

**Interactive Fiction for Education: Healthy and Safety**

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# Abstract

For a long time, education has been the cornerstone of human progress. Good education not only maintains social stability, but also promotes economic development. How to improve the quality of education is a problem that people are very concerned about. In the last two decades, the gaming industry has grown very rapidly, and the number of gamers has grown by leaps and bounds. Educators have found that combining education and games can increase the effectiveness of people's learning. Games that are combined with education are called serious games. Serious games have to ensure playability while also achieving the goal of educating students.

Health and safety is always the most important thing at university. Health and safety includes not only the student's, but also the student's property, the university's property etc. Only when the health and safety of the students is ensured, can the students carry out a range of activities such as classes, group discussions, doing experiments and so on.

The aim of this project is to raise students' awareness of health and safety through an interactive fictional educational game. It helps students to avoid behaviours that may be harmful to the health and safety of the University. The target group of the game is university students, who will learn about health and safety during placement, what to look for in various laboratories, etc. The game will be developed using the Renpy engine.

**Keywords:** health and safety, interactive fiction, serious game, Renpy.

**Declaration**

All image resources used in this interactive fiction have been sourced from open source image sites or open source interactive fiction projects. Their authors declare that people are free to modify and use these resources. The plot of the game is original to me and cannot be copied without permission. The game has been uploaded to the open source site GitHub and the free game site itch.io.

# Introduction

Education has always played an essential role in human society. Human progress and development cannot be achieved without it. Different educational approaches can have different learning outcomes, and excellent education can enable students to learn more in the same amount of time. Based on students' engagement and participation behaviour when learning, researchers and educationalists have developed the ICAP framework, which divides education into four learning modes: interactive, constructive, active and passive. Researchers have found that learning becomes more effective as students become more engaged with the learning material. Of the four models, the interactive model achieved the most outstanding level of learning, followed by the constructive, which in turn was better than the active model, with the passive model having the worst learning outcomes.

This project is to verify whether the interactive model is better for education. In order to build out the interactive learning model, the project will combine games and education. The educational interactive fiction is an excellent model of interaction. Students will be educated as they play the game and interact with it based on what they have learnt. With the rapid development of computer technology, games are becoming more and more common in people's lives. The categories of games have become broader, including adventure, simulation, role-playing, shooting games and strategy games (Amory et al., 1999). Interactive fiction is a type of role-playing game. Players take on the role of a character in an interactive fiction and then use this role to explore the game's plot as written by the developers. Interactive fiction is primarily a text-based format that moves the plot forward. There will be several branches in the fiction for players to choose from. The player interacts with the fiction by choosing branches based on the plot, which leads the player to different storylines and endings. In the interactive fiction mode, knowledge can be added to the plot of the fiction, and players use the knowledge in the fiction to choose branches and thus move the storyline forward. Compared to other game types, Interactive fictions are less difficult to develop and have relatively low development costs, so they are suitable for single person development. This project aims to create an educational interactive fiction and pre-test and post-test the players to determine if the fiction is more educational.

The theme of the interactive fiction is the health and safety of university campuses. A university is a vast, complex organisation with a high concentration of people, valuable property and sophisticated instruments. If a security problem occurs, the university suffers losses that are often incalculable. Staff and students in universities have an extensive range of activities, some of which involve unpredictable risks. Creating a risk-free environment is difficult to achieve, so it is essential to train students and staff in health and safety before entering university. The university provides education to students before they start their studies, for example, by issuing safety brochures or allowing people to watch relevant videos. The objective of this project is to educate entrants about health and safety through an interactive fiction format, which is biased towards teaching students how to keep themselves healthy, how to prevent safety issues and how to deal with safety issues if they occur.

# Background

## ICAP

Depending on the behaviour of the students involved, learning models have been divided into four categories: interactive, constructive, active and passive. As research into pedagogy continued, educationalists found that learning modes had a significant impact on the effectiveness of learning. They used to incorporate active learning strategies into the classroom. Pedagogues have found that active learning is much more effective than passive learning and that students prefer active learning strategies compared to the traditional lecture teaching mode(Eison and Bonwell, 1991). To explore the efficiency of these four learning modes in depth, ICAP theory was proposed by Chi and Wylie in 2014. In ICAP theory, students' learning efficiency decreases as they become less engaged with the learning material, moving from interactive to constructive to active to passive. (Chi and Wylie, 2014)

The passive engagement model is described as students passively receiving information from instructional materials without actively doing anything related to their learning (Chi and Wylie, 2014). Most of the traditional education we normally receive is based on the passive model, such as lectures in universities. Once there is no behaviour related active learning from the students, then the teaching model becomes a passive model. In a lecture, the lecturer will basically explain the knowledge in the textbook. Students will just sit in their seats and listen to the lecture without doing anything else related to learning, which is a clear passive mode of participation. The passive mode is also the lowest level of engagement in the ICAP framework.

When students adopt certain behaviours to interact with the instructional material, the pattern of teaching and learning escalates from passive to active. In the case of a university lecture, when students listen to the teacher explain the teaching materials, they discuss knowledge with a classmate or students record some key notes. This changes the student's mode of participation to active mode. Active mode can also take many forms, such as manipulating parts of the learning material by pointing with the finger at what is being read (Alibali and DiRusso, 1999), pausing an instructional video or going back to a specific part of the video (Chi, Roy and Hausmann, 2008), and so on. In addition to the need for students to initiate certain behaviours, it is also very important whether students' attention can be attracted by these behaviors. (Chi and Wylie, 2014). For example, when students are asked to read aloud a complete text (Oakhill, Cain and Bryant, 2003), the behaviour tends to be more passive because the student's attention is not focused on the text. The content of the text does not pass through the student's mind. If students are asked to read a particular sentence or paragraph aloud, then their attention will be focused on the text. Sometimes it is ambiguous whether an activity should be categorised as passive or active unless it can be determined whether it elicits focused attention (Chi and Wylie, 2014).

Constructive models are defined as learners producing or generating additional externalised outputs or products from the learning material. The constructive model is similar to the active model in that they both require additional learning behaviours from the learner. Whereas they differ in that the constructive model requires learners to create new ideas that go beyond the given information (Chi and Wylie, 2014). For example, if text and diagrams are separate in the instructional material and learners integrate the text and diagrams, then this is a constructive mode (Butcher, 2006). This is because the student has created new ideas outside of the original teaching material. If the student simply copies the text and diagrams, then this is just the active mode because nothing new is being produced. In addition, constructive activities include creating diagrams, making plans, predicting trends, etc. Because the diagrams, plans and trends are additional learning outcomes created by the students. In the constructive mode, teachers or tutors can better assist students in constructive learning (Chi et al., 2001). This is because many of their strategies can be seen as encouraging or prompting learners to construct knowledge. They can also guide students to engage in deeper thinking. Students are expected to add more knowledge to their yes or no answers, which facilitates a more constructive response.

The interactive learning model is the one in which students are most engaged with the learning material. The interactive model requires people to take turns communicating constructively during the learning process. Two conditions need to be met for interactive behaviour; people's behaviour must be primarily constructive and a sufficient degree of turn-taking must occur. The definition of interactive behaviour is restricted to verbal communication or dialogue (Salomon and Perkins, 1998). It requires verbal discussions, not just movement or physical interaction, when people work and study together (Milrad, 2002). For example, when two students summarise the key points in each other's study notes on paper, this is not a mode of interaction. But when they share with each other what they think are the main points, they are learning interactively. In interactive learning, it is important that all people needs to have enough communication. If it is just one person who has something substantial to contribute and others only acknowledge or disapprove of their contribution without elaborating on the reasons why, then this model is known as personal dialogue (Resnick, Asterhan and Clarke, 2015). In this model, the speaker is constructive, and the listener is active, so this is not an interactive learning model either. An interactive mode is constituted when both parties share substantially, such as debating an idea (Schwarz, Neuman and Biezuner, 2000), asking and answering questions to each other (Webb, 1989), etc. Conversations must meet a certain frequency of turn in order to be considered interactive. When two groups take turns giving a presentation, the learning achieved may not be as good as when the other two groups keep talking to each other, asking and explaining questions to each other.

When we want to determine which mode a student's behaviour falls into, we first need to know whether the student is actually learning. For the passive mode of participation, if the student is apparently listening to the teacher, but his or her brain is thinking about things that have nothing to do with learning, then that learning is not even in the passive mode. For active, constructive and interactive, the additional behaviours performed by the student must also be relevant to the learning content. Irrelevant behaviour not only does not enhance learning, it also reduces learning outcomes. Student output or dialogue can only be considered truly constructive or interactive if it is relevant to the activity (Chi and Wylie, 2014). Furthermore, students' learning outcomes should be externalisable outputs. Externalised outputs provide researchers with data and evidence that researchers can use to analyse and verify whether students have completed the task or improved their learning. Externalised output has two other advantages. The first advantage is that it can help to overcome cognitive load. Students can use externalised output to check for errors or to infer new knowledge (Sweller, 1994). The second advantage is that the process of externalising output provides students with the opportunity to monitor whether they really understand the material. Externalised output allows students to recognise the extent to which they have understood the knowledge (Kitchner, 1983).

In the passive engagement model, the newly received knowledge is stored in an encapsulated isolated manner. This means that new knowledge is not combined with existing knowledge, and it can only be accessed when specific prompts are given. When students engage in an active way, the body of knowledge in the learner's head related to the new knowledge is activated and new knowledge is added to the system of knowledge. It makes the system of knowledge more complete. Students' behaviour in a constructive manner may involve many types of inferring. In the inferring, new information is integrated with previously activated knowledge, and new knowledge is then inferred from the activated and integrated knowledge. In the interactive model, the inferred new knowledge can be combined with the inferences of other partners, from which innovative ideas and perspectives may emerge. These ideas cannot be generated in the context of independent work. This model allows the learner to have the deepest understanding of knowledge. In the ICAP framework, students can have the deepest understanding in the interactive mode compared to the constructive mode. And the constructive mode enhances learning more than the active mode. The active mode is in turn superior to the passive mode. In the ICAP framework, learning levels will be ranked in the direction of I>C>A>P (Chi and Wylie, 2014).

## Interactive fiction

The learning tools that students use in their interactions are important. Educationalists have conducted experiments based on the ICAP framework and the results show that video-based learning is the most effective. It allows students to be more actively engaged in learning (Dodson et al., 2018). Video games are electronic or digital games that can be played on some platforms, including personal computers, game consoles, mobile devices, the internet, etc. (Jones et al., 2014). Video games interact with the user through graphics, animation, text, and music. Interactive fiction is also referred to as text adventure games or text-based games. As described by its alternative name, text adventure games, interactive fictions are adventure games. Adventure games engage players mainly through adventure and puzzle-solving (Grace, 2005). In interactive fiction, players access the information in the game and interact with the game entirely through the text. Interactive fiction usually has a main plot, which must be consistent and coherent, and is accompanied by some puzzles and quests (Ammanabrolu et al., 2020). Plots in interactive fiction often take place in real or fictional worlds, which requires the player to have a certain amount of common sense, e.g., an axe can be used to chop wood, etc. (Ammanabrolu and Riedl, 2019). The player observes textual descriptions of the simulated world and then issues textual commands to influence the simulated world in the fiction as well as the progression of the fiction's plot and gains points for the story (Hausknecht et al., 2020). Gameplay refers to the interaction with the virtual world through the control panel of the hardware, with the aim of accomplishing the core objectives in the game. The main feature that stimulates players to interact with video games is gameplay. Gameplay adds to the enjoyment of the game and is a fundamental quality of video games. Excellent gameplay is necessary for good games (Tavinor, 2005). Interactive fiction is developing very rapidly, and interactive fiction's commercialisation has been a great success. Interactive fictions like Zork (Infocom 1979), Planetfall (Infocom 1983), Amnesia (Electronic Arts 1987), The Secret of Monkey Island (LucasArts 1990), and Curses (Infocom 1993), are some classic commercial interactive fictions. The research community is now interested in interactive fiction, and there will be more and more research on this in the future (Sharma et al., 2010).

## Educational games

Since the invention of games, they have been considered a tool for entertainment for a long time. Spending too much time and energy on games is considered by society to be unproductive, as games can affect people's learning and work performance. Study from Taiwan, China, has shown that video game addiction is negatively associated with academic performance, and people with video game addiction are more hostile than the general population (Chiu, Lee and Huang, 2004). Other researchers have suggested that video game playing is similar to pathological gambling among adolescents (Fisher, 1994). In short, many people believe that the adverse effects of gaming are far greater than the positive ones. However, in 2001, an article entitled "Computer Game Studies, Year One" changed the perception of gaming. The article claimed that computer games were a vibrant cultural genre and that computer games should be a new field of study. Game studies could include media studies, aesthetics, sociology, etc. (Aarseth, 2001). Since then, there has been a gradual increase in research addressing the positive effects of games, and people also realize that games can bring many benefits. After that, games have since been shown to be helpful in education, defence, healthcare, religion, etc. Games can illustrate scientific research, train professionals and disseminate information in these areas, and so on. (Djaouti et al., 2011).

The use of educational games in learning environments is increasingly common, but researchers have found that some games are described as edutainment (merging the words education and entertainment). "This term is often used to label those initiatives that correspond to the "educational content" extreme of the spectrum" (Moreno-Ger et al., 2008). Educational games are different from recreational games, and their main difference is their interactivity. Edutainment games regularly invoke the same patterns of action and do not focus on the learning curve. Therefore, this game fails in terms of imparting knowledge. Educational games focus on theoretical and linear progression. The role of video games in education is to create interactive and challenging worlds in which the user can be the leader in the game (Denis and Jouvelot, 2005). Edutainment often has a set skill and drill format, where players have to practice skills over and over again or rehearse memorized facts. Educational games require players to use their knowledge to develop strategies and solve problems. Simply learning by rote is not enough (Dondlinger, 2007). Players often need to interact with the content of educational games, such as storylines and levels, based on what they have learnt. The game will provide feedback based on the player's interaction. Interactive fiction games fit these characteristics, and this game model is ideally suited to the production of educational games(Charles et al., 2011).

## Serious games

The original intention of serious games was to combine serious aspects such as non-exhaustive and non-exclusive teaching, learning, communication, or information with a source of playfulness from video games to give them coherence. In simpler terms, serious games are a combination of utilitarian functions and video games (Alvarez and Djaouti, 2011). Serious games have two characteristics. Firstly, they combine video games with one or several utilitarian functions: broadcasting information, providing training, etc. The second is that it targets a market other than entertainment (Alvarez and Djaouti, 2011).

The question of whether a video game is a serious game can be judged in terms of G, P and S. "G" is gameplay. Serious games provide feedback on the performance of the player, from which the player can know whether they have won or achieved a good outcome in the game." P", as "purpose". Serious games need to have a primary function, such as whether serious games can be used to broadcast information, provide training, collect data, or have more than one of these functions at the same time." S", as "sector". Serious games need to have a target audience, or a market for serious games to be played. For example, such serious games might be applicable to defence, education, health, etc. (Alvarez and Djaouti, 2011).

The term 'serious games' was first formally introduced by Clark Abt in 1970 (Abt, 1987). But the wave of 'serious games' began in 2002. In the eight years since 2002, 1265 'serious games' have been released. In contrast, between 1980 and 2001 (21 years), only 926 were released (Djaouti et al., 1987). (The market for serious games was already worth €1.5 billion in 2010 (Alvarez et al., 2010). This shows that the potential of serious games is huge. Today, serious games are used in many fields such as healthcare, defence, education, media, training, etc. They are constantly expanding. Serious games have attracted a great deal of attention and have received a lot of, even strong support. Examples include a strong push from the French government, funding from the US Institute of Health and EU funding for the GaLA network (Crookall, 2010). Today the study of serious games is becoming increasingly interdisciplinary, with serious games becoming a link to a number of other disciplines (Wilkinson, 2016). There is still great scope for serious games in the future. If serious games are used wisely, people will not only learn better, but also avoid many unnecessary problems.

## Health and safety on university campuses

Safety at university is an issue that cannot be ignored. Universities are densely populated, with many staff, researchers, etc., in addition to teachers and students. In addition, universities often have a lot of expensive laboratory equipment and hazardous materials (chemicals, biological viruses), which can lead to significant injuries and property damage in the event of a safety incident. In recent years, campus safety incidents have occurred at a number of UK universities, such as a major fire at the University of Southampton in 2005, which destroyed an entire building and caused £50 million in damage, and a fire at Swansea University in 2020, which destroyed a £450 million academic building. A survey from Germany shows that around 79.5% of students expect their university to offer at least one health and safety oriented group course when they enrol, which means that a large percentage of students are eager to receive health and safety related training (Stock, Wille and Krämer, 2001). Many students report that university campuses are not decidedly safe and they consider them to be a moderately safe environment (Jennings, Gover and Pudrzynska, 2007). However, students are a vulnerable group in society and a moderately safe environment is not at all sufficient. A university can be seen as a small community that encompasses many aspects of health and safety: occupational safety and health needs of staff, students, radiation protection, waste control, fire protection, etc. Urban campus health agencies lack jurisdiction, so it is the responsibility of the university community to create a safe and healthy environment (DeRoos, 1977). There is a growing awareness of risk on college campuses and students are considering campus safety as an important issue when choosing a school (Carrico, 2016). Many campuses now have policies in place to enhance campus safety and wellbeing, such as offering relevant courses, implementing alarm systems, increasing the frequency of campus patrols, and training campus police, students and other personnel (Schafer et al., 2018). The University of Manchester, for example, offers a health and safety course for students. The course is mandatory and newly enrolled students must pass a test for this course, and students who do not complete the course by the deadline cannot view their final exam results.

# Research methodology

## Determine the theme

The ultimate goal of educational interactive fiction is to teach the player or student about the knowledge of a particular topic. Therefore, when developing an educational interactive fiction, it is important to first determine the theme of education. When choosing a theme for the fiction, I initially wanted to choose school bullying. However, my tutor reminded me that school bullying is a very broad topic and there is a lot of knowledge in it. If I chose school bullying, I would need to spend a lot of time on it, which might result in me not being able to complete the project within the time limit. Then, I thought about the health and safety course I received when I first started at Manchester University. Health and Safety is a compulsory course for every new student at Manchester University, but most students do not engage seriously with this course; they skip the learning part and take the test straight away, then rely on other students' answers to pass the test. This leads to the fact that even though many people have passed health and safety courses, they have no knowledge of health and safety. In turn, the health and safety of students' persons and property is so important that either physical injury or loss of property can be a disaster for students. Not only does this affect their academic performance, but it may even delay their graduation. Therefore, health and safety deserves to be chosen, and it should be taken more seriously.

## The game engine

The game engine is the most important thing in the game development process, without which a game cannot be developed. Game engines perform many essential functions such as writing game code, enforcing game rules, running the game, maintaining game state, and presenting game elements to the player (through an audio-visual interface) (Sharma et al., 2007). There are many popular free game engines such as Unreal Engine, Renpy and others.

### Unreal Engine

Unreal Engine is a game development engine developed by Epic, a complete set of integrated tools for building games, simulations and visualisations. It is the most open and advanced game development engine in the world. With continuous improvements from Epic, it can be used not only for game development, but also for many other industries such as architecture, automotive and transportation, training and simulation, film, broadcast and live events. Unreal Engine 4 supports a variety of platforms such as mobile platforms (Android game development, IOS game development, mobile augmented reality development), virtual reality platforms (SteamVR development) and more. The visual scripting system that Unreal Engine has is very flexible and very powerful, as it provides designers with all the concepts and tools that are generally only available to programmers. Developers do not pay anything for the Unreal Engine and only pay a 5% technology royalty when profits reach $3000. However, the Unreal Engine is suitable for creating large 3D video games and is not suitable for interactive fiction.

### Renpy

Renpy, on the other hand, is a game engine that specialises in video fiction. Ren'Py has released thousands of games and is currently the world's most popular visual fiction engine. It can combine text, images and sound to generate interactive stories that run on computers and mobile devices. Renpy also provides players with menu options that allow them to make selections about the plot of the story (The Ren'Py Visual Fiction Engine, n.d.). Similar to the Unreal Engine, Renpy supports most major platforms such as Windows, MacOS, Linux, Android, IOS, etc. Renpy's development environment is Atom, where developers can use Renpy's scripting language, which is very easy to learn. Developers can use the scripting language to write large visual fiction easily and efficiently. In addition to this, Ren'Py is based on the Python language. That means that if more complex functionality needs to be implemented, developers can use python to do so. Each project created in Renpy contains some of the basic features of interactive fiction, such as starting a new game, saving the game, loading the game, scrolling back, supporting mouse, keyboard or gamepad to control the game, and much more. In addition, the Renpy engine is compatible with a wide range of popular assets, such as JPEG/JPG, PNG etc., for images, WAV, MP3, MP2 etc., for sound and MPEG 41, MPEG 2, MPEG 1 etc., for movies (Why Ren'Py?, n.d.). All in all, Renpy is a powerful and easy to use visual fiction development engine, and this project will be developed using the Renpy engine.

## Understanding Knowledge

The core component of the Educational Interaction Fiction is education. If games want to educate others, game developers must have a knowledge base in the relevant field and ensure that knowledge is accurate. In understanding health and safety and knowledge, I chose to take a course on health and safety offered by the University of Manchester, which consists of three modules: Your Safety (educating students on what they can do to keep their person and property safe), Practical Work (Introducing health & safety good practice and raise awareness of specific hazards in various practical environments), and Placements (Teach students what they can do to have a safe and successful placement). The link to the course is [https://online.manchester.ac.uk/webapps/blackboard/content/listContent.jsp?course\_id=\_22343\_1&content\_id=\_13167286\_1&mode= reset.](https://online.manchester.ac.uk/webapps/blackboard/content/listContent.jsp?course_id=_22343_1&content_id=_13167286_1&mode=%20reset.) In addition to knowledge of the subject, knowledge of a programming language is also necessary. The Renpy engine uses the python programming language, and it also has its own scripting language. Python-related knowledge mainly comes from university classrooms. Most computer science students in college take courses in python. For the scripting language，I refer to the official Renpy engine tutorials (Welcome to Ren'Py's documentation, n.d). The tutorial documentation is very detailed, and it provides not only a syntax tutorial but also relevant examples. This can be very helpful for users to learn.

## Preparing the story

The genre of educational interactive fiction is still fiction, so it should have some elements of fiction: characters, the time in which the story takes place, the setting, and a specific plot. Besides, it should have characteristics unique to interactive fiction—for example, player choices, plot branches, different endings. The interactive fiction has three chapters, each with a theme that corresponds to a Health and Safety course module at Manchester University. The player must make the correct choice to move on to the next topic. Otherwise, the chapter will start again. The story is prepared by first writing a complete plot and then adding to this the options available to the player, as well as the different plot branches. Different storylines will occur when players choose different options. This is to stimulate the curiosity of the player, many people are curious about what will happen to the story if they choose another option, so they will make a save game before making a decision so that they can explore the different storylines, which will enhance the education. There are options that simply result in different dialogue for the characters, but there are options that affect the outcome of the game. They can affect whether the player can progress to the next chapter, or they can affect the player's performance in the game. The different options also affect the length of the plot. When the player has chosen all the correct options in a chapter, not only will the player get a good outcome, but the story will also become relatively short. Each chapter is divided into two general sections, the first of which teaches the player about the health and safety aspects of the chapter. The second part is the main plot of the game, in which key options are presented and the player needs to use what they have learned previously to make choices, which is the core of the game. Some of the wrong choices may have a slight effect on the outcome of the game, but when the player makes too many wrong choices, these mistakes can add up to a bad outcome.

## Developing games

The Renpy engine offers a wide range of built-in features. The function like scene switching, adding sound effects, plot jumping, menu selection and many more features can be easily implemented in Renpy. The plot of the fiction, character details and other essential elements of the fiction should be prepared before developing the game. In addition, prepare assets that may be used in the fiction, such as images, audio, etc. The game uses Renpy's Atom, the recommended development environment for Ren'py. Atom supports Renpy's scripting language and allows for some slightly more complex functionality to be implemented using python. It is important to focus on playability and fun when developing games. A balance between entertainment and education should be maintained when developing games; if education is over-represented, it will disinterest the player. While if entertainment is over-represented, it will fail to achieve an educational effect.

# Game Design

## Question Consideration

It is very important to think about the questions related to the project before developing the game, as this can be very helpful for research.

### Target Group

The first question to consider is who is the target group for the interactive fiction? The theme of the interactive fiction is about health and safety on university campuses, where students are the largest proportion of the population, and therefore the target group for the interactive fiction is university students on university campuses. Today, college students have very little knowledge about health and safety, and they take this knowledge very lightly. Many will choose not to attend health and safety classes. Even when they are forced to attend, their attitude is perfunctory. However, knowledge of health and safety affects their physical and mental health and the safety of their property, so it is necessary to equip them with this knowledge. In addition, university students are young people who have not yet had a full experience of life. It is easy for them to overlook some of the behaviours in their lives that may affect their health and safety. They need to be aware of this as it can help them avoid a lot of unnecessary trouble.

### Purpose of the project

There are two main aims of the project. The first is to find out whether using the interactive fiction model of education is more effective than using other models. Young people of today are generally very fond of playing games. When they are playing games, they are highly focused and are extraordinarily attentive to the content of the game. If this type of edutainment works better, it could provide a new way of thinking about education. The second is the to give players a deeper understanding of health and safety at university after experiencing this interactive fiction. When they encounter potential dangers at university, they are expected to be sensitive and able to recognise them in time. As well as when they encounter dangerous scenarios at university, it is hoped that they can use their knowledge from the game to protect their health and safety. By testing the players, it will be possible to verify that the project has achieved its intended purpose.

## Asset Preparation

Interactive fiction is essentially a game. There are many images, videos and audio materials that will be used to develop the game. These materials need to be collected in advance. The main sources of background images for this interactive fiction are Unsplash (The internet's source of free-usable images, n.d.) and Pexels (The best free stock photos, royalty free images & videos shared by creators, n.d.). These two sites offer a wide range of high resolution images that can be downloaded and used for free. The style of the interactive fiction is cartoonish ，but the background images are mostly realistic, so it was also necessary to cartoonise the images. The website Cartoonize (Cartoonize your world, n.d.) can be used to generate the cartoons for the background images. The images of the characters in the interactive fiction were mainly taken from the project of itch.io (itch.io is a simple way to find and share indie games online for free, n.d.). Itch.io is a website that allows game developers to publish indie games online for free. Game developers can choose whether to charge players a fee when publishing their games. In this interactive fiction, character images are all sourced from free and open-source games. Some of the images are of inappropriate size and content. They can be modified by using Adobe Photoshop software to achieve the desired effect (Start with Photoshop. Amazing will follow, n.d.).

## Synopsis of the stories

Players will take on the role of a new student entering university in an interactive fiction. They will experience some interesting stories about health and safety from the time they enter university to the time they finish their studies. The fiction has a prologue and three main chapters. This section will introduce the story of the game, including the plot of the story, the impact of the options and the possible outcomes.

### Prologue

The prologue is a guide to the storyline. The prologue serves as an introduction, or to set the scene with some plot points, etc. In this interactive fiction, the prologue is mainly a brief introduction to the background of the fiction. The aim is to give the player an idea of the theme of the interactive fiction and to familiarise them with some of the basic information in the fiction. The player will learn about the background of the protagonist and the relationship between the other characters and the protagonist in the fiction. In the prologue, the game will generate a random image as the player's best friend. If the friend is male, the name is Kevin (the name used in this thesis), if female, the name is Natasha. The player enters university with his best friend Kevin. Both are computer science students. The player and Kevin meet Missy, their cohort advisor, at the university orientation, where Missy talks to the students about the basics of health and safety. The students will also learn from Missy about the importance of health and safety.

### Chapter one

The story is divided into a fire storyline and a library storyline. There are six endings to the fire, four of which are bad and two of which are good. The player can only move on to the next chapter after reaching a good ending, otherwise the game will start again. The player and Kevin are very good friends, and they also live together. After studying at the university for a while, the player discovers that Kevin has taken up the habit of smoking and that Kevin discards unextinguished cigarette butts at random. These cigarette butts are very close to flammable objects, and this makes the player very worried. The player decides to ask Missy, who explains to him about fires. This knowledge is very important, and the player will have to use it to make the right choices later in the episode. After Missy has finished explaining the fire to the player, the player will again come across Kevin throwing cigarette butts in the flat. If the player chooses to stop Kevin and gives the right advice, then the fire will be stopped but the player will encounter a fire escape drill. If the player does not choose to stop Kevin or uses the wrong method to stop him, then the player will encounter a fire. Whether it is a drill or a real fire, the player will smell smoke. When the player notices smoke or flames inside the kitchen, the first key option will be available. The player can choose whether to close the fire door or not. If the player chooses to simply run away, whatever the player chooses afterwards will lead to a failed ending. Then, the player comes to the stairway where they can choose whether to take the stairs or the lift. If the player takes the lift, they will enter a bad ending, as it is very dangerous to take the lift in the event of a fire. If the player chooses to take the stairs and does not close the fire door beforehand, the player will also fail to escape as the smoke will disperse too quickly. The only way to get to the good end is to close the fire door and take the stairs. The player may encounter a real fire or an escape drill, each of which has two bad endings, so there are four bad endings in total. There are also two good endings. In the fire episode, even if the player manages to escape from the fire, the fire causes a huge amount of damage, so this ending is not perfect. In the fire drill episode, if the player manages to escape from the building, it is the perfect ending because the player did not trigger the fire. The fire stage ends when the player successfully escapes from the dormitory building. The fire stage is primarily designed to teach the player what they can do to prevent fires and to make them aware of the importance of closing fire doors and taking the stairs to escape.

After playing the fire stage the player will move on to the library storyline. There are three endings to the library stage, two of which are bad endings and only one of which is a good ending. Again, the player has to restart the game after choosing the bad ending. In order to complete their homework, the player and Kevin decide to spend the whole day in the library to study. At noon, they decide to buy some food. At this point, the player is faced with the first important choice - whether to put away the computer, mobile phone and other items that will be used for studying. If the player chooses to leave these items on the table, they will enter the first bad ending. When the player has finished buying food, they will find that their belongings have been stolen. The player loses some of the assignments that have been completed and ultimately fails the course. If the player chooses to put away their personal belongings, they can continue with the game. After a period of study, the player will discuss with Kevin what behaviour is not good for health and safety when studying, and Kevin will remind the player that he should not put miscellaneous items such as school bags in the aisles as they are likely to trip over others. Players will be faced with a second important choice - whether or not to tidy up the aisle. If the player decides to put away the personal belongings in the aisle, they will be able to access the good ending. The player will not trip over anyone and will eventually pass the class without any problems. If the player ignores Kevin's advice, he trips an elderly cleaner. This cleaner fell very badly. She is even admitted to hospital. The player took all the money to compensate this injured person, resulting in the player having no money to pay for the course. Eventually the player chooses to drop out of school. Usually, students spend a lot of time studying in the library. Usually, students spend a lot of time studying in the library. Therefore, the library plot focuses on giving players an understanding of how to protect their own health and that of others, as well as their own property in the library.

### Chapter two

In university, students in different majors will work in different practical environments. The second chapter is designed to raise students' awareness of specific hazards in various practical environments. This chapter has two good endings and four bad endings. The player’s character will have his summer vacation after the first chapter. The players had planned to use their summer vacation to travel, but the sudden arrival of the covid-19 pandemic forced the players to stay at school. At the same time, the covid-19 pandemic has had a major impact on the economy. As a result, the player does not have enough money to live on for the summer vacation. In order to survive, the player decides to get a job. The player asks Missy for help, and Missy recommends a job as a cleaner. A new laboratory building has been built at the university and professional cleaners are urgently needed. There are many different types of labs in the building and the player is responsible for the electrical, mechanical, chemical, biological and nuclear labs. The job pays very well, but training is required to get the job. During the training, Missy will explain the health and safety aspects of practical work, which the player will need to remember as they will be used when cleaning the labs. After the training, Missy gives the player personal protective equipment. When the player returns home, Kevin will ask the player to borrow personal protective equipment. At this point, the player will be faced with a choice - whether or not to lend Kevin. The player is expected not to lend it to Kevin, as personal protective equipment cannot be used outside of practical environments. If the player lends it to Kevin, Kevin will accidentally break the gloves and cause an accident when the player uses them in the chemical lab, which is the first bad ending. On the first day of the job, players choose what to wear. Then, the player is faced with two more choices - whether to wear tight-fitting clothes and whether to wear sandals. The player is then faced with two more choices - whether to wear tight-fitting clothes and whether to wear sandals. Each wrong choice has a bad ending. If the player chooses to wear loose clothing and sandals, he will have an accident in the mechanics lab or the biology lab, as students should avoid wearing sandals and loose clothing when doing practical work. After making the choice about what to wear, the player will start the first day of work. In the laboratory, players will encounter some difficulties. Players need to choose how to solve the difficulty. In the laboratory, the player will encounter several difficulties. Missy will record these choices. If the player makes only one wrong choice, the player will be assigned to another job. This is because no mistakes can be made in cleaning the laboratory, otherwise it might cause great damage to the school. The player's salary will be reduced and he will end up spending the summer in straitened circumstances. This is a good ending, but not perfect. If the player makes all the right choices, the player will keep the job and spend the summer holidays comfortably. This is the best ending. If the player makes more than two wrong choices, the player will not get any job. This is a bad ending, and the player will start the game again.

# Ethical and professional considerations

The ethical aspects of an educational interactive fiction project include two aspects. Firstly, as a computer science project, computing has ethical and moral considerations. Secondly, as a game, there are ethical issues that may be involved in the game's content to be considered.

## Computer Science Project

The technology used in developing the program and the resources used in the project, if not original to developers, should be used only with the permission of the relevant platform and the author. When developing a game, developers should also be fully aware of local laws and regulations to ensure the legality of the game. For example, some places have rules that allow elements such as violence and blood in the game, while others do not. Computer developers also have professional ethics to follow, such as not snooping on users' data, not modifying their data, respecting privacy, etc.

## Game topic

The theme of the project is health and safety. There will be sensitive content in the game, such as fire, theft and other episodes. Ethical and moral issues that may be involved in the content of the game are to be explained to the user at the beginning of the game. This is because some players may have previously been psychologically disturbed by specific scenarios and may be easily irritated or sensitive to them. The content should also avoid sensitive issues such as religion, race, politics, culture, etc. This may cause some players discomfort. The games are primarily aimed at mentally healthy adult college students. As the game can involve public safety issues, the audience for the game does not include minors and mentally unhealthy people who are mentally immature and may use the knowledge in the game to disrupt public order.

# Risk considerations

As a computer science project, it is complicated to completely ignore the risks that may be involved in the project. From a technical point of view, Renpy is a new game engine for me and I have no previous experience of using Renpy, so there may be some technical aspects to the project. To address this risk, I have obtained Renpy's tutorial documentation from the official Renpy website. When a problem occurs, I can consult these documents to find a solution. From a testing perspective, students already enrolled at Manchester University have already studied the course in question, which can lead to inaccurate data for the test. In order to address this issue, I will be selecting new students who will be attending Manchester University to conduct the test.

# Project assessment

In order to accurately assess whether or not the project is achieving its aim of educating students, students will take a pre-test before viewing the educational interactive fiction. The purpose of the pre-test is to gauge the student's knowledge base on health and safety, as some students may already have this knowledge. It is not meaningful to count these students. After the pre-test, the participants will be divided into two identical groups by gender and number. One group will play an educational interactive fiction game, and the other group will be studying the University of Manchester Health and Safety course. These two groups form a controlled relationship. After they have completed their studies they will again take a test, which is based on the knowledge mentioned in the game or in the course. The test results are compared with the results of the pre-test to determine whether the educational interactive fiction can achieve its aim of educating the students. The results of the two groups will also be compared to see if the educational interactive fiction is more effective than other educational methods. At the end of the experiment, the participants who played the educational interactive fiction were asked to evaluate the fiction and record their feelings about it. This effectively allows me to recognise the shortcomings and weaknesses of the educational interactive fiction so that I can improve it in the future.

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