

WIZARDRY ACADEMY: THE IMPACT OF EARLY COMPUTER SCIENCE
EDUCATION ON ADDRESSING GENDER DISPARITY AND INDUSTRY
ADVANCEMENT

by

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Abstract

With the growth of the computer science industry, a fundamental introduction to the topic was needed at the middle school level. This research investigated the effectiveness of fun and engaging game design within an educational space. Additionally, inequity within the industry as well as the impact of earlier education on industry growth had to be examined. The outcome of this research was creating a computer science game meant to educate middle school students. This subsequently involved creating a game that was both fun and educational, addressing elements of gender disparity within game design, and implementing a game design that catered to everyone. Wizardry Academy is a 3D open-world adventure game where students play through levels modelled after early computer science concepts. The designed game is inclusive, while providing an opportunity for students to discover an interest in computer science. Advancement of the industry in terms of equity and overall growth is the delayed benefit highlighted by this study.

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Chapter 1

Introduction

1.1 Motivation

The importance of introducing computer science to middle school students is driven by the recognition that it has become a significant industry in today's fast-paced, technology-driven world. Middle school students need a better introduction to the topic to ensure their future interests do not bypass the field of computer science. Developing an engaging and educational serious game in this field can address this and several other important issues.

Primarily, existing games often struggle to balance engagement and educational value and may not be easily accessible to students [3]. Creating an engaging and educational game can provide a valuable learning tool for students, making computer science concepts enjoyable and practical to learn. Additionally, there is gender disparity in the computer science industry, with fewer women than men on average [4]. Creating a game that piques interest in middle school before potential interest loss can help promote equality in the industry by providing an inclusive and accessible learning experience for all students, regardless of gender. Finally, high school students often need help in career exploration and may dismiss potential opportunities prematurely. Developing an engag-

ing and enjoyable game can help students explore the field of computer science early on, contributing to more informed career decision-making and opening up possibilities for students [5].

By addressing these gaps in current computer science education, we can ensure that interest in the field is not lost.

1.2 Problem

Given the rapid progression of technology and its integration into our daily lives, including areas such as education, employment, communication, and entertainment, computer science has emerged as an essential skill that must be properly introduced to middle school students. In its current form, middle school students are exposed to coding primarily in mathematical contexts, with limited or no exposure to other essential coding concepts [6]. There needs to be an instrument that can introduce students to coding concepts they will see later once they reach high school. Furthermore, it is essential to ensure that the students find this instrument engaging and do not develop negative feelings towards the field as a result.

1.3 Contributions

This project represents a valuable addition to computer science education, as it addresses the critical need for practical instructional approaches that introduce younger students to fundamental concepts. By leveraging the interest of younger students, this serious game aims to create a positive and enjoyable learning experience that motivates students to actively engage with the content and develop a strong foundation in early computer science concepts.

Furthermore, this project offers a valuable teaching tool for educators in an educational setting. Conversely, students can use it independently at home without the requirement of direct teacher supervision. Students have the autonomy to play the game individually wherever they wish. This project also enables the gradual integration of using coding concepts together as students progress through the game.

Chapter 2

Background

2.1 Overview

This section delves deeper into critical aspects of the project, including the development of educational games and game design, the issue of gender disparity in the computer science field, and using these aspects as strategies for advancing the industry. It will examine related works in the field, thoroughly reviewing existing research and educational games. It will also involve analysing the current state of the area.

2.2 Educational Games

When examining educational games designed to teach computer science, it becomes evident that only a limited number of them can effectively incorporate two essential aspects of an educational game: user engagement and educational value [7]. These two elements are crucial for creating a game that captures the players' interest and attention, and effectively imparts educational content.

Engagement and fun are crucial factors in the success of an educational game. Students who find a game enjoyable and entertaining are more likely to be motivated to

participate, explore, and learn from the game actively [8]. Games that are engaging and fun can promote curiosity, critical thinking, and problem-solving skills among players, which are essential cognitive skills for learning computer science concepts [8].

The educational value is equally important in an educational game. While engagement and fun are essential, the game must also provide meaningful educational content that aligns with the learning objectives of the computer science curriculum [9]. The game should effectively convey relevant concepts, theories, and practical skills pedagogically soundly, ensuring that players acquire a solid understanding of the subject matter [9].

However, many educational computer science games focus on engagement or educational value and need help to balance the two [7]. Some games may be engaging and fun but need more educational content, while others may be informative but need to captivate and motivate players [3]. This imbalance can limit the effectiveness of educational games in truly promoting learning outcomes in computer science education. Furthermore, the accessibility of educational games can pose a challenge. Many educational games with engagement and educational value are often difficult to find or access [3]. They may not be readily available to students due to limited availability, high costs, or lack of awareness. This can restrict the potential impact of educational games on a broader audience and limit the opportunities for students to benefit from these learning resources.

Addressing the gap between engagement and educational value, as well as improving the accessibility of educational games for computer science, can be a significant motive for developing a new game that effectively incorporates both aspects [8]. This would require a careful and strategic approach to game design, ensuring that the game is engaging, fun, and educationally valuable, while being accessible and inclusive to a wider audience of learners.

2.3 Addressing Gender Disparity

Gender disparity in computer science is a well-documented issue, with women being significantly underrepresented compared to men [10]. This disparity is evident in enrollment numbers and other areas of education within the field. Women are often underrepresented in computer science programs at all levels of education, from K-12 [11] to higher education institutions [10]. Furthermore, the gender disparity in computer science is not limited to enrollment numbers alone. It also extends to other areas, such as career opportunities, leadership roles, and industry representation [12]. Women often face challenges in job opportunities and career advancement in the tech industry, which can further perpetuate the gender gap in the industry. [12].

During an interview on September 29, 2022, Juliann Baker, a computer science teacher at an Ontario high school, shared her thoughts on gender disparity in the field of computer science:

"I think there are a couple of reasons why there is a large gender gap in computer science. Exposure to computer science prior to high school has only ever really been video games, such as Minecraft or Roblox. I find that male students are more interested in these games and, therefore, end up with greater exposure to computer science prior to high school. Also, computer science historically has been a male-dominated field, which may intimidate some female students from enrolling in these courses."

Gender bias and discrimination can create an unwelcoming environment for women in computer science, leading to lower retention rates and reduced participation [11]. Stereotypes, unconscious biases, and gender-based expectations can negatively impact women's confidence, motivation, and persistence in pursuing education and careers in the field [11].

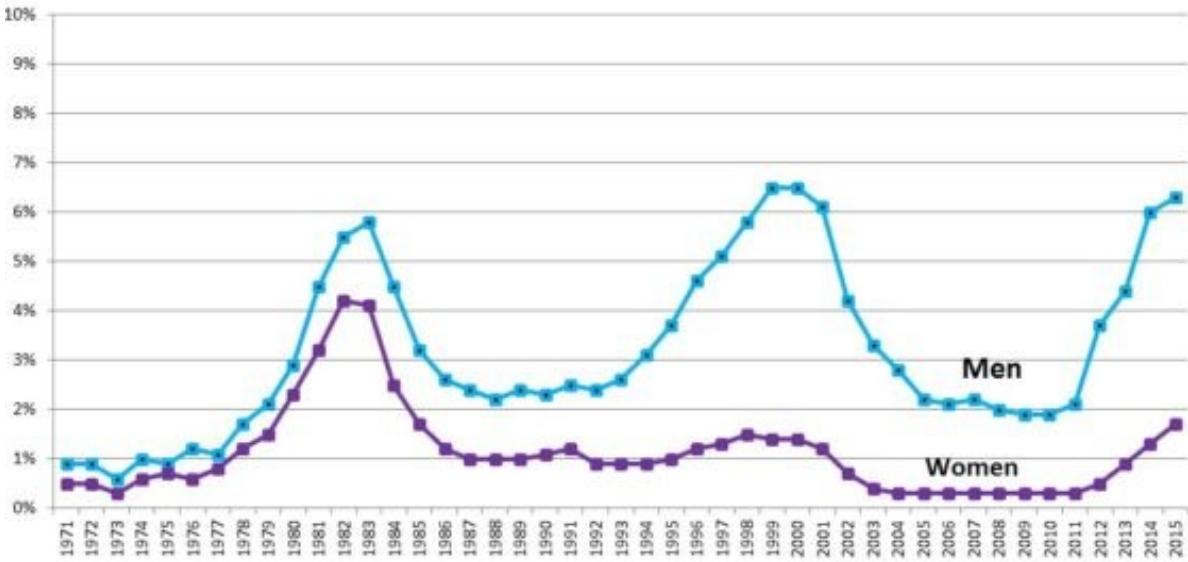


Figure 2.1: Proportion of students planning to major in computer science, by gender (1971-2015) [1]

Figure 2.1, sourced from the Cooperative Institutional Research Program Freshman Survey conducted by the Higher Education Research Institute at UCLA, presents the percentage of incoming students who intend to major in computer science. The data reveals that, on average, male enrollment in computer science surpasses female enrollment by two-fold [1]. In some instances, male enrollment can be as much as six times higher [1].

Figure 2.2 illustrates the percentage of female employees in the workforce across different companies, categorised into "Tech Jobs", "Non-Tech Jobs", and "Total Workforce" [2]. The data highlights that female representation in "Non-Tech Jobs" is comparable to their male counterparts, but the percentage of female employees in "Tech Jobs" is considerably lower, averaging only one-sixth of the male representation [2].

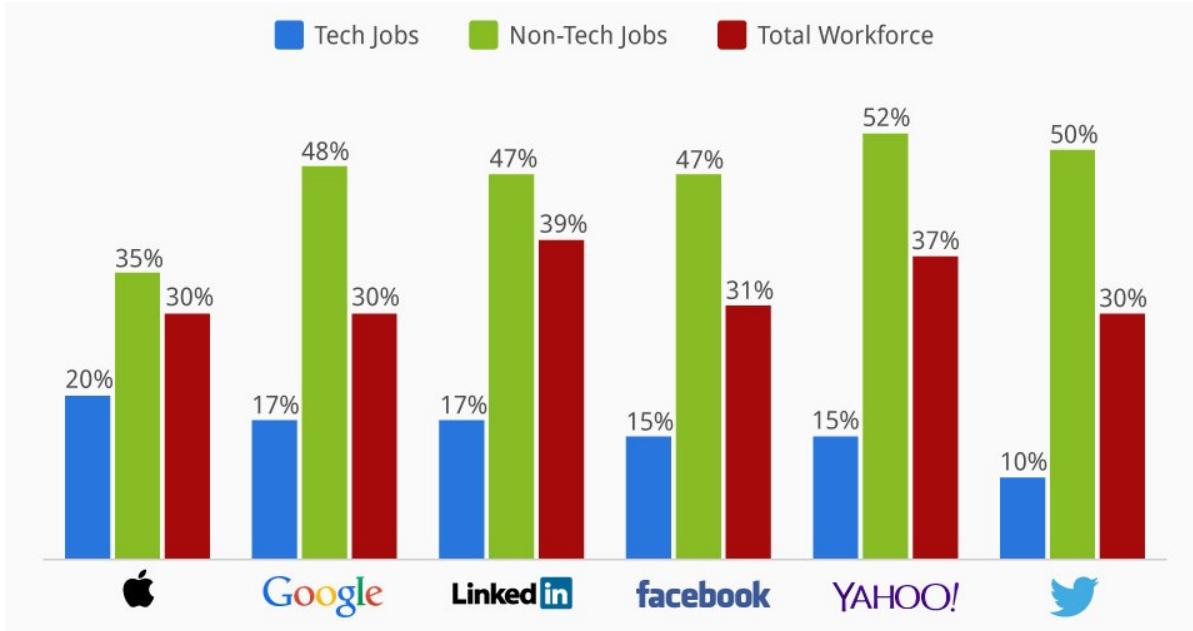


Figure 2.2: Percentage of female employees in the workforce of tech companies [2]

To address these inequities, creating an educational game aimed at middle school students can be a proactive strategy. Middle school is a critical stage when students begin to form their attitudes, interests, and aspirations towards different fields of study [5]. Introducing computer science through an engaging and accessible game at this stage, before potential interest loss or dropout rates occur, can help address the disparity between gender disparity, racial and ethnic disparities, and other forms of inequity in the field [5].

An educational game can be designed to be inclusive, showcasing diverse characters, story-lines, and perspectives that reflect the real-world diversity of the computer science industry. Furthermore, the game can provide hands-on learning, problem-solving, and collaboration opportunities, fostering a positive and empowering experience for all students, regardless of gender, race, ethnicity, or socioeconomic status.

2.4 Industry Advancement

In high school, students often face the challenge of choosing a field of study for their future careers, and this decision can be overwhelming, especially for younger students. Many students may only consider potential opportunities without considering all of their options [13]. In this context, the creation of an educational game that is both fun and engaging could be a valuable tool. Such a game has the potential to not only provide an enjoyable experience for the user but also increase the educational value. This increase is fulfilled by presenting concepts and challenges related to the field of study in an interactive and immersive way. Research has found that educational games can positively impact students' motivation and engagement, increasing interest and exploring the subject matter [8].

By incorporating engaging gameplay elements, a well-designed educational game can capture the interest and attention of students, motivating them to explore and learn more about the subject matter [8]. This can be particularly effective in fields like computer science, where students may have yet to gain prior exposure or experience. The game can serve as a gateway for students to investigate the field further, sparking their curiosity and encouraging them to delve deeper into the subject matter.

Furthermore, an educational game that is accessible and user-friendly can help bridge the gap between the student's current knowledge level and the complexity of the subject matter [14]. It can provide a supportive and interactive learning environment that encourages exploration and experimentation, gradually helping students build their understanding and skills [14]. This can be especially beneficial in fields like computer science, which may involve abstract and technical concepts that can be challenging to grasp without proper guidance.

Developing a well-designed and engaging educational game can be a promising approach to help students overcome the challenges of choosing a field of study. This may encourage them to consider and explore opportunities they might have otherwise dismissed prematurely [13]. Additionally, when inclusivity and accessibility are incorporated into an educational game, it has the potential to effectively address some of the industry disparities highlighted in section 2.3.

Chapter 3

Wizardry Academy

3.1 Overview

Wizardry Academy is an educational game that aims to teach computer science concepts in fun and engaging ways while addressing gender disparity, inclusivity and accessibility. The game is specifically targeted towards middle school students to spark their interest in the field before they make decisions about their future career paths.

In *Wizardry Academy*, players embark on an immersive adventure where they assume the role of aspiring young magicians. As players engage in a series of quests, challenges, and puzzles, they approach computer science concepts in the game as if they were performing magical feats. These concepts are integrated into the gameplay, and as the players progress through levels, they gain new abilities that they can creatively use around their world. As players unlock new abilities, they are empowered to explore the game world, achieve milestones, and collect items. By the culmination of the game, players are expected to have developed a solid understanding of early computer science concepts and patterns, equipping them with foundational knowledge in a fun and interactive way.

3.2 Learning Objective

Wizardry Academy aims to teach students fundamental computer science concepts such as coding, pattern recognition, code visualisation, and problem-solving skills. Additionally, as players advance in the game, they gradually learn coding concepts that align with the curriculum of a grade 10 computer science class.

Students are exposed to various challenges and puzzles that require them to use coding principles to overcome obstacles and achieve their objectives. Pattern recognition is a crucial aspect of the game, where players are encouraged to identify and analyse puzzle patterns. This helps the student develop critical thinking and analytical skills. Additionally, the game incorporates code visualisation techniques, allowing players to visually understand how code is structured and executed, promoting a deeper understanding of coding concepts. Problem-solving is a fundamental skill in computer science, and Wizardry Academy reinforces this skill through gameplay. Players face various challenges that require them to think critically and devise strategies. This fosters a problem-solving mindset, which is valuable in computer science and many other fields.

3.3 Game Design

Wizardry Academy is a 3D open-world adventure game crafted using the Unity game engine. The game features a unique blend of atmospheric exploration and casual puzzle-solving, making it an inclusive experience for players of all genders [15]. The game's genre selection is carefully curated, considering the proportion of men and women in various gaming genres to ensure a balanced representation.

The game's immersive world is designed to engage players in a magical wizard-themed setting. The high-fantasy theme of the game draws inspiration from genres that

typically have a comparable representation of men and women [15]. This deliberate choice aims to create an inclusive game environment for all players, regardless of gender.

In Wizardry Academy, players embark on a thrilling adventure as they explore the world, solve puzzles, and uncover the secrets of the academy. The game's open-world design allows players to roam and interact with the environment, uncovering hidden treasures, and unlocking new abilities.

To align with the principle of engaging and enjoyable game design, players in Wizardry Academy are encouraged to freely explore their world at their own pace, without the need to complete levels immediately. As players explore, they will come across interactives that pique their curiosity, but they will only be able to fully utilise them when they gain new abilities by playing through levels. This motivates players to complete levels, and they will acquire new skills and knowledge in computer science concepts along the way. Once players gain these new abilities, they can return to previous interactives and use their newfound knowledge creatively, allowing for a dynamic gameplay experience. This game design approach fosters a sense of discovery, curiosity, and mastery, while reinforcing the learning of computer science concepts in an engaging and meaningful manner.

Wizardry Academy employs a visually appealing low-poly design, a deliberate artistic choice combining simplicity and charm. The low-poly style utilizes geometric shapes and minimalist textures to create a distinct aesthetic that is visually appealing and accessible to players of all ages and backgrounds. This design approach not only adds to the overall visual appeal of the game but also serves practical purposes in terms of performance optimization, making the game accessible to a wide range of devices, including lower-end systems.

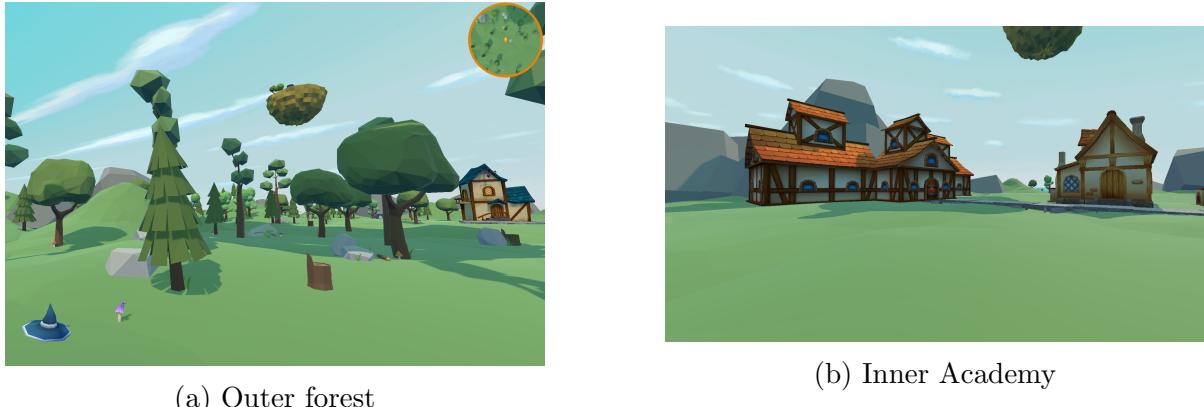


Figure 3.1: Low-poly outdoor models

Furthermore, the low-poly design (as seen in Figures 3.1 and 3.2) in Wizardry Academy allows for a focus on gameplay and educational content without being overly distracted by complex graphical details. This allows players to fully immerse themselves in the game world and focus on the core objectives of learning computer science concepts, problem-solving, and creative thinking rather than getting overwhelmed by intricate visual elements.

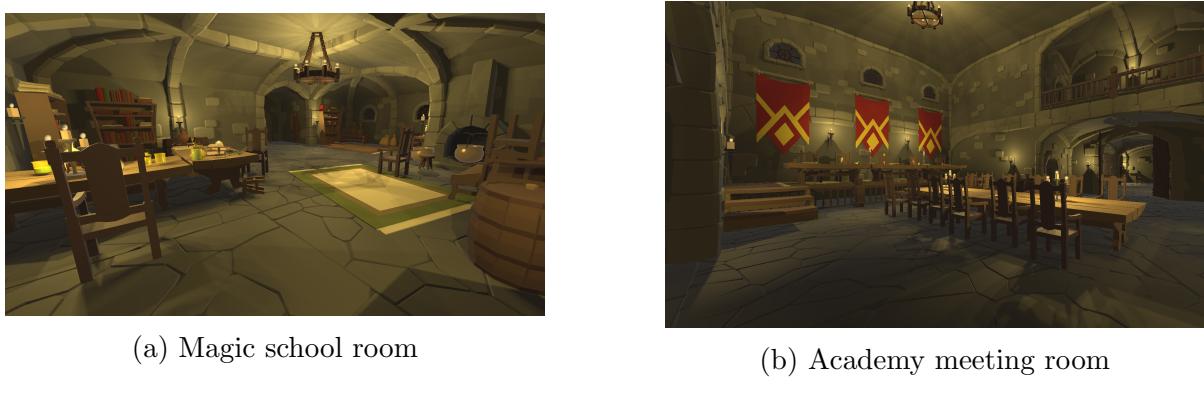


Figure 3.2: Low-poly indoor models

A significant portion of the assets utilised in developing Wizardry Academy is sourced from the Unity Asset Store (Credited in Appendix A), a marketplace that offers

various pre-designed game assets. These assets, ranging from 3D models to animations, textures, and sound effects, were carefully selected and integrated into the game to enhance its visual and auditory elements and streamline the development process.

The use of assets from the Unity Asset Store also contributed to the overall aesthetics of Wizardry Academy. In line with the game's low-poly design, the carefully chosen assets were blended together cohesively to create a visually appealing and immersive game world. This helped create an engaging and enjoyable gaming experience for players while maintaining a consistent and polished look and feel throughout the game.

The menu interface of Wizardry Academy (as seen in Figure 3.3) is thoughtfully designed to create an immersive and engaging experience for players. The colour palette chosen for the menu is warm and inviting, with carefully selected hues that align with the game's wizard-themed aesthetics. These colours are strategically chosen to evoke a sense of magic, mystery, and adventure, setting the tone for the overall gameplay.



Figure 3.3: Menu of Wizardry Academy

The controls in Wizardry Academy (as seen in Figure 3.4) are intuitively designed to provide players with a familiar and seamless gaming experience. Drawing from popular controls used in many other games [16], the control scheme in Wizardry Academy is crafted to ensure ease of use and familiarity for players.

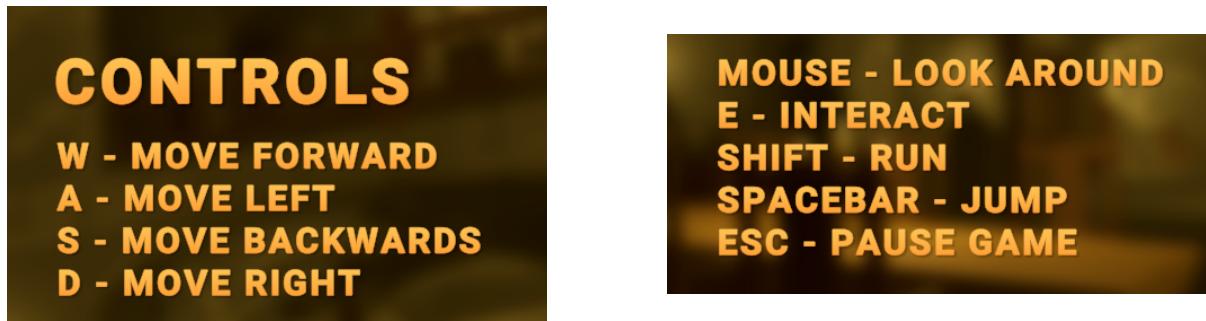


Figure 3.4: Wizardry Academy in-game controls

3.4 Gameplay

As of April 2023, Wizardry Academy is currently optimised for desktop and laptop devices, providing players with an immersive gaming experience on these platforms. The game displays on a digital interface and uses a mouse and keyboard as the primary input devices.

Upon launching Wizardry Academy, students are greeted with a user-friendly start menu (as seen in Figure 3.3) that provides easy access to game controls, instructions, game options, and the option to exit the game. This start menu is a hub for players to navigate through the game's instructions and settings, ensuring a seamless and intuitive user experience from the beginning.

Once players start the game, they are transported to Wizardry Academy (starting screen seen in Figure 3.5), where they embark on their educational journey. They

are greeted by a non-player character (NPC) who guides them (as seen in Figure 3.6), providing instructions and guidance on navigating the world and interacting with various elements.



Figure 3.5: First screen seen upon game entrance

The NPC is a mentor, introducing players to the game mechanics, objectives, and challenges they will encounter throughout their adventure. They may provide helpful tips, hints, and explanations of the computer science concepts that players will learn as they progress in the game. This NPC-guided approach ensures that players have a smooth and engaging introduction to the game, allowing them to quickly grasp the gameplay mechanics and understand their role in the game world.

As players explore the world of Wizardry Academy, they can interact with various objects, characters, and environments to uncover secrets, complete quests, and unlock new abilities. The NPC provides ongoing instructions and guidance, ensuring that players clearly understand their objectives and how to progress in the game.

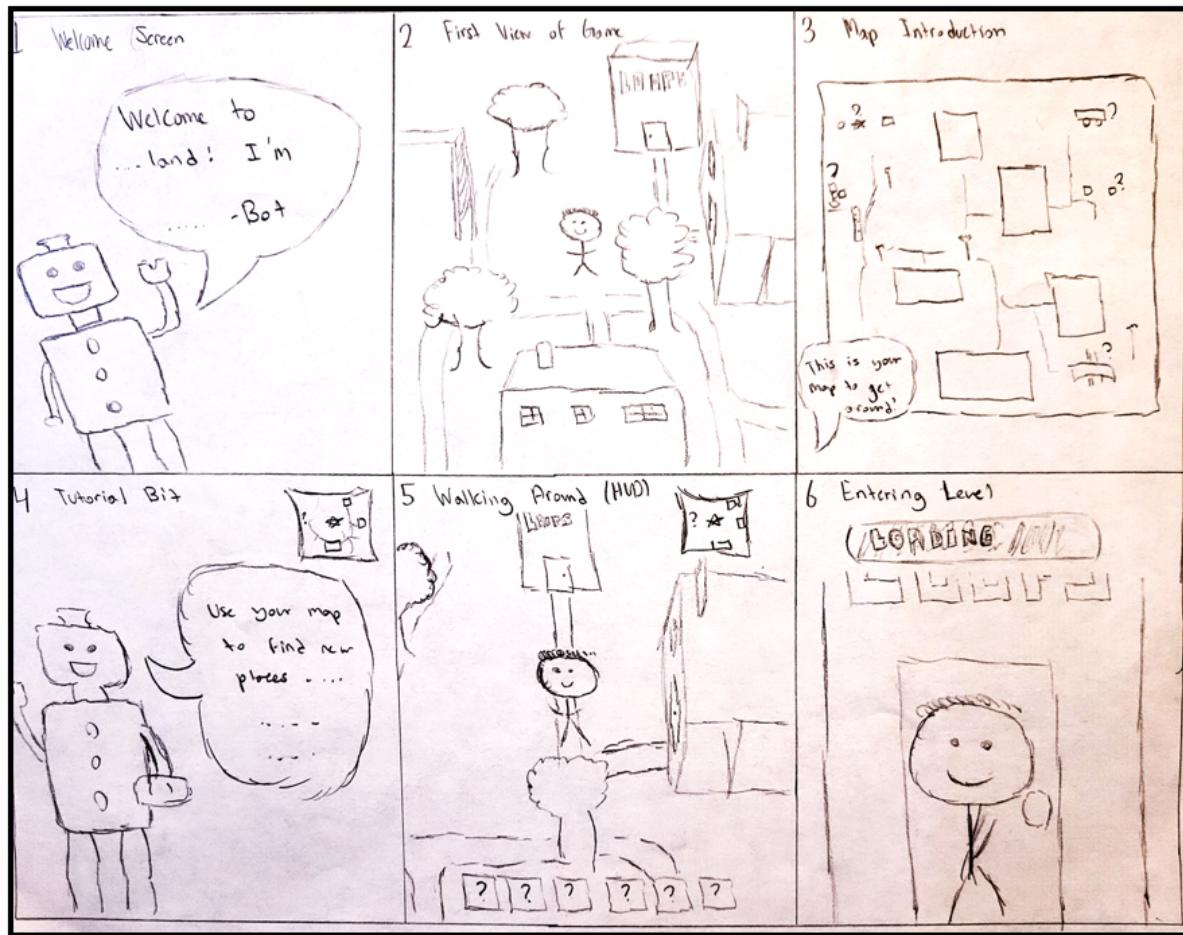


Figure 3.6: First storyboard sketches of gameplay

One of the design elements used to enhance usability is the strategic use of red buttons, which serve as visual cues to represent interactive elements that users can click on (as seen in Figure 3.7a). The red buttons are deliberately chosen for their high contrast against the game's background, making them easily noticeable and distinguishable. They are carefully placed in strategic locations within the game's interface, such as dialogues and interactive objects, to draw users' attention and prompt them to take action.

These red buttons are used to represent clickable elements that users can interact with to trigger actions, make selections, or progress in the game. They provide clear visual feedback to users, indicating which elements are interactive and inviting them to engage with the game's content.

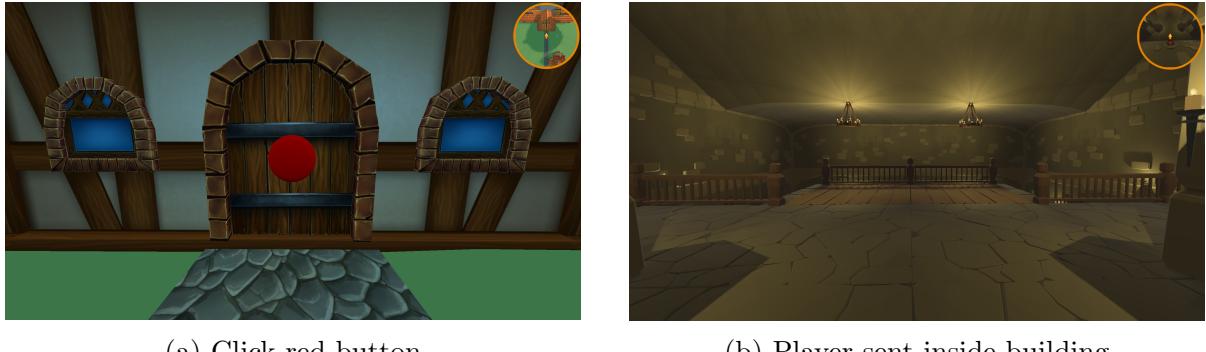


Figure 3.7: Interacting with red button to access different area

In Wizardry Academy, players progress through levels and gain unique abilities that enhance their gameplay experience (levels elaborated in Section 3.5). These abilities empower players with new capabilities, including picking up, storing, and placing items within the game world. As depicted in the fifth storyboard slide of Figure 3.6, the abilities acquired by players are located at the bottom of the player's screen. This user-friendly design ensures easy ability access, allowing players to quickly and intuitively utilize them during gameplay.

One of the abilities players acquire is the item manipulation ability, which allows them to use an operator tool to manipulate items in various ways. This could involve rotating, scaling, or moving objects to solve puzzles, overcome obstacles, or create new pathways in the game world. The item manipulation ability provides players with a creative and interactive way to interact with the environment and use their problem-solving skills to progress. In addition to the item manipulation ability, players gain access to an item duplicator ability. This ability enables players to create copies of items they have found or acquired in the game. This feature allows players to strategically duplicate items and use them in different ways, such as placing duplicates in multiple locations, solving puzzles that require multiple copies, or utilizing duplicates to unlock new areas or secrets in the game world.

Table 3.1 below provides a comprehensive breakdown of the abilities in Wizardry Academy, including the level at which they are obtained, their in-game name, and their respective function(s).

Ability Breakdown		
Level Unlocked From	Name	Usage(s)
1	Item Manager	Allows user to pickup, store, and place items
1	Variable Selector	Allows user to select variables to use with Operator Tool, Item Switcher, and Item Duplicator
2	Operator Tool	Allows users to manipulate items (Resizing, etc)
4	Item Switcher	Allows user to switch items with other items
5	Item Duplicator	Allows user to duplicate selected item

Table 3.1: Breakdown of each ability in Wizardry Academy

The abilities acquired from playing through levels in Wizardry Academy are designed to add depth and versatility to gameplay, providing players with a range of options to approach challenges and puzzles creatively. These abilities enrich the gameplay experience and encourage experimentation and exploration, allowing players to discover new strategies and solutions as they progress through the game.

As an illustration of the game mechanics in Wizardry Academy, players can create a pathway to a floating island (as seen in Figure 3.8) by utilizing their abilities. They can start by placing a box at the base and then using the item duplicator to make copies of the box. Players can construct a tower to reach the floating island by strategically stacking the duplicated boxes on each other. This creative use of abilities, in combination with the item duplicator and strategic placement, enables players to access previously unreachable areas and unlock new gameplay opportunities.



Figure 3.8: Floating islands that are only accessible by ability usage

In addition to the engaging gameplay mechanics, Wizardry Academy features a quest log that keeps track of the player’s progress and objectives. This quest log provides

players with clear instructions on what they must do to advance in the game. Players can easily reference their quest log to stay on track and complete objectives organizationally.

The game includes a system of achievements players can earn by accomplishing specific tasks or reaching certain milestones. These achievements add a layer of challenge and motivation for players to strive for, enhancing the replayability and long-term engagement of the game. Additionally, Wizardry Academy incorporates collectables that players can find and gather throughout the game world. These collectables serve as rewards for exploration and discovery, encouraging players to explore the game environment and uncover hidden treasures thoroughly. Collectables can also be used to showcase a player's progress, allowing them to display their accomplishments within the game proudly.

Together, the quest log, achievements, and collectables systems in Wizardry Academy provide players with a sense of accomplishment, progress, and pride. Navigating through the game world, completing quests, achieving goals, and gathering collectables enhance the game's overall educational value and enjoyment.

3.5 Level Design

The level design in Wizardry Academy serves as a strategic means to effectively communicate fundamental computer science concepts to the player. Each level is intentionally designed to incrementally increase in difficulty while introducing those new concepts, providing players with a progressive learning experience.

The game has five levels, each focusing on a specific computer science concept that aligns with the grade 10 computer science curriculum [17]. In the first level, players are introduced to the concepts of variables, constants, and data types, which forms

the coding foundation. The second level builds upon this foundation by focusing on expressions and their significance in programming. As players progress, the third level delves into code visualization, helping players understand how code is structured and executed. The fourth level introduces the 'if statements' concept, which is fundamental in programming for making conditions-based decisions. Finally, the fifth level focuses on the 'loop' concept, a critical component in programming for repeating tasks and controlling flow.

Each level in Wizardry Academy is thoughtfully crafted to provide players with a hands-on learning experience, allowing them to apply the concepts they learn practically and engagingly. By aligning the level design with the grade 10 computer science curriculum, players are offered a unique opportunity to gain a deeper understanding of the concepts they may encounter in a formal high school level computer science course.

Level Design					
	Number	Concept	Puzzle Design	Abilities Unlocked	Restrictions
1		Variables Constants Types	Matching Game	Item Manager Variable Selector	None
2		Expressions Operators	Matching Game	Operator Tool	Cannot finish level without Variable Selector
3		Code Visualisation	Visual Learner Interactable	-	None, Recommend levels 1/2 before starting
4		If Statements	Puzzle Game	Item Switcher	Cannot start level without Operator Tool
5		Loops	Puzzle Game	Item Duplicator	Cannot start level without Item Switcher Cannot finish level without Variable Selector

Table 3.2: Breakdown of each level in Wizardry Academy

Table 3.2 provides a comprehensive breakdown of each level in Wizardry Academy, including the corresponding computer science concept, general puzzle design, abilities unlocked, and level-specific restrictions.

In Wizardry Academy, restrictions are purposefully designed based on the abilities that players have not unlocked (see Table 3.2 for restrictions), ensuring they are equipped with the necessary skills to complete each level. This approach intends to guide players through the game progressively and logically, allowing them to build their knowledge and skills from foundational concepts, such as variables, to more advanced topics, like loops, in a seamless manner.

By aligning the level restrictions with the abilities unlocked, players are encouraged to play the levels in a recommended order without feeling constrained or forced. This approach fosters a sense of natural progression, where players can apply the newly acquired abilities in solving increasingly challenging puzzles and mastering higher-level concepts. It also provides a sense of achievement and reward as players unlock new abilities and overcome the restrictions in each level, further motivating them to progress and explore the game world.

Levels 1 and 2 provide players with hands-on experience in matching different types of variables and constants, and assembling expressions, laying a solid foundation for further learning and progression in the game. Level 3 in Wizardry Academy is a critical stage in helping players understand real-world coding structures by providing an immersive experience in designing and organizing their code. As players advance to levels 4 and 5, the game introduces more challenging puzzle games that require higher-level thinking and problem-solving skills. These puzzles are designed to be more complex and demanding, pushing players to think critically and creatively to solve them. However, the increased difficulty is balanced by the rewarding aspect of unlocking more satisfactory and more powerful abilities upon completion.

Figure 3.9 presents initial sketches of level 5 in Wizardry Academy, centring around the concept of loops. In this level, players are tasked with connecting the loop by utilizing the Item Switcher tool to arrange numbers in the correct order as seen in Figure 3.10.

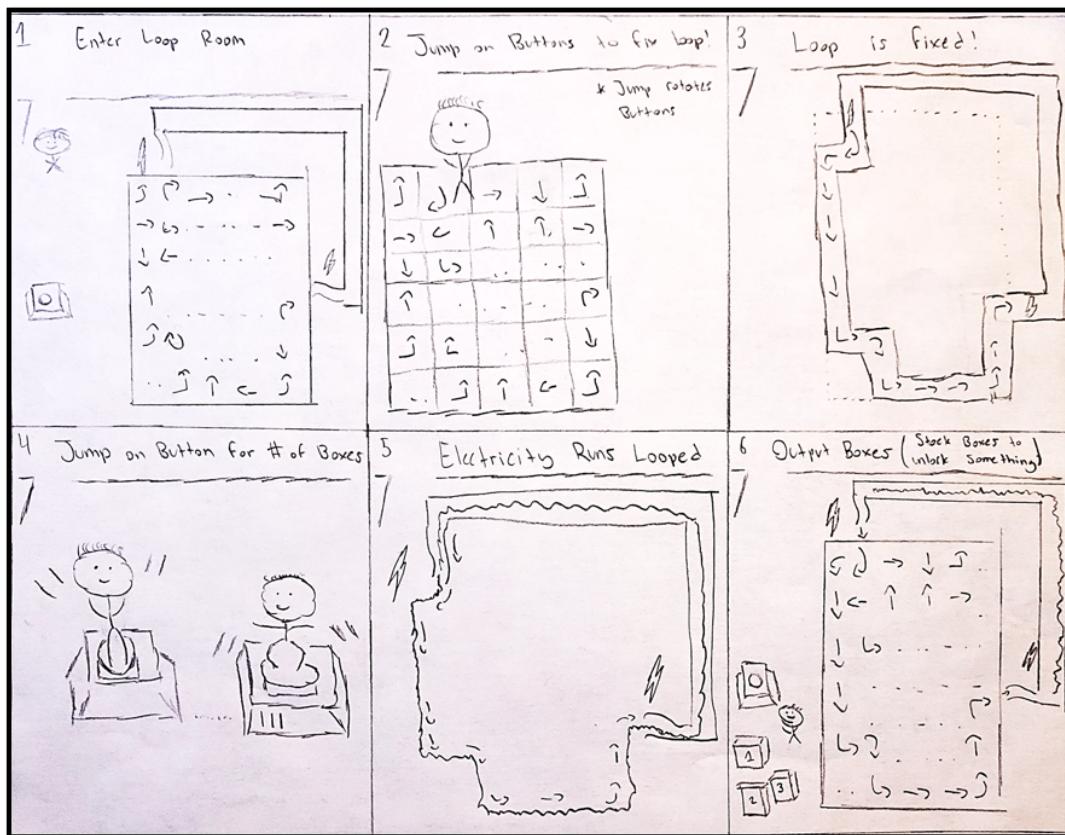


Figure 3.9: First storyboard sketches of loop puzzle

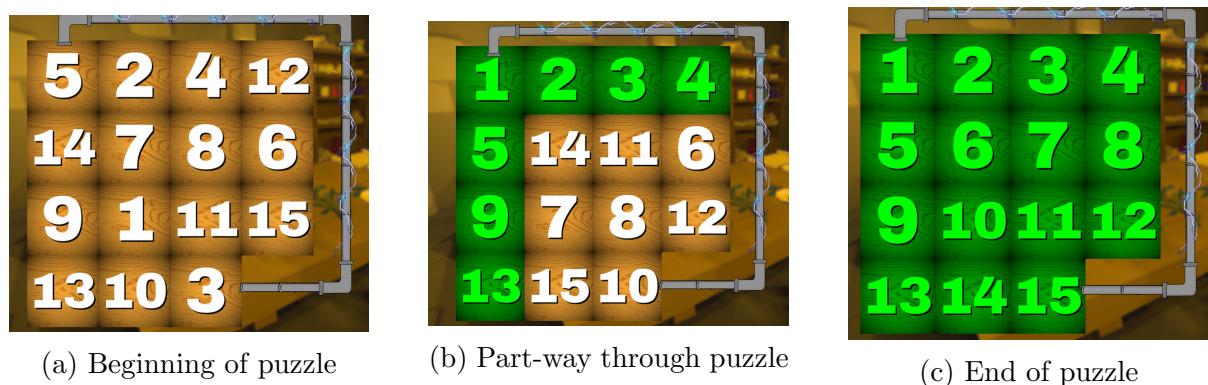


Figure 3.10: Visual stages of loop puzzle

The levels in Wizardry Academy are designed to provide visual feedback to players, guiding them towards the correct solution. Players will receive visual cues and hints that indicate they are moving in the right direction, helping them to progress through the level. Additionally, the NPC within the game will provide further instructions and guidance on how to solve the puzzle, ensuring that players have the necessary information to complete the challenge successfully.

Upon completing a level, players are rewarded with a snippet of code that showcases what code looks like in a real-world programming context. This provides a tangible and visual representation of the coding concepts and principles that players are learning throughout the game. It allows players to visualize how the concepts they have learned are applied in actual code, reinforcing their understanding and helping them connect the gameplay and real-world programming.

Chapter 4

Conclusion

4.1 Summary

The Wizardry Academy project is an educational game that has the potential to effectively teach computer science concepts while keeping players engaged and entertained. It provides an immersive and interactive learning experience promoting critical thinking, problem-solving, and the development of coding skills. The project has developed a game that prioritises accessibility and enjoyment for players of all genders while also promoting inclusivity and diversity within the gaming and computer science space. With further development and refinement, Wizardry Academy has the potential to become a valuable tool for educators and learners alike in computer science education.

4.2 Limitations

Wizardry Academy has limitations that are important to acknowledge. As of April 2023, these limitations include the following:

1. Platform Restrictions: Wizardry Academy only works on desktop and laptop devices. This may limit its accessibility to players who prefer to play games on other platforms, such as mobile devices, gaming consoles, and those who do not have access to desktop or laptop devices.
2. Controls and Interface: The game relies on keyboard and mouse controls. This may be uncomfortable for all players, particularly those with physical disabilities or who prefer alternative control methods. The game's current interface may also challenge players with visual impairments or other accessibility needs.
3. Content Scope: While the game offers levels and abilities based on grade 10 computer science concepts, the scope of the content is limited to the specific concepts chosen for the game. Players may not be exposed to a comprehensive range of computer science topics beyond those covered in the game.
4. Level Design: While the game's level design is intended to introduce players to computer science concepts progressively, some players may find the difficulty curve too steep or too gradual. Potential loss of interest in the game could arise in these situations.
5. Technical Limitations: The game's development may be subject to technical limitations imposed by the Unity engine or other technological constraints. This may impact the game's overall performance, functionality, and user experience.

Continued efforts to address these limitations and improve the game's restrictions, content, accessibility, and inclusivity will be essential for its ongoing success.

4.3 Future Work

The future work for Wizardry Academy encompasses various aspects, including computer science content, game design, inclusion, and accessibility.

Regarding computer science content, the primary focus will be implementing all the levels with code examples, ensuring that the educational content is comprehensive and aligned with the targeted learning outcomes.

In terms of game design, adding interactives around the map and the quest log is essential. Implementing achievements within the game incentivizes players to complete challenges, accomplish goals, and explore all of Wizardry Academy's content.

In addition, efforts will be made to ensure that Wizardry Academy is accessible to a wide range of players. This includes adding a third-person camera option to provide players with a view of their characters and creating diverse and customizable characters to promote representation and inclusivity [18]. Furthermore, accessibility options such as colour-blind mode, text-to-speech functionality, and options for players with mobility impairments will be implemented [19]. These measures aim to make Wizardry Academy enjoyable and inclusive for a diverse player base, catering to various needs and preferences.

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Appendix A

Wizardry Academy Asset Credits

The media used in Wizardry Academy came from different sources. Many of the 2D/3D objects were obtained through the Unity Asset Store. Jeremy R. Mohammed created other 2D objects.

Please find below the links for the credited assets used in the game (As of April 2023):

<https://assetstore.unity.com/packages/2d/textures-materials/hand-painted-rocks-road-texture-196235>

<https://assetstore.unity.com/packages/3d/environments/landscapes/low-poly-ground-61071>

<https://assetstore.unity.com/packages/3d/environments/dungeons/ultimate-low-poly-dungeon-143535>

<https://assetstore.unity.com/packages/3d/environments/landscapes/free-low-poly-nature-forest-205742>

<https://assetstore.unity.com/packages/3d/environments/landscapes/low-poly-simple-nature-pack-162153>

<https://assetstore.unity.com/packages/3d/environments/fantasy/wizard-props-21394>

<https://assetstore.unity.com/packages/3d/environments/fantasy/fancy-tavern-52113>

<https://assetstore.unity.com/packages/3d/environments/fantasy/baker-s-house-26443>

<https://assetstore.unity.com/packages/3d/environments/stylized-fantasy-house-153587>