board game was developed as a practical solution to this challenge. It transforms the standard curriculum on vertebrate animals and geography into an interactive and competitive experience. By focusing on native Iranian fauna, the game makes learning tangible and culturally relevant, fostering a sense of place and environmental stewardship.

2. The Ashiyan Game

2.1. Target Audience and Learning Objectives

"Ashiyan" is a 4-player board game designed for students in the fourth grade and above (ages 10+). The game's core content aligns directly with concepts from the Grade 3 Science and Grade 4 Social Studies textbooks in Iran (Ministry of Education, Iran, 2024a; Ministry of Education, Iran, 2024b). The primary learning objective is for players to identify and classify Iran's native vertebrates based on six

key characteristics: class, habitat, diet, body covering, breathing method, and reproduction type. Beyond cognitive goals, the game aims to cultivate affective outcomes, such as enhancing students' interest in wildlife, developing empathy for animals, and fostering a sense of responsibility toward environmental conservation.

2.2. Gameplay and Mechanics

The game is played on a board featuring a map of Iran with its distinct climate zones and habitats. Players assume the role of zoologists trying to earn the most points by correctly identifying the features of an unknown animal, which is revealed only by its name and picture on a card.

The gameplay unfolds in rounds, with players taking turns placing their limited number of tokens on the board to guess the animal's characteristics. The game's mechanics are designed to maximize engagement and strategic thinking:

Information Gap: Players must use their existing knowledge and deductive reasoning to guess the hidden traits, sparking curiosity.

Shared Placement: Players can place tokens on spots already chosen by others, leading to strategic competition.

Divided Scoring: Points for a correct guess are divided among the players who chose it. A lone correct guess earns the maximum of 4 points, whereas a guess shared by all four players earns only 1 point each. This incentivizes calculated risk-taking.

Penalty System: Tokens placed on incorrect guesses are temporarily lost, making each decision meaningful.

The game ends when a player reaches 80 points. These mechanics create a dynamic where learning the curriculum content becomes the key to victory, thus boosting intrinsic motivation.

Figure 1. The "Ashiyan" game board, featuring a map of Iran with its habitats, animal classification categories, and a scoring track.

3. Educational Impact and Innovation

"Ashiyan" is innovative in its pedagogical approach rather than its technology. As a non-digital, tactile tool, it is accessible and easily integrated into classrooms where digital resources may be scarce. Its design converts passive learning into an active, hands-on process that promotes critical thinking and peer interaction.

Research has demonstrated the game's effectiveness through a mixed-methods study combining quantitative and qualitative data. Quantitative results from a quasi-experimental study showed that students in the experimental group achieved 28% greater accuracy in species identification compared to the control group. Furthermore, they exhibited 35% higher retention of ecological relationships four weeks after the intervention, with both results being statistically significant (Omidi et al., 2025). Qualitative data from teacher interviews and classroom observations revealed enhanced motivation, with 80% of students voluntarily participating in conservation-related activities after playing the game. Thematic analysis identified three key drivers for this engagement: Gamified rewards, Supportive peer interactions, and Real-world ecological storytelling (Omidi et al., 2025).

4. Conclusion

"Ashiyan" is more than just a game; it is a pedagogical tool designed to cultivate the next generation of environmental guardians in Iran. By blending curriculum-aligned content with engaging, competitive gameplay, it offers an effective and culturally responsive model for environmental education. It demonstrates that even without high-tech resources, well-designed serious games can achieve significant learning outcomes and inspire a lasting connection to the natural world.

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Excellium: Designing a Psychological Visual Novel to Foster Reflection on University Students' Mental Health

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Abstract

Excellium is a psychological visual novel designed to foster reflection and raise awareness of mental health challenges faced by university students. Inspired by *Squid Game*, the game explores positive discomfort as a narrative strategy to provoke reflection on issues such as anxiety, burnout, and isolation. In this short paper, we describe our thought process in designing the narrative and level structure of *Excellium*, and how we incorporate mental health research on Portuguese university students into the characters to create meaningful and relatable experiences.

Keywords: Visual Novel Game; Digital Games; Mental Health Awareness

Introduction

Mental health has become a global priority, particularly after the COVID-19 pandemic, which exposed how isolation, academic uncertainty, and burnout affect student well-being (World Health Organization, 2025). University students remain especially vulnerable to psychological distress, with studies in Portuguese higher education reporting increasing levels of anxiety, depression, and emotional exhaustion (Amaro et al., 2024; Rodrigues et al., 2023). Interactive media, especially digital games, offer unique opportunities for mental health awareness by combining emotional engagement with experiential learning (Schlote and Major, 2021). Yet few have explored how positive discomfort, or morally complex narratives can prompt reflection. Excellium addresses this gap through a psychological visual novel inspired by Squid Game (Hwang, 2021) and grounded in research on the mental health of Portuguese university students (Amaro et al., 2024; Rodrigues et al., 2023).

Excellium's Narrative

As previously mentioned, *Excellium*'s narrative was inspired by the first season of *Squid Game* (Hwang, 2021). Before writing the plot, we began by constructing its world: Where does *Excellium* take place? Why are they experimenting on university students without being caught? Who are they? How does the process of eliminating students occur in *Excellium*'s world? How are the students recruited?

Character	Degree	Character Feature
Lourenço	Psychology	Student Worker; Lacks time
Mary	Medicine	Burnout; Sleep Deprivation
Matilde	Sociology	Emotionally Resilient
Joana	Biotechnology	Emotionally Resilient
Bernardo	Law	Burnout, Emotional Exhaustion
Rui	Philosophy	Substance use
Daniela	Game Design	Social Isolation
Mateus	Marketing	Depression; Suicidal Ideation

Table 1: Character Features of *Excellium* Source: Author's original dataset.

In *Squid Game* (Hwang, 2021), 456 participants are recruited annually, and some disappear without anyone noticing. Replicating that number would have been unrealistic for our setting, so we decided to focus on eight university students, each from a different academic background, who also share financial struggles. Each character was designed with distinct traits inspired by previous research on the mental health of Portuguese university students (Amaro *et al.*, 2024; Rodrigues et al., 2023). These features are summarized in Table 1

One of the defining aspects of Squid Game (Hwang, 2021) is its violence and the death of participants. We chose to avoid that approach and instead opted for a less violent form of consequence. When a participant loses, they lose their memory of the event and experience a decline in certain cognitive abilities. This narrative decision explains why such experiments could continue without the organization being exposed.

Our story takes place during the 34th edition of Excellium, implying that this procedure has been ongoing for 34 years. In this edition, players assume the role of Lourenço, a male psychology student who, after losing his scholarship, is now in

debt. The story unfolds from his first-person perspective, allowing players to make dialogue choices that shape Lourenço's interactions with other students and engage directly with the financial and mental health struggles central to his experience.

Excellium's Gameplay

Excellium is a psychological visual novel featuring multiple branching choices. At the time of writing, the game includes a prologue introducing Lourenço (the main character) and the first mini game: Two Truths and a Lie.

In the prologue, the player awaits a mysterious pick-up announced in a letter. Whether they choose to wait or leave, a limousine eventually arrives, leading to Lourenço's capture. These early choices influence Matilde's reactions and shape the player's understanding of the world. Later, players can decide whether to join a group discussion with other students or remain alone with Mary, whose personal conversation reveals shared struggles and societal pressures.

Figure 1 In this mini game, the player has to identify which character statement is a lie. © Copyright of the author. Licensed under Creative Commons (CC BY 4.0). Image source: [Author's original work].

This choice becomes central to the game's moral structure: the player's relationship with the characters determines who will win or lose in the first mini game. In Two Truths and a Lie (Figure 1), players must identify false statements to earn points, with mistakes costing them. The story culminates in a moral dilemma where the player must choose who retains their memories (Mary or Joana) with an alternate ending allowing both to be saved if the player chooses to lose.

Funding Statement

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Gamifying Financial Literacy with Venture Valley Video Game

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Abstract

Venture Valley is a free, award-winning multiplayer business simulation video game that teaches financial literacy and entrepreneurship through fast-paced, competitive gameplay. Players run virtual companies, making decisions on pricing, staffing, marketing, investment, and growth, and immediately see consequences in a risk-free environment. Venture Valley translates abstract concepts into hands-on learning that builds confidence, critical thinking, and entrepreneurial mindsets. Adopted across classrooms, clubs, and campuses via game tournaments, Venture Valley pairs gameplay with standards-aligned resources to support instruction and discussion around entrepreneurship. Real-world use now spans US school districts nationwide, global pilots in Poland (2023), and partnerships across Scotland's Developing Young Workforce network. In higher education, the game is being written into the curriculum at Ohio State University's Fisher School of Business and will be incorporated into McGraw-Hill's "Entrepreneurial Small Business" textbook (Jerome Katz) used across 400 US universities (March 2026 release). Independent evaluations (Suffolk University and Lemelson-MIT) report players' gains in decision-making, resource allocation, and financial understanding. The Venture Valley game received numerous awards and honours for its innovative and effective approach to teaching entrepreneurship and financial literacy through a medium that resonates with its target market.

Keywords: Entrepreneurship education; Financial literacy; Game-based learning; Business simulation; Serious Games

Introduction

Venture Valley is an award-winning, free-to-play "game for good" created by the Singleton Foundation for Financial Literacy and Entrepreneurship. Its purpose is to close persistent gaps in financial literacy and entrepreneurial readiness by meeting students where they already spend time: in digital games. Rated "E for Everyone," the game has reached more than 273,000 students since launch and logged over 88,000 hours of gameplay.

The game primarily serves students aged 16–24, particularly high school and college learners interested in business but lacking access to practical, low-risk entrepreneurial opportunities. It is used in economics, business, and financial literacy

courses as well as entrepreneurship clubs and after-school programs.

Venture Valley is available on PC (via Steam) and mobile (iOS and Android), offering a 100% free experience with no ads or in-app purchases, thereby removing economic barriers for students and schools. Its gamification and esports-style competition make financial education culturally relevant and engaging for Gen Z, while the mobile-friendly design ensures equitable access regardless of a school's resources. The Venture Valley game also offers free standards-aligned resources, including lesson plans to supplement the game and further support teachers with student engagement.

Narrative, Mechanics, and Interactions

In each match, players pursue business goals ranging from running a dog-walking service to leading a robotics factory. They might boost marketing at a pizza parlor, scale revenue in a drone delivery startup, or outpace rivals in other dynamic ventures.

Success hinges on real-world decisions such as pricing, employee morale, marketing spending, R&D, and risk management. Gameplay mirrors real-world challenges, such as managing scarce resources, balancing budgets, and adapting under pressure. "Boost" and "Adversity" cards add unpredictability, demanding quick adaptation and sharp strategy. Competitive matches let students test their business acumen directly against peers.

How Learning Goals are Achieved

Venture Valley turns abstract financial concepts into practical, memorable lessons. Students practice cash flow management, pricing, and resource allocation in a risk-free environment, gaining confidence through applied learning.

Independent research confirms its impact:

- Suffolk University & Lemelson-MIT Evaluation (2025–26): 85% of students said the game helped them better understand business and entrepreneurship in a risk-free setting, 83% reported increased knowledge of financial decision-making, and 76% said playing the game encouraged them to consider careers in business or innovation.

- Dubit Research: 80% of the players surveyed reported that the game effectively taught them entrepreneurship and business skills; 82% stated they could envision themselves as successful entrepreneurs after playing.

Educators highlight Venture Valley's ability to spark discussion, teamwork, and problem-solving, while students describe it as both "fun" and "practical." Many credit the game with boosting their confidence in financial decisions. Teachers also value its curriculum-aligned lesson plans, guides, and flexible gameplay modes that integrate seamlessly into instruction.

Across studies, competitions, and classrooms, Venture Valley consistently shows:

- Stronger decision-making confidence and financial literacy skills.
- Higher student engagement than traditional instruction.
- Broader entrepreneurial awareness and self-belief.

Global Adoption and Reach

The game's adoption highlights its global and academic relevance:

- Integrated into the curriculum at Ohio State University's Fisher School of Business.
- To be featured in McGraw-Hill's Entrepreneurial Small Business textbook across 400 U.S. universities (launching March 2026).
- Adopted in Poland's schools under a national government program (2023).
- Rolling out through Scotland's Developing Young Workforce, including large-scale STEM events in Dumfries and Galloway (1,000+ students, 2025).
- Hosted live tournaments at MIT, Boston University, Seton Hall, USC Upstate, University of Tampa, University of Arizona, Baruch College/CUNY, Florida State University, and more.
- Partnered with the Collegiate Entrepreneurs Organization (CEO) for a Nationwide Collegiate Cup, reaching thousands of student players (2022–23).

Figure 1. Venture Valley screenshot © Copyright of The Singleton Foundation for Financial Literacy and Entrepreneurship

Immersed in Conservation

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Abstract

Immersed in Conservation is a digital escape room that explores connections between individual buying habits and deforestation in places like Ulu Muda. Designed with the University of Nottingham for National Geographic, the game highlights how human actions impact the lives of the creatures with whom we share the planet.

Keywords: serious game; conservation; rainforests; digital escape room

Introduction

The increasing urgency of addressing environmental challenges, particularly deforestation and its impact on global ecosystems, demands innovative approaches to engagement and education. This paper presents Immersed in Conservation (IIC) (single player version: https://www.echogames.co.uk/games/immersed-in-conservation), a digital escape room designed to explore the complex relationship between consumer choices and the degradation of vital rainforest habitats, specifically focusing on the Ulu Muda Forest in Malaysia. Developed in partnership with National Geographic and informed by research into people's behaviour regarding climate change, IIC utilises a game-based approach to foster empathy and encourage critical reflection on everyday actions.

The game's core mechanics – a point-and-click digital escape room – are designed to immerse players in a simulated scenario where they must make purchasing decisions, directly impacting the forest environment. Through interactive puzzle-solving and strategic choices, players confront the consequences of their actions and gain a deeper understanding of the interconnectedness between local communities, global ecosystems, and individual consumer behaviour.

Background

The game is based on reforestation efforts in the Ulu Muda Forest in Malaysia. In 2019 we partnered with Dr Ran Peleg and Dr Cedric Tan to develop a game based around their research into people's behaviors and relationships with climate change. We suggested a digital escape room (DER) as the main entertainment hook to draw players in as DERs are known to create effective learning environments (2).

Developed over the course of 8 months, we engaged in an agile development process (3), iterating over the game design document, software components, and playtest sessions to ensure we were developing the game to fit the objectives of the client.

Gameplay and Narrative

The game is a point-and-click digital escape room with elements of puzzle solving. The story follows the player's character having applied to be a research assistant in the Ulu Muda rainforest. At the beginning of the game, they receive a letter from the chief researcher in the rainforest accepting their application and inviting them to join the campsite. This is where phase 1 of the game (see above) starts. After celebrating their successful application with friends and family and reflecting upon their choice of which party items to purchase (phase 2), they then begin their journey to Malaysia. Once they arrive, they discover the researcher is nowhere to be found, and danger lurks in the area. They must search the campsite for clues (escape room phase 3, see above) to the researcher's whereabouts and send out a search and rescue team using the nearby morse telegraph. Finally, they rendezvous with the researcher who thanks them for all their help and encourages them to engage in positive action (phase 4).

Purpose and Objectives

The game's purpose is to raise awareness of the deforestation happening in the Ulu Muda rainforest and promote critical reflection on climate change more generally. For example, during the Shop phase, players must purchase several items for the upcoming party to celebrate their joining the research team in Malaysia. Their purchase decisions have consequences for the environment, namely because of the carbon footprint exposed either through packaging or transportation. Yet they are asked to balance this environmental impact by maximizing the number of items purchased for a given budget. This reflects everyday decisions consumers make yet the consequences of which often go unnoticed; our game serves as an introduction to people's behavior and its impact on the environment, adding to growing literature base suggesting the effectiveness of games as instructional materials (4). IIC directly engages the player, showing the consequences of their action on the rainforest as in the next phase they must decide which area to cull to facilitate the land required to grow crops and ingredients for the products they purchased.

The Escape Room phase provides an entertaining break from heavy decision making, providing space for the players to decompress and immerse themselves in puzzles. Providing time and space to consolidate is known to be an effective part of learning (5). The core objective of the escape room phase is to build empathy in players by exposing techniques used to monitor protected environments (e.g. using camera traps, inspecting animal hair samples). Players are incentivized to complete the escape room as quickly as possible. The final phase of the game is reforestation. Players are rewarded for their urgency in the escape room with positive action tiles based on how quickly they found the researcher, reflecting how positive change is possible if we act fast and together. They can then choose which parts of the forest they culled earlier (see above); this reinforces the concept that their actions can have

a positive impact on the environment.

Target Audience

The game can be played by people of all ages, although basic reading comprehension is required to fully engage with the narrative. In our effort to raise awareness of the impact of everyday consumer choice, our target audience is non-experts. IIC features an easy-to-understand story to maintain focus on its 'serious message. In development, we adopted an integrative design process (6) that engaged players throughout. We found player-centricity and active involvement to be critical to shaping the game (7).

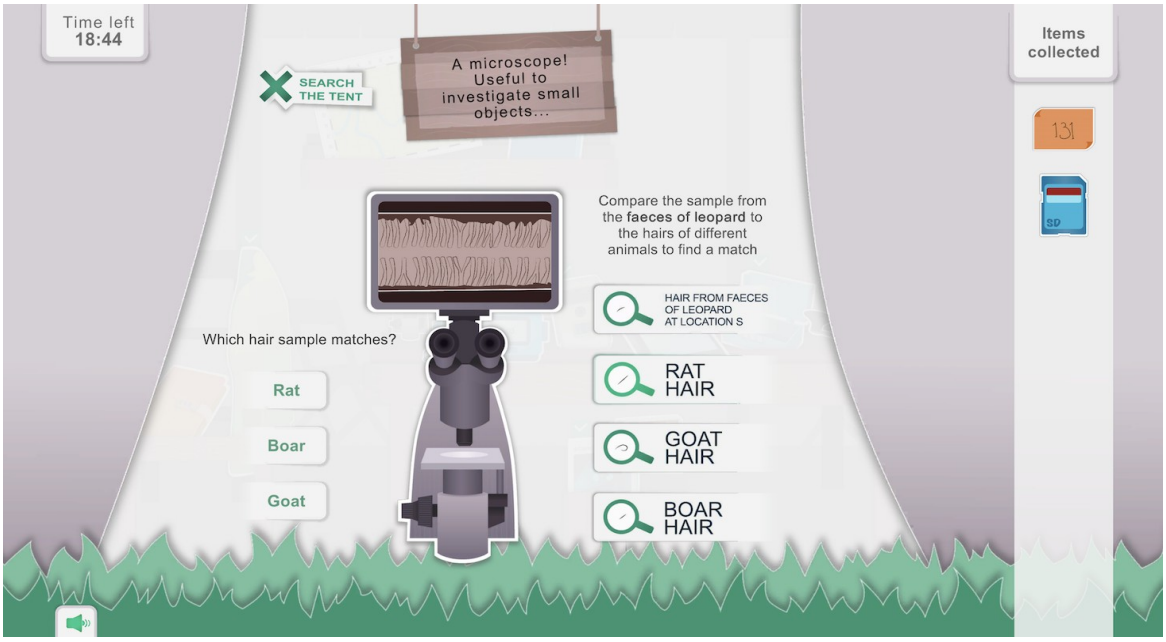

Figure 1. A screenshot of the Escape Room phase. Here, players have found some items in the tent and must solve a puzzle which will provide them with a clue to the researchers' last known whereabouts. © Echo Games CIC. Licensed under Creative Commons *(CC BY 4.0)*. Image source: Echo Games CIC.

Impact

IIC was well received by conservationists and climate change researchers, with several citing it as a fun, easy-to-engage' way to raise awareness of the Ulu Muda rainforest initiatives to combat deforestation. It is designed to have a positive impact on players' understanding of environmental conservation and their daily actions. By exploring the connections between individual buying habits and deforestation, we aim to encourage empathy and critical thinking about the consequences of our choices. Through the game, players will experience firsthand how human actions can affect distant ecosystems, such as the Ulu Muda Forest.

Players will also gain a deeper appreciation for the importance of environmental conservation and develop skills to make more informed decisions about their daily habits. The game's multiplayer mechanics also fosters collaboration and discussion among players, promoting a sense of community and shared responsibility. Our goal

is to inspire players to take small but meaningful actions that can collectively contribute to positive change in society and the environment. In this way, the game engages players while encouraging them to become agents of change in their communities.

Acknowledgement

We thank National Geographic for funding the development of IIC. We thank all our participants who helped us play test the game during development, and who played the online version and responded to surveys conducted to explore the game's themes. We thank the University of Nottingham Malaysia for funding the game's development. We thank Dr Cedric Tan and Dr Ran Peleg for their thematic guidance and support.

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Jungle the Bungle

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Abstract

Jungle the Bungle is a colourful and playful learning adventure that helps children explore both language and emotions in a lively jungle full of talking animals. Players travel through different areas, solve puzzles, read stories, and interact with characters that each express different feelings and challenges. The game makes language learning natural and meaningful by using words in real-life contexts rather than drills or repetition. With its bright design, joyful soundtrack, and varied mini-games, Jungle the Bungle can be used at school or at home. Beyond learning, the project also creates social impact: for every license sold, one copy is donated to an asylum seeker centre, ensuring that all children — no matter their background — can learn and play together.

Keywords: language learning; children; empathy; storytelling; education

Figure 1. Instruction card. Licensed by Jungle the Bungle bv, under CC BY-NC 4.0

Purpose and relevance

Jungle the Bungle shows how games can make language learning and emotional growth both fun and meaningful. Many children find it difficult to learn new words or

express their feelings through traditional lessons. This game turns those challenges into an adventure by using play, exploration and storytelling to help children connect language with real emotions and everyday life. It was created to support teachers and parents who want to make learning more engaging, inclusive and emotionally rich.

Audience and learning goals

The game is designed for children aged 8–12 and can be played in classrooms, language programs or at home. Teachers and parents use it to strengthen vocabulary, encourage emotional awareness and start conversations about empathy and communication.

The main goals are to:

- Discover and understand new words in real-life contexts.
- Recognise and express emotions.
- Build confidence, curiosity and resilience through play.
- Jungle the Bungle fits naturally into social-emotional learning (SEL) programs and language curricula, offering a playful bridge between education and personal growth.

Figure 2. In-game shop. Licensed by Jungle the Bungle bv, under CC BY-NC 4.0

Gameplay and learning experience

Players follow a young explorer who travels through a lively jungle filled with talking animals, each representing different emotions or personal challenges. Through dialogue, puzzles and short stories, players restore balance to the jungle while learning to use language in meaningful situations.

A world map connects a variety of mini-games — from reading and listening to counting, collecting and matching — keeping the experience diverse and rewarding. Children interact through simple touch or mouse controls, unlocking new items, friends and customisation options as they progress. Feedback is gentle and personal, helping learners grow at their own pace while staying motivated and curious.

Figure 3. World map. Licensed by Jungle the Bungle bv, under CC BY-NC 4.0

Innovation and impact

Jungle the Bungle stands out for combining language, emotion and social purpose in a single experience. The game runs smoothly on web and tablet platforms and features expressive 3D visuals designed for young learners. Its buy one, give one model ensures that for every license sold, a copy is donated to a centre for asylum seeker children. This approach extends the game's educational impact beyond the classroom, allowing more children to learn, play and grow together.

Figure 4. Mini-game DJ Kakki. Licensed by Jungle the Bungle bv, under CC BY-NC 4.0

Acknowledgement

The author would like to thank the educators, children, and partner organisations who participated in the pilot sessions of Jungle the Bungle. Their feedback was invaluable in shaping the game's learning design and storytelling approach.

Generative Artificial Intelligence Disclosure

No AI tools were used in the design or development of the game itself.

Funding Statement

This project received no specific grant from any funding agency, public or commercial. The development of Jungle the Bungle was self-funded by Jungle the Bungle bv.

Author Contribution Statement

Jungle the Bungle was created by Carolina Bongers. The game is co-creation between Jungle the Bungle bv. and Hulan bv.

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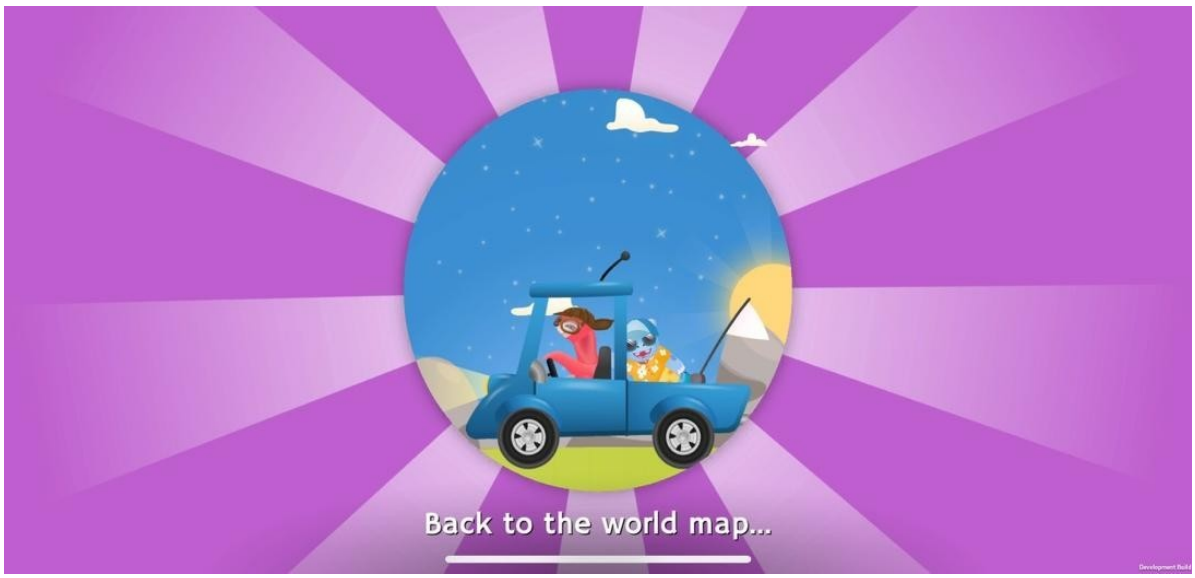

Figure 5. Travel screen. Licensed by Jungle the Bungle bv, under CC BY-NC 4.0

Moniz Game: A Musical Game for Stimulating Motor Coordination in People with Deficits

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Abstract

The Moniz Game is a musical rehabilitation game designed to improve motor coordination in people with physical impairments. Developed with the Unity Engine by a team of physiotherapists and engineers, it combines music-based interaction with accessible gameplay for smartphones and tablets. The game includes free play and journey modes, encouraging users to reproduce musical sequences to progress. A 3D-printed piano controller was later added to enhance realism and engagement. Ongoing updates include cultural adaptations and usability improvements. Future research will explore cognitive and neurofunctional benefits, while a freemium model is planned to broaden access. The Moniz Game aims to complement traditional physiotherapy through an enjoyable and motivating digital experience.

Keywords: music, rehabilitation, motor coordination, game, music training

Context and Development of the Moniz Game

Learning a musical instrument can bring various benefits, whether cognitive or motor-related (Moniz et al., 2022). Due to these potential benefits, musical elements have begun to be implemented to facilitate motor rehabilitation. Some examples include the incorporation of music and dance to stimulate active movement and gait in patients with Parkinson's Disease, and the use of sonification devices and instruments to encourage movement in stroke survivors.

However, many of these methods do not realistically mimic actual musical training designed for individuals with motor impairments. Therefore, the initiative arose to create a musical game for mobile platforms such as smartphones and tablets, which could serve as a complementary tool to traditional physiotherapy.

A game was developed using the Unity Engine by a team composed of physiotherapists with musical training and software engineers (Moniz et al., 2025). A plan was devised outlining the functional and logistical requirements the game

should meet. Examples of these requirements included accessibility—the game needed to be easy to use and able to run on virtually any device without requiring external equipment. Another fundamental requirement was that the game should realistically simulate musical training, albeit in a simplified and feasible way so that even individuals with motor impairments could use it.

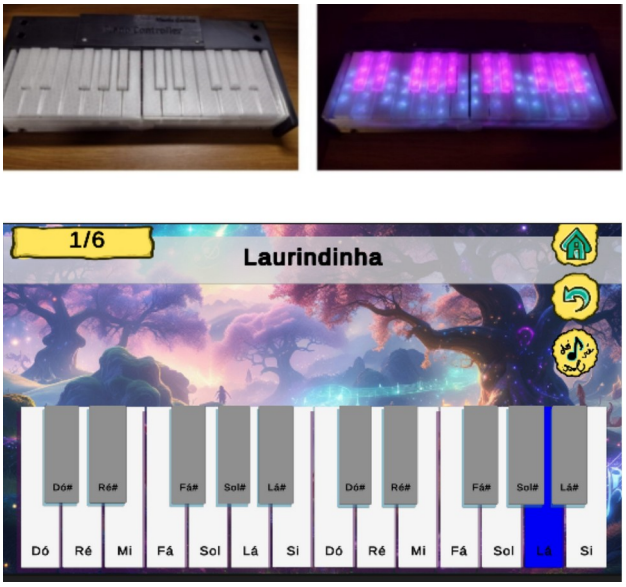

Figure 1. Moniz Game with Piano Controller

Evolution of the Moniz Game

The first version of the Moniz Game consisted of a game in which the user could interact with two modules. The first was the free play mode, created for users to play pre-existing melodies on a virtual piano or to practice the melodies they learned in the other module (Moniz et al., 2024). The main mode was the journey mode, where users watched and listened to musical sequences on the virtual piano and then had to reproduce them accurately. If they achieved over 50% accuracy, they could progress and unlock a new difficulty level.

Since its initial conception in 2022/2023, improvements and new versions have been made, aligned with the goals of the target audience and based on feedback from all studies conducted since then (Moniz et al., 2024).

An important contribution to improving the system was the creation of an adapted, low-cost 3D-printed piano controller to integrate with the game. This product was essential for providing a more realistic experience for users. In a study with healthy individuals, it was reported that using the piano controller made the experience more enjoyable and meaningful.

There was also a cultural adaptation of the game for Portugal. Although the game can have an international and multicultural appeal, the authors believe that learning familiar melodies within one's cultural context can be more inspiring and engaging than music that holds little emotional or personal meaning.

Future Perspectives

The next steps for the Moniz Game continue to focus on clinical application and research. Studies conducted so far have primarily focused on variables related to motor coordination. Future research aims to explore how the game can also contribute to cognitive and neurofunctional outcomes.

In addition, the next phase involves optimizing the system for distribution under a freemium model. The goal is to offer free interaction modules and more advanced modules—integrated with the piano controller—as paid options.

We aim to see the system serve as a complement to traditional rehabilitation, regardless of the acquisition model.

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Nabbovaldo and the Cyber Blackmail

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Abstract

This paper presents the videogame “Nabbovaldo and the Cyber Blackmail” a serious game created for children aged 11–13 with the aim of enhancing their understanding of responsible use of digital resources and tools, while promoting the adoption of good cybersecurity practices.

Keywords: cybersecurity; cybersecurity education; game-based learning; digital education

Introduction

Cybersecurity for children is an increasingly important and fast-growing area of concern, driven by the widespread availability of the Internet and the growing presence of children in digital spaces. As young users spend more time online to do several activities, including learning, gaming, and social interaction, they become more exposed to a wide range of risks, including cyberbullying, identity theft, privacy violations, and exposure to inappropriate content. This highlights the urgent need for tailored educational initiatives, tools, and strategies that empower children to navigate the online world safely and responsibly, being aware of all possible risks. Cybersecurity has become a shared responsibility across all levels of society. Integrating cybersecurity education into school curricula is essential to equip children and adolescents with the knowledge and skills needed to protect themselves in an increasingly connected world. Therefore, it is essential to inform and update new generations about the major threats posed by new technologies as well as about the appropriate individual and collective behavior to take to reduce risks. The need to address the skills challenges linked to cybersecurity is also recognised in the recommendations that have led to the adoption of the EU Digital Education Action Plan 2021-2027. Furthermore, if ‘there is a need to create a cybersecurity education program for primary and secondary schoolchildren’ (EIT Digital Academy, 2020), then it also becomes fundamental to provide teachers with proper training in cybersecurity skills so that they can transfer them to the classroom.

Thus, we introduce *“Nabbovaldo and the Cyber Blackmail”*, a serious game specifically designed to raise cybersecurity awareness among children through a game-based learning approach. The game engages young learners aged 11–13 in interactive storytelling and problem-solving scenarios that reflect real-world online threats, helping them build digital resilience in a fun and accessible way.

Nabbovaldo has been further developed and integrated within the Erasmus+ project "SuperCyberKids" [5]. This initiative aims to embed cybersecurity education into formal school curricula by providing teachers with a dedicated platform and pedagogical tools. The enhanced version of the game serves as a core component of this educational framework, supporting instructors in effectively teaching digital safety and online ethics to students across Europe.

The rest of the paper is structured as follows: the next section briefly presents the state of the art about the game-based approach in education. Section 3 presents the video game while Section 4 draws the conclusion of the paper.

State of the art

Game based Learning (GBL) has emerged as an innovative pedagogical approach that integrates educational content into a game format to enhance knowledge acquisition and skill development. By incorporating elements such as points, levels, achievements, and interactive storytelling, GBL transforms learning into an active and engaging process [1,2,3]. Closely related to GBL, the concept of serious games is, on the other hand, defined as games designed for purposes beyond entertainment, specifically, to train, educate, or influence user behavior. Serious games create realistic and risk-free virtual environments where learners can experiment with decision-making and problem-solving. In the context of cybersecurity training, such games immerse players in simulated attack and defense scenarios, requiring them to identify vulnerabilities, implement countermeasures, and manage security resources strategically. This experiential learning process not only enhances technical competencies but also supports the development of analytical and behavioral skills critical to cyber resilience. Several serious games have been developed to promote cybersecurity awareness and training. Examples include Info Sentinel and Agent Surefire by *MAVI Interactive*, aimed at improving general public awareness of cybersecurity risks; CyberCIEGE [4], created by the *U.S. Naval Postgraduate School*, which provides interactive lessons on encryption, access control, and patch management, and CyberCity Chronicles, commissioned by the *Department of Security Intelligence*, designed to simulate real-world cyber incidents in a narrative-driven format. These projects demonstrate how serious games can effectively integrate theoretical content with practical, scenario-based challenges. Empirical research has consistently supported the effectiveness of game-based learning methods. Despite these advances, serious games targeting children and adolescents remain limited. Existing initiatives predominantly address issues related to online safety, such as cyberbullying and privacy, rather than technical cybersecurity competencies. Extending serious game development to younger audiences could therefore promote early awareness, responsible online behavior, and foundational cyber literacy.

The videogame

The videogame "*Nabbovaldo and the Cyber Blackmail"* is a video game aimed at children aged 11-13 to improve their knowledge related to the use of digital resources and encourage the adoption of good practices. It is a single-player game that can be used both in the classroom, as a supplement for the teacher's lectures,

and by kids on their own as a self-consistent game. The main character is Nabbovaldo, a young inhabitant of Internetopoli, the city of the Internet, passionate about the online world but naive (as the name “nabbo” tells, the Italian translation of “noob”) and not very knowledgeable of the possible risks. The videogame deals with these cybersecurity issues: *malware, phishing, online scams, hackers, cyberattacks, dark web, troll, haters, fake news*. To kick off the story in the videogame, Nabbovaldo faces a ransomware attack. To advance in this challenge and win the game, he will have to perform a series of actions and to go through several minigames. The videogame also features other characters who help Nabbovaldo in his quest and have a functional role in the game. The players are involved in exciting scenarios that change according to the challenges to overcome, all of which are divided into levels. The game has a hybrid structure: players can either follow a fixed path, or move freely along the map, talk to characters and play the mini games in any order.

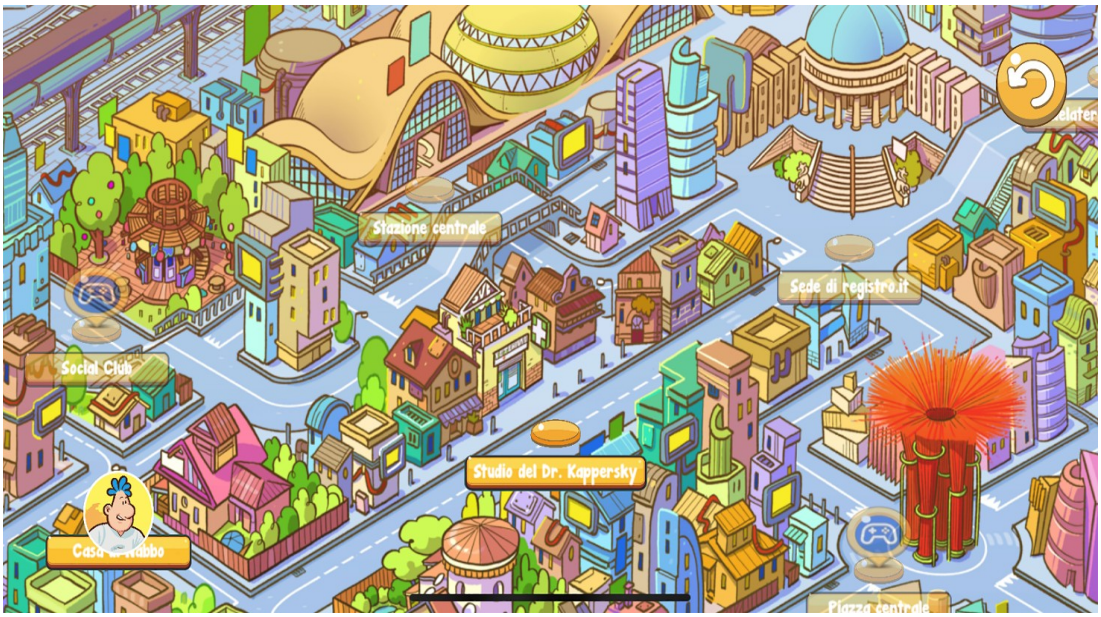

Figure 1. The map of Internetopoli

During the gameplay, the player constantly moves across the sections of the fictional city of *Internetopoli* and is involved with Nabbovaldo in dialogues with several other characters. When moving across the *Settings,* the player can use a Map to know Nabbo’s geolocalisation. When a player taps on a *Setting*, the Map (Figure 1) closes automatically, and he/she is directed to the selected *Setting*. They usually introduce concepts and definitions related to cybersecurity good practices. Some of these dialogues may require a choice at the end, acting as a sort of multiple-choice quiz. The players are involved in exciting scenarios that change according to the challenges to overcome, all of which are divided into levels. They can move freely around the map, talk to the characters, and solve the minigames in the order they prefer, but the game's plot revolves around four main chapters, plus an epilogue in which the player can only perform a final dialogue. The mini games are:

- *Virus Clean-up:* The player must detect the memory blocks contaminated (the red ones) and hit them with the ball to save the uncontaminated ones.

- *Whack a Worm:* worm viruses have invaded the garden of somebody in Internetopoli, and the player must whack these worms.
- *Adware Attack*: *Nabbovaldo* is attacked by a group of popup windows. The player must “swipe” them before they get too close.
- *Slot machine*: the player can earn points *only the first time* they play. If they continue, they will lose points. The purpose is to show the risks of gambling.
- *Firewall game*: Nabbovaldo must watch the boxes which are transported on a conveyor belt and analyzed by x-ray to detect those infected by a virus.

Finally, the *Nabbopedia* collects definitions of the technical terms on cybersecurity. The player can access this dictionary at any time. The game progress can be saved, so that players opening the game at subsequent times can start off where they left. At the end of the game the player is ranked according to the number of likes collected during the game as a scoring system based on the completion of quizzes, dialogues, and mini games.

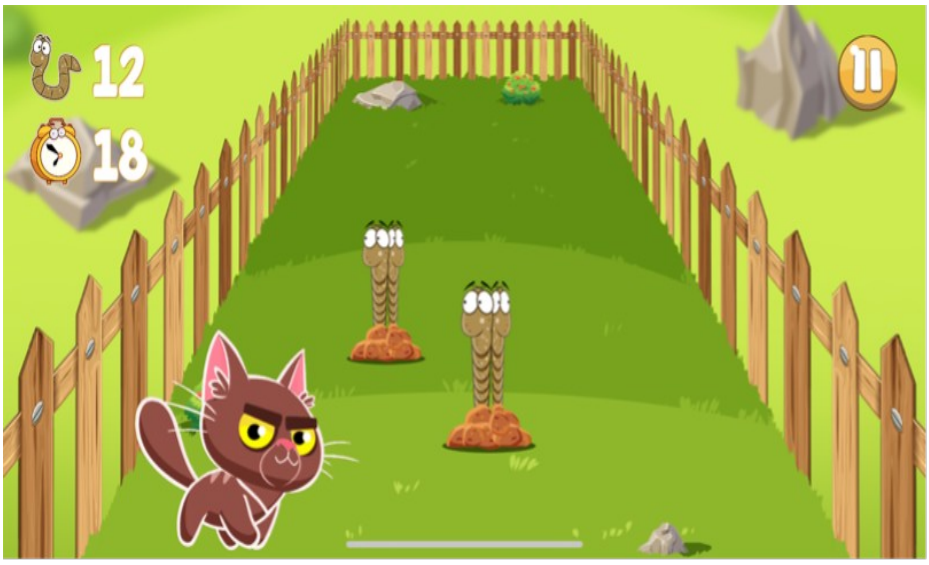

Figure 2. Nabbovaldo Minigame

Conclusion

We presented “Nabbovaldo and the Cyber Blackmail”, a serious game designed for children aged 11–13 to raise awareness of cybersecurity risks encountered online. An enhanced version of the game allowing teachers to choose chapters and topics, has been developed within the European Erasmus+ project “SuperCyberKids”, together with lesson plans that help teachers use the game in a classroom context. Nabbovaldo illustrates how serious games can increase student engagement, support teachers in addressing complex topics, and promote digital resilience from an early age.

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Off Grid: Red Team

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Abstract

Off Grid: Red Team (OG: RT) is a prototype serious game from Semaeopus, designed to address the UK's cybersecurity skills gap by surfacing latent aptitude and fostering an attacker mindset. It blends a 3D single-player game with a live, hackable companion website; together they scaffold hands-on exploration of real-world vulnerabilities and defensive practices. The pilot targeted "near-industry learners" and beginners, offering an accessible on-ramp to infosec concepts and language, while evaluating persistence, problem-solving and creative thinking.

Initial evaluation across playtests, questionnaires and interviews indicates high engagement and meaningful learning outcomes. Half of the target learners reported an overall positive shift in understanding. Stakeholders with hiring responsibility identified OG: RT's potential for screening candidates, onboarding and CPD. OG: RT demonstrated that an integrated game world and companion website paradigm can introduce complex topics, reveal aptitude signals and catalyse behavioural change. It offers a promising route to broaden participation in cybersecurity learning at scale.

Keywords: serious games; cybersecurity; hacking; attacker mindset; vocational learning

Game Description

Off Grid: Red Team places the player in the role of an attacker 'Red,' mentored by the in-game guide pr0metheu5 (fig. 1). Play flows between a 3D environment and live companion website(s) that intentionally feature authentic, learnable mis-configurations (fig. 2).

Early objectives set expectations for this alternation.

Example puzzle: An inworld sticky note hints at an entry code; pr0metheu5 directs the player to the companion site. Reconnaissance reveals robots.txt and a directory listing; a user-manual PDF discloses a default access code; returning to the 3D world unlocks the next room. As missions progress, vulnerabilities and techniques escalate in complexity; players may chain exploits and approach problems in multiple ways. The companion site and inworld objectives make techniques concrete and reward careful notetaking.

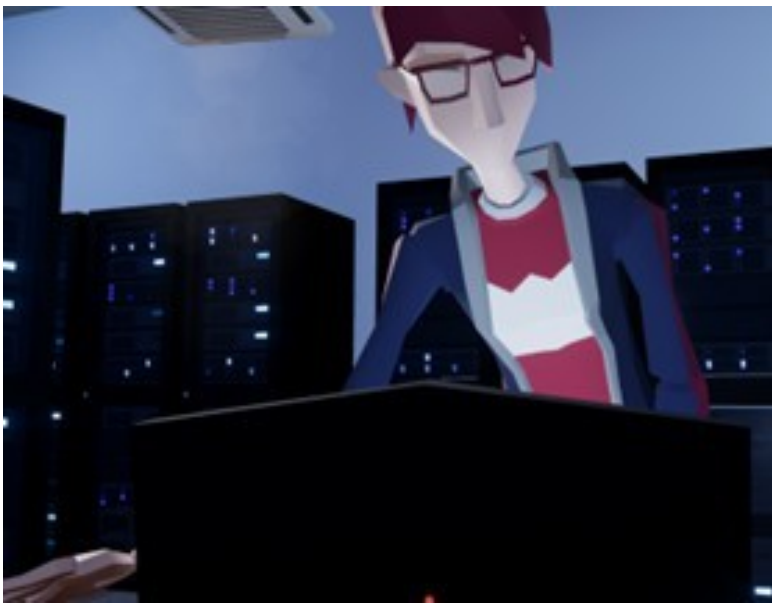

Figure 1. The lead character in OG: RT, Red. Shared with permission of the rightsholder © Semaeopus, 2025, All Rights Reserved.

Figure 2. One of the hackable devices in OG: RT. Shared with permission of the rightsholder © Semaeopus, 2025, All Rights Reserved.

Teaching mechanism. Narrative in-game chat directs players to hands-on tasks on the companion site. Links to resources, fake forums and files provide context; the game blends guided discovery with independent problem-solving.

Pedagogical principles. Learning by doing; mindset over recall; realism with reflection. Interactions externalise tacit knowledge and tie vocabulary to concrete behaviors. Short debriefs anchor terminology and suggest next actions.

Themes and skills coverage. Design content is organized under three themes that structure missions, skills, goals, vocabulary and outcomes:

- **Attacker Mindset**. Thinking like an adversary to spot opportunities; insider threat; weak credentials; brute forcing; exploit chaining; reconnaissance; browser inspector use.
- **Exploiting System Weaknesses**. XSS; command injection; SSRF; SQL injection; weak tokens; no session expiry; website design flaws such as unmoderated public messages; IDOR.
- **Security Best Practices and Vulnerabilities**. Safe credential hygiene; stronger password strategies; mapping attack vectors; robots.txt and crawlers; directory listing risks; disciplined notetaking.

Standards alignment. Each mission's puzzles and challenges are mapped to common industry frameworks; this includes MITRE ATT&CK (MITRE, 2024), CAPEC (MITRE, 2024) and CWE (MITRE, 2024). These mappings anchor learning outcomes to widely used frameworks and support portability into CPD and assessment contexts.

Evaluation methods

We combined quantitative and qualitative methods: pilot recruitment funnel analytics; pre/post questionnaires; knowledge checks; a live observational play session; and interviews with players. Participants were grouped as cybersecurity professionals/adjacent and non-technical beginners. Key funnel figures: 103 expressed interest; 76 were invited; 46 received access after signing our studio NDA and completing the pre-test questionnaire; 34 shared completion confirmations; 22 returned post-play feedback.

Among the UK-based play testers required to satisfy our funding requirements: 23 engaged; 14 received access; 9 shared completion confirmations; 8 returned feedback, and 2 joined us for online interviews/debriefs.

Results

Learning outcomes. Players reported positive shifts in understanding across core concepts; password hygiene, insider threats and physical security awareness showed the largest gains. A mean self-reported change score across surveyed concepts was positive. Players commonly moved from abstract or zero awareness (e.g., "SQLi") to concrete understanding. Interviewees described adopting more secure behaviors post-play.

Industry validation. Hiring managers valued OG: RT for surfacing mindset, persistence and problem-solving; they recommended its use for late-stage screening and early onboarding, and saw its potential as a tool for CPD.

Engagement and progression. Our prototype deliberately contained a steep learning curve: 76% of players completed the first section; 38% completed all six missions. Mission 3b (brute forcing/password guessing) produced the highest drop-off; many requested additional in-game elaboration.

Discussion and contribution

OG: RT demonstrates an integrated design pattern that pairs an immersive game world with a live companion website to elicit attacker-mindset behaviors while making vulnerabilities legible. This approach shows promise as a funnel for talent identification and as a springboard into further study.

Limitations and next steps

Our prototype evaluation surfaced essential design considerations for inclusivity: clearer onboarding; smoother difficulty ramps; and layered hinting. In the future, we hope to move to a self-contained virtual machine deployment model to reduce installation friction and widen access; future content will be modular 45–60-minute scenarios aligned to skill competencies to support varied contexts, from schools to enterprise CPD etc.

Acknowledgements

We thank our play testers and industry stakeholders for their contributions.

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Data Availability Statement

Prototype access was provided privately for evaluation. A new release is planned. For collaboration or evaluation enquiries, contact: hello@semaeopus.com

Author Contributions

S.K.: Conceptualization, R.M.: Conceptualization. P.S.: Software. E.S.: Software. J.S.: Project Administration, Writing – Original Draft, S.A.: Project Administration, Writing – Review & Editing.

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Poetry Planet: a creative writing game for reading (CWGR)

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Abstract

Poetry Planet turns reading into a deep-space adventure of planetary discovery, quick-witted battling, and a collaborative treasure-map design and hunt. In response to radical drops in upper-secondary reading (PISA 2022), *Poetry Planet* represents a suite of games, a pedagogical approach, and a teacher-modifiable, immersive gaming platform that uses textual "recombination" as the key mechanic in competitive and collaborative, open world (immersion, exploration, and building) reading games to develop creativity and reading/writing engagement. *Poetry Planet* innovates by making words the fundamental material of the game (a planet skinned in text), basing all actions on fast, simple/rule-based and yet open-ended creativity (recombination), and balancing creativity (open, unjudged) and competition (closed, constant feedback/judging). The low level of entry (freewriting to fuel the rocket), the gradual difficulty curve (increasing integration of the reading text), and in-game direction, makes *Poetry Planet* a click-and-go solution for developing curricular reading engagement and writing/thinking creativity at the upper-secondary level.

Keywords: recombinatory writing game (RWG); combinatorial creativity; reading; engagement; immersion

Introduction

In answer to the radical drop in reading skills and engagement in upper-secondary (PISA 2022) and the importance of creativity in both the Norwegian core curriculum and as a 21st century skill, Poetry Planet uses an innovative, interdisciplinary approach that combines creative writing games, information visualization, and textual recombination as a game mechanic, all set in an immersive world of space exploration, battle, and competitive puzzling, to develop creativity and reading/writing engagement in the upper-secondary classroom. The game progresses from open creativity (freewriting games) to closed competition (solution-based) to take advantage of these competing but equally effective game goals/experiences. The game is fully adaptable as any text can be used; however, design and testing has focused on stories and poems as they have a higher base creative content (vocabulary and structure).

Gameplay

The game begins at school, in a classroom of bored and half-sleeping students. Then out the window a spaceship appears, and we escape! The first level is

freewriting any sentence to fuel the rocket. This level trains the player in freewriting as a game skill, focusing them on the creative keys of speed and freedom: anything they write is fuel; however, once the tank is half full, words (additives) appear and must be used (mixed), or they will destroy fuel (sentences). Additives begin the movement from open creativity toward combinatorial creativity (using words form the reading text), though the focus is still on the creative skill of freewriting and speed (lack of judgment), as they are racing other players to arrive at Poetry Planet.

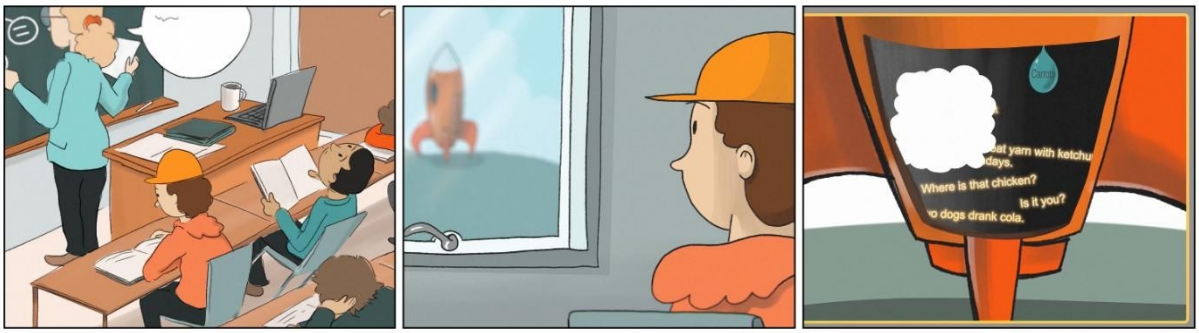

Figure 1. Cut-scene of classroom, the rocket appears, level one: free write tank-fuelling.

After crashing on Poetry Planet, the players move through a series of levels that use increasing levels of recombination (more words from the curricular text) to conquer territory, to battle over contended territory (battle Tetris-mechanic), and finally to design a treasure map that all players race to solve (fig. 2).

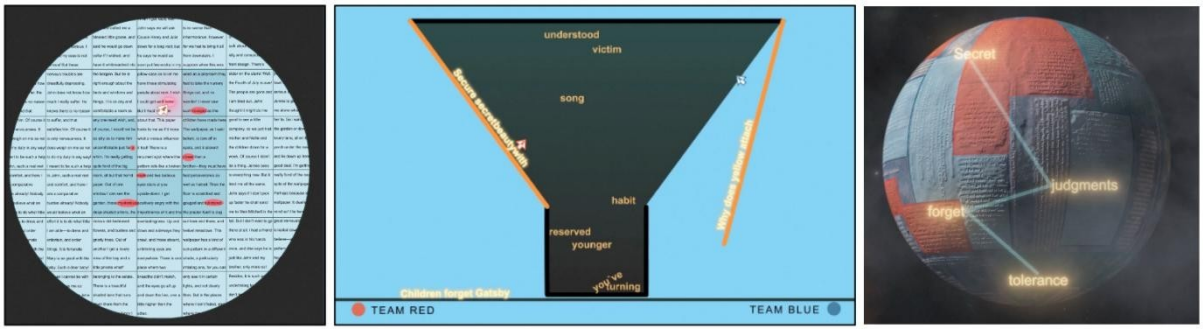

Figure 2. Conquering planet-surface text-squares by forming a sentence, battle Tetris mechanic, solving a treasure-hunt sentence-path.

The basic mechanic in all levels is sentence-making; however, the constraint of using more curricular text produces increasingly original (i.e. creative) texts that to some degree move students focus from competition toward the experience of their own humorous and provocative writing/recombination, culminating in the final sentence that functions as a treasure map (fig. 3). Players then race to map each other's sentences, success entailing rapid info-skimming of the entire curricular text.

Innovation

Various factors including digital reading (Baron & Mangen 2021) and the cross curricular use of reading/writing as assessment have reduced student engagement in longer texts. From observation and practice, it is clear that students find long texts

intimidating. In view of this, Poetry Planet completely rethinks the approach to reading, using play, creative writing, and a gradual integration of the reading text. The innovation lies in using game design to marry key discoveries in Digital Humanities (recombination as an analytical reading method) and the field of Creative Writing (the success of Surrealist-based, combinatory writing games). The final innovative aspect of Poetry Planet is its balancing of creativity and competition as game goals/experiences. This is difficult as the open space of creativity is in direct tension with the closed space of competition. The digital prototype aims to innovate further by increasing open world creativity (exploration, building, and immersion) to balance the non-digital game's competitive emphasis.

Challenges and Next Steps

The mechanics and experience of Poetry Planet have been studied as a series of 2D games and planets (Jones 2023, 2024, 2025); the immersive digital format is a prototype (Poetry Planet), so no measure has been made of the success of its intended immersion. One interesting question is to what extent the game can balance creative immersion against the more competitive aspects of conquering a planet. A recent iteration includes filling the "atmosphere" of the planet with AI images prompted by gameplay sentences. These images can increase student focus on the creative aspect and the semantic content of sentences, even as they serve primarily as speed-based/puzzle-based game strategies. This speaks to the overall challenge of moving gameplay flow toward increased linguistic interaction.

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RailQuest: A Gamified Teaching Platform for Concurrent and Parallel Programming

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Abstract

Teaching concurrent and parallel programming presents substantial challenges, primarily due to its conceptual complexity. RailQuest (previously called Railway Quest) is a gamified digital platform designed to facilitate students' learning of multithreaded programming concepts through an interactive approach. The platform's purpose is education, translating abstract programming challenges into visual train locomotion scenarios where trains represent threads. Key objectives include helping students understand concurrency issues like resource access conflicts and indefinite delays. A unique feature is that students develop and execute code-based solutions, immediately observing their impact in real-time simulations presented through a low-poly isometric interface. This visual, game-based approach enhances motivation and helps in conceptualising threading constructs. The platform supports both integrated and remote learning environments.

Keywords: Concurrent Programming, Parallel Programming, Gamification, Game-Based Learning, Computer Science Education

Introduction and Relevance

Concurrent and parallel programming (CPP) is a fundamental component of modern computer science curricula, yet it remains notoriously difficult for students to master (Zhu et al., 2020). The topic requires a significant paradigm shift from sequential programming, demanding a high level of abstraction to manage concepts like thread behaviors, race conditions, and deadlocks.

RailQuest is a gamified simulation platform developed to address this specific educational challenge. Its relevance to the domain lies in its ability to bridge the gap between abstract theory and practical application in a gamified, entertaining way (Ibáñez-Espiga, Di Serio and Kloos, 2014). It translates complex, non-deterministic CPP problems into tangible, visual scenarios involving train locomotion. In this metaphor, trains represent threads, shared track segments (like stations or crossings) represent shared resources, and programming errors manifest visually as collisions (data races) or trains waiting indefinitely (deadlocks).

Target Audience and Curricular Fit

The platform is designed for second-year undergraduate Computer Science students

enrolled in the "Parallel and Concurrent Programming" course. RailQuest is used in various learning contexts, including integrated classroom settings and distance learning. In its initial deployment, it served as the primary tool during 2-hour guided laboratory sessions, which followed a 1-hour traditional lecture. The platform's challenges are explicitly aligned with the course curriculum, supporting specific learning objectives for topics such as the introduction to thread execution, race conditions and synchronisation of threads, and coordination of threads with conditional variables.

Gameplay, Mechanics, and Objectives

The core gameplay loop is based on a constructivist approach (Ben-Ari, 2001). Students are presented with increasingly difficult challenges in a web interface, such as ensuring two trains can safely share a station or coordinating a resource transfer at a crane.

Unlike many educational games, students do not use a simplified visual editor. Instead, the primary mechanic requires them to write actual Java code in their own preferred Integrated Development Environment (IDE) on their local machine. They must use standard CPP synchronization primitives (e.g., ReentrantLocks, Condition variables) provided by the Java language, alongside a small platform-specific library, to control the trains' behavior. This approach favors near transfer of knowledge to similar tasks in real-world scenarios.

The objective is to write robust, error-free code that allows the trains (threads) to complete their tasks successfully, such as entering a station 10 times without collision. The platform tracks all attempts, marking them as "SUCCEEDED" or "FAILED".

Innovative Design and Technology

The platform's most innovative element is its hybrid architecture, which was developed through an interdisciplinary collaboration between the technology and the education departments in our institution.

The student's Java code (using a provided .jar) is executed by making calls to a REST API. A remote back-end simulation engine receives these calls, processes the logic using a discrete-event simulation model, and detects concurrency issues. The backend then streams the simulation state in real-time to the student's web browser, which renders the visual scene using an embedded Unity application.

This design allows students to use the actual programming language (Java) and tools of their trade, rather than a simplified sandbox, making the learning experience authentic and directly transferable.

Preliminary Results

RailQuest was deployed in the Spring 2025 semester (Babazadeh et al., 2025). Interim survey data from 45 students was highly positive. The platform received the highest mean score (4.4 out of 5) when students were asked if it "made it easier and

quicker for me to grasp the concepts". It was also ranked as the 3rd most useful learning resource, just behind "Guided exercises in class" and "Lecture slides".

Qualitative comments praised the platform as an "excellent possibility to visualize the concept of Threads" and "very fun and stimulating," validating its effectiveness as an engaging pedagogical tool.

Acknowledgements

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Generative Artificial Intelligence Disclosure Statement

The abstract and figure captions were refined for language purposes using Google Gemini, October 2025.

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Silent Lights – Playful solution for light pollution

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Abstract

Silent Lights is an educational game designed to raise awareness and foster understanding of light pollution as well as its ecological and societal impacts. Aimed primarily at K-12 students but suitable for broader audiences, the game integrates scientific learning with interactive exploration. Players take on the role of a city employee tasked with optimizing an urban lighting system, balancing ecological preservation and economic efficiency. Through experimentation, feedback, and problem-solving, they learn how different lighting parameters can affect species, ecosystems, and sustainability goals. By simulating real-world trade-offs, *Silent Lights* aims at promoting systems thinking, critical reflection, and responsible environmental decision-making in an engaging and playful format.

Keywords: light pollution; eco-sustainability; eco-game; K12 education

Introduction

Light is essential for regulating natural processes across ecosystems, influencing the behaviour and physiology of various animals, plants, and entire habitats (Falcón et al., 2020). Through widespread artificial illumination, humans often unintentionally disrupt these systems, such as light-sensitive bat species hindered by streetlights from reaching their hunting grounds (Voigt et al., 2018). When such interference becomes harmful, it is referred to as light pollution and can also affect human wellbeing. Despite its importance, awareness of light pollution remains limited (Schuler, Schatz and Berweger, 2018). The educational game Silent Lights aims to (a) to raise awareness and (b) to convey scientific knowledge about this issue.

1.1. Target audience and context

The game is designed for K-12 students and can be integrated into school curricula (e.g., biology classes). However, in principle, Silent Lights is intended for anyone interested in nature and the ecological impacts of human activity.

1.2. Objectives

The game aims to increase awareness of how light affects natural systems and highlights the harmful consequences of artificial illumination, known as light pollution. Players learn about possible interventions and optimization strategies to reduce these negative effects. The design of the game aims to encourage reflection on the

balance between often conflicting objectives, such as economic interests and environmental concerns for sustainability. Silent Lights thus aims to support various foundational goals in K-12 education, ranging from basic biology education to sustainability and environmental education, up to critical thinking in general.

Overview

The player assumes the role of a city employee tasked with optimizing the city's outdated lighting system, balancing both ecological and economic impacts. Players can modify various parameters of urban lighting, including intensity, colour, visible spectrum, beam angle, lamp shape, density, placement, and timing. Each decision affects various components of the city and its surrounding ecosystems, as well as the city's financial and operational goals. For instance, reducing local light intensity may help restore a corridor for bats to reach their hunting grounds, highlighting the need to balance environmental preservation with human needs.

Figure 1. Screenshot of a Scene in *Silent Lights*. Licenced by Lukas Ober, under CC BY 4.0.

Goals

Silent Lights is designed to facilitate learning through experimentation and interactive problem-solving, encouraging players to explore, test, and reflect on the consequences of their decisions. By adjusting different lighting parameters and observing their effects, players learn how artificial light can affect natural processes, species' behaviour, and economic objectives, as well as cause conflicts between them. For instance, excessive light intensity may eliminate sensitive bat species, while others remain unaffected, illustrating species-specific adaptations. This experiential learning shall foster understanding of ecological complexity and encourage players to develop balanced, optimized solutions for sustainable lighting.

Design and technology

The game is developed using the Godot Engine and incorporates visual and environmental elements from a licensed asset pack purchased on Itch.io. A

screenshot of a game scene is provided in Figure 1.

Generative Artificial Intelligence Disclosure Statement

The text of this contribution was refined and polished with the assistance of GPT-5 (OpenAI), October 2025.

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Competing Interests

None.

Data Availability Statement

None.

Author Contributions

Conceptualization: Lukas Ober, Stefan E. Huber, and Manuel Ninaus. Methodology: Lukas Ober and Stefan E. Huber. Project administration: Lukas Ober and Manuel Ninaus. Resources: Manuel Ninaus. Software: Lukas Ober. Supervision: Manuel Ninaus. Validation: Lukas Ober and Stefan E. Huber. Visualization: Lukas Ober. Writing - original draft: Lukas Ober and Stefan E. Huber. Writing - review & editing: Lukas Ober, Stefan E. Huber, and Manuel Ninaus.

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T Cell Titans

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Abstract

T Cell Titans is a single-player shooter game designed to help young patients understand what happens in their bodies during CAR T cell therapy. Developed for Great Ormond Street Hospital (GOSH) and co-designed with specialists and intended players, the game supports conversations about CAR T therapy between medical practitioners and young patients undergoing treatment for leukemia. This piece provides an overview of the game, its purpose, and potential to support patient comprehension and wellbeing.

Keywords: CAR T cell therapy, health and wellbeing, games for change, Great Ormond Street Hospital, co-creation

Introduction

T Cell Titans is a collaboration between Echo Games CIC and researchers at the UCL Great Ormond Street Institute of Child Health (ICH) that aims to help young patients understand the mechanics and effects of CAR T cell therapy. The game takes the form of a single-player 2D shooter in which ‘supercharged’ T Cells – supported by the body’s natural immune system – attack invading cancer cells. Using a fictionalised but familiar gameplay scenario, T Cell Titans is primarily intended as a tool for medical practitioners to explain complex concepts to young patients at GOSH, with the ultimate aim of improving care outcomes.

Game Overview

Background

T Cell Titans grew out of a small 2017 pilot project led by Dr Lee Scott and Dr Sara Ghorashian, Principal Clinical Research Associate at ICH, which explored how games could represent CAR T cell therapy in a way that made conversations about treatment more approachable and less intimidating for young patients. The resulting Pac-Manstyle game, titled T Cell, characterised T Cells as body defenders with special ‘superpowers’ to target and destroy cancer cells. Following validation of the concept with clinicians and players, Dr Ghorashian engaged Echo Games CIC to develop the idea further. This collaboration led to T Cell Titans, an expanded version that illustrates additional aspects of CAR T cell therapy such as the role of

macrophages and the potential effects of excessive cytokine release during treatment (i.e. a cytokine storm).

Gameplay and Narrative

T Cell Titans is set in the bone marrow – the body's blood cell 'factory' and a key site of immune defence. Under attack from cancer cells, the player's mission is to mobilise superpowered CAR T cells to clear successive waves of microscopic invaders.

The game unfolds across three levels. The first introduces the function of T cells and challenges players to combat proliferating 'divider cells' and more resilient 'heavy cells.

Level 2 focuses on the body's innate immune responses. Each attack releases cytokines (proteins involved in cell signaling), which recruit macrophages (white blood cells that recognise and engulf cancer cells) to join the fight. However, excessive cytokine release can trigger a severe immune reaction known as a 'cytokine storm'. Players must therefore monitor body health and moderate their attack rate, echoing management strategies used in CAR T cell therapy.

In the final level, players collect 'memory cells' – long-lived CAR T cells that retain the ability to recognise the cancer antigen they were engineered to target. These cells form a new battalion of supercharged defenders used to confront the final boss: a larger, more resilient tumor.

Purpose and Audience

The primary setting for T Cell Titans is clinical, initially designed for use by medical practitioners at Great Ormond Street Hospital to facilitate dialogue about CAR T cell therapy with young people with leukemia. The game is carefully structured to support these conversations, employing strategies such as concept scaffolding and the progressive introduction of key ideas across three levels: 1) T cells and cancer cells, 2) the body's role and immune response, and 3) memory cells for long-term defence. Beyond the clinic, the game can also be used by patients to help younger friends and family members understand their treatment. Crucially, the game goes beyond fictionalising medical concepts. For example, the depiction of a 'cytokine storm' reflects real patient experiences – children may feel unwell even while receiving treatment intended to help them, and including this reaction in the game helps explain why this can occur.

Impact

Although formal evaluation is ongoing, initial feedback from young people and specialists suggests that T Cell Titans has considerable potential to enhance understanding and communication around CAR T cell therapy. Driving this impact is the game's co-design sessions with children who have undergone or are receiving treatment. They helped conceptualise characters, playtest levels, steer the gameplay (e.g. the addition of a final boss in the final level), and even choose the title, ensuring gameplay and narrative were engaging, age-appropriate, and accessible.

Development also involved close collaboration with researchers and clinicians at ICH, ensuring scientific accuracy and alignment with medical practice. By enabling players to explore complex biological processes in an interactive and playful format, T Cell Titans demonstrates how games and co-design approaches (1) can enhance comprehension, reduce anxiety, and foster supportive dialogue around sensitive medical topics.

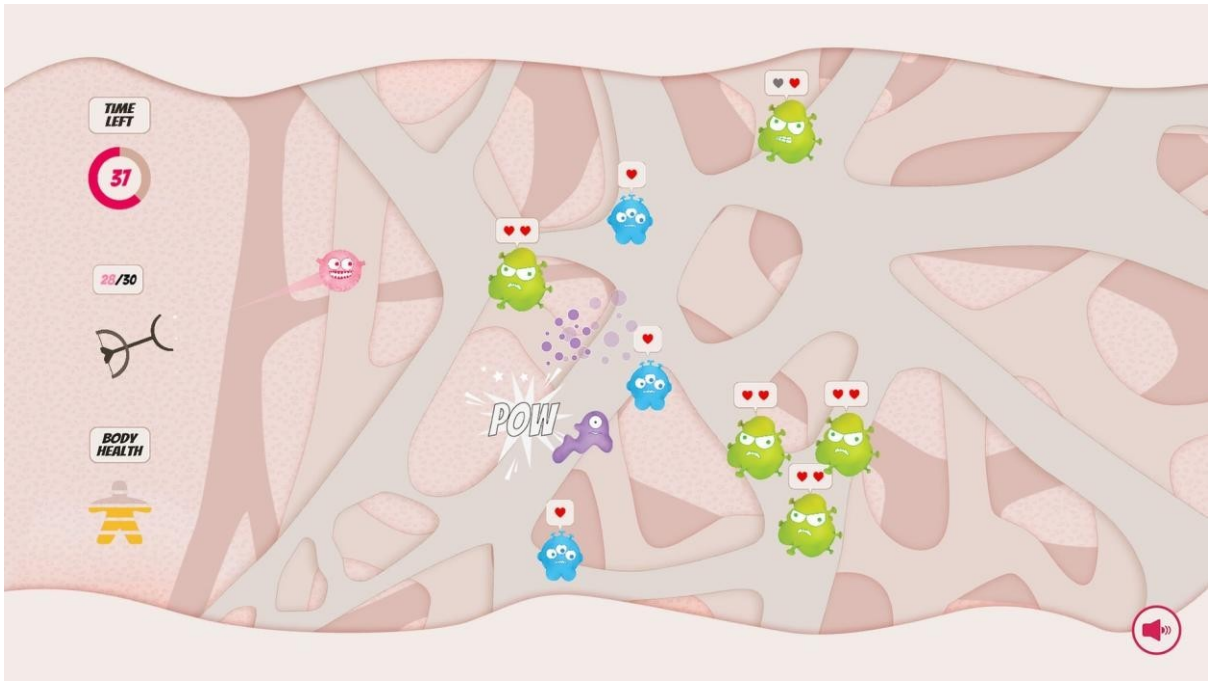

Figure 1. Gameplay of T Cell Titans. © Echo Games CIC. Licensed under Creative Commons (CC BY 4.0). Image source: Echo Games CIC.

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Talk Town: a serious game to promote psychosocial wellbeing in deaf youth

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Abstract

Talk Town is a self-advocacy and communication skills role playing game for deaf and hard of hearing (DHH) youth. Almost all DHH youth are born to hearing parents and attend mainstream school. Without suitable role models, DHH youth can struggle to develop positive identity, communication, and self-advocacy skills, resulting in poor psychosocial wellbeing.

Designed to give DHH children agency in their own psychosocial development, the learning objectives of *Talk Town* are to reduce internalised stigma regarding hearing difference, improve self-advocacy skills, identify environmental communication barriers, utilise assertive communication styles, utilise effective conversation repair strategies, and utilise appropriate social pragmatic skills. Design considerations for this population, such as readability and visual attention, were incorporated. Users create an avatar from diverse ethnic, gender, hearing device, and deaf-identity options. They then navigate social scenes where DHH youth experience unique communication challenges, such as during driving lessons.

Serious games such as *Talk Town* can provide isolated DHH youth with engaging, accessible, and uplifting interventions to explore their unique identities and communication needs.

Keywords: serious game; deaf; adolescent; self-advocacy; participatory design

Introduction

Permanent hearing difference is the most common disability identified at birth (1). Deaf and hard of hearing (DHH) young people may have difficulties developing language and cognitive skills such as social pragmatics (2) and theory of mind (3). In

New Zealand, almost all young DHH people attend local mainstream schools and have hearing families. Consequently, DHH people face unique identity and communication challenges, which are poorly understood by those around them.

Learning Objectives and Curriculum Alignment

Informed by lived experience of Deaf adults and the paediatric audiology habilitation research literature, *Talk Town* contains the following learning objectives: reduce internalised stigma regarding hearing difference, improve self-advocacy skills, identify environmental communication barriers, utilise assertive communication styles, utilise effective conversation repair strategies, and utilise appropriate social pragmatic skills. The reading level and subject matter of *Talk Town* are intended for players with developmental ages of approximately 10 – 16 years.

The learning objectives and in-game play of *Talk Town* support four of the five key competencies spanning the New Zealand Curriculum. 1. *Using language, symbols and text: Talk Town* models using several forms of language to support shared understanding including New Zealand Sign Language, spoken English, and written English. DHH youth can also benefit from explicit instruction in social pragmatics (4) such as is found within *Talk Town*. 2. *Managing self: Talk Town* promotes self-efficacy in managing social situations and communication breakdowns 3. *Relating to others* & 4. *Participating and contributing: Talk Town* help players understand non-playable characters' (NPC's) reactions to different communication choices. Within the curriculum theme of Health and Physical Education, the learning objectives of *Talk Town* support: *Personal Identity*, *Relationships*, *Identity*, *Sensitivity and Respect*, as well as *Interpersonal Skills*.

Game Overview

Designed to be played independently by young DHH users, Talk Town may also be used within clinical or remedial education settings by Speech Language Pathologists or Teachers of the Deaf, or at home with parents. Presented in visual novel style, the main interface is text-based with a reading age of 10 years. The gameplay mainly comprises of static 2D images, with some 2-frame animation 'easter eggs' to maintain engagement and present sign language content.

Gameplay and Mechanics

Users create an avatar, selecting from diverse ethnic and gender representations. Different hearing device types including hearing aids, a cochlear implant, or no device can be selected and customised. Players can then 'try out' different deaf identities (Fig. 1a).

Players then navigate *Talk Town*, containing age-appropriate social settings where DHH youth face unique communication challenges including school, hairdressers (Fig. 1b), cinema, fast food outlet, and driving school. Players click on the scene they want to go to, and experience 2-3 communication challenges. An 'undesirable' response prompts a social consequence (such as the teacher giving a detention), with prompts to try the scene again – promoting reflection and resilience when communication breakdowns occur.

Fig 1. Screenshot of Talk Town (a) avatar creation: deaf identity (b) hairdresser scene: washing hair vs devices. © Copyright Talk Town Ltd. Image Source: [Author's original work].

Between scenes, a score ticker accumulates points as each scene is completed. Once all other scenes are completed, the final 'party' scene is unlocked, containing more challenging and confronting communication breakdowns. In conclusion, new friendships are formed.

Innovative Design Elements

Positive representation of different hearing devices, varied deaf identities, and lived experiences is still novel in contemporary media (5). Affirming representation in published media, including games, is important to the development of positive self-identity in marginalized groups including DHH youth.

Future Work

Future work will include exploration of an inventory mechanic whereby players explicitly acquire and select different communication skills to apply in different settings, and investigations to determine if this mechanic supports transference of skills outside of gameplay. Structured debriefing materials will also be developed for clinicians and teachers to support acquisition and transference of learning objectives.

Conclusion

The format of a serious digital game enables accessible, engaging, personalised experiences for young DHH players and can provide agency in their own learning journeys. The learning outcomes of *Talk Town* support key competencies in the New Zealand Curriculum, as well as unlocking the 'hidden curriculum' of the deaf and hearing worlds.

Acknowledgements

We sincerely acknowledge the valuable insights and lived experiences shared by members of the New Zealand Deaf community. We also extend our gratitude to our collaborators, The Hearing House and Ko Taku Reo Deaf Education New Zealand, for their contributions to this work.

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Competing Interests

Zoë Hector is the sole shareholder of Talk Town Ltd, a not-for-profit social enterprise, founded to manage prize monies and grants awarded to produce the *Talk Town* game.

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The Mystery of EPP: A Serious Game for First-Year University Students in Academic English

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Abstract

The Mystery of EPP is a narrative role-playing serious game created for first-semester students in English for Professional Purposes 1 (EPP1). Set in a peculiar academy where the syllabus has vanished and lecturers have lost their memories, players piece things together by tackling language-based challenges. The game blends storytelling with grammar work, Sustainable Development Goals (SDG) vocabulary, listening tasks, and short writing activities, all mapped to the course syllabus. Delivered in the browser with a pixel-art look, it is easy to access and aims to spark intrinsic motivation, build confidence, and ease students into academic communication. Students can play alone or in pairs, in class or independently, making it a flexible onboarding resource. Beyond discrete skills, the design reframes the lecturer's role as a guide and encourages self-directed learning—an approach that responds to declining motivation and the lure of shortcuts in digital learning. The work draws on established frameworks in motivation and game-based learning (Deci & Ryan, 1985; Gee, 2003; Arnab et al., 2015; Dörnyei, 2020).

Keywords: higher education, serious game, English for academic purposes, onboarding, self-directed learning

Introduction and Relevance

Learning academic and professional English in the first university semester can be daunting: students encounter unfamiliar genres, formal vocabulary, and new cultural expectations while simultaneously adapting to independent study. The Mystery of EPP reframes this transition by turning course onboarding into a playful, goal-oriented experience. Instead of passively receiving grammar rules or writing conventions, students advance through a mystery narrative in which puzzles map directly onto course outcomes—a design that aims to reduce anxiety, provide comprehensible input, and support technology-mediated autonomy (Horwitz et al., 1986; Krashen, 1982; Reinders & Stockwell, 2022).

Developed by the author within a university teaching context, including texts contributed by lecturers at the University of Applied Sciences for Management and Communication, the game forms part of a broader effort to counter disengagement, foster self-regulation, and make academic content more accessible—particularly at a time when generative-AI tools can tempt learners to outsource cognitive effort.

Target Audience and Context of Use

The game is designed for first-semester students, especially those enrolled in English for Academic and Professional Purposes 1 (EPP1). It meets a diverse cohort —students with varied schooling histories and first languages—by offering an immersive, inclusive start to academic English. Used in the opening week as an onboarding activity, it fits multiple settings: short in-class sessions (solo or in pairs), flipped-learning tasks between sessions, and orientation or pre-semester workshops. As it works across these contexts, the game supports both structured teaching and independent study, smoothing students' transition into higher education (Tomlinson, 2013).

Objectives and Curriculum Integration

The Mystery of EPP supports a number of English for Professional Purposes (EPP) learning objectives. First, it uses play to introduce the curriculum: students practice their grammar use, including tenses, conditionals, determiners, and prepositions, as well as vocabulary related to the UN´s Sustainable Development Goals (SDGs), typical academic text kinds, and listening exercises derived from professional communication. By offering a low-stakes, exploratory environment that boosts confidence and reduces linguistic anxiety, the design also aims to affect. The plot as it develops keeps students interested and encourages independent practice as they go at their own speed. As a helpful figure in the story, the lecturer's function changes from gatekeeper to guide. The game helps students apply important abilities rather than just study them by reinforcing key EPP elements. (Lave & Wenger, 1991; Little, 2007)

Gameplay, Mechanics, and Design Features Narrative and Structure

Students begin their journey at the Academy of FH Wien, where a magical disruption has erased the course syllabus and left the faculty in a state of amnesia. To restore order, students must retrieve lost knowledge by progressing through various rooms, each of which contains one or more interactive language tasks that advance the storyline. Grammar puzzles (including gap fills, reordering, multiple choice questions and error correction), vocabulary games centered on academic words and SDG terminology, embedded listening tasks, and brief writing prompts are some of the game's features. Many of the riddles are hinted at in the humorous interactions with NPCs or in their delicately crafted punchlines or poems. Accurate answers open up fresh material and establish a significant link between story development and language proficiency. (Squire, 2011; Gee, 2003) The game is completely browser-based, mobile-friendly, and features a vintage pixel-art aesthetic reminiscent of 1990s RPGs. It requires no installation or login, and its modular architecture allows for quick, adaptable play sessions that run 25 to 40 minutes.

Figure 1: Gameplay screenshots, depicting the title and an in-game grammar challenge © Mag. Xiaming Zhu, BA; images partly created using artificial intelligence

Pedagogical Rationale and Learning Impact

The design of Mystery of EPP is based on recognized theoretical frameworks. The game places learning in a relevant context by utilizing role-playing and narrative, drawing on Serious Game Theory (Gee, 2003). Through choice-driven games, it also integrates ideas from Self-Determination Theory (Deci & Ryan, 1985), which promotes learner autonomy and competency. Additionally, by addressing linguistic variety and promoting classroom inclusion, the game encourages teamwork and fosters problem-solving capabilities. Numerous beneficial learning outcomes, such as enhanced student engagement, better memory of the course information, and a greater willingness to participate in class activities, have been shown with initial classroom use. Students also reported a more positive attitude toward language tasks overall. From an emotional perspective, many learners described the game as “non-threatening” and “motivating,” noting that it helped them feel more prepared for the course and less afraid of making mistakes — particularly in early-semester activities where anxiety can be high. (Krashen, 1982; Reinders & Wattana, 2015)

Innovations and Future Developments

A number of novel aspects set The Mystery of EPP apart from other language-learning resources. The game creates a fun yet educational environment by fusing academic information with plot, humor, and difficulty. Its narrative presents the lecturers as helpful in-game characters, encouraging approachability and engagement, and its structure closely corresponds with the course syllabus, enabling seamless curricular integration. The game encourages students to learn via exploration rather than perfection by emphasizing introspection and patience in addition to performance-based activities. In the future, the game will be extended into modules that concentrate on job application skills, intercultural communication, tourism management, and EPP2, the second chapter of the game series.

Generative Artificial Intelligence Disclosure Statement

The abstract and figure captions were refined using ChatGPT-5.0 (OpenAI), August 2025.

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Tiara and Her Troubled Pedigree: A Serious Game for Enhancing Working Memory and Attention

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Abstract

Tiara and Her Troubled Pedigree is a 2D serious game developed to enhance working memory and selective attention while emphasizing human values via artistic, narrative and cognitive mechanisms. Built in Unity, the design draws on classical cognitive models such as Atkinson & Shiffrin's memory framework (1968) and Miller's capacity theory (1956). This Android puzzle-platformer game is appropriate for ages 12 and above *rated* by Iranian ESRA (Entertainment Software Rating Association). Over five core stages and four training rooms, in addition to the Great Star Memory stage specialized for daily adjustable training, players perform increasingly complex tasks targeting verbal, visual and auditory memory. Finding from Pilot 15 participants study, using self- reports and structured interviews, indicated improved attention and memory perception after one month. Based on scientific review at school of medicine, Shahid Beheshti University of medical science, the game received an Honourable Mention in the Iranian 10th Fajr National Computer Games Festival (2025).

Keywords: serious games; working memory; attention; cognitive training

Introduction

Over the past decade, serious games have emerged as promising tools for cognitive enhancement, particularly targeting executive functions such as memory and attention. Yet, many existing interventions struggle to maintain both scientific validity and narrative appeal (Gao et al 2025; Alexio 2025). This work introduces Tiara and Her Troubled Pedigree, designed to integrate rigorous cognitive theory with a poetic and symbolically rich narrative environment. By structuring gameplay around metaphorical "Mind vaults" and symbolic challenges, the game encourages players only to perform cognitive tasks but also to engage reflectively with moral metaphors. This hybrid of cognition and narrative aims to deepen both adherence and transfer beyond the game context.

Game Design and Cognitive Framework

2.1. Gameplay and narration

Tiara, the heroine of the game is a member of a troubled pedigree, remains bound to the pain and mistakes of her ancestors, whose past actions have led to the illness of the young prince. The player accompanies Tiara through the mental world of her lineage, solving cognitive puzzles to release mental suffering and reshape the past.

Guiding spirits provide information and encouragement, while the mischievous Black Pea, a symbol of the inner shadow, both challenges and directs her. The player must find symbolic passwords to unlock each ancestor's mind, track the Black Pea among similar clones, recall paired signs and open mental vaults. By reversing the dissonant melodies echoing from the "doors of mind," the player transforms each ancestor's inner harmony and completes the stage.

Dynamic feedback includes changes in light and shadow based on success and errors, shining stars and auditory cues. Cognitive tasks progressively increase in difficulty, and 4 training rooms allow players to consolidate skills, collect Stars, and brew the Star Potion, which is ultimately used to save the ailing prince. Upon completing the journey, the player gains access to the Great Memory Star Room, an adjustable space for daily memory and attention practice.

2.2. Theoretical Basis

Each task aligns with established cognitive principles. Attention and visual tracking draw on models of Atkinson and Shiffrin short term memory (1968) and the game's difficulty scaling respects human processing speed and bandwidth limitations as described by Miller (1956) (Friedenberg & Silverman 2015; Sternberg & Sternberg 2017).

2.3. Game Structure and Tasks

The game consists of five main stages, each containing four cognitive tasks:

a) Verbal Memory (Task1): players unscramble letters to form meaningful passwords (e.g. Figure 1).

b) Selective Attention (Task2): the "Black Pea" (Nokhod Siah) must be tracked among similar clones, moreover, players must remember the location where it disappears (e.g. Figure 1).

c) Associative memory (Task3): players memorize paired symbols' positions and relationships to unlock the Mind Vault (e.g. Figure2).

d) Auditory–Visual Sequence Reversal (task4): participants memorize an opening sequence of musical-coloured doors and must reproduce it in reverse order simultaneously engaging phonological and visuospatial working memory (e.g. Figure2). Following the narrative progression, four training rooms allow repetitive refinement of all skills, and a final "Great Memory Star" stage enables daily practice, score recording, and adjustable difficulty.

Benefits

This project demonstrates how a minimalistic 2D aesthetic, when coupled with metaphorical narrative, can reduce extraneous cognitive load (Sweller et al 2019) and promote deeper engagement. Importantly, the game invites moral reflection. Tiara and her troubled pedigree aspires not only to train the mind but also to provoke introspection.

Implementation

The game was implemented in Unity using C# for Android devices, with full bilingual support (Persian and English). A multidisciplinary academic team (cognitive scientists, programmers and artists) collaborated to develop the game. A pilot study with 15 participants aged 14–25 was conducted over one month, comprising structured interviews and self-report logs. Qualitative data from a one-month gameplay period showed that 80% of participants experienced improvement in memory and attention, including promising preliminary results. These results set the stage for upcoming quantitative and neurocognitive validation.

Figure 1. Task 1 (Unscrambling passwords)/ Task2 (Tracking the Black Pea).

Figure 2. Task 3 (Unlocking mind vault)/ Task4 (Reversing the doors' opening order).

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Author Contributions

Susan Dadkhah designed the game and wrote the manuscript. Yoones Sekhavat provided mentorship and Leila Ayyari contributed to the educational studies related to the game.

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Trash Clash: An Educational Card Game for Waste-Sorting Awareness

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Abstract

Trash Clash is a 2D card-based serious game that designed to raise awareness of proper waste sorting and environmental responsibility. Players engage in fast-paced matches where each card represents a specific type of waste, requiring them to decide the correct disposal category while balancing energy and strategy. The game introduces players to the importance of waste segregation, a crucial step in reducing pollution and landfill buildup, particularly in regions where public awareness remains low. By combining entertainment with education, Trash Clash demonstrates how games could effectively deliver learning experiences that are more interactive and enjoyable compared to traditional media. This approach not only fosters engagement but also strengthens environmental knowledge through the gameplay. Ultimately, Trash Clash aims to inspire behavioural change and promote sustainable habits among players through fun, accessible, and meaningful gameplay.

Keywords: Serious Game; Card Game; Environmental Education; Waste Sorting; Game-Based Learning.

1. Game Summary

1.1. Introduction

Improper solid waste management remains a critical global challenge, particularly in developing countries where waste collection and segregation systems are often inadequate. According to the World Bank, more than 2 billion tons of municipal solid waste are generated globally each year, with at least 33% not managed in an environmentally safe manner (Kaza et al., 2018). Poor segregation practices contribute to pollution, health hazards, and the contamination of soil and groundwater (Ziraba, Haregu and Mberu, 2016; Abubakar et al., 2022). A recent review also highlights that ineffective waste separation can undermine recycling efforts and exacerbate environmental degradation, emphasizing the need for educational initiatives to promote behavioral change (Trushna et al., 2024).

To address this issue, Trash Clash was developed as a serious educational game that combines entertainment and learning to improve awareness of proper waste sorting. The game challenges players to identify, classify, and dispose of different types of waste correctly within an interactive card-based system. By blending playful engagement with environmental education, Trash Clash aims to make learning about waste management both accessible and enjoyable. Through gamification, the project promotes sustainable behavior and supports global efforts toward achieving

environmentally responsible waste practices.

1.2. Target Audience

Trash Clash targets teenagers and adults aged 13–35 who enjoy strategy or card-battle games. Designed for both casual and competitive players, it appeals to those seeking meaningful entertainment while raising awareness about proper waste segregation and environmental sustainability through engaging, educational gameplay.

1.3. Educational Objectives

The main educational goal of Trash Clash is to raise awareness about proper waste segregation and environmental responsibility. Through strategic 1v1 card-based gameplay, players learn to identify and categorize different types of waste correctly, understanding the consequences of improper disposal in an engaging and interactive way.

1.4. Core Gameplay

Trash Clash features a fast-paced, turn-based 1v1 system of six rounds, where players compete to earn the highest score by sorting waste correctly and using strategic card play.

1.5. Card System and Waste Categories

There are 30 different cards across five waste categories (Organic, Inorganic, Residue, Paper, and Toxic) each with unique effects that reward correct sorting or penalize mistakes.

1.6. Randomized Objectives

Three trash bins appear in randomized rounds, ensuring varied matches, maintaining challenge, and enhancing replay ability through dynamic objectives and unpredictable gameplay outcomes.

1.7. Cross-Platform Accessibility

Trash Clash is available on PC and Mobile, expanding accessibility and promoting environmental education across diverse player demographics.

2. In-Game Visuals

Figure 1. Screenshot of Trash Clash gameplay on PC (left) and on mobile (right) © Bawang Studio. Licensed under CC BY 4.0. Source: Author's original work.

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Unlock Bath: Built from Beneath

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Abstract

Unlock Bath: Built from Beneath is a digital escape room that invites players to explore the layered history of Bath through the lens of its iconic Bath Stone. Developed by Echo Games and co-designed with five regional museums, the game blends time-travel, puzzle-solving, and digital storytelling to uncover the city's bright and dark historical chapters. Players assume the role of future researchers working for the Unlock Collective, traveling back in time to investigate a mysterious colour-change phenomenon. Through a series of puzzles, the project aims to foster curiosity and promote cultural heritage engagement. The project also encouraged collaboration among small museums.

Keywords: heritage; escape room; digital; game; Bath

Introduction

Unlock Bath: Built from Beneath is a digital escape room experience developed by Echo Games CIC to engage players with the multilayered heritage of the city of Bath. Funded by the Bristol+Bath Creative R+D Trailblazer, the game was co-created with five regional museums to bridge the gap between cultural heritage and digital innovation. By combining interactive storytelling with real artefacts, the game offers a unique educational experience that deepens understanding of Bath's social, industrial, and architectural evolution.

Game Overview

Background

Bath Stone, a distinctive oolitic limestone, has shaped the city's architecture and identity for centuries (1). Its story, however, extends far beyond its aesthetic appeal. From its Jurassic origins to its extraction by miners and its use in grand buildings, Bath Stone reflects the city's complex socio-economic history. Yet, Bath's public narrative has often leaned toward celebrating its grandeur and elegance, focusing on the achievements of the wealthy and the beauty of its Georgian architecture. This selective storytelling tends to overlook the contributions of the working class - the miners, builders, and laborers - who physically constructed the city and whose lives were deeply intertwined with its development and everyday life. Unlock Bath: Built

from Beneath challenges this one-sided view by exploring the multiple layers of Bath's past, presenting both the bright and dark chapters and giving voice to those who have historically been left out of the spotlight.

Purpose and Objectives

The primary aim of Unlock Bath: Built from Beneath is to **educate and engage** players with the rich, layered history of Bath through an immersive digital experience. By stepping into the role of a time-traveling researcher for the Unlock Collective, players uncover stories connected with the Bath Stone used to build the city. Those stories reflect the city's social, industrial, and architectural evolution. The game seeks to highlight the contributions of both the working class and the elite, offering a balanced and nuanced narrative.

The project also aims to **foster curiosity and deepen public engagement with five regional museums** that weren't offering digital experiences yet due to a lack of resources and whose collections often remain in the shadow of Bath's more famous landmarks the Roman Baths and the Abbey): Bath Royal Literary and Scientific Institution (BRLSI), Radstock Museum, the Museum of Bath at Work, the Museum of Bath Stone, and Bath Medical Museum. To ensure equitable representation, the development process was deeply collaborative. For example, we held a one-day participatory workshop where museum professionals from each museum shared stories and institutional values. This integrative design approach encouraged collaboration among small museums, sparked critical conversations about the history of Bath, and informed future joint initiatives (2).

Target Audience

The game is intentionally designed as an escape room to appeal to the general public, including museum visitors and tourists interested in Bath's history. Escape rooms are increasingly popular worldwide and attract players from diverse backgrounds and demographics (3).

Gameplay and Narrative

Players assume the role of time-traveling researchers for the Unlock Collective, tasked with investigating why a piece of Bath stone was discovered tinted blue instead of its iconic creamy beige. The game unfolds through a series of puzzles tied to four key historical thematic periods for Bath:

- Prehistory and the origins of Bath stone.
- The quarry and its workers.
- The colliery and its workers.
- Medical legacy of Bath.

Each theme in the game is represented by an image. Players can select an image to explore scenes related to that theme, solve puzzles, and collect clues. Within each theme, players must complete a series of puzzles – some of which require clues to

unlock. Each puzzle is connected to real artefacts and museum collections, enhancing the game's educational value. As puzzles are solved, more information is revealed, gradually populating the player's initially blank map. Once all puzzles are solved, players are left with all the clues needed to complete their investigation.

Impact

By linking digital storytelling to real artefacts, the game enhances public understanding of Bath's heritage and invites deeper exploration of its historical complexities. It makes history more accessible and engages a wide audience. Furthermore, the collaborative development process brought together five regional museums, inspiring future collaborations – something that happens very rarely. In the end, the game not only serves as an educational tool but also as a catalyst for innovation in how museums collaborate and share their collections. The game is currently hosted by Echo Games CIC so the museums need not engage any technical setup or configuration and to ensure that museums do not face maintenance issues, and it is freely available to play online: www.echogames.co.uk/games/built-frombeneath.

Figure 1. Game map. Image source: © Echo Games CIC. Licensed under Creative Commons (CC BY 4.0). Image source: Echo Games CIC.

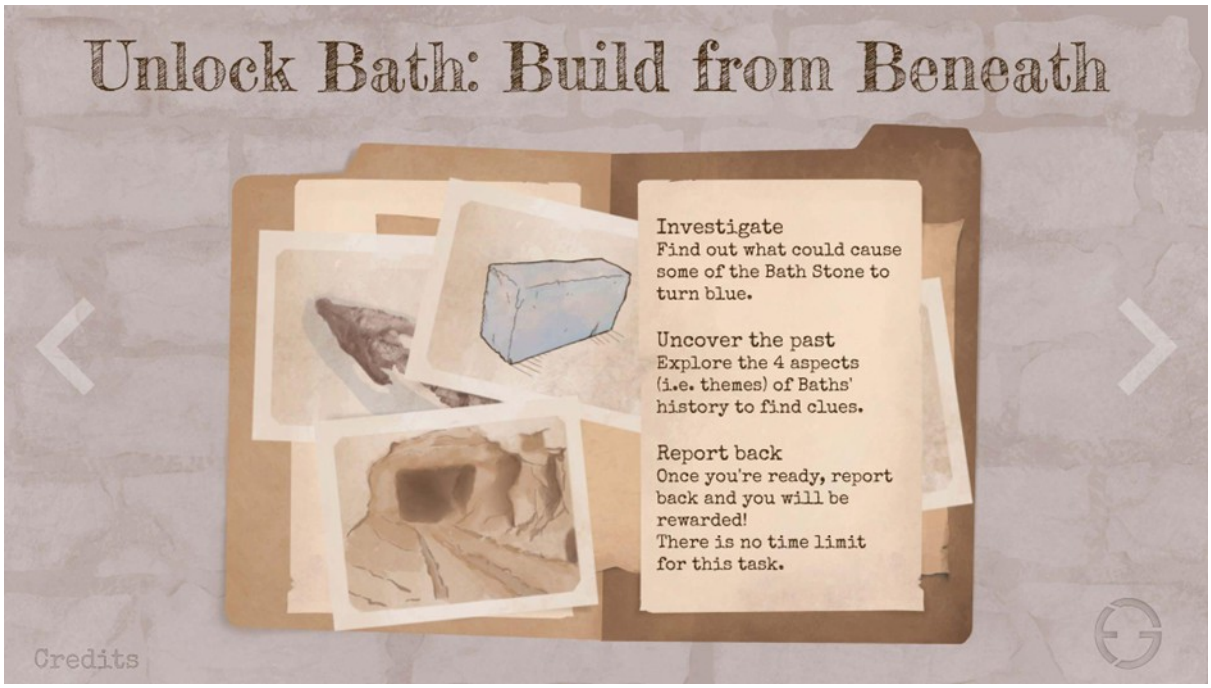

Figure 2. Game mission. © Echo Games CIC. Licensed under Creative Commons (CC BY 4.0). Image source: Echo Games CIC.

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Up The Stairs: Research-Based Serious Game to Empower Young Adults with Aphasia

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Abstract

Up The Stairs is a research-based Serious Game designed to empower young adults with aphasia, through educational, self-directed, accessible play. Developed with game engine technology (Unity), it merges a 3D exploratory island with 2D mini-games and audiovisual art and design, integrating evidence-based speech-therapy methods (PACE, Cognitive Speech Therapy; MIT planned) to enhance communication, cognition and confidence. Gameplay progression follows a multilayered “Station System,” aligning location, linguistic theme, communicative function, and alphabetical order (here: Greek A-Ω). Each Narrative Station integrates functional and outcome-based actions to strengthen language, cognitive and perceptual skills - supported by adaptive difficulty, modular progression and a human-centred, multimodal design, that promotes personalisation, autonomy and long-term engagement through an accessible, ergonomic User Interface with intuitive navigation and feedback. The prototype demonstrates transferability to linguistic, health and educational contexts, paving the way for further development of a Game Mechanics for Empowerment Framework (GaME-F).

Keywords: serious games; inclusive game design; speech therapy for aphasia rehabilitation; accessible language learning; Game Mechanics for Empowerment Framework (GaME-F / GaME-F-A)

Introduction

About two million people in the United States alone are affected by aphasia, a language disorder that impairs expression and/or comprehension of spoken and/or written language, which occurs in 38% of stroke survivors [1]. As identified in the author’s earlier research [2], most aphasia rehabilitation efforts, which predominantly target older individuals, often overlook younger adults and the empowering potential of self-directed game-based approaches. To address these gaps, Up the Stairs was developed within the author’s dissertation and builds on her earlier research Game Mechanics in Serious Games for the Empowerment of Young Adults with Aphasia [2]. Outcomes from that study - especially the New Specialised Categorisation of Game

Mechanics for Serious Games (and Gamification) for Aphasia and the Three-Pole Conjecture - informed the game’s design logic and structure, following a Design Thinking approach.

Game Overview: Integrated Design Serving the Game's Purpose

Every design solution (visual, audio or technical) is a deliberate choice to serve the game's main goals.

Concept, Target Audience and Objectives: Up the Stairs was created primarily to empower young adults with aphasia and secondarily to support older users, therapists, and families. It is a first-person exploration adventure, set in 3D, enriched with 2D mini games across multiple sub-genres. The game aims to enhance expressive and receptive communication, cognitive flexibility, and confidence in language use (Greek in this prototype), while fostering emotional resilience and self-agency, preserving the fun elements of gaming. Unlike stand-alone gamified therapy or learning tools, it embeds evidence-based methods - PACE (Promoting Aphasics' Communicative Effectiveness), Cognitive Speech Therapy and Melodic Intonation Therapy (MIT, planned for future version) - within self-directed gameplay. Designed for independent use and early exploration within therapeutic contexts, Up the Stairs shows potential for broader educational and rehabilitative applications.

Synopsis and World (Look and Feel): The game opens with a light tremor (cut-scene) that shakes a vast staircase spiraling towards a floating sculpted head in the sky. A burst of cloud-shaped letters erupts. The player - glimpsed in first person - falls from the sky and lands on a gently surreal Greek Aegean Island, warmly sunlit and slightly dreamlike. The visual style blends surrealism, symbolism, romanticism and grounded realism to shape a poetic, emotionally resonant and safe world. Here, prickly pears hover, chickens have humor, corn holds meaning, and postcards are never sent; each a symbolic yet functional element within the economy and reward systems, that support progress towards the game's ultimate goal: rebuilding the great staircase, a metaphor for recovery and return to life.

Technical Design, Controls and Interaction for User-Specific Needs*:* Built in Unity (currently PC-based) primarily using visual scripting to minimise C# coding and to enable rapid, design-oriented prototyping. Finite-state machines, integer comparisons and global variables manage object states, progression and challenges, while arrays support the economy, reward systems and randomisation in the card-based minigames. Unity's native terrain, lighting and environmental systems (sky, water, wind, particles) shape the island's atmosphere, supported by ProBuilder for iterative structure, Post-Processing for the Mediterranean tone, and the Animator Controller for animation and transitions. (Assets were created with 3ds Max, Mudbox, Substance Painter, Photoshop, Premiere Pro and Cubase). Audio combines ambient and interactive soundscapes to enhance focus and inclusion, includes over 300 recorded entries for future integration, and features an original soundtrack for empowerment. UI and navigation integrate: arrow-key and mouse control with intuitive point-and-click menus and 2D interfaces (haptic feedback planned), icon-based overlays, hover feedback, colour and sound cues (for guidance and reward), auto-collect on collision (to reduce user motor load), and terrain layout supporting spatial orientation and ease of movement; all designed to address user-specific needs.

Level Design, Game Mechanics and the "Station System": Up the Stairs opens with an introductory training level, structured around a beginning, middle and end, both narratively and spatially: the terrain follows a π-shaped path that guides players through progressive stages of "Exploration, Familiarisation, and Autonomy". The first mission introduces multi-purpose prickly pears as access tokens, symbolic items, and navigation markers, followed by a 2D memory-card mini-game, which functions both as tutorial and cognitive exercise. This "Memory Bridge Station" unlocks the island's main areas and initiates the player into the modular Station System. The system governs progression through a multilayered, adaptive framework that integrates narrative, challenge, accessibility, and therapeutic/educational functions. Stations operate as independent training modules, allowing modular progression, adaptive difficulty, repetition and free exploration, while sequential unlocking, combined with the freedom to revisit, supports self-paced practice. Rooted in human-centered design, the system fosters personalisation, autonomy and multimodal interaction through sound, image, and text, enhancing long-term engagement and accessibility. Each Station represents a thematic communication field (e.g. food, animals) with targeted activities combining functional and outcome-based tasks to strengthen linguistic, cognitive, and perceptual skills (e.g. lexical retrieval, naming, focused listening, numeracy, problem-solving, and working-memory training). Spatial layout aligns location, linguistic theme, communicative function and alphabetical order. For instance, the "Windmill Café Station" explores the theme of "food - breakfast" with a card game designed primarily to support auditory comprehension and word-image association, while introducing vocabulary linked to the first four Greek letters - Αυγό (egg), Βούτυρο (butter), Γάλα (milk), Δημητριακά (cereal). Eight designed Stations span the Greek alphabet (three currently functional), adaptable to other languages and contexts. Furthermore, within this ecosystem, players are guided by Young Oceanus (meaning "ocean"), a mentor figure running a whimsical pop-up canteen, envisioned for full 3D development to expand practice, dialogue and narrative integration.

Future Development and Outlook

Future iterations are designed and envisioned to expand narrative integration, Stations and everyday scenarios, vocabulary and verb networking, musical intonation (MIT), 3D character interaction, social-skills enhancement, and multilingual extensions, while incorporating ethical design and further testing through interdisciplinary human centred co-design, advancing towards an inclusive platform for creative engagement, progress, and empowerment for individuals with aphasia. Together with its design documentation and preceding research outcomes on game mechanics, this prototype forms a unified body of work bridging theory and practice, and laying the groundwork for a Game Mechanics for Empowerment Framework (GaME-F) and its aphasia specific version (GaME-F-A), to conceptualise an interdisciplinary, evidence-based methodology and design taxonomy that connects game design and technology with educational/rehabilitative practices, for accessibility, engagement, and empowerment across Serious Games and gamified processes in digital and real-world contexts.

Figure 1. Composite of in-game captures: “Reflection Dome Station”, map, controls, Colour Challenge. © A. Mavroeidakou 2025 (CC BY-NC-ND 4.0). Source: Up The Stairs (prototype).

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Generative Artificial Intelligence Disclosure Statement

Portions of the text were refined for clarity and language using ChatGPT-5 (OpenAI), October 2025. All ideas and content are the author’s own.

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Virtual OV

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Abstract

Virtual OV, which is Dutch for Virtual Public Transport, is a serious Virtual Reality game designed to train independent travel using public transport, primarily aimed at neurodivergent youth such as those with autism or mild intellectual disabilities. Ultimately, it can be used by anyone who wants to learn to travel with public transport. The goal is to educate and build confidence for safe and efficient use of public transport, thereby promoting accessibility and inclusion. The game is developed using 6DoF VR technology, enabling training of participants' executive functions and management of sensory stimuli. Virtual OV aligns with national education programs on Citizenship and provides governments with a means to implement the UN Convention on the Rights of Persons with Disabilities. Virtual OV promotes behavioural change through realistic simulations, interactive scenarios, and immediate feedback. It supports schools and governments in implementing inclusive mobility training.

Keywords: Public transport; neurodiversity; virtual reality; educational simulation; accessibility

Introduction and Relevance

Independent use of public transport is essential for social participation and inclusion (Lang, 2022). Virtual OV addresses the need for training and support, especially for neurodivergent youth, by providing a safe virtual environment in which every day public transport situations can be practiced. The neurodivergent population is substantial (approximately 15–20% of the global population) (Doyle, 2020). A large portion of this group needs specific support to become self-reliant in traveling by public transport. This has major implications for governments, especially regarding school transportation, where increasing tailored and inclusive solutions are demanded. Virtual OV can serve as an innovative tool to reduce transportation costs and promote independent travel, positively impacting users as well as municipal policy around school transport.

Target Audience and Context

The Virtual OV platform targets neurodivergent students in special education and young adults in vocational education (MBO). Virtual OV is used in schools, special support institutions, and organizations focused on inclusive mobility.

Objectives and Curricula

Virtual OV aims to enhance self-reliance of neurodivergent youth in knowledge, social skills, and confidence regarding public transport, and also contributes to managing external stimuli more broadly. It can be integrated into educational programs on citizenship and mobility, aligning with social inclusion and accessibility policy goals.

Narrative, Gameplay, and Mechanics

Virtual OV simulates everyday public transport scenarios such as planning your trip, traveling by various transport modes, and dealing with unforeseen circumstances. Gameplay combines realistic visuals with interactive tasks and situational choices, fostering active engagement and deepening the learning experience.

Achieving Goals

The game focuses not only on knowledge acquisition but especially on embedding actions by training procedural memory. Through repeated realistic scenarios and routine tasks, these actions become automated. Realistic repetition challenges and strengthens the brain's capacity by activating neuroplasticity mechanisms, as demonstrated by immersive VR training interventions which improve cognitive and social skills in neurodivergent individuals (Raffaele, Lombardo and Baron-Cohen, 2024), so players confronted with sensory overload in real travel can rely on trained routines and retain confidence to successfully complete their trips. The adaptive nature of the training allows difficulty level and sensory input to be tailored to individual needs and learning pace, promoting durable skill retention.

Innovation and Technology

Virtual OV uses advanced 6DoF VR technology providing full six-direction freedom of movement, creating an immersive and highly realistic training environment. This allows participants to actively practice real-world tasks. The intensive training in a controlled virtual setting strengthens executive functions such as planning, attention, and impulse control (Sun et al., 2024). Scenarios are supplemented with interactive elements and coach feedback, enriching the learning process and engagement. Repeated practice of various situations ensures skills are retained and performed automatically in real life, even under high sensory load, making this VR training unique in reinforcing procedural memory and behavioral retention.

Virtual OV is supported by a companion app that allows a teacher or coach to observe the player's actions in real time. The coach can intervene immediately and discuss task performance with the player to enhance executive function development. When stress levels are high, spoken instructions can be repeated to reduce tension. If a task is too challenging, for example, a student with an IQ below 60 needing to buy a train ticket, that task can be skipped, ensuring the journey continues without disruption. This supports confidence and motivation to complete the whole travel experience.

Visual Representation

Figure 1: Transition from specialized taxis to public transport through Virtual OV.

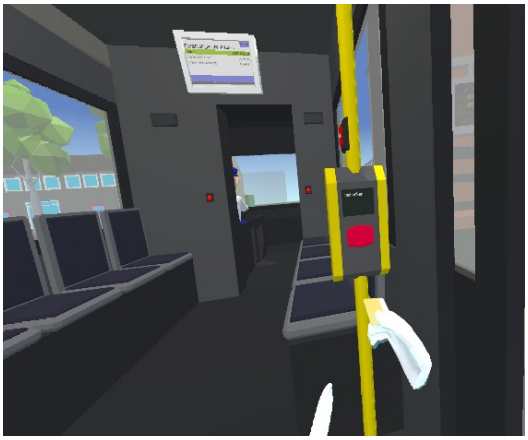

Figure 2: Screenshot of player checking in.

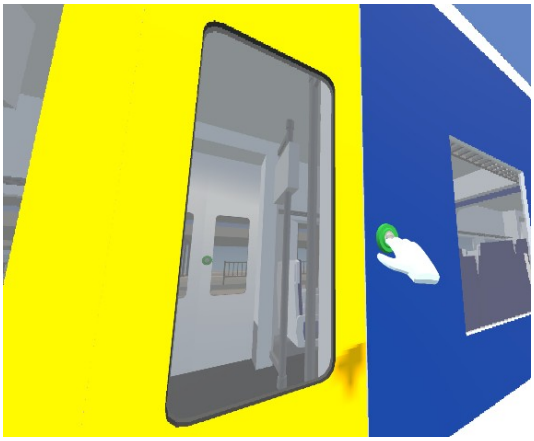

Figure 3: Screenshot of opening a train door.

Figure 4: Screenshot of the inside of a tram that displays the upcoming destinations.
 Image source: Author's original work.

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Volcanic Explorer NZ: Grab Bag Game

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Abstract

Volcanic Explorer NZ is a series of digital educational minigames designed to help children in Aotearoa New Zealand learn about volcanic hazards through play. Here, we showcase the Grab Bag minigame, which teaches emergency preparedness by challenging players to select and pack essential items before evacuating during an eruption. Players practice decision-making, resource use, and self-management through three stages: packing, tutorial, and evacuation. Developed with teachers, the game integrates New Zealand's science curriculum in primary schools and civil defense guidance around natural disasters. Gameplay sessions showed the game fosters discussion and reflection on real-world hazard responses in classroom settings. An accompanying teacher guide aligns gameplay with learning outcomes, supporting classroom collaboration and linking in-game experiences to hands-on activities such as creating personal grab bags. The analysis of teacher interviews and classroom observations demonstrates how locally grounded, human-centered design can strengthen disaster-preparedness education and promote collaborative learning within formal primary-school contexts.

Keywords: Serious Games, Science Education, Disaster Preparedness, Collaborative Learning, Volcanic Hazards

Introduction

Volcanoes are an integral part of the landscape of Aotearoa New Zealand, where communities reside close to both active and dormant volcanoes. Children, often the most vulnerable in disaster situations, need accessible ways to learn about volcanic processes, risk, and preparedness. Serious, or educational, games provide an engaging, low-risk environment for children to confront real-world problems and learn important communication and team-based skills (1,2). We designed Volcanic Explorer NZ using human-centred design, incorporating local imagery and culturally relevant elements, such as hazards represented by supernatural beings (Taniwha in the indigenous Māori world) and native fauna, to communicate volcanic science

through play. Volcanic Explorer NZ is designed as a set of minigames as a flexible intervention to address the different needs of learners and classrooms. Here, we focus on one minigame, the Grab Bag Game, which introduces students to the concept of an emergency "grab bag", a small bag packed with essentials like food and water, for rapid evacuation during a volcanic eruption or other natural hazards.

Learning Objectives and Curriculum Alignment

The game aligns closely with New Zealand's Nature of Science and Earth Systems science learning objectives, such as communicating and engaging in science (3). These objectives are threefold. First, within the sub-strand of Participating and Contributing, the game allows students to apply their developing scientific understanding to real-world contexts by identifying practical actions to prepare for volcanic hazards. Secondly, through the Engaging with Science capability, the game serves as a foundation to facilitate preparedness strategies both in class and at home, fostering communication and shared learning. Thirdly, under the Earth Systems contextual strand, students explore how geological processes affect communities and how proactive preparation can reduce risk with the game and accompanying learning materials. The accompanying teacher guide and student materials support these outcomes by providing background on civil defense guidance and curated online resources, discussion prompts for pre- and post-game reflection (e.g., "What would you pack and why?"), and suggested class and home activities, such as creating real grab bags.

Game Overview

The *Grab Bag Game* is part of *Volcanic Explorer NZ*, which includes several minigames as well as an accompanying teacher guide and student materials created in collaboration with New Zealand educators. Designed for formal classroom use, the game is played on school computers or tablets within a single lesson or as part of a broader science module on natural hazards. It targets primary-school learners aged 8–11 years and aims to build understanding of volcanic hazards, preparedness of the player, and prompt children to engage in conversations about emergency planning at school and home. The game is supported by curriculum-aligned teaching resources designed with New Zealand teachers, which include useful discussion questions, classroom activities and take-home activities.

Gameplay and Mechanics

To start, 5 Characters inspired by native New Zealand fauna can be chosen as player avatars for the minigame. This game aims to prepare players to pack and evacuate for a volcanic eruption across three phases. In the **Packing Phase** (Fig. 1a), players choose eight essential items from a larger pool of items to include in their grab bag, with selection influencing subsequent gameplay; for example, a torch enhances visibility while food restores stamina. During the **Tutorial Phase**, players practice navigation and interaction, learning how each chosen item functions, thereby giving players an incentive to keep replaying, if needed, to explore earlier decisions. This connects to a real-world strategy of practicing an evacuation route to reach a designated safe zone. The final **Evacuation Phase** (Fig. 1b) challenges players to independently reach the safe zone without guidance from the game, thus

applying an understanding of their items' utility while under pressure. The design promotes reflection-in-action, allowing players to experience the immediate outcomes of their choices and strengthening key preparedness concepts such as prioritization and resourcefulness. The stylized 2.5D environment draws inspiration from New Zealand's landscapes and cultural heritage to give players a sense of familiarity and recognition to feel connected with the game.

Figure 1. Screenshot of the Grab Bag Game's packing (a) and evacuation (b) phase. © Copyright of the authors. Image Source: [Author's original work].

Innovative Design Elements

The *Grab Bag Game* introduces three main innovations. First, it integrates **digital and physical learning** by linking in-game decision-making with take-home activities, bridging classroom engagement and home preparedness. Second, it applies to a **human-centered co-design** approach, with both the game and teacher guide developed iteratively alongside educators and trialed in schools to ensure strong curricular alignment and practical usability. Third, it emphasizes **familiar contexts for players**, weaving local cultural symbols and landscapes into the narrative and visual design to enhance relevance for New Zealand learners and uphold bicultural education principles.

Evaluation and Future Work

Preliminary analysis of classroom observations and teacher interviews suggests that the accompanying teacher guide substantially enhances discussion, collaboration, and student confidence when engaging with preparedness topics. Current and future evaluation efforts with more student and teacher groups focus on three main areas: (1) measuring collaborative behaviors and learning outcomes during gameplay to better understand how students co-construct knowledge; (2) refining the guide's usability to accommodate diverse teaching styles, class sizes, and technological contexts; and (3) expanding the Volcanic Explorer NZ ecosystem to include additional hazard scenarios, while maintaining the co-designed, education-centered development framework.

Conclusion

The Grab Bag Game demonstrates how serious games can enhance science

education by embedding authentic, locally grounded experiences within classroom learning. By integrating digital gameplay with curriculum objectives and teacher-facilitated reflection, the game aims to help young learners develop knowledge and confidence to take action to prepare for natural hazards, fostering both scientific literacy and community resilience.

Acknowledgements

We would like to thank all participating teachers and students from Canterbury schools, and the New Zealand Civil Defense for their publicly available resources on emergency preparedness. The games were developed by the research team in collaboration with Rodrigo Dias Takase (Game Development) and Shunsuke Fukuden (Art).

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Competing Interests

The authors have no competing interests to declare that they are relevant to this article.

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Watts and Homes: Enhancing Solar Energy Awareness through a Serious Game for Rural Electrification

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Abstract

Watts and Homes is a serious game designed to enhance public awareness and understanding of renewable energy, focusing on solar energy as a practical solution to rural electrification challenges in Indonesia's remote and hard-to-reach regions. The game combines a light narrative structure with level-based logic puzzles that simulate simplified solar panel installation through power-matching challenges. Players take the role of a volunteer tasked with bringing clean energy to underserved areas, with core concepts of solar energy and sustainability introduced throughout the gameplay. Players analyse limited resources and make efficient decisions to meet each household's energy needs. This interactive approach transforms technical energy concepts into accessible and engaging learning experiences, fostering understanding of how renewable energy can promote equal access and sustainable development.

Keywords: Renewable Energy; Solar Energy; Rural Electrification; Logic Puzzle

1. Introduction

Energy accessibility remains a global challenge, particularly in remote and underserved regions of developing countries (Rumbayan et al., 2025; Ukoba et al., 2024). In Indonesia, many rural communities continue to face unreliable or limited access to electricity due to geographical isolation, low population density, and high infrastructure costs (Bawan et al., 2025). Similar challenges are also found in other parts of the world, such as Africa and South Asia, where traditional grid expansion is often unfeasible (Rumbayan et al., 2025). Solar energy has emerged as a practical and sustainable solution to bridge this gap, offering decentralized power that supports essential needs such as lighting, education, and healthcare (Ukoba et al., 2024). However, despite its potential, public understanding of solar power technology remains limited, especially among younger audiences and communities with minimal technical exposure (Rumbayan et al., 2025). Watts and Homes was developed to address this issue through an engaging, game-based learning approach that simplifies renewable energy concepts and promotes awareness of how solar power can transform lives in under-electrified regions.

1.1 Target Audience

The target audience for Watts and Homes mainly includes teenagers and young adults aged 13 to 25. This age group is familiar with digital games and are generally

curious about topics like the environment and renewable energy. The game is also suitable for students, educators, and anyone interested in learning about solar energy through fun, interactive gameplay.

1.2 Educational Goals

The main educational goal of *Watts and Homes* is to introduce players to the basic idea of how solar power can provide electricity in areas with limited access. Instead of focusing on technical details, the game encourages players to think logically, plan efficiently, and see the value of renewable energy in daily life. Its design aims to build awareness and appreciation of clean-energy solutions through simple, puzzle-based learning.

1.3 Sustainable Development Goals (SDGs)

Watts and Homes aligns with SDG 7 (Affordable and Clean Energy) by presenting solar power as a practical and sustainable solution for electrification in remote and hard-to-reach areas. The game highlights how renewable technologies can improve energy access in regions where traditional grids are difficult to implement. It also supports SDG 4 (Quality Education) by using puzzle-based gameplay to teach simplified solar power concepts, making renewable energy education both interactive and easy to understand.

2. Gameplay Overview

Watts and Homes combines simulation and puzzle mechanics to deliver educational content about solar power systems through interactive play. The player takes the role of a volunteer assisting residents in a rural village to install home-scale solar power systems. Each level or house represents a different household, featuring unique installation challenges and energy requirements. The game maintains a narrative progression in each house that reflects real social impact, showing how electrification transforms the lives of the villagers and promotes energy independence.

2.1. Game Objectives

The main objective of Watts and Homes is for players to complete each level by efficiently supplying enough energy to meet every household's power requirement. Players can earn up to three stars based on how effectively they manage available resources, with high performance unlocking a secret level as a reward. The game features simplified power-matching puzzles, called the Power Match Challenge, designed to help players understand energy distribution and efficiency. Through this gameplay structure, Watts and Homes encourage players to think critically about energy efficiency and resource management while subtly introducing the core principles of renewable energy.

2.2. Game Mechanics

Gameplay is structured around a logic-based puzzle system representing simplified solar power setups. In the Power Match Challenge, players allocate limited solar cells, frames, cables, and other components to meet each household's energy demand. The game does not focus on building solar systems from scratch but instead emphasizes the logic and efficiency of distributing power effectively by

dragging and connecting each component to deliver the required power output. By translating real-world solar power concepts into interactive gameplay, Watts and Homes turns technical knowledge into an engaging and approachable learning experience.

2.3. Game Flow

The game follows a linear, level-based structure represented by a village map. Players progress through five main houses and can unlock a final secret stage by collecting all available stars. Between puzzle phases, short narrative dialogues unfold, reflecting the villagers' changing lives as electricity becomes available. The player's success gradually transforms the map's visuals from dark and unlit to bright and lively, symbolizing empowerment and self-reliance through renewable energy. This clear flow ensures that learning outcomes are seamlessly integrated with emotional engagement and visual progression.

3. In-Game Visuals

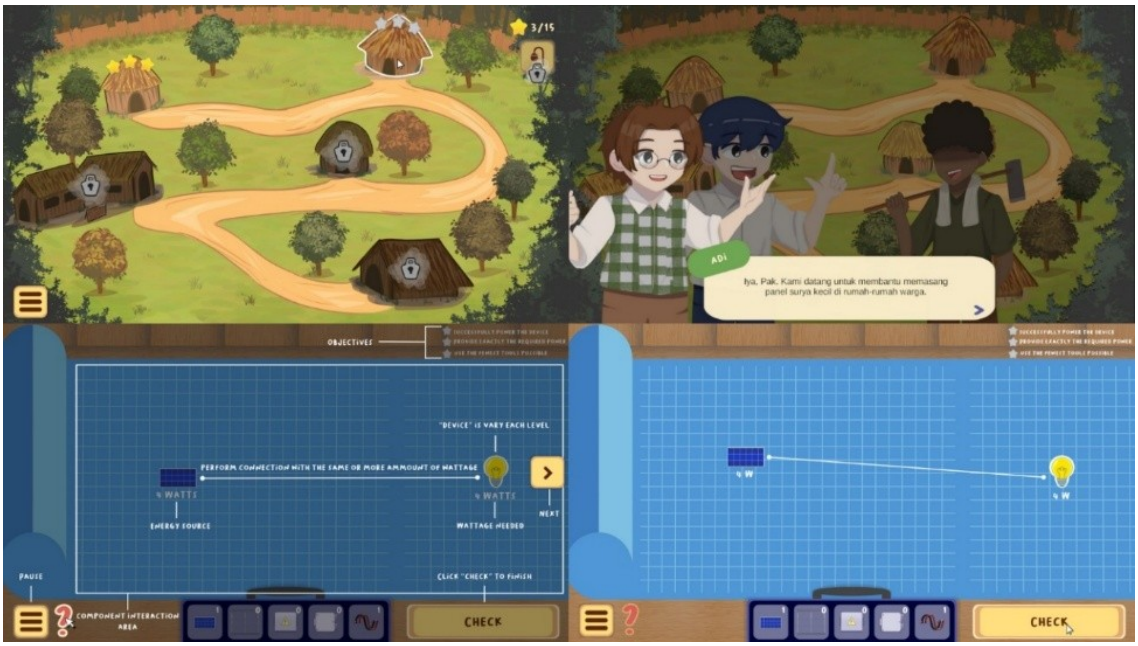

Figure 1. In-game screenshots from Watts and Homes showing, from top left to bottom right: Map Level, Dialogue Conversation, Tutorial Screen, and Power Match Challenge. ©Copyright of the author. Licensed under Creative Commons (CC BY 4.0). Image source: Author's original work.

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Way Home: A Serious Game for Psychosocial Rehabilitation of Mental Health Issues Through Domestic Simulation

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Abstract

Way Home is a serious game designed to support the psychosocial rehabilitation of psychiatric patients during their transition from hospital care to independent living. Developed in collaboration with the Day Hospital of Psychiatry in Ferrol (Spain), the game simulates the management of a virtual household, allowing users to practice instrumental activities of daily living (IADLs) in a safe, structured, and gamified environment.

The game targets adult patients with limited prior experience in digital environments and focuses on fostering autonomy, planning, and self-efficacy through repetitive, low-pressure tasks. Gameplay is structured around a virtual calendar, with daily routines and feedback loops that reinforce positive habits without penalization. The design prioritizes accessibility, cognitive simplicity, and therapeutic relevance, and has been validated by clinical professionals.

Keywords: Game Design; Behavioural Change; Psychosocial Rehabilitation; Occupational Therapy; Domestic Simulation.

Serious Games Applied to Mental Health

Serious games have demonstrated significant potential in the field of rehabilitation, contributing to cognitive enhancement and providing emotional support within clinical environments. Their capacity to motivate, emotionally engage, and facilitate learning through active interaction and positive reinforcement makes them particularly beneficial for individuals with mental health conditions [1,2].

Recent systematic reviews and meta-analyses reinforce the efficacy of serious games in improving mental health outcomes. For instance, Dewhirst et al. [3] reviewed studies on ADHD, depression, schizophrenia, and bipolar disorder, reporting positive therapeutic effects, especially in symptom reduction and increased motivation. Similarly, Abd-Alrazaq et al. [4] found that both exergames and games based on cognitive behavioural therapy (CBT) significantly alleviate depressive symptoms, although they highlight the necessity for more rigorous methodological designs. These findings support the role of serious games as effective complementary tools in mental healthcare.

According to a review published in *Frontiers in Psychiatry* [1], serious games for mental health can be categorized into six main types: exergames, virtual reality experiences, CBT-based games, adapted commercial games, biofeedback applications, and cognitive training tools. Among these, CBT-based games have shown particular promise. Consequently, our project focuses on this category.

Context and motivation

The Way Home project originated within the Master's Degree in Video Game Design, Development and Marketing at the University of A Coruña (Spain), as part of the Serious Games course. It was conceived to address a specific clinical challenge: supporting psychiatric patients in their transition from hospital care to independent living. Many patients face difficulties in re-establishing basic domestic routines post-discharge, which can hinder their autonomy and self-esteem.

Developed as a Service-Learning (S-L) initiative, Way Home integrates academic training with real-world social impact. The S-L methodology fosters both professional competencies and civic responsibility, offering students meaningful learning experiences while addressing community needs. Research by Salcedo Mateu [5], Sotelino-Losada et al. [6], and González-Geraldo et al. [7] underscores the value of S-L in higher education, particularly in cultivating resilience and social engagement.

The game provides a supportive, penalty-free virtual environment where users can practice household tasks repetitively and systematically, reinforced by positive feedback. Its design prioritizes accessibility, low cognitive demand, and clinical supervision to ensure suitability for the target population.

Design and methodology

Way Home was developed using an agile, participatory design approach [8], involving continuous collaboration between the development team and clinical professionals. The design adheres to best practices in therapeutic game development, emphasizing co-design, integration of CBT principles, accessibility, cognitive simplicity, and sustained user engagement [9].

Key design elements include:

- Domestic simulation: Users interact with a virtual home in disarray, performing tasks such as cleaning, cooking, and organizing.
- Routine-based gameplay: Structured around virtual days, weeks, and months to foster habit formation and time awareness.
- User-friendly interface: Simple mouse-based controls, low-poly visuals, and a slow-paced environment enhance accessibility.
- Positive reinforcement: Visual and auditory cues reward progress, avoiding punitive mechanisms.
- Progressive complexity: New rooms and tasks are gradually introduced to

maintain engagement.

The game is intended for use within hospital settings under professional supervision. Initial consultations with hospital staff identified the need for a tool that replicates a home-like environment to support the rehabilitation of instrumental activities of daily living (IADLs), addressing the limitations of traditional clinical spaces.

Following these discussions, the team conducted brainstorming sessions to define tasks, evaluate suitable mechanics, and anticipate potential challenges through premortem analysis. Iterative development cycles, informed by regular feedback from clinicians, ensured alignment with therapeutic goals. This collaborative process culminated in the hospital's full validation of the final design, confirming its clinical relevance and functionality.

As can be seen in Figure 1, the objective of the game is to organise and maintain a virtual home. This helps to develop executive skills, such as planning tasks, prioritizing actions, managing time, using tools properly, and making functional decisions. The environment responds visually and audibly to this progress, generating a sense of achievement and stability.

Figure 1. A sample of the Way Home prototype showing the kitchen. The toolbar for cleaning tasks is at the bottom, the arrows for changing rooms are on the side, the day of the week is indicated at the top right, and the button for the end of the day is in the bottom right corner. © Castro, Alberto & Martos.

To ensure a minimal learning curve, user interaction is restricted to basic mouse controls: users perform actions with a left click, while they can rotate the virtual room using the mouse wheel. This streamlined interface enhances usability, particularly for individuals with limited digital literacy. On the first day of gameplay, an interactive tutorial with pop-up messages guides users step by step. Additionally, practical tips are displayed during loading screens to reinforce the game mechanics.

Future research directions will focus on conducting empirical evaluations with patient populations to assess the game's therapeutic efficacy, exploring its adaptation to alternative care settings such as nursing homes and day centers, integrating clinical metrics to enhance the monitoring of patient progress, and developing mechanisms for content personalization to better accommodate individual user profiles and therapeutic needs.

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ZemIsland: A Climate Change Game

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Abstract

ZemIsland is a climate-change simulation game that puts players in charge of a scaled-down version of Earth. As the governor of ZemIsland, your mission is to combat climate change over the next 30 years by making strategic, science-based decisions. Players engage in short-term actions—such as building wind turbines, solar farms, and EV charging stations—and long-term strategies such as educating residents, investing in climate-tech startups, and raising funds through creative means like fundraising or clean energy sales. A typical session takes approximately one hour to play and supports team play (1-12 teams, each with 2-3 participants), making it ideal for classrooms, workshops, and group training. ZemIsland helps players understand key drivers of climate change, explore policy trade-offs, and discover collaborative paths to net-zero emissions by 2050s.

Keywords: Climate change; net-zero emissions; climate-technology

Background

Climate change is one of the most serious challenges humanity faces today, yet many of us lack a clear idea of how to tackle it. Because it is global in scope, the problem can feel vast and abstract. To make it tangible, we introduce Zem (Zero-Emission) Island—a fictitious island that serves as a 1:10,000 scale model of Earth. Participants act as the island's governors. Their mission: achieve net-zero CO_2 emissions within 30 years, thereby demonstrating how climate change can be overcome on Zem Island.

ZemIsland is designed to inspire action through fun, strategic, and collaborative gameplay. If we can achieve net zero on Zem Island, we can achieve it on Earth.

Game Objective and Target Audience

Our goal is to create a learning tool that teaches the key actions (Doerr, 2021) needed to achieve net-zero CO_2 emissions and, ultimately, address climate change. The primary target audience includes university and graduate students, high-school students, and adults. A new version designed for a younger audience is also under development.

Gameplay

Figure 1 shows the game's user interface: an island scene with action buttons, supporting controls, and progress indicators.

Core Strategies

Players explore four core strategies for achieving net-zero emissions:

- Build: Develop wind turbines, solar farms, ESS (Energy Storage System), smart grids, forests, and EV charging stations.
- Subsidize: Support electric-vehicle adoption with financial incentives.
- Innovate: Invest in climate-tech startups to accelerate decarbonization.
- Educate: Raise awareness and build public support for long-term climate
- solutions.

Budget

Because fighting climate change is costly, the government's Base Budget is insufficient and is depleted midway through the game. Players must secure additional funding via:

- Clean Energy Profit: Sell electricity generated by wind and solar.
- EV Assembly Support: Lobby the island assembly to reimburse EV subsidies.
- Green Cooler Fund: Fundraise from residents; happier citizens donate more, influenced by benefits received and visible improvements on the island.
- Innovation Return: Earn returns from successful climate-tech investments.
- Players also take Climate IQ quizzes that deepen understanding. Correct answers award bonuses that can be used as budgets.

Team Play

Although solo play is possible, teams of 2–3 are recommended. Up to 12 teams can play in one room; for larger groups, multiple rooms can run in parallel. This setup fosters friendly competition and encourages collaboration and idea-sharing within teams.

Game Flow

The game begins in the current year and runs for 20 years in 2-year turns, then fast-forwards 10 years to the 2050s. At the end, the team with the lowest CO_2 emissions wins. Teams that achieve net zero earn the special title "Net-Zero Hero."

Figure 1. User interface of the ZemIsland game, showing the island scene with action buttons, supporting controls, and indicators to track progress.

Learning Outcomes

ZemIsland helps participants grasp the science, economics, and trade-offs of climate policy while building systems thinking, teamwork, and civic responsibility. Designed for classrooms, workshops, and team-based learning, ZemIsland turns complex climate challenges into hands-on experiences—promoting real-world impact through informed, collaborative action.

References

Doerr, J. (2021). Speed & scale: An action plan for solving our climate crisis now. New York, NY: Portfolio/Penguin.

Reviews for version 1

Emily Carter:

General comment:

I confirm that all abstracts submitted for inclusion in this conference have been reviewed and formally accepted for presentation and publication according to the conference's review procedures as outlined in the preface.