Comprehensive Creative Technologies Project: Gamifying Sex Education

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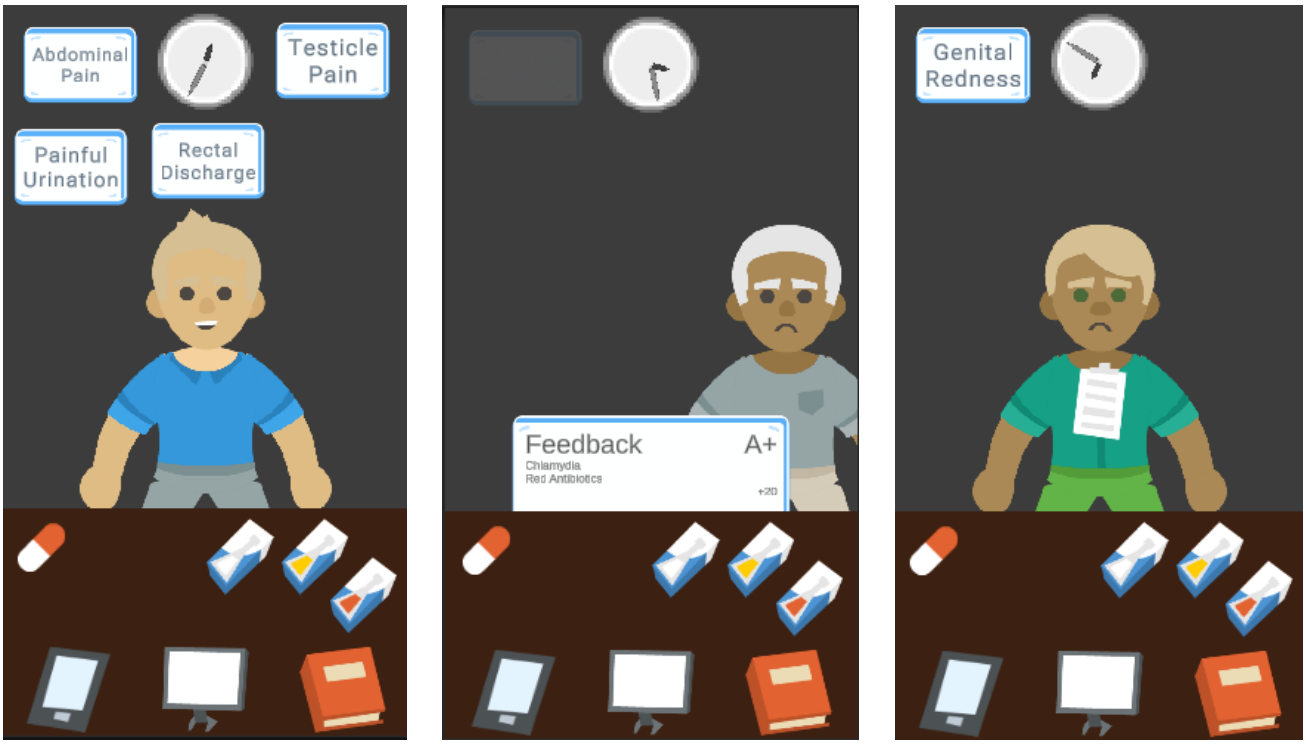

Abstract

Gamification is a topic that is becoming increasingly popular for improving engagement and motivation in education, this project investigates gamification and game-based learning techniques for improving the delivery of sexual health topics. Traditional methods of teaching sex education to secondary school students are often uncomfortable and insufficient, sending young people into adulthood without adequate knowledge of their sexual health. This project outlines the development of an educational game designed to teach young people about sex education through an engaging medium: games.

Keywords: educational games, serious games, sex education, sexual health, gamification, game based learning

Brief biography

The concept for *"Symptoms Please"* began with my feelings on recieving an inadequate education on sexual topics at school. I felt sex education classes were uncomfortable and embarassing with a stigma surrounding the topics; hindering me from asking any questions I might have about sex and how my body works. I feel there is a lack of engagement and enjoyment in sexual health education that could be solved through educational games; where students can learn at their own pace, privately. Hence why I have developed *"Symptoms Please".*

Portfolio: https://zar67.github.io/Portfolio/

How to Access the Project

The project can be accessed through the Releases section of the GitHub linked below. There are .apk files for use with Android devices.

GitHub URL: https://github.com/zar67/CCTP-symptoms-please

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1. Introduction

It has been claimed sex education in the UK is outdated, uncomfortable and non-inclusive with students leaving school without a basic understanding of their bodies, sex, consent and more. Many children and teachers find sex education uncomfortable, full of judgment and jokes; most students feel discomfort asking questions fearing ridicule by their peers (Pound 2016).

Today we are seeing that Gamification and game-based learning techniques are becoming increasingly popular in education. There is evidence to suggest gamification and game-based learning improve engagement, motivation, and retention (Kapp 2012).

The aim of this project is to create an interactive experience to improve engagement and understanding in sex education through game-based learning; producing a private, fun, inclusive way for secondary school children to receive sex education – with future goals to make sex education more enjoyable.

1.1 Project Objectives

- Produce an interactive learning experience to aid in sex education using gamified methods.
- Design a safe, un-biased and comfortable environment for secondary school children to learn about sex.
- Assess methods to measure the levels of engagement offered by the application and the approaches used.

1.2 Research Objectives

- Research current SRE curriculums and establish what topics can be included.
- Research gamification and game-based learning methods and identify which should be used.
- Identify tools and platforms that will support delivery of the project artefact.

1.3 Learning Objectives

- Learn the effectiveness of gamification, game-based learning and their educational use.
- Learn modern gamification and game-based learning techniques.
- Learn how to implement gamification and game-based learning.

2. Literature Review

2.1 Sex and Relationships Education

Sex and Relationships Education (SRE) teaches children about sex, relationships, sexual health, consent and many more topics. Many students feel they have received inadequate sex education (Pound 2016, Ezaydi 2021), with several key reasons identified below:

1. Sex is an awkward topic for students and teachers resulting in a limited scientific-based curriculum.
2. Students often 'mess around' in SRE classes out of insecurity, feeling judged for not knowing information they feel they should.
3. Teachers are often unqualified or have their own values which interferes with a comprehensive sex education for students.
4. Sex is often regarded negatively; school curriculums often promote abstinence and fear.
5. SRE is outdated and irrelevant - Davies and Matley (2020) state many participants expressed views to support this.

The Department for Education (2021) sets out guidance for what pupils should know by the end of secondary school including information about STIs, healthy relationships (seen in Figure 1) and the law.

Intimate and sexual relationships, including sexual health	Pupils should know • how to recognise the characteristics and positive aspects of healthy one-to-one intimate relationships, which include mutual respect, consent, loyalty, trust, shared interests and outlook, sex and friendship. • that all aspects of health can be affected by choices they make in sex and relationships, positively or negatively, e.g. physical, emotional, mental, sexual and reproductive health and wellbeing. • the facts about reproductive health, including fertility, and the potential impact of lifestyle on fertility for men and women and menopause. • that there are a range of strategies for identifying and managing sexual pressure, including understanding peer pressure, resisting pressure and not pressurising others. • that they have a choice to delay sex or to enjoy intimacy without sex. • the facts about the full range of contraceptive choices, efficacy and options available. • the facts around pregnancy including miscarriage. • that there are choices in relation to pregnancy (with medically and legally accurate, impartial information on all options, including keeping the baby, adoption, abortion and where to get further help). • how the different sexually transmitted infections (STIs), including HIV/AIDs, are transmitted, how risk can be reduced through safer sex (including through condom use) and the importance of and facts about testing. • about the prevalence of some STIs, the impact they can have on those who contract them and key facts about treatment. • how the use of alcohol and drugs can lead to risky sexual behaviour. • how to get further advice, including how and where to access confidential sexual and reproductive health advice and treatment.

Figure 1: *Department for Education (2021) what students should know about sexual relationships and sexual health.*

The Department for Education (2021) states that SRE should give young people tools and information to form healthy relationships; this contradicts a study by Pound, Langford and Campbell (2016) who found young people thought SRE was negative, poorly delivered and insufficiently comprehensive. A comprehensive sex education is important to help teach consent and reduce rape culture Ezaydi (2021); Haruna et al (2018) also state that sex education can reduce misinformation as well as improve critical thinking, communication and self-confidence. Glazzard and Stones (2020) provide advice and support for teachers to aid in delivering SRE content in schools, they provide information on all topics of the SRE policy set out by The Department for Education (2021).

2.2 Game Based Learning

Games have been used as learning tools for as long as centuries with Chess being used to teach strategic thinking (Cahill, 2021). The first written justification of gamification was "The Game of Work" by Charles Coonradt, which recommended using the feedback loop from sports in the work environment to improve motivation and teamwork (Coonradt, cited by Christians 2018).

Game-based learning can be a beneficial educational tool to increase student engagement and motivation; as Cahill (2021) states, "the goal is for students to enjoy the process of learning itself" while Gee (2008) states humans and primates can find learning highly pleasurable under the right conditions. Kapp (2012) describes games as "incredibly appealing" and engaging due to immediate, direct feedback as well as consequences to player actions. Gamifying techniques cause students to be intrinsically motivated by the learning activity (Wouters and Van der Meulen 2020) which leads to active learning (Cahill 2021). Learning through games can also be confidential in nature; Haruna et al (2018) state confidentiality encourages students to freely discuss sexual health matters, even in areas where such topics are not discussed openly, for reasons such as religion or culture. The same research also states students can learn at their own pace with game-based learning, free to explore their interest in the topic without embarrassment or judgement.

Techniques for gamifying content vary from simple methods to more theoretical tips and ideas. Deterding (2012) condemns reducing games to stock features such as badges, levels and leader boards due to the complexity of how games engage players. Implementation of these simple techniques does not automatically lead to user engagement; Deterding goes on to state instead of focusing on implementation of stock features, a deeper understanding of the needs to users' needs is more important. Kapp (2012) defines four main elements that make gamified experiences more engaging than traditional learning techniques; freedom to fail, interest curves, effective storytelling and immediate feedback. These elements are not expressly defined as game mechanics however refer to element's learners need for engagement, as Deterding suggests. True Education (2020), Haruna et al (2018), Mohammad (2014) and Kiryakovq, Angelova and Yordanova (2014) all also suggest game elements that motivate and engage players, with many game elements stated in multiple sources. Common game elements mentioned also focus on the adaptation of challenge as "if tasks are very easy or very difficult, is possible demotivation of learners and negative outcome" (Kiryakovq, Angelova and Yordanova 2014).

2.3 Game Design Theory

Good game design plays an important role in gamification, as well-designed game elements keep players engaged and wanting to continue playing. Different game mechanics can fulfil different human desires, or game dynamics (Bunchball 2010) as seen in Figure 2.

Figure 2: *Common game mechanics mapped to human desires, where the green dot indicates the primary desire of a mechanic (Bunchball 2010)*

Shi and Shih (2015) describe a game-based learning model that aims to help design and test educational games; the model includes the categorisation of game factors that should be considered when designing an educational game, starting with the game goals. This model can be seen in Figure 3.

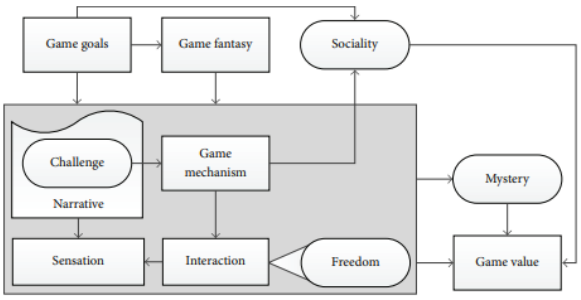

Figure 3: *Game-Based learning model designed by Shi and Shih (2015)*

Flow is a widely accepted term in game design, and critical for user engagement (Berube, 2021). Flow was introduced by Csikszentmihalyi (1990) who stated we enter flow when challenge aligns with our skill, but eventually either boredom (from not enough challenge) or frustration (from too much challenge) sets in. Berube (2021) states some elements that can affect flow in a video game and states two types of flow: microflow and macroflow. Microflow lasts for short periods of time and heavily engages users due to creating an emotionally intense state (Berube, 2021). Macroflow creates enjoyment and fulfilment in the player, often through a series of successful achievements (Berube, 2021).

3. Research Question

The research question for this project is:
Can gamified methods be used to improve engagement and retention in sex education for secondary school children?

4. Research Methods

To answer the research question a mixture of qualitative secondary research will be used. This will build upon existing research in the gamification and game-based learning fields including journal articles, blogs, government publications and books. The research is provided as a literature review with investigation research topics such as learning types, player types, gamification, game-based learning and Sex and Relationships Education (SRE) as these are the most relevant topics to the project objectives.

A competitor analysis of serious games and SRE based games were also conducted for a deeper understanding of existing products (seen in Appendix F). Analysis of such competitors helped to identify where educational games are failing and succeeding and what aspects of these competitors could be useful in the project artefact.

Further research for the project included user testing to evaluate the effectiveness of the project artefact. Due to ethical considerations and challenges around data collection within younger demographics, user testing was conducted with students in higher education. The aim of user testing was to provide thoughts and feedback and to measure success of the final artefact in terms of the project objectives and educational potential. User testing was conducted through remote unmoderated testing and testers were asked to complete two questionnaires, one before and after using the application, these questionnaires can be found in Appendix F and G respectively. Artefact builds sent to testers contained logic to record and measure specific metrics such as time played and success values, the data gathered from the application can be found in Appendix H. User testing was carried out with six participants.

5. Ethical and Professional Principles

An important ethical consideration for this project was the appropriateness of the content included. Sex education can be considered a controversial topic where views and opinions differ greatly. This controversy can stem from religious belief or cultural beliefs as well as a societal belief that sex is a taboo topic. Some controversial topics include the use of birth control and abortion where views and opinions differ greatly. As such the syllabus used to scaffold this project was sourced directly from the Department for Education's SRE curriculum.

Linked to this, certain topics may be offensive to those with differing religious views, restricting content to the curriculum set out by the

Department for Education will help focus the project on its objectives as opposed to the educational content. Disclaimers will also be added to the final project artefact to ensure user testers are aware of the content included.

A major ethical concern with this project was the prospect of user testing with children, which requires significant ethical approval. Due to the time restraints of this project, it was not possible to conduct testing with the target demographic in the timescales provided. Instead, user testing in higher education was conducted to test the specific project objectives.

Participants of user testing received an information sheet, consent form and data privacy notice to provide them with all the information they need to be fully informed about the artefact and its contents. The data privacy notice includes information on how and why data will be used as well as how the data will securely be stored and managed.

6. Research Findings

Defining a policy for teaching SRE is the responsibility of individual schools, the government defines topics students should know however delivery is tailored per school. Parents can also remove their child from SRE classes if they wish, and religious schools can omit information due to religious beliefs. There have been many policy changes that haven't changed how students and teachers view SRE, many still believe it is outdated, uncomfortable and not sufficient. An educational game could encourage young people to confidentially explore sex and relationships topics without embarrassment or judgement.

The content of the final artefact has been focused to SRE topics given by The Department for Education (2021) and has been scaled to account for the project's time scale yet focused to make sure enough of the syllabus is included. The following is a list of learning objectives to be completed by playing the final artefact:

1. Should know the range of contraceptive choices available.
2. Should know how different sexually transmitted infections (STIs) are transmitted, how to reduce risk and the importance of and facts about testing.
3. Should know about the prevalence of some STIs, their impact and key facts about treatment.
4. Should know how to get further advice, including confidential sexual and reproductive health advice and treatment.

The gamification techniques important to successfully create a gamified experience previously discussed around game-based learning and gamification can be used to aid in good game design for the final project artefact that will engage and motivate players to learn more about the content. Figure 4 displays the most mentioned game elements that lead to user engagement and motivation as seen through research.

Figure 5 shows the result of the process of the game-based learning model designed by Shi and Shih (2015).

Game Element	Description	Sources
Rapid and Immediate Feedback	Feedback is immediate and rapid for any player actions, where the player can see the consequences or results of their actions.	Mohammad (2014) Haruna et al (2018) True Education (2020) Kapp (2012)
Clear Goals	Clear and achievable goals for the player to follow.	Haruna et al (2018) (Kiryakova, Angelova and Yordanova 2014)
Narrative	A story or narrative alongside the gameplay.	Haruna et al (2018) True Education (2020) Kapp (2012)
Freedom to Fail	There are no large consequences for failing, the consequences are manageable for the player so as not to disengage them.	Kapp (2012)
Interest / Challenge Curves	The level of challenge increases as the learners gain more knowledge and skill.	(Kiryakova, Angelova and Yordanova 2014) Mohammad (2014) Haruna et al (2018) True Education (2020) Kapp (2012)
Social Connection	Connection with other players, to provide motivation and engagement.	Mohammad (2014) True Education (2020)
Repeatability	Learning activities can be repeated in case of failure.	(Kiryakova, Angelova and Yordanova 2014)
Choice/Control	Objectives completable through multiple paths and leaners control over the paths they take.	(Kiryakova, Angelova and Yordanova 2014) True Education (2020)
Context	Allowing leaners to understand the context of what their learning, to understand the significance.	Mohammad (2014)

Figure 4: *Table of common game design features found through research.*

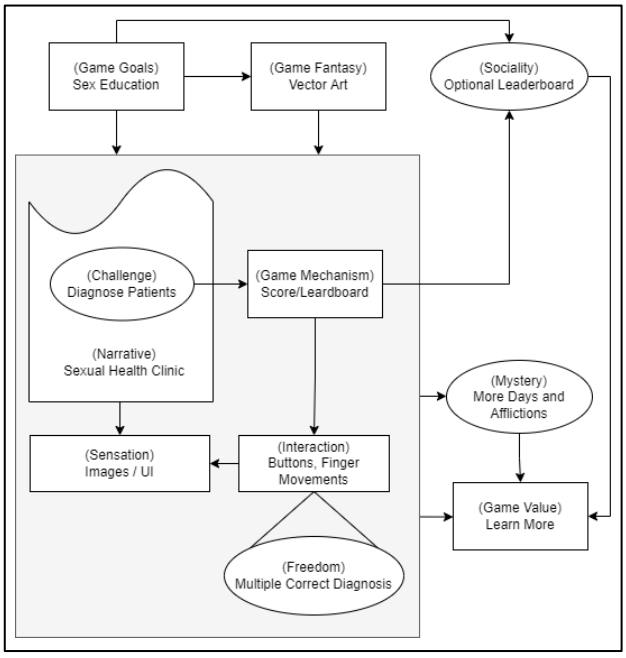

Figure 5: *Completed GBL design diagram produced through the GBL design process by Shi and Shih (2015)*

7. Practice

The outcome of this project, the game *"Symptoms Please"*, is a sexual health clinic simulation game where the player interacts with patients to help diagnose and treat them. The game starts with the player handling two sexually transmitted infections (STIs) and as the game progresses the player encounters more STIs with different symptoms. The goal of the game is to learn the symptoms and treatments of each STI and gain more effective at handling patients.

7.1 Game Design

The game is designed around a system of a day cycle where patients enter from the left of the screen and exit to the right when the player has taken an action. The player has all the information available to them including the symptoms and treatments for each STI (seen in Figure 6), but using these resources takes time. Time is important as the player should try and get through as many patients as they can before the day runs out. The day cycle in the game is the main game loop, where the player has a set amount of time to treat patients. The fastest way to deal with a patient is to already know what STI the patient has just from the symptoms displayed; the player will learn the symptoms as the game is played and so will progress over time, thus producing a player progression loop.

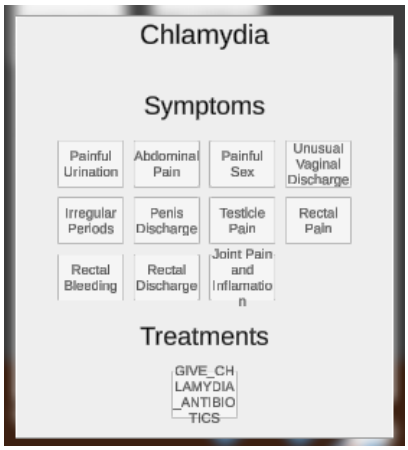

Figure 6: *STI information pop-up showing information about the STI.*

Advancement through the game is player led; as the player deals with patients they will begin to recollect which symptoms belong to which STIs as well as how to treat them. The number of STIs active in the game is handled by an event system where STIs are 'activated' and 'deactivated' on specific days, patients that enter the clinic will only have the STIs that are currently active in the game.

Several of the gamified methods from Figure 4 have been included in the game. Immediate feedback is given when the player takes an action, showing the player whether they have helped the patient or not as seen in Figure 7. The feedback also gives information on the score gained, the STI the patient had (if the player has cured them) and a grade on how well they did.

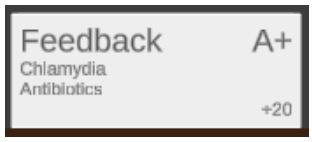

Figure 7: *Feedback pop-up showing the player how effective their action was at treating the patient.*

The game contains a clear goal: treat as many patients as possible within the time provided, led by the narrative that the player is a doctor at a sexual health clinic.

Players can incorrectly treat a patient with minimal penalty, allowing the player the freedom to fail frequently, but not feel the need to disengage. Therefore, players can progress through the game and continue to learn about different STIs. When players do mis-diagnose a patient, the consequence of a lower score would not impact the game loop or player engagement.

As players progress, they are expected to handle a greater number of STIs, knowing the symptoms and treatments for them to treat patients effectively. The addition of more STIs increases the interest and challenge of the game and as the player gets more familiar with the STIs, another is introduced to add interest/challenge curve that keeps the player absorbed.

Social connection to other players is not prioritised in this game as it is a private educational game. Regardless, the additional of an online leader board (which is optional for players) adds a layer of anonymous social connectivity and competition to the game.

All the patients the player encounters can be treated multiple times; patients treated incorrectly will come back the next day with information on how they were treated to support the previously learned information. Giving the player three chances to correctly diagnose the patient allows them to learn from their mistakes.

Choice and control have not been as clearly implemented into the game; patients have one treatment action which cures them, the other actions do not work. The player has a range of options for determining the diagnosis of the patient, with one being more preferable over the other. The easiest method is to use the testing

kits, so the player is explicitly told which STI the patient has as seen in Figure 8. These testing kits are designed to help the player in the early stages of the game and for STIs that have similar symptoms. The preferred method of diagnosis is for the player to learn the symptoms of each STI. All the information for each STI can be found in a tablet pop-up, which can help player if they are struggling to remember the symptoms and can act as a reference tool through the game loop.

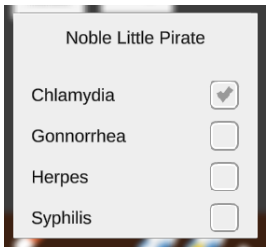

Figure 8: *Swab test kit results pop-up showing the patient has Chlamydia.*

The symptoms of the STIs show the significance and the consequences of getting an STI, however the game does not currently make clear how the patients contract these STIs and how to prevent contraction, as specified in the learning objectives.

7.2 Technical Structure

"Symptoms Please" is written within Unity using C# scripts. The game is heavily data driven using scriptable objects to make adding new STIs, symptoms and actions simple.

STIs are stored as scriptable objects and contain information about the treatment effectiveness, symptoms and potential advice. Symptoms are also scriptable objects to provide a single location to find information such as icons and descriptions and to help with scalability beyond this prototype and the potential inclusion of additional STIs. Currently the symptoms scriptable object contains information for a description and incompatible symptoms (e.g. period cramps and testicle pain). Before a symptom is randomly selected to be displayed to the player, it is checked against the symptoms already being displayed to ensure all symptoms are compatible with each other.

Patients are generated at runtime when a new patient is required. PatientData is a serializable class that contains; the patient's name, how many times the player has incorrectly treated the patient (the number of strikes), the STI the patient suffers from, the symptoms the player has already seen for this patient and the list of previous actions taken by the player. On generation of the patient the STI is randomly chosen, the rest of the information is updated later once the player has taken an action.

The "strikes" system for patients is used to determine a new appointment event; if a patient is not cured when the player takes an action, an event is generated and saved to the save file. The new appointment event structure contains the patient data as well as the day number for the patient to come back. The patient will return the next day with one "strike" assigned in the patient data. When patients are generated throughout the day the active events are checked first before generating a new random patient. Since the events are added to the save system, the events persist between instances of the game.

The save system in the game uses JSON serialization from Newtonsoft. All data entered into the system is in a dictionary format with a key for identification and the data to be saved as the value, data is serialized as seen in Figure 10. Fetching the data from the save system simply means finding the data with the correct key and deserializing it as seen in Figure 9. Objects that need their data saved, such as the PatientManager, subscribe to the OnSave and OnLoad events that are invoked by the save system.

In the OnSave callbacks data is serialised into the correct format and the SaveObject function called to add the data into the file. In the OnLoad callbacks data is deserialized and set to the variables in the script for runtime use. Data will not be saved until the SaveSystem.Save() function is called, if the application is closed any changes made since the last save will be lost.

```
public void T LoadObject<T>(string identifier)
{
  if (HasObject(identifier))
  {
    string data = m_data[identifier];
    return JsonConvert.DeserializeObject<T>(data);
  }

  return default;
}
```

Figure 9: *Code for loading an object from a save file*

```
public void SaveObject(string identifier, object data)
{
  string jsonData = JsonConvert.SerializeObject(data);

  if (IsTextFile)
  {
    string text = identifier + "=" + jsonData + '\n'.
    File.AppendAllText(FilePath, text);
  }
  else
  {
    string text = identifier + "=" + jsonData;
    string hex = ConvertToHex(text, Encoding.Unicode);
    hex += '\n';
    File.AppendAllText(FilePath, hex);
  }
}
```

Figure 10: *Code for saving an object with a string identifier to a save file.*

The addition of new STIs is handled through a scriptable object, shown in Figure 11, that handles the activation and deactivation of different topics; every STI has a topic it relates to when its topic is deactivated patients will not be generated with the affliction. Topic activations also have a description that will appear on the day start panel to indicate to the player that a new STI has been activated.

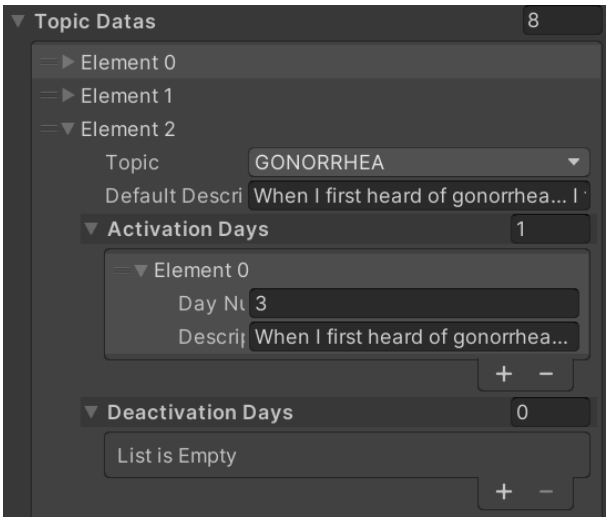

Figure 11: *Modifications scriptable object containing information about when STIs are activated and deactivated. The data also contains a description to show when the STI is activated/deactivated.*

To help the player understand the game there are some tutorial pop-ups that occur only on the player's first experience of the game. These pop-ups highlight how the player interacts with patients and what the player needs to do as seen in Figure 12. Using the save system, a Boolean value is saved for each pop-up stating that the player has seen it. It is therefore assumed the player has read the information. The pop-up won't show up again once this Boolean value is saved, meaning the player won't become overwhelmed and annoyed with tutorial pop-ups every time they play.

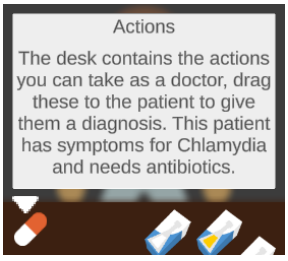

Figure 12: *Tutorial pop-up describing the actions a player needs to use to diagnose patients.*

An additional feature that had been added is a leader board; this is a side feature that is designed to complement the main part of the game by motivating players through competition. Due to the private and confidential nature of the game, the leader board is optional, and players can enable and disable the leader board whenever they wish to. By default the leader board is disabled. For further anonymity the players all have a random name from a specified list, ensuring that no personal data is shown to any other players.

Data for the leader board is stored in Firebase using the Realtime Database. To store user specific information for the leader board, a sign-in needs to be created for each user, this is created by using the users random name with "@email.com" appended and a pre-defined password. This user sign in creates a user-id that identifies the entry in the Realtime Database and allows the data of each user to be stored separately, an example of an entry can be seen in Figure 13.

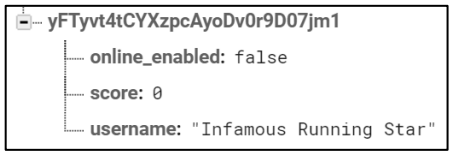

Figure 13: *User data saved in Firebase's Realtime Database.*

Finally, a simple audio manager handles the playing of sound effects in the game. This audio manager is static and so it's functions can be called anywhere. The function for playing a sound effect can be seen in Figure 14. These audio effects indicate to the player when they have correctly diagnosed a patient to reinforce the reward the player receives. There is also a sound effect for when the player misdiagnoses a patient to reinforce that they were incorrect.

```
public void Play(EAudioClipType clip)
{
  int numClips = m_audioClipDictionary[clip].Length;
  int index = Random.Range(0, numClips);
  float pitch = Random.Range(m_minPitch, m_maxPitch);

  m_effectsAudioSource.pitch = pitch;
  m_effectsAudioSource.clip = m_clipDict[clip][index];
  m_effectsAudioSource.Play();
}
```

Figure 14: *Code for saving an object with a string identifier to a save file.*

7.3 User Testing

Once a stable version of the game, with all features implemented, had been created, user testing could begin. The aim of user testing was to determine how well *"Symptoms Please"* met the objectives of the project and evaluate the user experience of the game. User testing was conducted with a focused group of six people, with an interest in their qualitative feedback. Participants were asked to fill in the questionnaires and play a build of the game. The preliminary questionnaire and final questionnaire sent to participants can be found in Appendices D and E respectively.

7.3.1 Thoughts on Sex Education

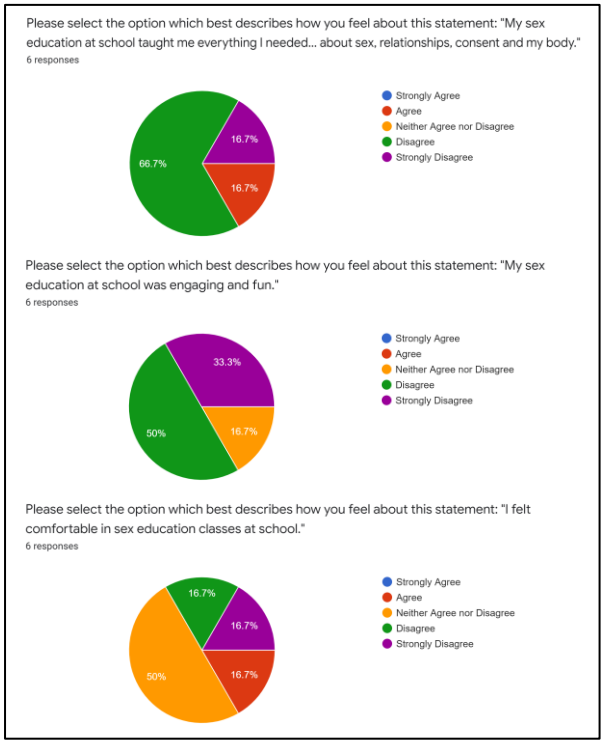

Figure 15: *Responses to the Educational Performance section of the preliminary questionnaire.*

The preliminary questionnaire asked participants about their experience with sexual education to determine their current understanding, although the apps materials are targeted at a younger audience. As seen in Figure 15, most participants were unsatisfied with their sexual education at school in terms of the knowledge and entertainment experiences as well as the comfort they felt with the subject matter.

7.3.2 STI Knowledge

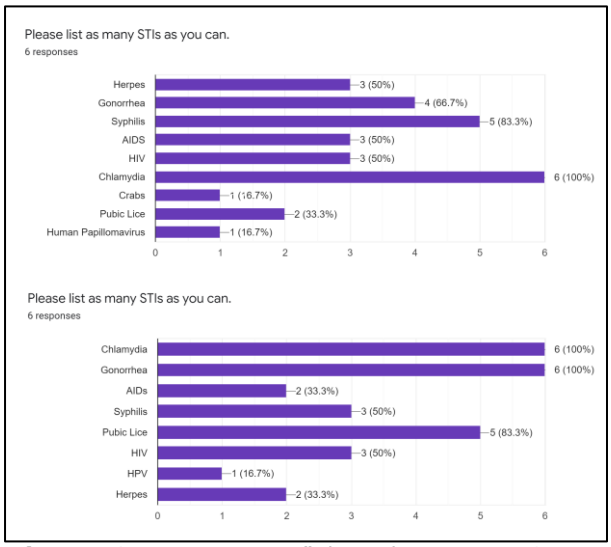

Figure 16: *Responses to: "Please list as many STIs as you can" from the preliminary questionnaire (first) and the final questionnaire (second).*

The preliminary questionnaire asked participants questions to determine how much knowledge they had about STIs before playing *"Symptoms Please"*. All participants were asked about Chlamydia and Pubic Lice as these are the first two STIs to appear in the game and to keep the testing fair and balanced.

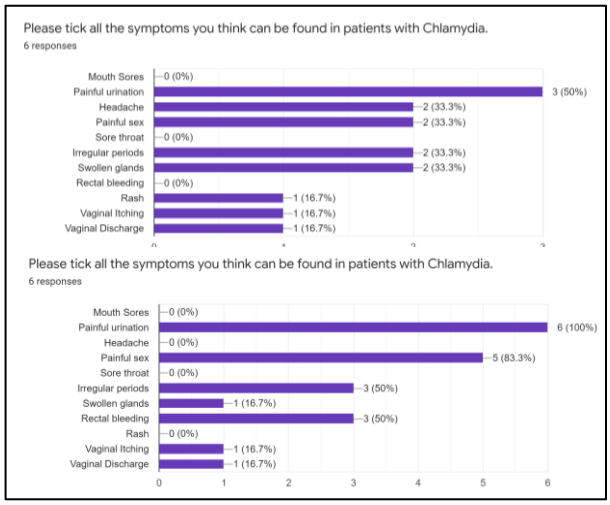

Figure 17: *Responses to the statement "Please tick all the symptoms you think can be found in patients with Chlamydia" from the preliminary questionnaire (first) and the final questionnaire (second).*

Questions determined how much more information participants knew about STIs after playing *"Symptoms Please".* The results of this question can be found in Figure 16. Responses show that participants knew of a wide range of STIs before playing *"Symptoms Please"* however the entry of "Crabs" in the preliminary questionnaire shows that not all participants know the formal or medical names for each STI. Figure 17 shows the responses to the questions about Chlamydia symptoms while Figure 16 shows the percentage of correct answers submitted.

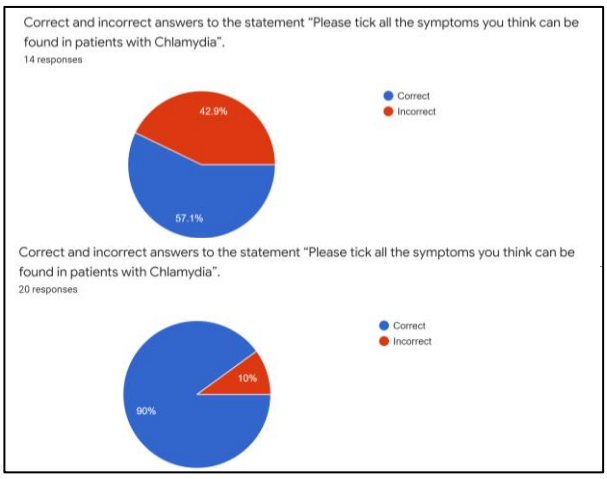

Figure 18: *Percentage of correct answers to the statement "Please tick all the symptoms you think can be found in patients with Chlamydia" from the preliminary questionnaire (first) and the final questionnaire (second).*

Figure 18 shows that participants understood the symptoms of Chlamydia much more clearly after playing *"Symptoms Please",* with only one incorrect symptom being reported in the final questionnaire.

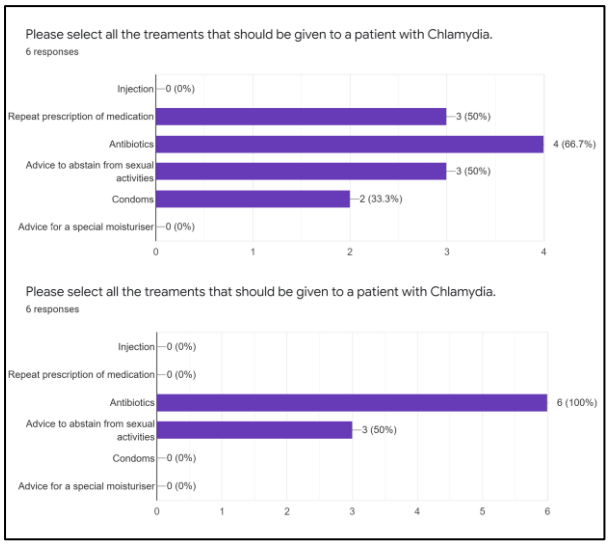

Figure 19: *Responses to the statement "Please select all the treatments that should be given to a patient with Chlamydia" from the preliminary questionnaire (first) and the final questionnaire (second).*

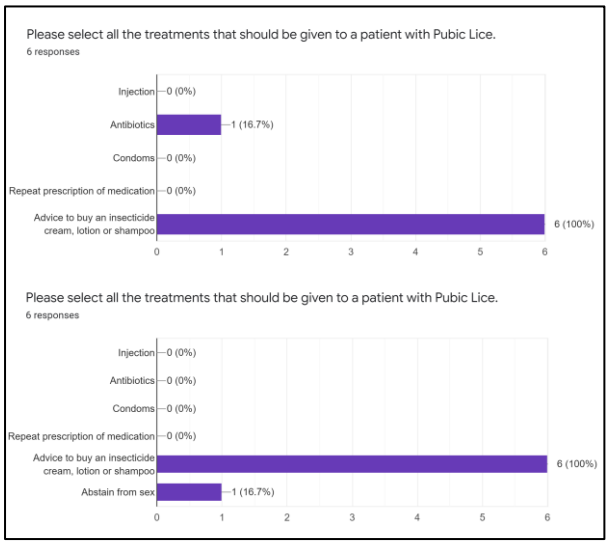

Figure 20: *Responses to the statement "Please select all the treatments that should be given to a patient with Pubic Lice" from the preliminary questionnaire (first) and the final questionnaire (second).*

In Figure 19 it can be see that participants were generally unclear as to the treatment for Chlamydia, but after playing *"Symptoms Please"* all participants gave the correct answer of treating Chlamydia with antibiotics, with some advocating for abstinence from sexual activities as well.

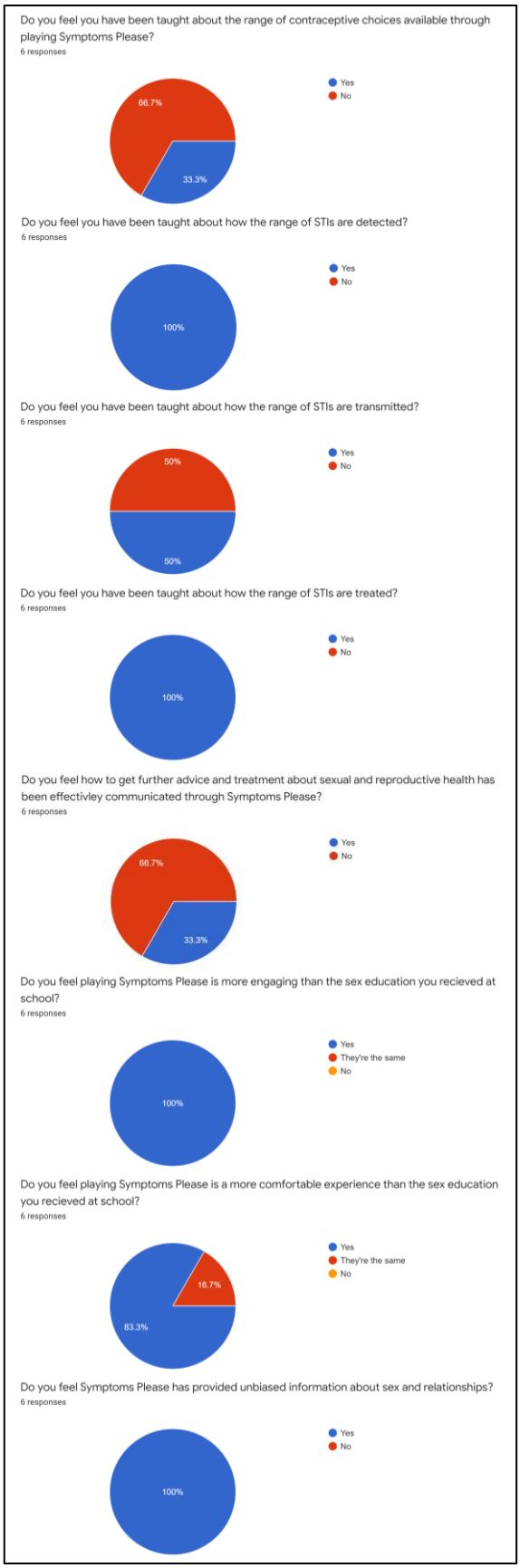

Figure 21: *Responses to the user experience section of the final questionnaire relating to the learning objective in Section 6 and overall user*

Participants also improved their understanding of treatments for Pubic Lice as seen in Figure 20, although the improvement was smaller than that of Chlamydia treatments. It should also be noted that participants who knew the correct treatment for Pubic Lice prior to playing *"Symptoms Pease"* merely retained the information they had from the content in the application.

7.3.3 User Experience

The final questionnaire asked participants to evaluate their experience of playing *"Symptoms Please"*, the results of these questions are shown in Figure 21. The results of the user experience questions confirm that objectives 2 and 3, relating to STI symptoms and treatment have been met and that objectives 1 and 4, relating to contraception and where to find sexual health advice, require more consideration.

7.3.4 Improvements and Suggestions

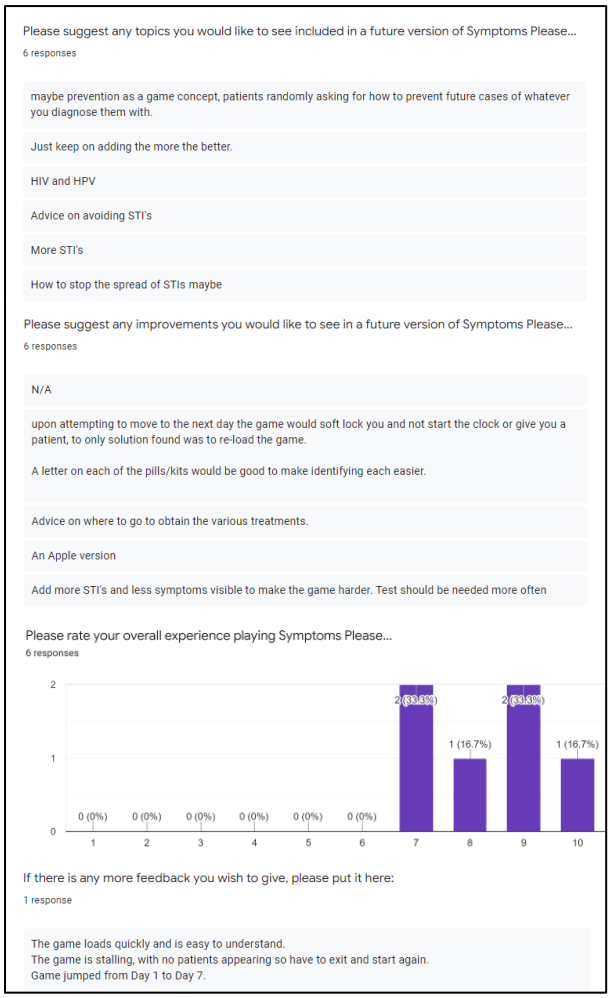

Figure 22: *Responses to the improvements and feedback section of the final questionnaire.*

The last section of the final questionnaire provided a section where participants could suggest features and improvements to *"Symptoms Please"* to enhance the game. These suggestions are displayed in Figure 22. Suggestions included adding more STIs, which was expected as participants were only expected to play the first couple of in game days of the game, which only includes the treatment of Chlamydia and Pubic Lice linked to the progression system. The other main suggestion was including prevention and how to avoid STIs; generating patients that come in with questions on how to prevent catching STIs would fulfil this suggestion as well as reinforce learning objectives 1 and 2. Participants also reported some bugs during the play testing, which is helpful for improvement of the game.

7.4 Iteration After Testing

Bugs and improvements were detailed during the user testing, therefore a final pass over the game was completed to fix issues and make final additions and updates. The most significant portion of this final iteration was bug fixing, ensuring all the features worked as intended. One of the main bugs fixed was where patients stopped generating. This was due to the game timer not being reset.

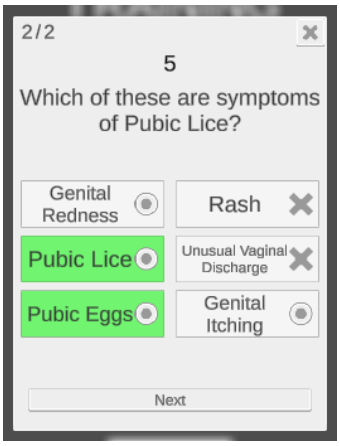

Figure 23: *Training pop-up with a correct answer given.*

The quiz questions were also finally added for the training section. This section is designed to refresh their knowledge with a quiz if they've been away from the game for a long time. The quiz questions are structured around the content in the game; it is expected that players learn the knowledge through the main gameplay loop, rather than the training. Questions have topics and just like the progression in the main game, only questions with active topics will be displayed. Due to this the questions that come up will only be based on topics that the player has encountered in the main gameplay. Figure 23 shows the training setup. Players are asked multiple choice questions. Value to players answers was added that gives a score based on the quality of their answers. This score also

contributes to the leader board but at a reduced rate compared to the main game to encourage players to use the main gameplay loop instead.

Descriptions of the symptoms were added to make them clearer, ideally the symptoms should be shown as icons, however for the prototype the symptoms are shown as text.

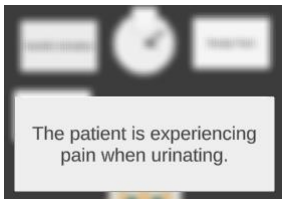

Figure 24: *The symptoms description pop-up showing more information about the symptom.*

Adding descriptions gives more information to the player about the symptoms to help them if they are unclear on what the icon or short text means. There is a pop-up to show the description of the symptom which can be seen in Figure 24.

One piece of feedback from the user testing was that there should be a way to easily identify between the different pills as well as the different testing kits. This was done by firstly adding images of the different kits and their meanings into the tutorial pop-up that is shown.

The final iteration made on the project after user testing was a design pass of the entire UI, this pass attempted to improve the layout, usability, and aesthetics of the UI. Doing this made the UI look more cohesive and screenshots of the updated UI can be seen in Figure 25.

8. Discussion of Outcomes

During user testing the participants did retain new information from playing *"Symptoms Please"*; the results of the user testing showed the application was successful in increasing the knowledge of participants on the STIs Chlamydia and Pubic Lice. While participants only experienced a small part of the game, it is possible they would also have gained more knowledge in the other STIs included if exposed to the full progression loop of the game.

Whether the retention improved upon traditional teaching methods is unclear; participants completed the final questionnaire immediately after using *"Symptoms Please"* and so the knowledge they learned would have been fresh in their short term memory, which is likely to have been easier than remembering those facts from their distant memories of secondary school lessons. To begin to understand whether *"Symptoms Please"* improves retention compared to traditional teaching methods user testing would need to be completed on a bigger scale with more robust, structured testing methodologies. It should also be stated that encouraging participants to play the game for longer would have provided more information about retention and engagement.

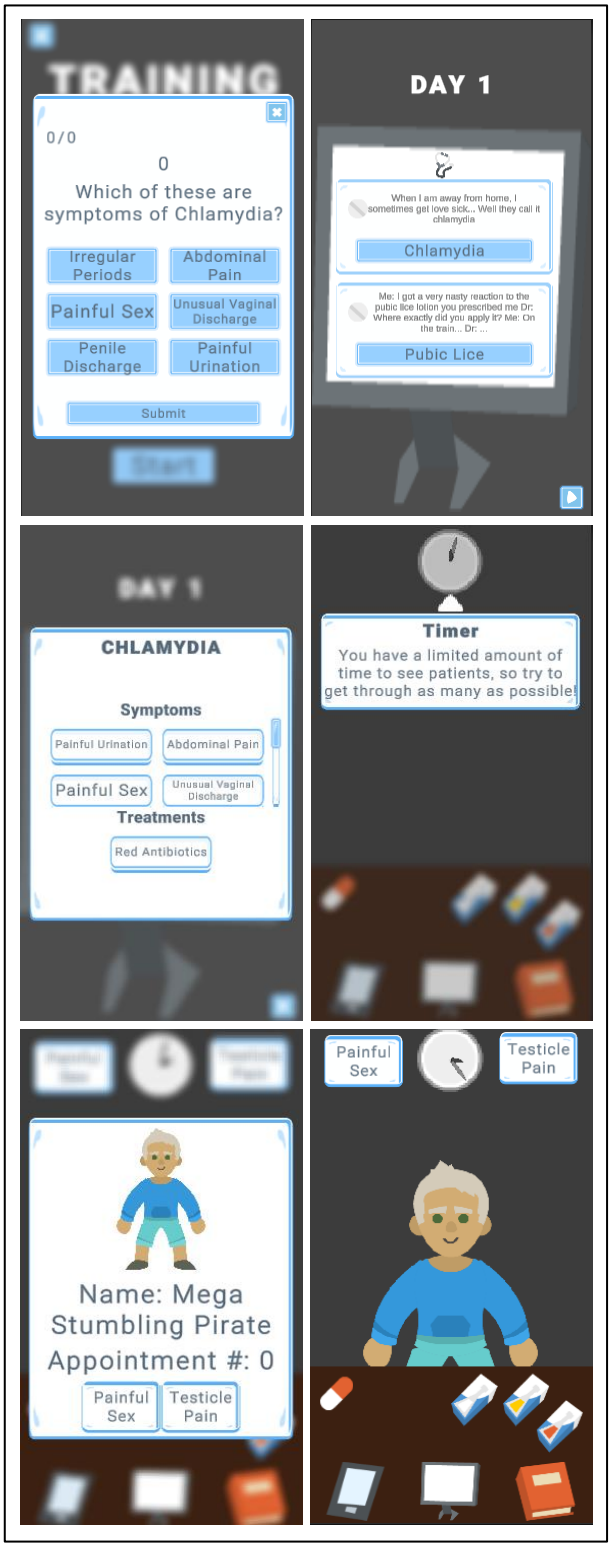

Figure 25: *Improved UI design screenshots.*

"Symptoms Please" provides a gamified way of presenting information about STIs, with the goal of educating young people about the symptoms and treatments of such diseases. The project attempts to subtract the taboo nature of sex education where students feel uncomfortable and shy, allowing them to freely access the information they need to stay healthy through confidential means. All the participants of the user testing stated that playing *"Symptoms Please"* was more engaging than the sex education they received at school; most participants stated that playing *"Symptoms Please"* made them feel more comfortable than learning sexual health at school, however the participants were not the target demographic for the application. This feedback provides evidence that the use of an application such as *"Symptoms Please"* to teach young people about sexual health topics would be beneficial to their enjoyment, knowledge, and experience of sex education.

The project fell short on educating about contraceptives and preventing STI transmission; participants stated that they did not learn about the range of contraceptives available to stop the transmission of STIs and many participants also felt that they did not learn where to find advice and more information about treatment options. This was expected as development was heavily focused on the game mechanics of diagnosing and treating patients, and less focused on education of transmission of STIs and further information resources. With further development these topics could be included as well.

User testing provided good feedback on the success of the project, including a questionnaire before and after using the project artefact enabled comparisons of knowledge and showed that users gained knowledge from the application. However due to the short timescale of the project, longer retention of the learned information could not be evaluated in the user testing method undertaken. Participants of the user testing also only completed the first few days of the game, meaning that they only encountered two STIs. While this gave some insight into the retention of the symptoms for these two STIs, there is no clear understanding of whether the progression of the game has it's intended use: to get players more comfortable with a range of STIs and their symptoms. The short playtime of the participants also negates the use for participants to state as many STIs as they can, since they only encounter two STIs in the game; if participants played longer this question might have been more interesting to see if there was any improvement on the knowledge of different STIs.

The project has created an interactive learning experience that aids in sex education and is designed to be safe, un-biased and comfortable. Through user testing it has been demonstrated that users felt engaged while playing *"Symptoms Please"*. Due to this is it safe to say the project was a success in terms of the project objectives set out in Section 1.1. The research objectives of the project required research into SRE curriculums, gamification, game-based learning and tools and platforms. While there was little research on the tools and platforms that could've been used to make the project, the ones chosen have proven to be fit for purpose and have provided the ability for quick iteration. It was discovered that the SRE curriculum in the UK is pre-determined by the government and individual schools all teach the same topics.

Gamification and game-based learning methods were the focus of the research in this project as well as the potential benefits of using gamification in education. It is clear there is a wide popularity for gamification but rare success in creating a truly gamified experience, where the player doesn't feel as though they are learning but are instead just playing a game. This project tried to focus on providing this gamified experience, focusing on the design of gameplay loop. While common features like a leader board and a quiz were implemented into the game, these are used to complement the main gameplay rather than be the subject of the game itself.

The learning objectives have been achieved through the research into the project as well as the development of the project artefact itself. Research into gamification and game-based learning has proven the potential to be effective in education, as well as the user testing of the project artefact. Gamification and game-based learning techniques, such as the ones shown in Figure 4, were implemented into *"Symptoms Please"* to a high standard. This can be reinforced by the user testing where all participants said they were engaged while playing the game.

"Symptoms Please" is one of very few educational video games produced to educate children on sexual health topics. The majority of sex related apps on the Google Play and Apples stores are targeted towards adults, not the education of young people. Wider use of this application could mean using the application in schools to teach young people, or for young people to explore sexual health topics in their own time. Other professionals should draw from the learning techniques used in this project, in particular the focus on gameplay mechanics rather than the leader board or quiz structure.

The results from the research and development of the project artefact, *"Symptoms Please"*, can be said to have proved the potential for gamified methods to improve engagement and retention in sex education and as such the project is ready for wider focused testing with the target demographics to get more substantial results.

9. Conclusion and Recommendations

This project aimed to create an engaging educational game for teaching secondary school children about sexual health topics. The user testing showed that the project could be successful in giving users new knowledge about the symptoms of STIs and how to treat them, but the results are inconclusive on educating about how to prevent the transmission of STIs and the contraceptive choices available. The user testing also showed that participants found the application engaging and so, while not the target audience, gives a good indication that the game would be more motivating than traditional teaching methods.

Future directions of the project should include topics like the transmission of STIs, safe sex and types of contraception; the project has been designed in such a way to be scalable for additions such as this. Possible future topics also include consent, the menstrual cycle, however with the diagnose and act design of the game, implementing these complex topics may take a considerable amount of thought.

Long term use of this application could range from teachers referencing the game as a resource for students to explore for information to supplement their classes to the application being used in classes for students to play and learn with. The main objective would be to put the game into the hands of students to give them a confidential space for them to learn about topics they may not be comfortable asking their teachers.

This project has aimed to show that gamification and game-based learning are powerful tools for education. It is important that young people learn how to be safe and well-informed regarding sex education and the results of this project show that the artefact is ready for further development towards the target demographic. The project has produced a fully functional game that can be expanded to be used for the education of young people on how to appreciate and understand their sexuality while keeping themselves and others safe.

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Appendix A: Project Log

https://zar67.github.io/cctp-devlog/

Appendix B: Project Timeline

Appendix C: Assets used in the Project

The avatar sprites and audio for the project were sourced from https://www.kenney.nl/ under the CC0 1.0 Universal (CC0 1.0) license. The following Kenney packs were used:

- Generic Items: https://www.kenney.nl/assets/generic-items
- Modular Characters: https://www.kenney.nl/assets/modular-characters
- UI Audio: https://www.kenney.nl/assets/ui-audio
- Interface Sounds: https://www.kenney.nl/assets/interface-sounds

The UI Sprites were sourced from https://wenrexa.itch.io/free-ui5 under the CC0 1.0 Universal (CC0 1.0) license.

Newtonsoft JSON Framework: https://www.newtonsoft.com/json

Firebase: http://firebase.google.com/

Appendix D: Preliminary User Testing Questionnaire

Symptoms Please User Testing Questionnaire

This questionnaire is designed to gather information about your experience with sex education at school and an idea of your existing knowledge of STIs.

Please read the following Participant Information carefully.

zoerowbotham1@gmail.com (not shared) Switch accounts

Invitation
You are invited to take part in a feedback opportunity taking place at the University of the West of England, Bristol. Before you decide whether to take part, it is important for you to understand why this feedback opportunity is being done and what it will involve. Please read the following information carefully and if you have any queries or would like more information, please contact Zoe Rowbotham (zoe2.rowbotham@live.uwe.ac.uk), Faculty of Environment and Technology at University of the West of England, Bristol.

What is the project?
As part of our module Comprehensive Creative Technologies Project (UFCFHQ-45-3) we are required to design and develop a project of interest to us. An element of this process involves testing our project with potential users and iterating upon our design based on any feedback received.

What is the aim of user testing?
We are looking to gather any constructive feedback from users who test our in development mobile game with the aim to reflect on our own work and make amendments based on recommendations. To help us gather feedback from testers you will be asked to complete a preliminary questionnaire, use the application of interest, and complete a final questionnaire. All data collected from any user following the testing period will be made anonymous in our work.

Why have I been invited to take part?
As a potential user of the completed application, we are interested in gaining information about your experiences and views on what we have produced for the mobile game. We may wish to ask specific questions relating to the design and user experience of the design and application. It is important to consider how our mobile game will be received by a diverse audience, so the purpose will be to gain information about your experience and your views.

Do I have to take part?
You do not have to take part in this testing opportunity. It is up to you to decide whether you want to be involved. If you do decide to take part, you will be given a copy of this information sheet to keep and will be asked to sign the consent form (at the bottom of this document). If you do decide to take part, you are able to withdraw from the research without giving a reason although after the point at which your data is anonymised and can therefore no longer be traced back to you, you can no longer withdrawal.

What will happen to me if I take part and what do I have to do?
If you agree to take part, you will be asked to take part in a user experience session of the application. This will be conducted by Zoe Rowbotham. The user testing will take approximately 10-15 minutes. You will be provided with a build of the project for you to run.

Your data will be anonymised at this point and will be analysed by Zoe Rowbotham only to support future development and a written report of the project.

What are the possible risks of taking part?
We do not foresee or anticipate any significant risk to you in taking part in this user testing. If, however, you feel uncomfortable at any time you can ask for the user testing to stop. If you need any support during or after user testing, then the supervisor (Lloyd Savickas. lloyd.savickas@uwe.ac.uk) will be able to put you in touch with suitable support agencies. The user testing will be designed with these considerations in mind.

What will happen to your information?
All the information we receive from you will be treated in the strictest confidence.

All the information that you give will be kept confidential and anonymised following the user testing session and not shared outside of the module team.

Where will the results of the research study be published?
A report will be written containing the user testing findings. This document will only be shared between the module team and the individual conducting the user testing.

A copy of the report can be made available to all user testers if you would like to see it at the discretion of Zoe Rowbotham.

Who has ethically approved this research?
The project has been reviewed and approved by University of the West of England University Research Ethics Committee. Any comments, questions or complaints about the ethical conduct of this study can be addressed to the Research Ethics Committee at the University of the West of England at: Researchethics@uwe.ac.uk

What if I have more questions or do not understand something?
If you would like any further information about the research, please contact in the first instance: Zoe Rowbotham (zoe2.rowbotham@live.uwe.ac.uk)

Consent
Please ensure that you have read and understood the information above and asked any questions before you continue. If you have any questions please contact a member of the module team, whose details are set out above.

- I have read and understood the information above before asked to continue.
- I have been given the opportunity to ask questions about the study.
- I have had my questions answered satisfactorily by the module team.
- I agree that anonymised quotes may be used in the final Report of this study.
- I understand that my participation is voluntary and that I am free to withdraw at any time until the data has been anonymised, without giving a reason.
- I agree to take part in the research

If you are agree with the above statements and are happy to take part in testing and providing feedback on the application, please continue with the questionnaire.

User Information

To provide some information on yourself and your experience at school compared to your experience playing Symptoms Please, the following questions will ask you to rate your experience with sex education at school.

Please select the option which best describes how you feel about this statement: "My sex education at school taught me everything I needed to know about sex, relationships, consent and my body." *

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neither Agree nor Disagree
- ◯ Disagree
- ◯ Strongly Disagree

Please select the option which best describes how you feel about this statement: "My sex education at school was engaging and fun." *

- ◯ Strongly Agree
- ◯ Agree
- ◯ Neither Agree nor Disagree
- ◯ Disagree
- ◯ Strongly Disagree

Please select the option which best describes how you feel about this statement: "I felt comfortable in sex education classes at school." *

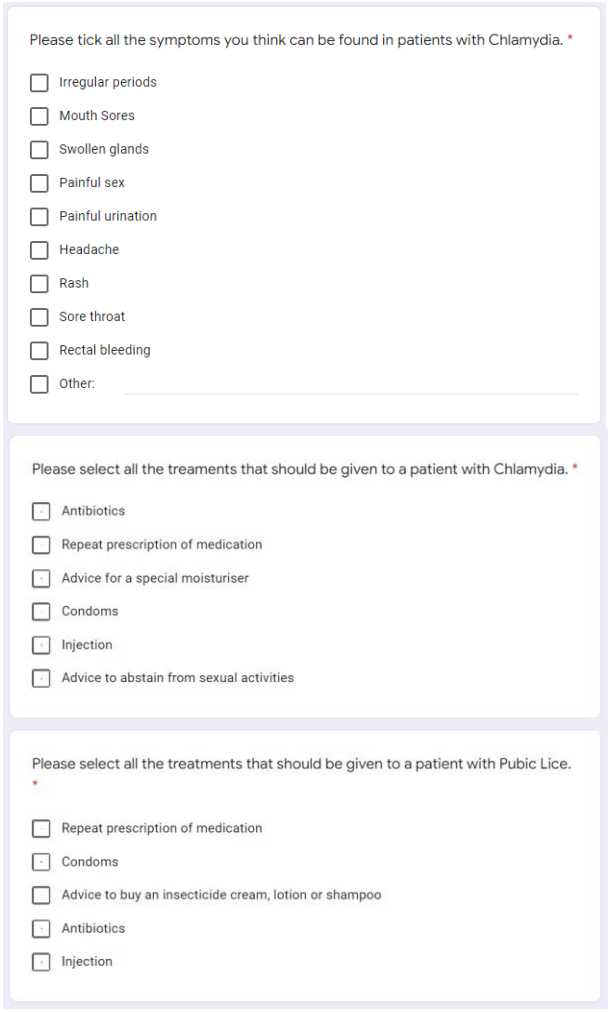
- ◯ Strongly Agree
- ◯ Agree
- ◯ Neither Agree nor Disagree
- ◯ Disagree
- ◯ Strongly Disagree

STI Knowledge

To provide a baseline for the knowledge gained in the session, the following questions ask you about your knowledge of sexually transmitted infections. Please answer these questions to the best of your ability without the use of the internet of any other source of information.

Please list as many STIs as you can. *

Your answer



Please tick all the symptoms you think can be found in patients with Chlamydia. *

- [ ] Irregular periods
- [ ] Mouth Sores
- [ ] Swollen glands
- [ ] Painful sex
- [ ] Painful urination
- [ ] Headache
- [ ] Rash
- [ ] Sore throat
- [ ] Rectal bleeding
- [ ] Other:

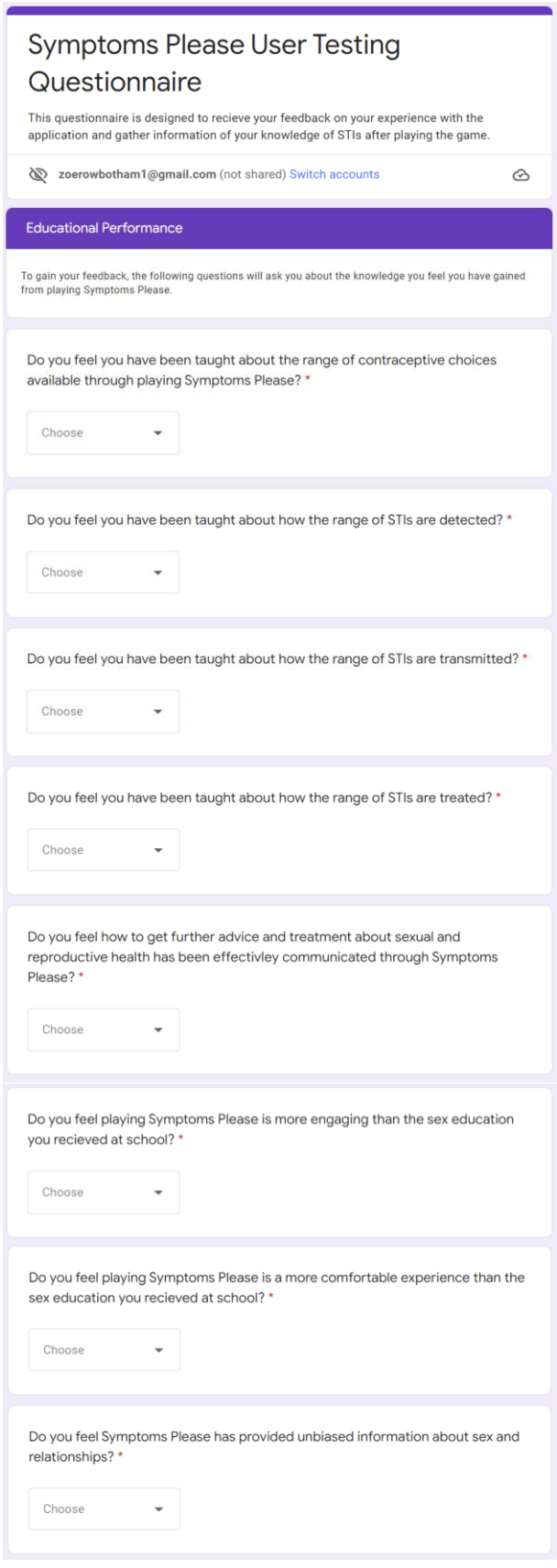
Please select all the treaments that should be given to a patient with Chlamydia. *

- [ ] Antibiotics
- [ ] Repeat prescription of medication
- [ ] Advice for a special moisturiser
- [ ] Condoms
- [ ] Injection
- [ ] Advice to abstain from sexual activities

Please select all the treatments that should be given to a patient with Pubic Lice. *

- [ ] Repeat prescription of medication
- [ ] Condoms
- [ ] Advice to buy an insecticide cream, lotion or shampoo
- [ ] Antibiotics
- [ ] Injection

Appendix E: Final User Testing Questionnaire



Symptoms Please User Testing Questionnaire

This questionnaire is designed to recieve your feedback on your experience with the application and gather information of your knowledge of STIs after playing the game.

zoerowbotham1@gmail.com (not shared) Switch accounts

Educational Performance

To gain your feedback, the following questions will ask you about the knowledge you feel you have gained from playing Symptoms Please.

Do you feel you have been taught about the range of contraceptive choices available through playing Symptoms Please? *

Choose

Do you feel you have been taught about how the range of STIs are detected? *

Choose

Do you feel you have been taught about how the range of STIs are transmitted? *

Choose

Do you feel you have been taught about how the range of STIs are treated? *

Choose

Do you feel how to get further advice and treatment about sexual and reproductive health has been effectivley communicated through Symptoms Please? *

Choose

Do you feel playing Symptoms Please is more engaging than the sex education you recieved at school? *

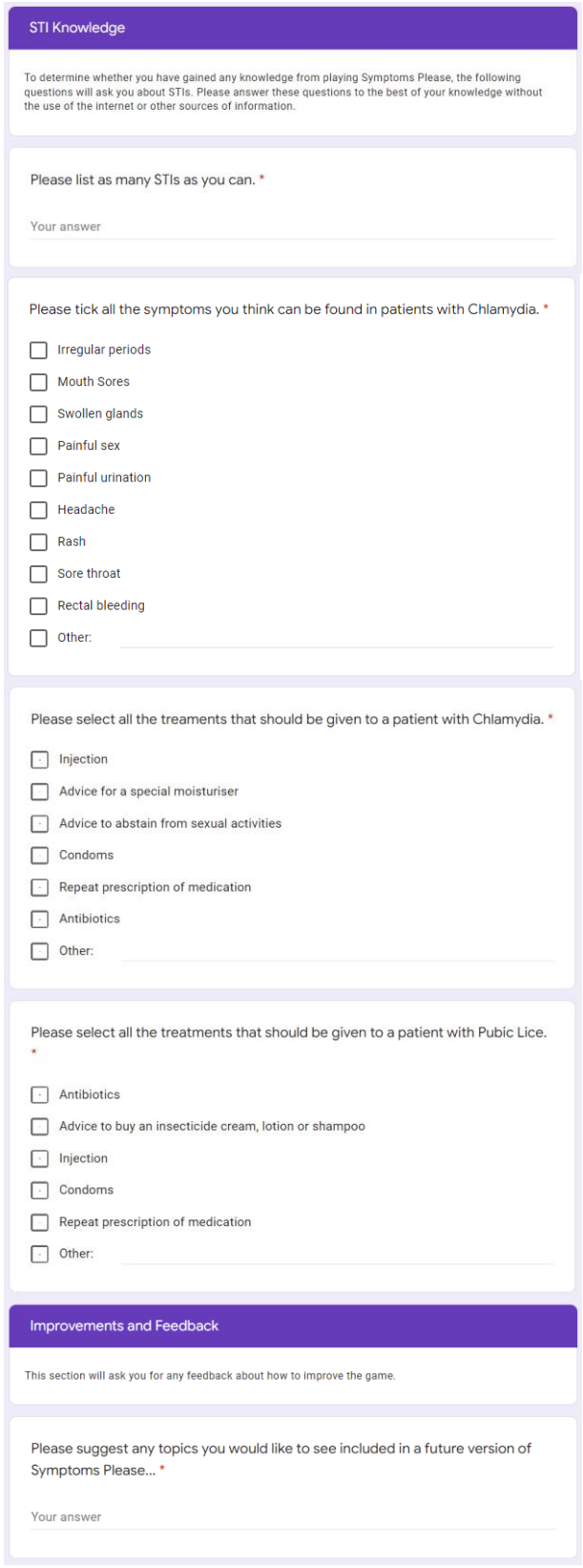
Choose

Do you feel playing Symptoms Please is a more comfortable experience than the sex education you recieved at school? *

Choose

Do you feel Symptoms Please has provided unbiased information about sex and relationships? *

Choose



STI Knowledge

To determine whether you have gained any knowledge from playing Symptoms Please, the following questions will ask you about STIs. Please answer these questions to the best of your knowledge without the use of the internet or other sources of information.

Please list as many STIs as you can. *

Your answer

Please tick all the symptoms you think can be found in patients with Chlamydia. *

- Irregular periods
- Mouth Sores
- Swollen glands
- Painful sex
- Painful urination
- Headache
- Rash
- Sore throat
- Rectal bleeding
- Other:

Please select all the treaments that should be given to a patient with Chlamydia. *

- Injection
- Advice for a special moisturiser
- Advice to abstain from sexual activities
- Condoms
- Repeat prescription of medication
- Antibiotics
- Other:

Please select all the treatments that should be given to a patient with Pubic Lice. *

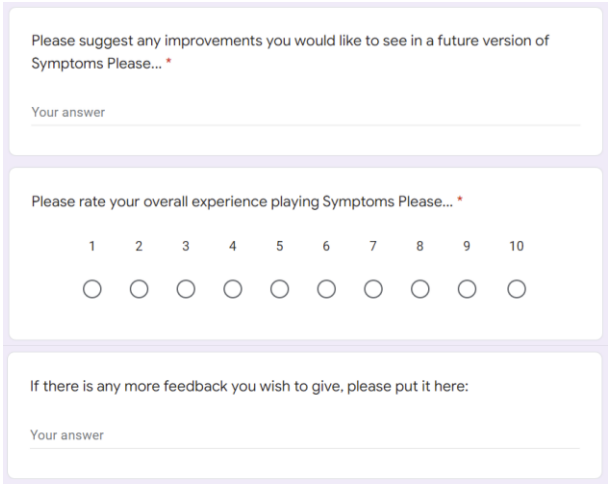
- Antibiotics
- Advice to buy an insecticide cream, lotion or shampoo
- Injection
- Condoms
- Repeat prescription of medication
- Other:

Improvements and Feedback

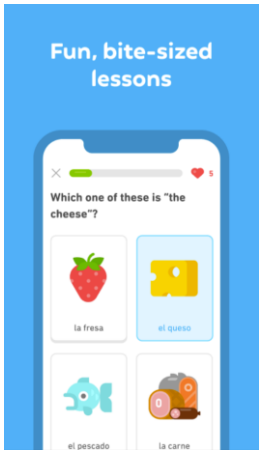
This section will ask you for any feedback about how to improve the game.

Please suggest any topics you would like to see included in a future version of Symptoms Please... *

Your answer


Please suggest any improvements you would like to see in a future version of Symptoms Please... *
Your answer
Please rate your overall experience playing Symptoms Please... *
1 2 3 4 5 6 7 8 9 10
If there is any more feedback you wish to give, please put it here:
Your answer

Appendix F: Competitive Analysis

Criteria	Tap That	Duolingo	Happy Play Time	My Sex Doctor
				
Reference	Peiying Feng (2016) Tap That (2016) [mobile game]. Available from: https://pfeng.cc/work/tap-that [Accessed 15 December 2021].	Luis von Ahn (2012) Duolingo (Version 5.38.4) [mobile app]. Available from: Google Play [Accessed 15 December 2021].	Tina Gong (2014) HappyPlayTime (2014) [web game]. Available from: https://play.happyplaytime.com / [Accessed 15 December 2021]	Fabrizio Dolfi (2013) My Sex Doctor (Version 1.1.7.1) [mobile app]. Available from: Google Play [Accessed 15 December 2021]
Platform	Mobile	Android, iOS and Web	Was iOS (banned) Now Browser	Android and iOS
Price	Free	Free (paid premium)	Free	Free
SRE Topics	STIs, Condoms	N/A	Female Masturbation	All
Visual Style				
Core Gameplay	Keep humans healthy by giving them condoms and medicine to protect them.	Answer questions correctly by selecting from multiple choice, writing out answers or speaking answers.	Complete a range of motions by tapping and swiping to make the character happy in a limited time frame.	Selecting a topic and reading about it.