Games for Teaching Children

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Abstract

The goal of this project is to make a digital game – with a modified story of <Hansel And Gretel> – to educate children on gender identity topics and foster empathy and puzzle-solving skills. This is achieved by introducing LGBTQ+ characters and problems into the game story. Background studies and surveys for parents are conducted to generate design ideas on the game type and length. The game is made with Renpy, and playtested to collect children's feedbacks.

Authorship

Draft outlines of each chapter were formed by the entire team simultaneously. The introduction was written and edited by all team members simultaneously. All other sections of the report were divided up to be written individually by team members and then edited simultaneously by the entire team.

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1 Introduction

The goal of the project is to design and develop an educational, 2D visual-novel game for children. The game is a modified version of an existing fairytale, *Hansel and Gretel*, and is altered to integrate empathetic LGBTQ+ characters, word puzzles, LGBTQ+ gender education, and a completely different story with a different ending, with the main protagonists being Hansel and Gretel. The game allows players to select among choices that place an effect on the future development of the story. Most importantly, we design the game to serve educational purposes for children, fostering empathy, self-awareness, creativity, and puzzle-solving (argumentation) skills.

Nowadays, more and more games are trending and people play games for entertainment. At the same time, games are used as a support tool to complement traditional teaching methods: improve the learning experience of the learners while also teaching other skills such as following rules, adaptation, problem-solving, interaction, critical thinking skills, creativity, teamwork, and good sportsmanship (Zirawaga). Both traditional and digital educational games become children's favorites and we find them abundant and diversified. However, among all types of educational games, we find one type that rarely appears: visual-novel games. This type of game is usually 2D and made with a game script, images, and sounds. Trending educational games either appear as a complement to classroom teaching (*Hangman, Bingo, Pictionary*) , or have a three-dimensional structure to allow players to perform easy and meaningful tasks. Most non-3D games are puzzle and vocabulary games and overall have a simple and easy structure that is built for small children. Hardly can we see any story in the game. As a result, we want to design a digital educational game that takes the form of a novel, not only providing fascinating story plots and corporate these plots with knowledge and educational meanings, but also giving more complexity into its design of narratives and characters. Thus, the game we are making – a modified version of *Hansel and Gretel* visual-novel game– has its unique story and resembles no other educational game in the current game markets.

2 Background

This chapter is intended to provide sufficient background information for readers to understand the globe and importance of our game design project and to understand its context in games designed for children, especially for education. We will first introduce the development of digital educational games history and its comparison with traditional educational games, followed by the discussion of how games benefit children in general. We will further introduce narrative-designed games of their importance in educational games. As our game is designed for children, we will also talk about the impact of LGBTQ elements design and its educational purpose. Then we will describe the stakeholders of this project and various design elements in the context of games. The chapter then examines past game design efforts to educate children involving both traditional methods and digital methods.

2.1 Traditional Games and Digital Games

Traditional games are games that people play in person. Although no record has been made on when humans designed the first game, evidence has shown that before B.C. 2600, board games are parts of life in human experience. One of these earliest board games, currently exhibiting in the collections of the British Museum in London, is “decorated with shells carved with lapis lazuli and limestone.” Similar to today’s boardgames, the traditional board games used dice to determine steps and squares to represent current location. This board game is defined as a race game in which the winner is the first player who moves all of their pawns off the board via the exit square followed by certain paths as shown in Figure. 1 (C. Soubeyrand, 2000).

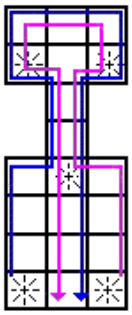

Figure. 1 Royal Game of Ur Board Game Paths

Digital games often have a simulated virtual environment for children to play. The first documented digital game with a virtual environment is a video game designed by Brookhaven National Laboratory’s instrumentation group, called Tennis for Two, to allow people play tennis on a display screen as in Figure. 2. With roughly a month after the head of the group, Higinbotham, raised the idea of playing table tennis games virtually, they modified an oscilloscope that had a knob to adjust the angle of the ball and a push-button to hit the ball towards the other player. Despite not having fancy graphics and only some green prints on the screen, it appeals to most of the visitors and interested people in designing and developing video games with more adequate devices and fundings(A. Chodos, 2008).

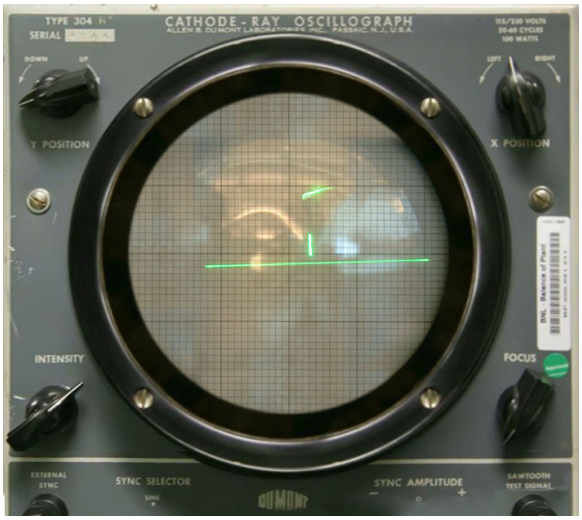

Figure. 2 Tennis For Two on a DuMont Lab Oscilloscope Type 304-A

In recent years, digital games are taking the place of traditional games for children. Studies have shown that due to the exponential rate of growth of technology development in that both new games equipment, such as hand controllers with body position sensors and VR, and better performance products for the computer have led to a drastic increase in the number of digital games in the market (V. Rheenen, 2012). The average time spent by children playing video games was 4 hours a week in the 1980s. Two decades later, in 2004, this time spiked to 13 hours per week or around 2 hours per day for playing digital games (F. Erumit, 2016). These new technologies also shift children's game preferences from outdoor playgrounds to digital platforms. The traditional indoor games and sedentary games are now considered obsolete by children and diminished over the last few decades (D. Hayes & Brian, 2004).

Furthermore, the rule settings are distinctive for digital games and traditional games. In digital games, the rules are actual (C. Deleon, 2014). The limitations are real in that the players playing computer games might not be able to access the game's further contents when players could not work around the current constraints. This situation is due to the computer game's fixed state such that the players being not able to reach the further content are programs to follow. In contrast, the rules of traditional games are artificial (C. Deleon, 2014). The punishment, however, could be both actual and artificial. For example, if a police officer pulled players for speeding and handed tickets, then they were receiving artificial punishment by artificial rule. If the cars were rolled over, the punishment was actual and it was more about

law/rule of physics than artificial, unprogrammed rules.

2.2 Digital Game-Based Learning Elements for Children

Games, contributing to children's self-perception, physical, social, and emotional well-being, are essential factors for children's growth and development (Batdi, 2017). Digital games, however, further enhance children's intrinsic motivation, cultivate their creativity and problem-solving skills, and satisfy children with a feeling of freedom (Mclnnes & Birdsey, 2013), if they are programmed in the right way. In this section, we will discuss: how people learn by human information processing, the motivations for children to play digital games, and evaluation of game elements affecting students' motivations.

2.2.1 How People Learn

In 2007, a conference paper raised a point that games enable a unique form of learning that "produces new dispositional stances, exercises the play of imagination, and provides for a complex sense of agency," which allows us to think of the human learning process as "learning to be." This idea altered people's thoughts on old times when "learning about" prevailed (Thomas & Brown, 2007).

The idea of "learning about" was first raised in the 1950s when people commonly treated the human mind as a computational engine followed by a specific routine of input-process-output models, or cognitivism as described in terminology (Still & Costall, 1991). Under their deduction, memory was illustrated as a form of data disk (Bransford et al. 2000). Later, a researcher pointed out that thinking is a way of deliberate manipulation of computing mental representations (Holder, 1995). On this account, people tilted more toward thinking as formal reasoning in propositional calculus and learning are mechanics. Whereas, contemporary researchers stated that two underlying misassumptions were made with the idea of thinking-as-computation (Chee, 2016): the assumption of separating "outer" physical reality from "inner" mental world; and the assumption of the belief of the correct representation of "outer" reality is "true knowledge." The correct way to think of the first assumption, as mentioned in another paper, is that "explicit human consciousness is inherently linguistically colored, and it cannot be causally linked to underlying neuronal states." (Munz, 1999) As such,

he argues that looking barely to the brain for a mechanism of the mind is fallacious and unwarranted. The second assumption made an explicit mistake in that it suggested that everything between human's subjective knowledge and the physical objects of the outside world is one-to-one correspondence (Gergen, 1999).

Another approach to understanding humans learning algorithms is to think of it as mimicking and habituating what they have experienced. A researcher suggests that learning is to memorize and make useful actions habitual which benefits humans when they face similar situations in the future (James, 2007). For him, thinking is not controlled by computational mechanisms. Instead, he agrees that experiencing and learning is a non-cognitive process that is determined by the current state of emotion, personal habit, and imagination (Holder, 1995). Another researcher also demonstrates the learning process as shaped by subjective desire and that is why pragmatism is here (Peirce, 1992). In the pragmatism scenario, researchers believe that learning is anchored with experience. They mention that people are the participants in life rather than spectators of life (Dewey, 1988) and learning is a two-way transaction that mutually reinforces and the relationship between an organism and its environment is interdependent and co-constitution (Chee, 2016).

2.2.2 Motivations for Children to Play Digital Games

From a study conducted in public schools in South Carolina and Pennsylvania for 7 to 8 graders on children's motivations of playing games, most of them agree that games are just fun. While the difference between girls and boys statistical result is not significant, more boys tend to play games for competition and to win for the difficulties and challenges and for relaxation. Girls tend to play games when they are bored (Olson et al., 2007). Some other reasons for playing games for children comprise of making new friends and learning new things, and etc.

A research promoted by Massachusetts General Hospital finds more social, emotional and intellectual and expressive aspects of motivations for children to play digital games as listed in table.1 below (Olson, 2009).

Social Motivations	**Emotional Motivations**	**Intellectual and Expressive Motivations**

A Focus for Hanging Out	Regulate Feelings	Challenge and Mastery
The Joy of Competition	Absorbed by Goal-Driven Activity	Experimentation With Different Identities
Can Teach Each Other		Expressing Creativity
Making Friends		Curiosity, Discovery and Learning
Opportunities to Lead		

Table. 1 Motivations for Children to Play Digital Games

2.3 Stakeholders

Education is not a small matter that is only relevant to parents. As beneficiaries from education, children took hope from parents for education. Teachers are another stakeholders in this project while we deliver our game to them. Some kindergarten and elementary schools that use digital platforms to teach students will also benefit from our educational games. In this section, we will discuss those affected by our project.

2.3.1 Children

Children are the primary users of educational games. In the world, 27% of the entire population are children (M. Szmigiera, 2022). In the United States, the number of children has reached 73 million in 2021. According to American Government Officials, 89% of children or families have access to computers on which our game would be installed. As for now only the English version of the game would be developed, but we will gradually spread our game to all the reachable corners on earth, meaning that most of the children would have access to our game if they have computers.

2.3.2 Parents

As the main supervisors and responsible people for children, parents are an indispensable part of the growth of children. Parents are able to choose the type of educational games mainly based on their expectations of children. In other words, the quality and quantity of education

outside of the school depends on parents. As a stakeholder, parents also reserve the right to reject any educational techniques and equipment that are unfavorable to them on educating their children. In addition, effective educational digital games would reduce the extra time of fostering children's personalities and intelligences for good.

2.3.3 Teachers

Elementary school and kindergarten teachers are also one of the stakeholders that will be influenced by our project. Making use of new study materials requiring teachers to understand the materials first. In this scenario, teachers will spend extra time getting familiar with our game design to decide how and when to let students play. They will also need to revise their syllabus in the advent of this new game.

3 Methodology

The goal of this project was to design and develop an educational, 2D visual-novel game for children to let them learn things outside of the classroom. We want to teach them that LGBTQ+ people are friendly, nice, good, and helpful; they deserve as many rights as the other people do, and they should, living in the modern society, gain respect from others, and be treated equally.

In order to reach our goal, we come up with relevant design ideas for our game and then determine the best tool for game development. These design ideas, of the narration, two protagonists – Hansel and Gretel, five LGBTQ+ characters – Lisa, Lily, Alex, Jade, and Lucy, and of the background and music all should serve educational purposes for children. The best tool – a game development engine – will help us develop the game efficiently and generate desired results, which not only make our testing easier but also give excellent game experiences to players (children, and potentially their parents).

We come up with the following objectives that we need to accomplish to meet our goal:

1. Identify game contents, structure, and educational goals.
2. Determine the best game development tool that comes out with the desired game designs we have in previous objective, and use it to develop the educational game.

The design ideas we come up with include the design for game contents and game structure. We notice that existing expectations from parents towards such games, which are specifically designed for children. For example, the length of the game should be limited, so that the children do not need to play for long hours; besides, the game characters should have high moral standard and good characteristics in them, such as kindness, enthusiasm, and helpfulness, so children will be influenced in a positive way, and they will show empathy towards these characters while playing. Lastly, the general content of the game also has limitations. The game should not cover any violent scenes or display contents that are either not suitable for young audiences, or holds a potential risk of negatively affecting them. We should always keep in mind our goal, design a game with a bunch of positive characters, and satisfy both children and their parents' expectations.

The tool that we come up with should help us design the game, and implement all the designs and functions we want in the game. We notice a better tool will be a game development engine that helps us develop quickly, considering the time limit. At the same time, it should have enough (or more) functions that we need to implement every element we need: game script, characters, images for characters and background, background music, etc. In this way, the tool will develop a visual novel game, with vivid characters, detailed dialogues, clear narration, and being easy to use for its players.

3.1 Objective 1: Identify educational goals and relevant game contents, structure.

3.1.1 Educational Goals

Our main education goal is to let children learn that LGBTQ+ people can be good, which is something they might not learn in the classroom. To help them recognize that LGBTQ+ people are "good," we will design the relevant characters to be friendly and helpful. When the protagonists meet troubles, whether they reach out for help or not, these LGBTQ+ characters will try their best to help them. In the game story, protagonists, as ~10-year-old children, have no place to sleep and no food to eat, because they get lost in their way in a big house. LGBTQ+

characters give them food, water, a place to sleep, and chat friendly with them to ask if they need other help.

In order not to bore the children, we design the story of the game to be fun, and each LBGTQ+ characters has their own personalities, and are very different from one another. Also, children (as players) have choices to decide what to say or to do, and their choices may affect the direction the story advances (for sure, the game only has one happy ending, but the plots before that can vary).

When the protagonists of the game get lost, they finally succeed to go back home with the help from LGBTQ+ characters. Before the protagonists leave, they make a speech that is the key idea we want to convey in our game: LGBTQ+ people deserve respect, should be treated equally as everyone else, and they have all the rights as others have to enjoy their lives. The speech will be further explained in *3.1.3 - vii. Story Design* as a crucial plot just before the game's ending.

3.1.1 - i. Survey

In the original Hansel and Gretel stories, five main characters exist to play their roles. Hansel and Gretel are siblings that are depicted as smart, brave, and positive. Their father is neutral and pessimistic but barely emotionally bonded with their children and obedient to his wife. Two evil figures, who are their step mother and the owner of the candy house, also play a role where Hansel and Gretel would like to fight against. Since we want our game to have an educational purpose, we would add characters that are within the LGBTQ+ group based on the survey as in the Appendix.

We conducted a survey (appendix A) on parent's understanding of gender identification education, their satisfaction with their children's current gender education, their children's age if they have one, and their time duration allowance toward their children playing online games every week. This was intended to determine how long they think children should be playing games per week. Based on the survey results, we will modify our game designs accordingly.

3.1.2 Game Structure

For 2D visual-novel games, the fundamentals for the game is to have a framework that keeps the path of the game intact, or main branch as described in the game scenario. Story is the key to visual-novel games, and we will come up with game scripts that tell a story.

In order to do so, we have two choices: we can either write an original story from nothing, or develop a story based on existing ones. We choose to modify the story based on a current one, considering the time restraint of the project. After performing research on the internet, we decided the story will be *Hansel And Gretel.* This fairytale, published in 1812 by *German Brothers Grimm*, is also known as the famous Candy House story; in the story, having a great plot and being read by millions of people, the fairytale is a ready-to-read story for children.

However, there are many elements in the story that are dark, show cruelty, and bring nightmares to children. In the original story, 2 protagonists, Hansel and Gretel are a brother and sister abandoned in a forest. They fall into the hands of a witch who lives in a Candy House – a house made of gingerbread, cake, and candy. The witch is cannibalistic and threatens the children she will eat them after feeding them and waiting for them to become fatter. Eventually, Gretel outwits the witch and kills her, and the two children escape the forest and return home with the witch's treasure (Wikipedia).

Cannibalism, violence, crime of killing, threats of death…etc. They are not suitable elements for children. Nowadays, parents and adults still show disfavor towards this kind of fairytale due to cruelty in its nature. The others may like it, but the fairytale itself in any way does not serve our education purposes and could bring negative effects to children.

Thus, we will build a new story based on *Hansel And Gretel*, but a completely different one from the beginning, to get rid of all the violence and cruelty, while adding new characters to educate children that LGBTQ+ people can be good.

The story we make also has the name *Hansel And Gretel,* having the two children as main protagonists, but a structure that varies from the original on its theme, narration, plots, story plots, and the ending. Our final product is a visual novel game, instead of a story, so more changes will be made. The modification made to the original *Hansel And Gretel* story will be further explained in the next section. We will go through our design ideas one by one in *3.1.3 Game Content*, and explain how these designs help to serve education purposes for the children.

3.1.3 Game Content

3.1.3 - i. World Design & Game Theme

The world, set differently from the original story, will be in a more modern timeline. It shares commonalities with the world we are living in, but is still a fictional world where phones

are not popular. Our protagonists – Hansel and Gretel – lives in the countryside near an ancient forest, which they will get lost in after leaving home without notifying their parents. The world is designed to have magic, but magic is also known to few people, and Hansel, Gretel, and their social circle won't know such existences. The magic is practiced by one of the LGBTQ+ characters and this eventually becomes a way for her to send two children home. The world is free of violence, blood, malicious strangers, and potential inappropriate content for children.

Our *Hansel And Gretel* game is an adventure visual-novel game that involves some word puzzles solving, and a change of maps as players leave their home, enter the forest, and find the Candy House. However, there won't be any kind of traps in the game that cause characters to die or hurt characters in any way. There won't be traditional adventure game elements in the game either (Health Points, Mana Points, backpacks, weapons, etc). The game will advance with graphic adventure with little or none action elements, and the images and characters in the game are mostly still.

The flow of the game is "exploring the Candy House, meeting interesting characters, and going back home with their help." The length of the game is expected to be around 10 to 20 minutes, with one happy ending where children come back home and LGBTQ+ people return to society and enjoy their lives while being treated with dignity and respect.

3.1.3 - ii. Environment Design

The game mainly takes place in three places: Hansel and Gretel's home, the forest, and the Candy House. Design ideas are different for them.

Hansel and Gretel's home will be a detached house next to the forest. It is a ranch with one kitchen, one living room, two bedrooms, etc. The house is small but always has a warm orange light, and gives a lively and harmonious atmosphere. In the kitchen, there is food that mother will prepare the night prior to the morning she is busy and goes to work early. Hansel and Gretel, while eating breakfast in the place, chat about going into the forest.

The forest is a mysterious place with beautiful natural landscapes. In the daytime, it looks normal; at night it will shine with fireflies' lights. There are countless trees in the forest. The forest is a safe place without dangerous, wild animals.

The Candy House is an interesting and beautiful place. Different from its original settings, we will let it be made of candies only. Candy House is huge like a maze; it has several rooms and all the furniture, except for the soft bed sheet, are all made of candies.

3.1.3 - iii. Music Design

We will not compose the music for the game. To look for background music from the internet, we will choose ones that fit best into the scene. Only if the protagonists are in the forest (we will find mysterious music), the music we choose will always be soft, sweet, delightful, or peaceful.

3.1.3 - v. Protagonists Design

Two main protagonists are Hansel and Gretel – the brother and the sister.
Hansel is calmer and tends to think of more before making decisions. He is hesitant and sometimes it is hard for him to decide. However, he does not draw back as he meets a challenge and he has a desire to stand out in the peers (eg. in order to let other children look up on him for his bravery, Hansel decides to go into the forest with Gretel).

Gretel is more enthusiastic, talkative, and out-going than her brother. She makes decisions fast and is very curious about people's sayings of “weird things” happening in the forest. The curiosity pushes her to go out without telling parents and get lost. They are both friendly and kind, do not do things as the original story suggests – killing a witch, and do not meet anyone evil.

3.1.3 - vi. LGBTQ+ Character Design

There are three groups of LBGTQ+ characters. They are all good people who live in Candy House and give help to the children.

The first group is Lisa and Lily. They are lesbian couple, with Lisa being talkative and Lily being shy and withdrawn.

The second group is Alex and Jade. They are gay couple and Jade is transgendered. They are both naughty and energetic, loving to make jobs about each other and the children (sometimes it can be irritating). They want friends, but because they live in the Candy House for too long and lose connection with people except for each other, they do not really know the right way to make friends.

Lucy is a queer (or questioning). She prefers the “she” pronoun and is born as a male. She wears dresses, does not talk much, is always immersed in her thoughts, and does have a mysterious aura. She doesn’t like dealing with people so she lives alone in the center of Candy House, and makes animal friends instead. Lucy is the only one who performs magic; in the end, she becomes friends with Hansel and Gretel and uses magic to train birds to lead Hansel and Gretel the correct way out of the forest, and come back home.

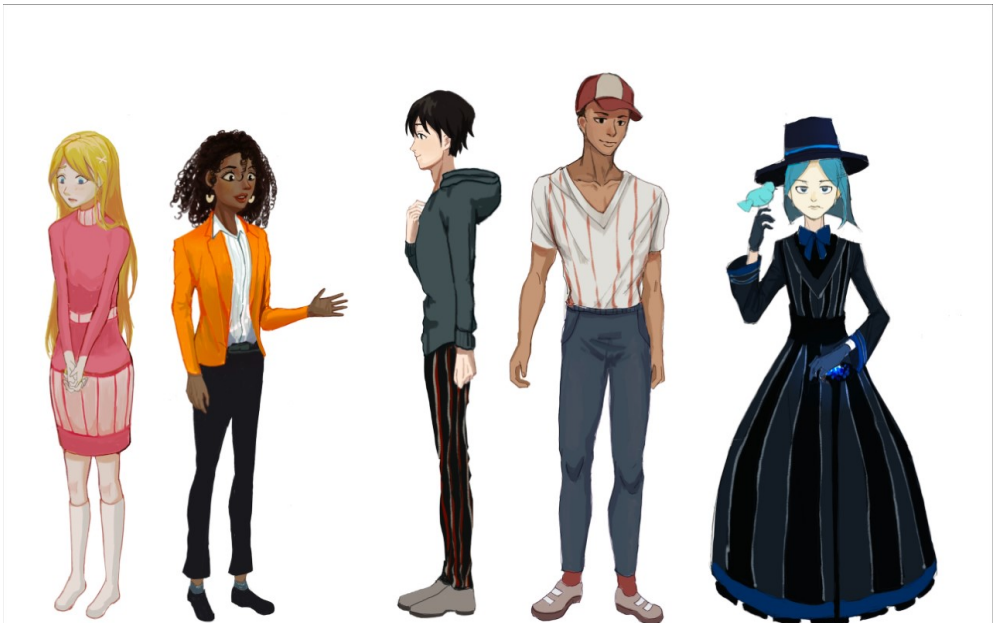

Figure. LGBTQ+ Character Figures From Left to Right: Lisa, Lily, Jade, Alex, and Lucy

3.1.3 - vii. Story Design

The story includes seven plots and the outline is included in Appendix B. To introduce briefly, after Hansel and Gretel get lost in the forest, they meet Lisa and Lily first, who provide them with food and a place to sleep. Lisa and Lily tell the children to find Lucy, because Lucy’s magic-trained birds may know a way to send them home. Thus, the children go towards the center of Candy House to find Lucy. However, they are found by Alex and Jade first, and Alex and Jade play a prank on them by giving them a quiz, and only let them go if they answer correctly. No later after the children realize that Alex and Jade are also good people, they become friends. Alex and Jade tell them the right direction to find Lucy, who as the owner of Candy House and as a good witch, sends birds to lead the children home. Before leaving, the children tell all the LGBTQ+ characters that they know they are different, but they should not hide in

Candy House anymore, because the outside world welcomes them and now, thousands of people just like them are living there and treated equality by others. After hearing the children's words, all LGBTQ+ characters promise that one day they will visit them, in the outside world, at Hansel and Gretel's home.

The things we notice are the difference between the new *Hansel And Gretel* story we come out with and the original one. In our modified version, evil people, a world with violence and cruelty no longer exists. Instead of being thrown out to the forest by their parents, Hansel and Gretel decide themselves that they will go on an adventure in the forest; and instead of having the children fight with a bad witch, the game lets them meet five good, friendly people. The ending comes as Hansel and Gretel are grateful for their help, and as they tell them that acknowledging their difference, the outside world from the forest welcomes them and welcomes their differences. In this way, we will meet our goal to let the game educate children that LGBTQ+ people can be good and the world is becoming more open, inclusive, diverse, and a better place for them to live and gain respect.

3.2 Objective 2: Determine the best game development tool that comes out with the desired game designs we have in previous objective, and use it to develop the educational game.

3.2.1 Ren'Py's Functions

Ren'Py is a visual novel engine, which is used by thousands of game creators around the world. The software helps creators to use words, images, and sounds to tell interactive stories that run on computers of different operating systems (Windows, Mac, and Linux). Ren'Py helps creators to create the game script easily and it has its own computer language, but it also supports Python. The default commands in Ren'Py itself can easily make both visual novels and life simulation games; if those commands do not satisfy our needs, we use Python codes to add more complex features, such as shaking the screen and adding animation – rainfall, snowfall, character's movement – to the story. The stories we made from Ren'Py can either be visual novels or life simulation games.

To add words, which is either a dialogue or narration, we simply add code following a format of "[name][word content]", and then the words will appear on the screen. We can adjust its position to up, middle (for story titles), and down (for dialogues). With a single mouse click, the dialogue advances itself, and the engine displays the next line of the story. Ren'Py has an "auto-play" function, where users do not need to use a mouse. By clicking it, users can play the game like watching a movie.

To add images, which can be either a background image, a button's image, an icon, or a character's portrait, we add code following a format of "image [name][status]." The images are imported at the top of the code file, and we use them in an efficient way. For example, we have the character "Lisa" and have four images of her being happy, sad, angry, or scared. When we have a Lisa' dialogue, we add the image code before the dialogue code, which will be "image Lisa happy." The engine automatically finds Lisa's happy face and displays it. In this way, we can add images with one command and be efficient with coding.

To add sounds, we use commands that are similar to ones with images. Ren'Py is able to accommodate a variety of sound formats, and the most used ones are mp3 and wav. We will upload the sounds first, then use code format "[type][sound's name]" to implement a sound. The benefit of setting type is to distinguish between a character's voice and background music. If it is a character voice, users click and then the voice will stop as dialogue changes; background music will continue playing no matter whether users click or not. Some Python code will allow background music to self-loop and it makes programmer's jobs easier.

3.2.2 Ren'Py's Functions align with our goal

Ren'Py is easy-to-use and efficient for game development. To make *Hansel And Gretel* modified versions of stories, we will have a game script (~6000 words) and character's portraits and illustrations (5 characters, ~10 portraits). Due to the time limit and the amount of visual elements we use in the game, it'll be extremely difficult for us to use a common IDE for game development to complete it within the time frame. *Hansel And Gretel* will be a visual-novel game, which means we only need the basic features – displaying text, images, and playing sounds. We chose Ren'Py for its particular usage on visual game development, and it will save an enormous amount of time to make our game with this engine. It is not only easy-to-use for programming but also efficient in adding text or image features. We will not compose music or

dub the characters' voices, but Ren'Py gives a lot of free music and sound effects that we can use for commercial or non-commercial purposes. In this way, we can add all necessary features to our game, with sounds, to make users' game experiences infinitely close to watching a movie or reading a visual novel with automatic page turnings.

Ren'Py makes our testing and playtesting easier by giving a wide range of choices on its supporting operating system. The software supports Mac, Windows, and Linux, and allows us, as a development group, to work at once with different computers. After the game development progresses and we have the beta of our game, we will download it into all versions, which can either be played on Mac and Windows, or on a web browser and on a mobile phone. With these versions, if we playtest it with children, they and their parents can choose the one that works best for them. Thus, we do not need to prepare extra devices for playtesting, and with the game size kept within a reasonable range (~100 Megabits to 300 Megabits), playtesters can download the game and start playing in minutes.

Ren'Py meets our needs by saving time on the game development process and giving the best users' playing experiences after the game is made. It builds game structure and content, helping us develop a game for educational purposes, which teaches children that LBGTQ+ people are good and friendly, and they have rights as other people to live and enjoy their lives in modern societies.

3.2.3 Other Game Development Tools

Other game development tools include illustrating and image-processing software, such as Photoshop and Procreate (Ipad). We will also be using 3D software (Maya, Blender, DesignDoll) to use as a supplement tool to make background illustrations. Websites like *Envato Elements* and *Loudly Soundtracks* provide downloadable music and sound effects that can be used for commercial purposes.

4 Implementation and Development

As stated in Chapter 3, Renpy is a software that everyone can use and become an expert if knowing the functions, data structures, and implementations in Python. With embedding functions in this software such as *show(), scene(), show text()*, etc., we are able to create the

scene frame by frame with the dialogue and questions with the locations they belong to. The order that we implement the game designs and the modified Hansel and Gretel are as follows:

- Scenes: Pictures, Background musics, Pictures, Figures, Narration, and Dialogues
- Questions/Choices
- Transitions, Animations, and Testings

In this chapter, we will introduce how we implement the game designs and stories as mentioned in the previous chapter in the above order.

4.1 Scenes

Scenes are constructed with dialogues as the foundation. To add image in the background, the first thing to do is to import the images and scale it in pixels with the Renpy function im.Scale(). For example, if the background image is in the folder “images” and named as “background”, and to fill the screen we need it to be scaled at 1920x1080 pixels, we would use the function as: bg = im.Scale(“images/background.jpg”, 1920, 1080), where bg is the name we defined for the “background”. After loading the background pictures and dialogues, the scenes is presented as in the **Figure 1.** and **Figure 2.** below

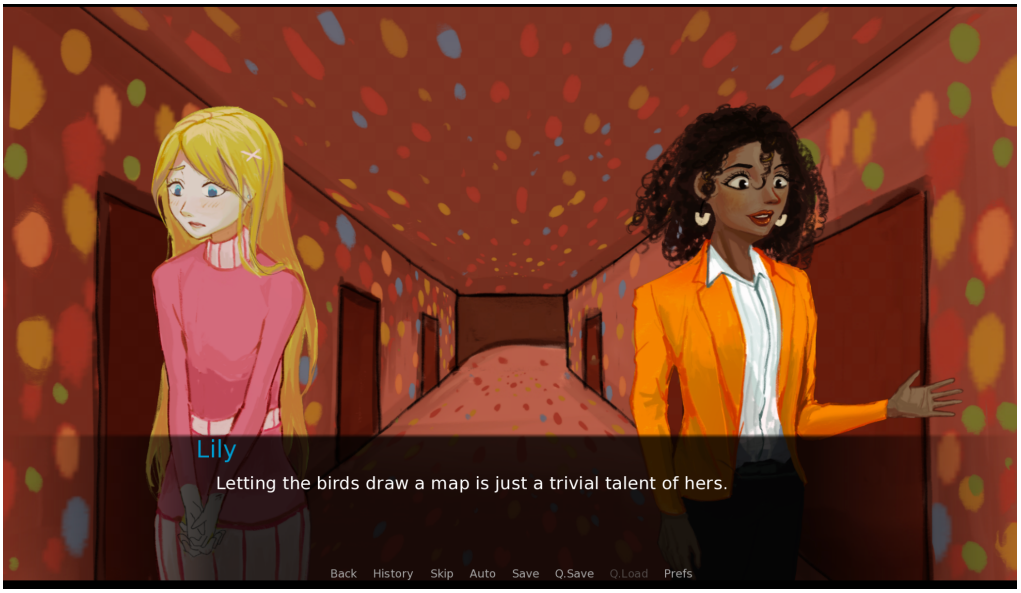

Figure 1. Example of Our Game Scene

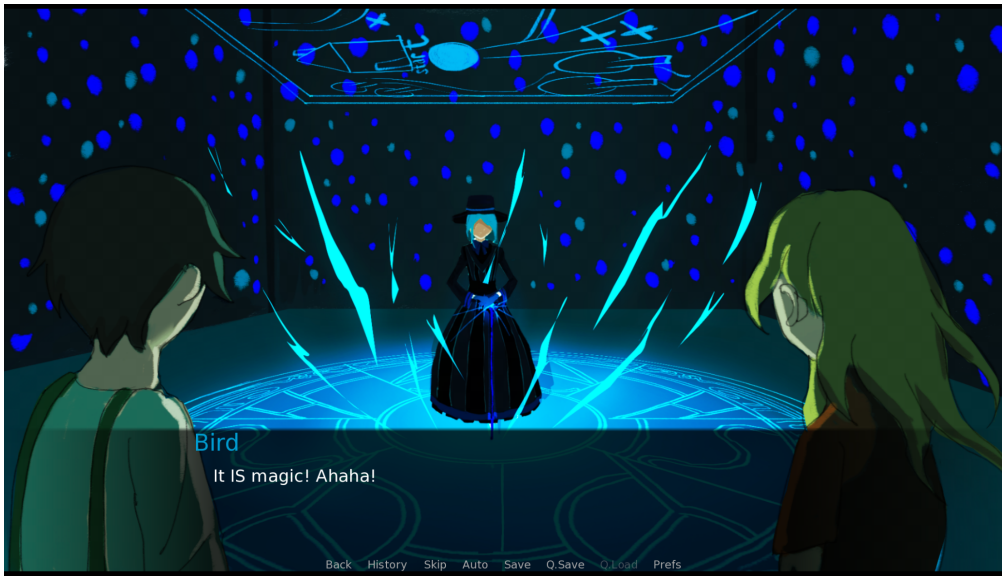

Figure 2. Example of Our Game Scene

4.2 Questions

The questions are added with the label function. In Renpy, label() essentially creates a subsection where the program would be running straight into and show the questions and conditions. We can use *menu()* function inside the *label()* function to create a switch case for the game with choices. These choices are implemented as conditions in the function or a if statement. Then another label is created if the false answer is chosen by the player, it will show the scene of false action. If the player answered it correctly, we added another label to let the game proceed, or the main branch in this case.

4.3 Animation

Our game design requires animations for transitions between each chapter, moving the objects and characters, and zoom in and out the characters. The transition between chapters is implemented with the Renpy *dissolve()* and *slowdissolve()* functions. The first one has the same effect as the dissolve function in powerpoints in that it will let the background pictures or figures slowly appears. The other one is the slower version of the first one where we use it to create a serious atmosphere. With the move() function in Renpy, we can easily implement the moving of figures. The move function contains three variables: x,y coordinates of the original location; x,y coordinates of the finished location; and the speed of the motion. Otherwise, if we want to move

out the figures to and from the center, we can use the functions moveinright() and moveoutbottom(), etc.

5 Result and Feedback

In this chapter, we introduce the methods we used to verify whether our game satisfies the educational goals, the results we obtained from the participants and a rough evaluation and analysis of the results.

5.1 Verification of the results

In traditional games, proving the result of the study would require educators to ask students additional questions in the end like final exams or quizzes. Regarding digital educational game-based learning, we develop a plan that is different from that of traditional games. Using the conveniences of programming, we add a parameter in the game to categorize the different problems into four kinds: mathematical problems, vocabulary problems, moral problems, and LGBTQ+ problems. The answers are also being recorded with another parameter. To monitor the progress of the learning, we will use the parameters to generate a plot after children finish playing the game to see the curve for the correctness of the problems for each category.

We also utilize the feedback loop concept to use the parameters of correctness for each problem. If the children answer the problem correctly, inferring that they have learned or know the answer to similar problems, the following similar problems would be less likely to appear later in the game to reduce the burden on the children. The program would then consider similar problems to be repetitive. When children answer the problems wrong, they would see more questions of the same kind as the game proceeds. Ultimately, we implement the curve for the problems for each category to see the educational result.

In short, with all questions being categorized, the game will show and prove its educational goals. Whether the children playing this game will learn something is depend on the curve of correctness: if the curve of correctness for similar problem has a growth trend, then less problems would appear in the later of the game, proving that our game has a positive educational result; otherwise, more questions would appear as the game progress, meaning that our game does not have good educational results.

5.2 Results and Analysis

The results are retrieved from the same participants of the survey as in chapter 3. In the total population of 14 parents who have at least a child aged 8-14 years old, six children tried our game and give us a basis for our game result. We asked participants to send back the parameters generated in the end which will show their understanding and improvements on each kinds of problems before and after they play our game.

For math problems, five out of six participants present a result curve that has an upward trend. One participant shows a flat curve, meaning that the children do not have a good basis for mathematic problem-solving skills and do not present either an active or passive learning tone. In this case, 83% of people show positive results, which proves that our game has an educational capability in mathematics.

The results for vocabulary problems are dramatic. Since the participants are from different countries in that not all participants are native speakers of English although all of them have a basic knowledge of English. From the result, we found that 2 out of 6 participants show a curve that has an upward trend. The other four participants generate a curve that's either in a flat shape or a downward trend. We found that the vocabulary questions were based on participants' vocabulary size. This leads to an inaccurate result of proving our game design has a limited capability of educating vocabulary.

Regarding moral problems, as the game progresses, the difficulty level of moral questions is getting higher. Therefore, we are expecting that if our game shows an educational capability in morality, the correctness curve would steadily increase. From the results, we saw that the curves for all six participants have upward trends, meaning that they are less likely to make a wrong choice in morality questions as the game proceeds. This shows that our game has an educational capability in morality.

LGBTQ+ problems are always controversial. As people debating on LGBTQ+ problems, they may neglect the actual nature of this topics and LGBTQ+ groups, which is that all should be treated equally. In our game design, we are trying to lead children to respect and treat everyone equally. As a result, for 3 out of 6 participants, the correctness curves for LGBTQ+ related questions present upward trends, other 3 shows flat curves. We found that one possible explanation for the three flat curves, after analyzing, is that they may not have faced such a topic before. Hence that for some of them, LGBTQ+ is a brand new topic to them and although they

get some LGBTQ+ questions right which might because of the instincts of human, other questions might seems new. Also, because the ideology left from feudal society suggests that all couples besides different sex would be considered “alien”, some of the children might also think that LGBTQ+ groups are strangers and are afraid to being friend with them.

6 Conclusion

This project provided a design of educational games for children and presented the results of whether the game satisfy our educational goals. Ultimately, we hope that the game design is both favorables to children and can teach something while they play. Because this was a student-led project which designed the educational games to educate children students, we also believe that this project will fit the students and parents need for both relaxation and education.

From the result, we found our project provided a good educational capability in math and morality, a fair educational capability in LGBTQ+, and does not show a good educational capability in vocabulary. After analyzing, we found that this problem could be caused by culture difference and different knowledge levels of children. The first limitation could be solved by giving the players the option to change language. This would requires a large amount of effort for translation and designing the vocabulary problems for the design groups. The second limitation could be dealt with implementing a difficulty level button in the beginning of the game such that children could choose the difficulty of the questions based on their knowledges and understanding on math, vocab, morality, and LGBTQ+ related topics.

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Appendix A: Survey Questions For Parents

☒By checking this box, I agree for my responses to be used for researching features and understanding parents' attitudes and educational objectives toward children's online games. I know that my responses will be anonymous.

What do you think of digital games in comparison to traditional games for children?
- Digital games are better
- Traditional games are better
- Both are great, if for educational purposes
- Neither are good for children

Do you have a child or children? If so, which one of the ranges belongs to the age of your youngest child?
- younger than 3 years old
- 3-6 years old
- 6-9 years old
- 9-12 years old
- above 12 years old
- I don't have a child

How do you rate the current online educational games that are available for children, generally, on a scale of 1 to 5? (1 represents not acceptable, while 5 represents great.)
- 1 - They are not acceptable to me
- 2- They are barely acceptable to me
- 3 - They are somewhat acceptable to me
- 4 - They are great but need some adjustments
- 5 - They are great so far

What aspects do you look into when you rate online educational games for children?
- [textbox (optional)]

Revise - to be more specific: e.g. fairytales were revised by us and would be better
How would you think about telling fairytale stories to children, on a scale of 1 to 5?
- 1 - They are not acceptable for children
- 2- They are barely acceptable for children
- 3 - They are somewhat acceptable for children
- 4 - They are great but need some adjustments
- 5 - They are great for children

Have you ever heard of visual-novel games?
- Yes.
- No.

Describe what you think gender education in school is.

- [textbox (optional)] (differing opinions)

How would you rate gender education in school, on a scale of 1 to 5? (1 represents not acceptable, while 5 represents great.)

- 1 - They are not acceptable to me
- 2 - They are barely acceptable to me
- 3 - They are somewhat acceptable to me
- 4 - They are great but need some adjustments
- 5 - They are great so far
- [textbox (optional)]

How long would you like to have your children play online educational games per week?

- less than 2 hours / week
- 2 - 5 hours / week
- 5 - 10 hours / week
- 10 - 15 hours / week
- larger than 15 hours / week
- I don’t care for educational purpose

Approximately how long would you think an educational game should be in length?

- Less than half an hour
- 1 - 3 hours
- More than 3 hours
- The length does not matter

Appendix B: Story Outline of Modified version <Hansel and Gretel>

Summary: Two protagonists, 10-year-old Hansel and Gretel, go into a mysterious forest out of curiosity and find a Candy House. They meet a bunch of good LGBTQ+ people there, receive help from them, and finally go back home under their helps. Hansel And Gretel finds out that these LGBTQ+ character escapes to Candy House, e because They are afraid of being different and judged by to others. Hansel and Gretel tells them that outside world has changed, and it became a more open place that welcomes people with all gender identities, and asks them to go out again. In the end, LGBTQ+ characters agree to leave the forest and go to visit Hansel and Gretel at their house.

Act1. Out of curiosity, Hansel and Gretel decided to get to the forest when their parents were not at home. They leave in a hurry, so they only bring bread, tearing it into pieces, and marking the way. Unfortunately, bread pieces are eaten by birds, and Hansel and Gretel don't know how to go back.

It is said that there is something "magical" deep in the forest. No one knows what it is. But they can hear, in the middle of the night, the songs people sing in the forests and see fireflies flying in the grass. It is said, they are the result of "dark magic," and an evil witch is living in the forests. No one should come close.

Act2. Hansel and Gretel find the Candy House. They don't eat for the trip and are hungry so they start eating the candies. A shadowy figure (Lucy) passes by quickly, and they are scared, because they don't know that's the bad witch, and they don't know whether to go back. They can't go back now: they enter the Candy House together.

A wooden sign hangs on the gate of the house; it says: "Our home." And some unrecognizable signatures. The human who passed by disappeared quickly. Hidden in the woods, he peeps at the sibling. He enters the Candy House too.

Act3. The Candy House is bigger than they expect. Much bigger. It is not that they get lost…But inside the Candy House is like a maze, all the walls filled with Candies and they can't recognize the directions they are coming from. More weird things happen: they find a paper on the floor, and some question is written on it ("why are you coming? Who are you? Do you know what this house is?"). They answer, speaking to the air, but the door in front of them is open – the opening leads them to a big room. A room with two beds, two desks, a plate filled with biscuits and fruits, and all furniture is made with candies.

Lisa and Lily notices them come too. However, Lisa and Lily doesn't trust the out-comers, even they are children. Lisa and Lily hands a paper through the crack of the door with questions to ask them. As soon as they find out the children are innocent, without malice, they come by accident and now need help, Lisa and Lily leave their room and the food to them.

Act4. Hansel and Gretel sleep a peaceful night in the big room. Lisa and Lily appear in front of them and talk to the children. Hansel and Gretel appreciate their kindness, and when Lisa and Lily ask "do you want to come back," Hansel and Gretel say yes, but they would like to stay for a few days. Lisa and Lily tell them they can go to find Lucy – the owner of the house, the mysterious guy who talks to animals – who might know a way to send them home. The siblings leave the room, and start going to the center of Candy house: Lucy is supposed to live there.

Great friends.

Lisa and Lily are lovers. It is clear: the intimacy when they hug and caress each other's hair Lisa and Lily tells Hansel and Gretel they always live together and sleep on the same bed. "Why are you in the Candy House? "The sibling asks. "People don't want us to be together," answered Lisa and Lily. "There are people who hate us. We cannot come back now… Everyone living in the house is like that.

but this is not the question you should worry about." …All residents here are like that.

Act5. On their way looking for Lucy, they met troubles. "Answer this question correctly, or we will block your way." "Answer this question correctly, or we will turn you to stones." "Answer this question correctly, or we will remove the floor you are standing on, so both of you fall into Abyss." The questions are easy at first, some reasoning questions and primary school math problems; however, it gets harder. The last question is to answer who "we" are. Hansel and Gretel had no way of answering it, but to their surprise, the floor didn't fall.

Two people(Alex and Jade) dance and appear in front of them arm in arm. Alex and Jade appear bad to them, but they later find out that Alex and Jade, without malice, just want to be friends with them, and they think joking is a way to get to know people and get closer.

Act6. Alex and Jade lead them to Lucy. Lucy says she is watching them all the way along, and she trusts them. She blames Alex and Jade for making those inappropriate jokes, and she performs magic in front of them, summoning birds that can lead the siblings home.

Hansel and Gretel learn the past of Candy House from Lucy. A long time ago, a bad witch was living here. The witch cut down trees, killed the animals in forests, and caught and imprisoned a child who lost his way in the woods. The child is smart and used strategies to defeat her,

obtaining the power to perform magic – the child is Lucy. Lucy maintains the Candy House and protected everything here, but she doesn't trust humans, and she refused to leave. Same for everyone here – they are to some extent scared of people because of the unusual identities they have, and the world won't accept them.

Act7. Before leaving, Hansel and Gretel tell everyone that the world has changed. They(Alex and Jade, Lisa and Lily, Lucy) don't know because they stay here for too long. And the time in Candy House passed much slower than outside (a year - three days) And that in the outside world, there are many people just like them, and they are well treated and loved.

Appendix C: Draft And Final Character Illustrations

[Name] ([age], [gender identity]) - (description …)

Lucy(15, questioning) - likes animals, born as a male but uses “she” pronoun and wears dresses.

Lily (22, lesbian) - shy and kind, likes cooking, white woman.

Lisa (24, lesbian) - enthusiastic, previous social worker, African woman.

Jade (20, transgender) - playful, Asian guy.

Alex (30, gay) - strong aesthetic white guy.

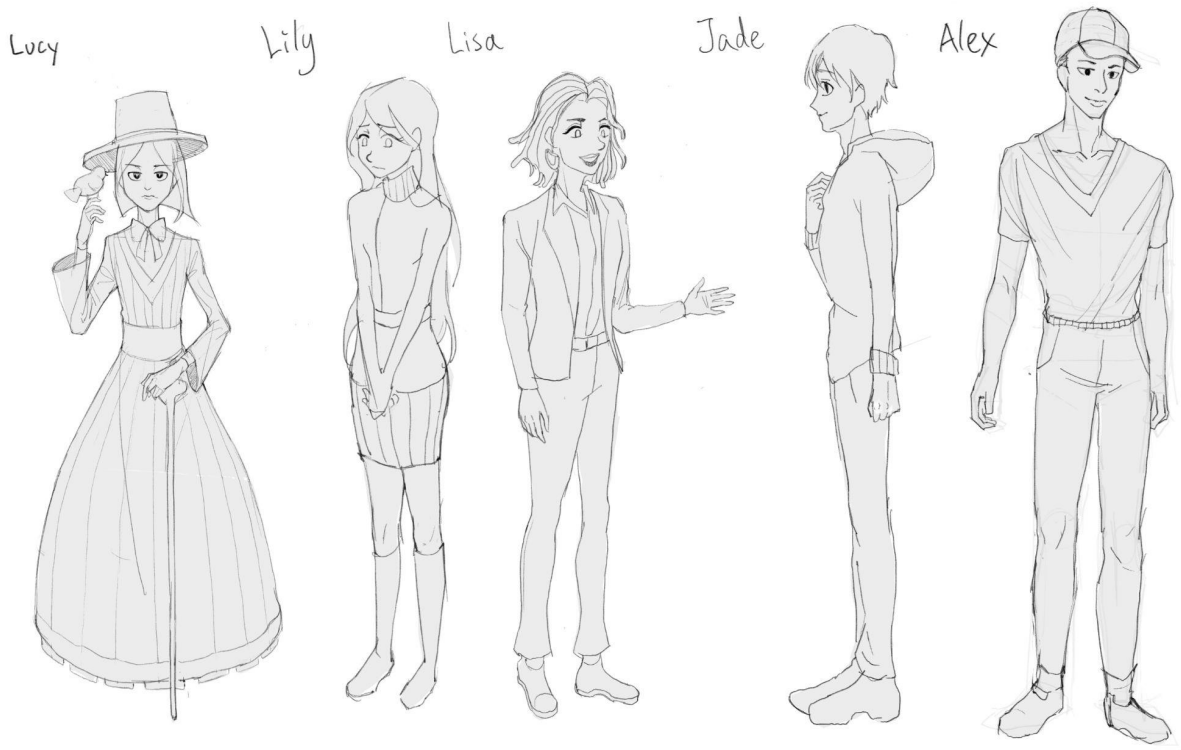

Figure 3. Draft For Character Design.

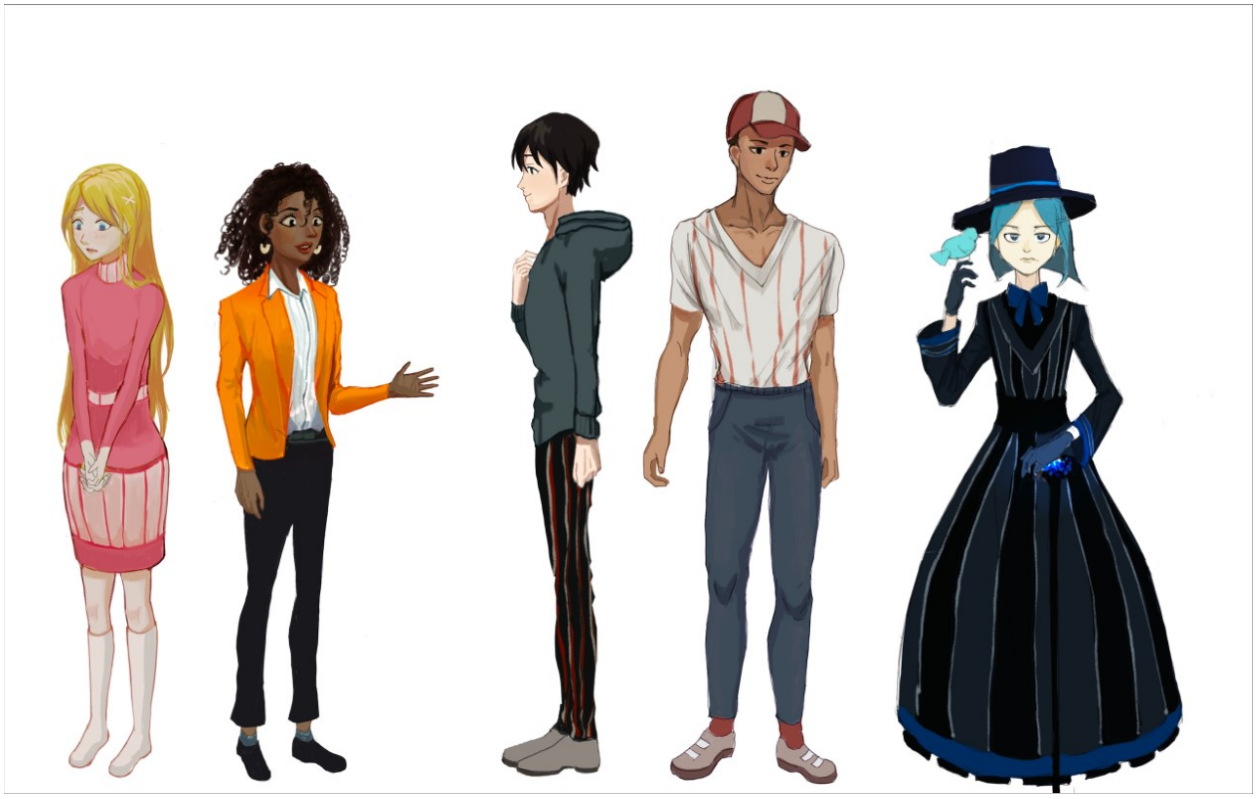

Figure 4. Final Character Design.

Appendix D: Other Illustrations

Figure 5. Game Cover Page.

Figure 6. Game Scene: Lucy Performs Magic To Generate A Map.

Figure 7. Scene: Forest (day).

Figure 8. Scene: Forest (night).

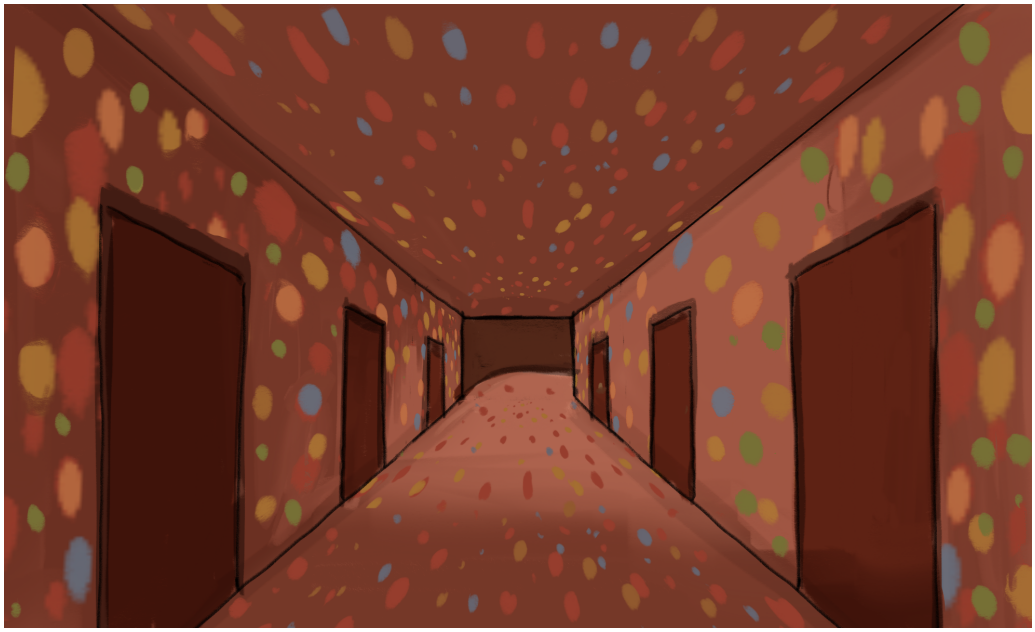

Figure 10. Candy House (corridor).