GAME-BASED LEARNING:
PREVENTING THE SPREAD OF MRSA

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Project Report in part fulfilment
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Bachelor of Science with Honours in Software Engineering
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ABSTRACT

This project is focused on the continual spread of superbugs, such as MRSA and how serious games can help to reduce this spread of infection. Serious games are different to conventional games because they are based on any subject and have target outcomes, which may have an impact of society. A survey was taken to ascertain the current level of knowledge the public have of the prevention methods for MRSA. The results show that over 53% were not aware of the prevention methods that are used within hospitals to control the spread of MRSA. A number of products and techniques have been developed to try and educate the public about how to prevent the spread of MRSA but it seems that these methods have limitations or that the spread of these superbugs are increasing so fast that they can’t be treated fast enough. By analysing the current products used to prevent MRSA, a list of requirements for the game was derived. The game had the following aim and objectives: to show players how to prevent getting infected from MRSA, to increase awareness about MRSA (in particular how and where MRSA can be contracted and the prevention methods used for MRSA), to produce a game that appeals to both adults and children in terms of quality and design and to produce a game that is easy to learn by both adults and children. Using the waterfall model as a design methodology, the game was developed. After a usability (survey) evaluation was undertaken, game developed was found to have achieved both the aim and objectives with 100% of the participants of a second survey answering that the game had taught them about the prevention techniques, but to found that the appeal to adults would be more guaranteed if the level of difficulty increased and if 3D graphics were used.
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Questionnaire participants
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1 INTRODUCTION

1.1 MRSA BACKGROUND

Methicillin-resistant Staphylococcus aureus (MRSA) is a bacterium from the
Staphylococcus aureus (SA) family.

SA is a common bacterium found on the surface of people’s skin or in their noses.
This can occur without the carrier contracting an infection, however, if the
bacterium manages to break through the skin it can cause infections, such as boils.
If the bacterium enters the bloodstream, being now able to spread to all areas of
the body, the effects can be more severe, such as septicaemia, meningitis and
pneumonia (NHS Direct, 2006). According to the NHS Direct Health Encyclopedia
(2006), approximately 1 in 3 people are carriers of this bacterium. These patients
are known as being ‘colonised’ with the bacterium.

Most types of SA can be treated with methicillin (a type of penicillin), but there are
some types that can have developed a resistance to methicillin. These are known
as MRSA. Some reasons why the number of people diagnosed with MRSA has been
increasing are that patients are not finishing the full course of antibiotics they have
been prescribed. This allows the bacteria to survive and develop a resistance to the
antibiotic. They the bacteria begin to multiply. Also, antibiotics are being overused,
allowing bacteria to develop a resistance to a wide range of antibiotics.
1.2 PREVENTION AND TREATMENT METHODS

There are a number of prevention and treatments methods being used to reduce the spread of MRSA. This includes simple tasks, such as visitors closing doors to isolated patient areas, patients checking under their beds and on surfaces for any sources of dust, maintenance staff cleaning surfaces thoroughly medical staff using disposable gloves when coming into contact with patients.

If a patient is found to be a carrier of the bacterium or has contracted the infection the patient is treated with antibiotic creams, antiseptic shampoos and lotions in order to destroy the bacteria.

Many methods and techniques have been developed and used to try and educate the public about how to prevent the spread of MRSA like posters and fact sheets that can be obtained from clinician’s. Of course, this information is also available from a number of web sites so it is fully accessible to anyone that has the internet.

Hospitals are using new equipment, such as flat keyboards and MRSA killing uniforms in the hope that these will make it easier to eliminate the MRSA bug and other bacteria. Screening is also being carried out on patients to detect, and treat possible cases of MRSA before it causes long term effects on the carrier or others. Paper based tools such as ‘Learning through action to reduce infection’ (National Patient Safety Agency, 2007), is also being issued to patients. This tool helps the patient to analyse any symptoms they may have and to then identify which infection they may have.
A number of reports (e.g. the Mandatory Surveillance of Health Care Associated Infection Report, 2006) have also been produced to analyse the rate at which MRSA and other super bugs are increasing so that they can generate new ways to control this spread.

A campaign (Clean Your Hands, 2004) was also launched to try and educate the public about the current level of super bugs within hospitals using toolkits containing a variety of equipment, such as posters targeted at both staff and patients, supporting media tools and materials etc.

But even with all of these methods the infection rate of MRSA and other super bugs seem to increase.

1.3 RATIONALES FOR PROJECT

According to a recent report (Mandatory Surveillance of Healthcare Associated Infection Report, 2006) since the discovery of MRSA in 1943, the rate of infection has been increasing. Figure 1 shows that since 1990 MRSA bacterium reports in NHS acute trusts in England have increased from 68 in 1990 to approximately 5,500 in 2005. The highest number of bacterium reports being 3,895 in 2000 (2006, p11).
After the mandatory scheme came into effect in April 2001 there were approximately 40% more MRSA bacterium reported under the scheme (2006, p11). Yet, as our awareness of MRSA increases, the amount of people being diagnosed with the infection has not been decreasing. This suggests a lack of distributed information about MRSA and how to prevent the infection from spreading.

A questionnaire was taken in a secondary school and sixth form centre in South London in order to ascertain the current level of knowledge the general public have...
regarding MRSA and the prevention and treatment methods used (see Appendix A).

This questionnaire was distributed to the school pupils and staff by a current member of staff (no contact was made between the children at the school and the author; therefore no criminal checks were required).

The results of this questionnaire show that out of 56 participants over 65% don’t know about prevention methods that can be undertaken at home and over 53% don’t know about prevention methods that are used within hospitals (see figures 2 and 3 respectively).

**Figure 2 - Do you know what methods you can use to prevent the spread of MRSA in your home?**
As MRSA and other super bugs are claiming more young victims as well as the elderly, these results are significant. More young people need to be educated about the methods available to prevent the spread of MRSA in the home and within hospitals.

These results also prove suggest that although the public may have access for prevention materials regarding MRSA, it is being ignored.

The question that needs addressing is how we get the public to acknowledge and retain this information in order to reduce the spread of the infection.

Game-based learning is a current method that has yet to tackle this medical problem.

1.4 SERIOUS GAMES AND GAME-BASED LEARNING

Game-based learning (or serious games) dates back as far as the late 1920s. It was first used in a fight simulator, the Blue Box, developed by Edwin Link used to develop his aviation skills. During WWII Link produced approximately 10000 Blue Boxes in order to train half a million men. Military and army found use for these products as it reduced the amount of time spent training every single soldier.

In 1967 medicine also benefited from this evolution of games. Oregon State University introduced the first computer based instruction system, the Tutorial
Evaluation System (TES). Today serious games cover a range of subjects such as training games, educational games (Brain Training), social games, advergames, business games, exergames (Dance Mat), health and medicine games, news games and political games. So it is an ideal medium to use to promote information about MRSA.

Serious games are effective as they can potentially appeal to all ages, therefore should educate a large amount of the population about MRSA. It is also a fun way of learning about a serious issue so the information is more likely to be retained.

1.4.1 The difference between games and Serious games

Prensky (2001), states that digital game-based learning (or serious games) is about fun and engagement and serious learning and interactive entertainment into a newly emerging and highly exciting medium (Chapter 1, p5). Serious games are different to conventional games because they focus on current themes or issues and have target outcomes, which may have an impact of society, such as how to run a business, improve processes or learn new software, instead of fictional entertainment. By integrating current issues with into game play the player learns and builds upon their current knowledge of that theme (sometimes subconsciously) and can use what they learn in their lives.

1.5 BENEFITS

If a game based learning solution to this problem is implemented it benefit all areas of society and the public. Similar projects may receive more funding, the public will be more willing to participate in research projects of this field, game based solutions
will be viewed as an alternative means to relaying important information to the public and more importantly it may save lives.

Players that have grown up in this digital age named by Prensky (2001) as the ‘Games Generation’ (Chapter 2, p10) will benefit from this method more than the conventional ‘tell-test’ way of learning new information as they already be familiar using games. At this point in time the games generation will range from aged 30 and below. As this age range is now more susceptible to the infection it is a good way of communicating this information to them.

1.6 PROJECT SCOPE

This project concentrates on MRSA, what prevention and treatment methods are currently being used against it and their results to find out why MRSA is continuing to spread. Once these results have been analysed, current health and medicine games will be researched in order to design and develop a game based solution to help reduce the MRSA infection from spreading.

The game will focus on techniques of how to prevent contracting MRSA and how to prevent it from spreading. It is important to decrease the number of cases arising so that the current infected patients now identified can be treated.

1.7 OVERVIEW OF THE FOLLOWING CHAPTERS

Section 2 (Limitations) of this project will discuss the current methods used to make the public aware of MRSA and the prevention methods that are currently being used. From this review, a list of limitations will be gathered and a requirements list for the game will be developed.
Section 3 (New Ideas) of this project will discuss the requirements for the game (determined from section 2) to satisfy the aim and objectives defined at the start of the project. The design of the idea proposed will then be finalised and the project timetable will be produced.

Section 4 (S/W Development) of this project will focus on a suitable design methodology for the game including the various HCI aspects that need to be considered during development.

Section 5 (Results and Discussion) of this project will focus on the audience and players’ opinions of the game developed. Positive and negative aspects, whether the game made them more aware of MRSA and whether it increases more people practicing the prevention methods when they enter hospitals.

Section 6 (Conclusions and Future Work) of this project will summarise the results established in section 5 and discuss the possible future that can result from this project.
2 LIMITATIONS

2.1 MRSA PRODUCTS

It is estimated 5,000 patients die every year because of superbugs. Some fear the figure may be twice as high (Mirror, 2007). This increasing number of infections indicates that the products and techniques being used to prevent MRSA are somehow limited. It could also mean that these collective methods are not working fast enough; although they may be successful, the infection seems to be spreading faster than it can be treated.

A number of products and techniques have been developed to try and educate the public about how to prevent the spread of MRSA. The recent prevention techniques and products being used are: posters and leaflets, online resources, disposable gloves, hand foams and surface cleaners, campaigning strategies, new hospital uniforms, flat keyboards, screenings and tools.

2.1.1 Alcohol rubs

Alcohol rubs were introduced into hospitals as part of the 2004 Clean Your Hands campaign (Clean Your Hands, 2004). Alcohol rubs are used in hospitals located mainly at the reception desks on different floors in each ward and towards the entrance of patient rooms. The liquid is usually in a clear, pump-bottle; however, if it is not clearly labelled and patients or visitors have no knowledge of this product they won’t know what it is or how to use it.
If not clearly labelled, visitors will not use it to clean their hands before entering hospital rooms. If they are carriers and are visiting patients particularly susceptible to MRSA they could be putting them at risk.

The Clean Your Hands Campaign’s Final Evaluation does state that it was thought that the alcohol rub dispensers were “seen as the most critical aspect of the campaign as it raised awareness.” (p17). This evaluation also stated that by having the dispensers around hospitals, 34% of staff said that they were asked about the dispensers by the public (p14). This shows that this product had increased awareness of MRSA within the public, but the products must also be properly labelled so people are certain what it is and will use it without hesitation.

2.1.2 Posters and Leaflets

Posters and leaflets providing information about MRSA can only be found in medical environments, such as general practitioners (GP) surgeries and hospitals. MRSA is a problem for everyone, so these posters and leaflets available to everyone, not just patients that visit GPs and hospitals regularly. Although displaying this information is useful, the visitors don’t seem to be noticing them. If they were, a decrease in the number of MRSA cases would be noticed. Many GPs have magazines which tend to distract patients from the posters and leaflets and these resources are only useful if they are being read.

Some solutions to the limitations of these resources would be to make the information more eye-catching so people of all ages want to and have to acknowledge them.
This information needs to be available to people outside these environments so that more people have access to them. This should help to reduce the spread of MRSA.

### 2.1.3 Online Resources

Online resources like the *Tips for...* fact sheets that the Center for Disease Control Prevention produces provide information for the different groups more susceptible to MRSA (Center for Disease Control and Prevention, 2006). These groups are adults, dialysis and surgical patients because these groups are most likely to contract the infection.

The main limitations of online resources are that everyone doesn’t have access to the internet which reduces the number of people that have access to these resources.

An age group that may suffer from this might be the elderly. They may find it difficult to gain access to these resources if they can’t use the internet (or confidently navigate through) to find the information that they require.

Another important limitation to this method is that now the MRSA infection is affecting younger patients, like the cases described on ITV’s *Tonight* episode titled ‘The New Superbug’ (Tonight, 2006). This suggests that this prevention method will need to be revised as it is now outdated.

Some solutions to the limitations of these resources would be to make the information more accessible for non-internet users by making the information easy to find.
This information should be targeted to all age groups not just those who are more susceptible to the infection.

### 2.1.4 Hand Foams and Surface Cleaners

Like the alcohol rubs, hand foam applicators have been developed to encourage the general public to clean their hands regularly with something more effective than soap. These products are being advertised on TV so that people of all ages can and will receive all the information. It can also be bought from any pharmacy, so it’s fully accessible to anyone.

Surface cleaners have also been developed to destroy MRSA. These encourage the public to clean regularly as MRSA can spread on dusty surfaces.

The limitations of the hand foams are that they don’t destroy the MRSA bacteria, but they do prevent the spread of infection if the customer uses the product regularly. Hand foams cannot be prescribed, so elderly may not buy it because it will be an extra expense.

To solve the limitations of this prevention method the solution needs to be free or cheap, able to destroy MRSA or help prevent the spread of infection, the solution should be also be advertised on mediums that everyone has access to.

### 2.1.5 Disposable Gloves

Disposable gloves are mainly used in hospitals by the medical staff to prevent the transfer of any infections to the patients. Disposable gloves are widely available. A pair can be found in a normal household first aid kit so everyone can obtain a pair.
Some limitations to using disposable gloves are that they are usually quite thin and may rip allowing infections to be transferred. This is why some doctors wear two pairs of gloves, however, in emergencies some may forget to put gloves on.

There aren’t many solutions to the limitations here as they have already been solved or can’t be avoided (emergencies). This resource doesn’t directly relate to the public.

2.1.6 MRSA destroying uniforms and flat keyboards

Student nurses in Kent and Medway are testing new MRSA destroying uniforms. They are made from a fabric containing an antimicrobial treatment which ‘electrocutes’ harmful bacteria to stop them spreading (BBC News, 2006). Keyboards used in hospitals have been proved that they can carry and transfer the MRSA infection. So to make them easier to clean, flat keyboards have been developed (BBC News, 2006). These keyboards will make be easier to clean with MRSA destroying products used by maintenance staff.

Some limitations to these new pieces of hospital equipment will be that not all hospitals will be able to afford these uniforms and keyboards so many hospitals may not see the benefits of this equipment. The equipment need to be used in hospitals which the number of MRSA victims has increased to judge whether the introduction this equipment will reduce the number of cases. The solution needs to be cost effective for hospitals (both private and NHS) so that all hospitals can prevent the spread of infection using these techniques.
Surveillance of Healthcare Associated Infection reports have been produced to analyse the rate at which MRSA and other superbugs are increasing and so that they can generate new ways to control this spread.

### 2.1.7 Copper fixtures

Copper, used in medicines for 4,000 years, has been shown to be highly effective in killing off viruses such as MRSA (Daily Mail, 2007). It has been presumed by these findings that if they replace objects that have continual contact with and that are more likely to transfer the bugs between humans, such as door handles and sink tops, may considerably reduce the number of cases diagnosed with superbugs.

The limitations to this prevention method are that replacing these fixtures of one hospital will cost a lot of time and money. This approach will probably increase the taxes of the public aggravating them further. This will also mean that during this transition hospitals will have reduced resources to take care of their current patients. This may increase their patients’ time in hospital, and with the increasing amounts of dust on the wards from changing all of the fixtures, it may also increase superbugs within the hospital making the patients chances of infection increase.

Therefore making all hospitals follow this method may cause more harm than good, especially if this transition takes years to fully implement. It may also take the same amount of time to see any positive results from this method.

The solution has to be low cost, implemented quickly (within six months or less) and won’t increase the spread of the infection whilst implementing.
2.2 THE SERIOUS GAMES INITIATIVE

In 2002, the Woodrow Wilson International Center for Scholars in Washington D.C. launched a "Serious Games Initiative" to encourage the development of games that address policy and management issues. It focuses “on uses for games in exploring management and leadership challenges facing the public sector. Part of its overall charter is to help forge productive links between the electronic game industry and projects involving the use of games in education, training, health and public policy” (Serious Games Initiative, 2007).

Initially, Prensky used serious games to focus on developing new training methods for companies, such as The Monkey Wrench Conspiracy (Games2Train, 2007). Today, Game-based learning can be applied to any industry, and can include content on any subject (Games2Train, 2007). In 2004 two additional serious games focus groups formed: Games for Change, focused on social issues and social change, and Games for Health, which addressed health care applications.

The Serious Games Initiative founded Games for Health to develop a community and best practices platform for the numerous games being built for health care applications. To date the project has brought together researchers, medical professionals, and game developers to share information about the impact games and game technologies can have on health care (The Serious Games Initiative, 2007).

2.3 CURRENT SERIOUS GAMES

There have been many serious games made for various companies via Games2Train. Some of Games2train's customers are innovative and forward-
thinking organizations such as American Express, Bank of America, Charles Schwab, Estee Lauder, IBM, JP Morgan Chase, Nokia, Pfizer, the US Department of Defense, and the Florida and Los Angeles Virtual Schools (Games2Train, 2007).

Some of the products that have been made are: The Monkey Wrench Conspiracy, Straight Shooter, Battle of the Brains and Personal Investigator (PI).

2.3.1 The Monkey Wrench Conspiracy

Think3, a company launching a new generation of mechanical design (CAD-CAM) software, wanting to make this training process more interesting and fun for the new users (mostly young engineers). Within a few months Games2Train incorporated the new software’s manual into a first person, 3D game. This game was completed in March 1999. In “The Monkey Wrench Conspiracy” the player takes the role of an intergalactic space agent who is teleported to a secret space station. Their mission is to save the space station and the universe! To do so they must learn to use the client's software tools but monsters, space walks, puzzles, traps, etc stand in their way. In contrast to most tutorials, the whole thing moves at the twitch speed that the Nintendo generation (and Think3’s young engineers) is used to.

Its quick development and up to date design made this game very successful. Over 1 million copies have been distributed (Games2Train, 2007).

2.3.2 Straight Shooter

A Bankers Trust Company approached Games2Train because they required a way to engage their young employees. The game produced, “Straight Shooter!” allows the player to improve and certify their knowledge while playing in a fun environment.
For the player to succeed they must become experts in the policies. This game was very successful and is currently used in over 20 countries (Games2Train, 2007).

2.3.3  **Learning Solitaire**

This was a web-based game template developed for BT. “Learning Solitaire” is developed to assist BT's employees become fully aware and up-to-speed on the details and complexities of their responsibilities regarding the elimination of Sexual Harassment at work. BT uses Games2Train for orientation, product training, diversity training, support staff training, systems training, help desk training, leadership training, and other applications. This shows how serious games can be applied to any subject. Serious games can also be adapted to suit the customer’s needs not just specific to one subject. BT uses this training template to distribute to 50 of the firm’s business units worldwide. They then use them to create department-specific training resources (Games2Train, 2007).

2.3.4  **Battle of the Brains**

Battle of the Brains is a team based, competitive game designed to reinforce and review information. It is commonly used as a finale to lessons, meetings and with large groups. The game can be customized with a sports or military theme.

2.3.5  **Personal Investigator (PI)**

Personal Investigator is a therapeutic 3D game aimed at teenagers. The Northern Arm & Hand Center, in Duluth MI, is an upper extremity trauma and rehabilitation center that provides ten different serious games as a means of physical therapy. These games have been so successful the center has “patients who over-exercise
because they enjoy the games so much...the clinic’s state-of-the-art software offers the best way to regain use of an injured limb” (RUST, 2003).

2.3.6 Other Serious Games

Since Games2Train was established in 2004, the company has supplied a number of serious games to a variety of customers. These include: a computer giant, a large commercial bank, an information service provider, a securities firm, an insurance company, a mutual fund company, a financial services company, a health care company and a hospitalities company.

All of these companies found that they received positive feedback and reactions to their software. The positive reactions lead to additional licenses for games2train.com products to use throughout the some of the companies, help companies find out what level of knowledge their employees have, keeps the employees awake and interested in the process and now the health care company uses games2train.com's Enhanced Classroom Learning products to liven up its training courses and make them fun and challenging.

The games provided to the mutual fund company allows employees that work from home to have access to easily updatable information on company products, pricing and policy in a fun, enjoyable environment. Between phone calls, sales representatives can use games2train.com's products to learn strategies and techniques. They can also play a Scenarios game that allows them to practice making decisions tied to performance skills.
2.4 ADVANTAGES AND DISADVANTAGES OF SERIOUS GAMES

Although serious games are an interesting way of learning new information there are some advantages and disadvantages of these types of games:

2.4.1 Advantages of Serious Games

- Serious games combine learning and a level of fun. This makes the information being learnt more likely to be retained.
- They also provide an interesting and alternative method to learn something for the public.
- Using games can also appeal to a wide age range, including younger members of the public, and encourage them to learn.
- As the games generation is getting older they will be more accustomed to using computers and may learn more from the game than a handout.
- Many serious games can be found on the internet, so they are very accessible.

2.4.2 Disadvantages of Serious Games

- On the other hand, serious games are still games and may not appeal to everyone. This may be because some of the public and businesses view games as only a source of entertainment.
- Companies may prefer to use handouts when training new and old staff because it’s simple and quick.
- The choice of converting to this new method of training may deter the smaller companies as they may not be able to afford it.
2.5 SUMMARY OF LIMITATIONS

From analyzing the current methods used to prevent the spread of MRSA and the treatment methods available, it has been discovered that these methods are not working fast enough as the threat of superbugs continue to increase in hospitals.

New hospital equipment such as flat keyboards and copper fixtures may be the answer to reducing the infection. However, to equip all the hospitals and medical centers that are within the NHS with these pieces of equipment would be expensive. More than likely taxes will increase in order to finance such a change. This will aggravate the public as results of whether these changes being made are working will take time to generate.

A solution that can be produced quickly, with little expense spent and that will appeal to the public encouraging them to assist in preventing MRSA needs to be generated.

Serious games such as “The Monkey Wrench Conspiracy” have proven that this method of learning works.

As this method will not cost the public anything to develop, serious games seem a suitable solution to this problem.
3 NEW IDEAS

3.1 AREA OF RESEARCH

The area of research that this project focuses on is games to change behaviour. Recent studies on the Social Impact Games web site (Social Impact Games, 2007) have shown that a number of health and wellness related games have been developed. There are two games that exist on this site and have been developed with the aim of teaching children the importance of asthma and diabetes management. After playing these games, studies found that the number of asthma emergency visits, diabetes emergency visits and urgent-care visits decreased by 40% and 77% respectively (Social Impact Games, 2007). These results suggest that the behaviour of the children playing these games changed. These results also support that serious games are successful and have a positive impact.

One other game that has been developed which has changed the behaviour of children is Glucoboy (Diabetes in Control, 2007).

3.1.1 Glucoboy

Glucoboy is a glucose meter that can be inserted into a Nintendo Gameboy. The product downloads programs contained within its circuitry into the Gameboy as a reward for maintaining good blood sugar control. Integrating a device into a computer system that is popular with young children automatically attracts the attention of young children. It also makes sure that young diabetic children will
monitor their blood sugar levels correctly because it is integrated into a fun way of learning.

This device has been complimented by parents saying that the changes to their children’s lifestyles are much easier now that they understand and are willing to monitor their levels themselves (Diabetes in Control, 2007).

Another game that has been developed which has changed the behaviour of children is Monster Nutrition.

3.1.2 Monster Nutrition

Monster Nutrition is a game designed to teach children about the different food groups. This is a game that can be played over the internet (Nutrition Explorations, 2007). You play by launching different foods from a conveyer belt into a monsters mouth. The game progresses to the next level if the player correctly feeds the monster all of the food groups.

![Monster Nutrition High Scores Board](image)

[Nutrition Explorations, 2007]

*Figure 4 – Monster Nutrition High Scores Board*
Judging by the high scores board of this game (Nutrition Exploration, 2007), it has been successful in attracting players, and may be assumed that sub-consciously these players have learnt which foods belong to what food groups through playing.

The games mentioned above have been tested on people that need and benefit from the solution. This is not the case with this project, because it affects a wide range of the public it needs to be exposed to a wide range of the public. This will increase the awareness of the problem and solution. The solution also needs to become available in places where it will be used by a large variety of people. Being in places like these will ensure that it has a greater effect on the people most likely to spread or catch the infection.

With this information it’s fair to assume that by playing a game designed to change the behaviour of people by increasing their awareness of MRSA, should reduce the spread of infection. This game will do this by making the public play through a series of scenarios based upon the current prevention methods and techniques.

3.2 LEARNING THROUGH GAMES

Many people think that computer games are simply sources of entertainment with little or no educational value. However, Prensky (2001) cites the work of Greenfield (1984) who found a number of things suggesting that computer games are more than a source of entertainment. Some of these findings include:

- “Skill in computer games enhances, and is a casual factor in, other thinking skills...”
- “The process of making observations, formulating hypotheses and figuring out the rules governing behaviour...”
- “Video game skills transfer to and lead to greater comprehension of scientific simulations due to increased ability to decode the iconic representation of computer graphics.”
- “Playing video games enhances players’ skills at ‘divided attention’ tasks...”

So not only has Greenfield found that computer games build upon old skills, but they also help to develop new ones. These skills are learnt from all genres of games.

### 3.2.1 Game Genres

Genre is the French word for type. The core genres are: sports (e.g. Fight Night), adventure (e.g. Broken Sword), action (e.g. Quake), simulation (e.g. Flight Simulator), strategy (e.g. Command and Conquer), role-play (e.g. Baldur’s Gate), management (e.g. The Sims), uncategorised (e.g. Tetris) and puzzle (Oxland 2004, p25).

Games of certain genres deal with different types of game play. These different types can determine what type of skills that are developed by the player. Prensky (2001) lists a number of ways to learn and possible game genres that develop these skills in Types of Learning and Possible Game Styles in the table (see Table 1). This table just identifies the main possible types of learning that can be learnt from the different genres, so small amounts of other skills can be learnt even though they may not be stated.
Table 1 - Types of Learning and Possible Game Styles

<table>
<thead>
<tr>
<th>“Content”</th>
<th>Examples</th>
<th>Learning activities</th>
<th>Possible Game Styles</th>
</tr>
</thead>
<tbody>
<tr>
<td>Facts</td>
<td>Laws, policies, product specifications</td>
<td>questions</td>
<td>game show competitions</td>
</tr>
<tr>
<td></td>
<td></td>
<td>memorization</td>
<td>flashcard type games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>association</td>
<td>mnemonics</td>
</tr>
<tr>
<td></td>
<td></td>
<td>drill</td>
<td>action, sports games</td>
</tr>
<tr>
<td>Skills</td>
<td>Interviewing, teaching, selling, running a</td>
<td>Imitation</td>
<td>Persistent state games</td>
</tr>
<tr>
<td></td>
<td>machine, project management</td>
<td>Feedback</td>
<td>Role-play games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>coaching</td>
<td>Adventure games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>continuous practice</td>
<td>Detective games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>increasing challenge</td>
<td></td>
</tr>
<tr>
<td>Judgment</td>
<td>Management decisions, timing, ethics, hiring</td>
<td>Reviewing cases</td>
<td>Role play games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>asking questions</td>
<td>Detective games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>making choices (practice)</td>
<td>Multiplayer interaction</td>
</tr>
<tr>
<td></td>
<td></td>
<td>feedback</td>
<td>Adventure games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>coaching</td>
<td>Strategy games</td>
</tr>
<tr>
<td>Behaviors</td>
<td>Supervision, self-control, setting examples</td>
<td>Imitation</td>
<td>Role playing games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feedback</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>coaching practice</td>
<td></td>
</tr>
<tr>
<td>Theories</td>
<td>Marketing rationales, how people learn</td>
<td>Logic</td>
<td>Open ended simulation games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Experimentation</td>
<td>Building games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>questioning</td>
<td>Constructing games</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Reality testing games</td>
</tr>
<tr>
<td>Reasoning</td>
<td>Strategic and tactical thinking, quality</td>
<td>problems</td>
<td>Puzzles</td>
</tr>
<tr>
<td></td>
<td>analysis</td>
<td>examples</td>
<td></td>
</tr>
<tr>
<td>Process</td>
<td>Auditing, strategy creation</td>
<td>System analysis and deconstruction</td>
<td>Strategy games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practice</td>
<td>Adventure games</td>
</tr>
<tr>
<td>Procedures</td>
<td>Assembly, bank teller, legal</td>
<td>imitation</td>
<td>Timed games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>practice</td>
<td>Reflex games</td>
</tr>
<tr>
<td>Creativity</td>
<td>Invention, Product design</td>
<td>play</td>
<td>Puzzles</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Invention games</td>
</tr>
<tr>
<td>Language</td>
<td>Acronyms, foreign languages, business or</td>
<td>Imitation</td>
<td>Role playing games</td>
</tr>
<tr>
<td></td>
<td>professional jargon</td>
<td>Continuous practice</td>
<td>Reflex games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>immersion</td>
<td>Flashcard games</td>
</tr>
<tr>
<td>Systems</td>
<td>Health care, markets, refineries</td>
<td>Understanding principles</td>
<td>Simulation games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Graduated tasks</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Playing in microworlds</td>
<td></td>
</tr>
<tr>
<td>Observation</td>
<td>Moods, morale, inefficiencies, problems</td>
<td>Observing</td>
<td>Concentration games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Feedback</td>
<td>Adventure games</td>
</tr>
<tr>
<td>Communication</td>
<td>Appropriate language, timing, involvement</td>
<td>Imitation</td>
<td>Role playing games</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Practice</td>
<td>Reflex games</td>
</tr>
</tbody>
</table>

[Source: Prensky, 2001]

3.3 SELECTED GAME GENRE
One of this project’s objectives is to make the public more aware of MRSA so that their behaviour changes as a result, so when they enter hospitals they use the different techniques to prevent themselves from contracting MRSA. But although Table 1 states that to learn behaviours, the selected genre should be a role-playing game the genre of this game is going to be an adventure game. This is because the ability to make judgements is also a factor when changing people’s behaviour. If they are able to make a decision about to their behaviours and see the benefits then this will help to change their behaviours. Thought processing is a part of changing behaviours in individuals and Oxland suggests that a great deal of thought processing is required by players when playing adventure games (2004, p37). So using an adventure genre for this game should be just as effective as using a role-playing genre.

Prensky (2001) states that there are a variety of theories of learning, for example, “you can’t learn unless you fail” and “learning happens when one is engaged in hard and challenging activities”. Adventure games as well as role-play games fulfil both of these ways of learning. If they fail when trying to overcome different puzzles and challenges, these challenges it will make them learn, therefore they should retain the information they are using and change their behaviours.

3.4 DEVELOPMENT TOOLS

There are a variety of tools available to develop games, some may be open source (free) and others may require a licence. The tools that are selected often depend on the accessibility, availability to the developer and what type of project will be developed with the tools. Another factor that needs to be considered is whether the
customer’s current hardware and software will be able to run the developed software or whether a full system upgrade will be required. In circumstances where the game has to be run on multiple computers, multiple licences may be required. In order for hospitals to commit to buying these software packages they have to be certain that the investment they make in the product will produce a game that will fulfil their expectations, otherwise it will not be cost effective.

All software has minimum requirements in order to run on computers. If the hospitals computers don’t match or exceed the requirements to run the software they will have to invest money to upgrade the computers. The amount needed to upgrade the computers will depend on how outdated they are compared to the system requirements used to run the new programs. It would be a sensible suggestion to develop this game in the program that has low system requirements. This would reduce the amount needed to upgrade the computers.

Detailed below are some of the tools fully available to develop the games for this project. These are the latest editions of the software at the time of writing this report.

3.4.1  Microsoft Visual Studio 2005

Microsoft Visual Studio is a collection of development tools. Multiple licences will be required for any additional computer needing to run the game.

3.4.1.1  Microsoft Visual Basic
VB can produce 2D applications. It is coded using the VB scripting language. A VB application has to be on a computer running a game using Visual Studio (see figure 5 for the system requirements for Visual Studio).

### 3.4.1.2. Microsoft Visual C++

C++ can produce 2D games. It is coded using the C++ language. A game developed using C++ doesn’t require the Visual Studio environment to run. Once the game is converted into an executable file, it will be able to be played on any computer. However, the requirements to run this file may be different to the system requirements of the Visual Studio environment. To ensure that the computer running the game will be able to support the file, it’s best to confirm the computer requirements are the same or higher than what is needed to run the Visual Studio environment (see figure 5 for the system requirements for Visual Studio).

To install Visual Studio 2005 Standard Edition, we recommend:

- Computer with a 600 mhz or faster processor
- Visual Studio® 2005 Standard Edition can be installed on the following operating systems:
  - Microsoft® Windows® 2000 with Service Pack 4
  - Microsoft® Windows® XP with Service Pack 2
  - Microsoft® Windows® XP Professional x64 Edition (WOW)
  - Microsoft® Windows Server™ 2003 with Service Pack 1
  - Microsoft® Windows Server™ 2003, x64 Editions (WOW)
  - Microsoft® Windows Server™ 2003 R2
  - Microsoft® Windows Server™ 2003 R2, x64 Editions (WOW)
  - Microsoft® Windows Vista™
  - 192 MB of RAM or more
  - 2 GB of available hard-disk space
  - CD-ROM drive
The requirements to run Visual Studio are quite high so it is possible that the computers will have to be upgraded in order to run this environment.

3.4.2 Macromedia Flash Professional Edition 8

Flash can produce 2D applications. It is coded using Actionscript. A flash application doesn’t require the flash environment in the order to run. Instead Flash uses Flash Player, a separate application that is free to obtain. In order to run Flash 8, the system requirements for this program must have the minimum of requirements (see figure 6 for the system requirements for Macromedia Flash Professional Edition 8 to run on a Windows operating system), but to run the Flash Player the system requirements are a lot lower.

Windows
Intel® Pentium® 4, Intel Centrino®, Intel Xeon®, or Intel Core™ Duo (or compatible) processor
Microsoft® Windows® XP with Service Pack 2 or Windows Vista™ Home Premium, Business, Ultimate, or Enterprise (certified for 32-bit editions)
512MB of RAM (1GB recommended)
2.5GB of available hard-disk space (additional free space required during installation)
1,024x768 monitor resolution with 16-bit video card
DVD-ROM drive
QuickTime 7.1.2 software required for multimedia features
Internet or phone connection required for product activation
Broadband Internet connection required for Adobe Stock Photos* and other services
Figure 6 - the system requirements for Macromedia Flash Professional Edition 8

Flash Player doesn’t have such high system requirements so upgrading the hospital computer will be minimal and the cost reduced (see figure 7 for the system requirements for Macromedia Flash Player 9).

Windows Platform Browser

Microsoft® Windows® Vista Microsoft Internet Explorer 7, Firefox 2.0, AOL 9
Microsoft Windows XP Microsoft Internet Explorer 6.0 or later, Firefox 1.x, Firefox 2.x, Mozilla 1.x or later, Netscape 7.x or later, AOL 9, Opera 7.11 or later
Windows Server™ 2003 Microsoft Internet Explorer 6.0 or later, Firefox 1.x, Firefox 2.x
Windows 2000 Microsoft Internet Explorer 5.x, Firefox 1.x, Firefox 2.x, Mozilla 1.x, Netscape 7.x or later, AOL 9, Opera 7.11 or later
Windows Me Microsoft Internet Explorer 5.5, Firefox 1.x, Mozilla 1.x, Netscape 7.x or later, AOL 9, Opera 7.11 or later
Windows 98 Microsoft Internet Explorer 6.0 or later, Firefox 1.x, Mozilla 1.x, Netscape 7.x or later, CompuServe 7, AOL 9, Opera 7.11 or later

Figure 7 - the system requirements for Macromedia Flash Player 9

Adobe provides a free license to allow you to redistribute Adobe Flash Player or Adobe Shockwave Player on your company's intranet, or with your software product or service. Use this online application to apply for a license for any or all of the Adobe web players (Licensing Adobe, 2007).

3.4.3 Autodesk 3D Studio Max (3Ds Max) 8
3Ds Max is a modelling and texturing tool. It cannot be used on its own to develop a game; it requires a 3D game engine. This would be a product required only for the developer to obtain and use so the requirements to run this application doesn’t need to be considered. Depending on which engines are compatible with 3Ds Max objects an engine will have to be purchased by the hospital. The cost of this game engine will also depend on which engine is compatible with the objects that are modelled.

3.4.4 Valve Editor

Valve is a 3D games engine. It has recently been used to develop games such as Half-Life 2 and Counter Strike. It is coded using the C++ language. This engine is free to obtain to run the game, however, the system requirements can be very high (depending the game developed) so to upgrade the current computers may cost a significant amount of money, especially if the intention is for the game to be played on multiple computers (see figure 8 for the system requirements for Valve Editor).

Valve Minimum System Requirements

OS: Windows, 2000/XP/Me/98
700mhz Processor
128 mb of RAM
64 mb Video Card

[Half-Life Files, 2007]

Figure 8 - the system requirements for the Valve Editor

In order to develop a game using this engine, a modelling application, such as 3D Studio Max, will be required to model additional objects and an image editing application, such as Adobe Photoshop, will be required to edit images in order to
texture these objects. But these are only required by the developer so these products or similar tools will have to be available and accessible in order to use the Valve Editor.

3.5 GAME FEATURES

3.5.1 Colour

When designing games some of the players may have disabilities that will affect their experience of the game. These aspects have to be considered in the design. For this reason it is not ideal to design a game with a wide variety of colours that are difficult to distinguish between. If a scenario within the game depended on this distinction being accurate in order to progress, if the player gets it wrong they could end up frustrated and won’t continue to play.

3.5.2 Font

Faulkner (1998, p23) suggests that serif fonts are easier to read than sans serif fonts. When reading from printed text, the removed shape from serif fonts decreases speed and accuracy. Serif fonts are found to be easier to read from computer monitors, although it is argued that depending on what type of font the user is used to seeing, they will find easier to read.

3.5.3 Graphics

The graphics have to be interpreted by all ages as the same object. As this game is supposed to be targeting a wide age range some age ranges may recognise one symbol one way and another age group may view it as something totally different. The graphics also have to appeal to adults as well as children, so the graphics used should be as realistic as possible (depending on the tool used for development).
Another factor to consider is the size of the graphics used. They have to be a suitable size so they can be easily identified, especially if they contain text. This would pose a problem to players who were partially sighted.

### 3.5.4 Copyright

Any graphics, logos or slogans used within the game have to be original to this game unless permission has been granted to include the graphic within the game.

### 3.5.5 Sound

Sound is an important aspect of games. It provides a form of feedback to the player drawing their attention to different aspects.

However, sound should not be relied upon within the game in order to be completed. If the player is required to depend on the audio feedback in order to complete the game and the player is unable to hear the audio feedback it will put them at a disadvantage. It may also hinder the player from completing the game and learning about the prevention techniques.

### 3.6 PROJECT MANAGEMENT

Project management is the process of coordinating different activities (LAI, 2007). Projects that do not adopt a good managing technique will usually fall behind schedule or fail. The project management technique will depend on the type of product being built. When developing projects for IT/business environments the ideal methods to use are prototyping methods, such as the Dynamic Systems Development method or the Rapid Application Development method. These methods are “an agile (or incremental) approaches for rapid iterative delivery for fast moving IT/business environments” (LAI, 2007). This is an ideal method for this
project mainly because it allows incremental and iterative development and testing is carried out throughout the entire lifecycle (see figure 9). Although using this type of method is more suitable to this project the constant iterations that have to be made will mean that development may take a long time. Also Galin states that using this method reduces preparation for unexpected instances if failure (2004, p127).

**Figure 9 – the Rapid Application Development method**

There is not an official or standard management methodology to develop games, and although the methods mentioned above are usually used when developing IT projects, the classic software development lifecycle methodology (or the Waterfall model) has been adopted for this project. This development process was devised by Royce (1970) and then Boehm (1981). It is a linear model consisting of 7 phases. There are no iterative steps so setting the project against a deadline will be easier to do as the customer will not continually input their changes into the system design. The evaluation of the system is carried out in one phase after all of the development has been completed (see figure 10).
3.7 PROJECT TIMETABLE

*Figure 10 – the Waterfall Model*

### Table 2 – Project Timetable

<table>
<thead>
<tr>
<th>Task</th>
<th>Allocated Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Registration/Proposal</td>
<td>1 week</td>
</tr>
<tr>
<td>Research</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Design</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Development</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Testing</td>
<td>12 weeks</td>
</tr>
<tr>
<td>Results/Discussion</td>
<td>7 weeks</td>
</tr>
<tr>
<td>Conclusions and Future Works</td>
<td>2 weeks</td>
</tr>
<tr>
<td>References, Bibliography</td>
<td>1 week</td>
</tr>
<tr>
<td>Appendices</td>
<td>1 week</td>
</tr>
</tbody>
</table>
3.7.1 Aim

The intention of this game is to show players how to prevent getting infected from MRSA.

3.7.2 Objectives

The objectives for this game are to:

- To increase awareness about MRSA, in particular:
  - How and where MRSA can be contracted
  - Prevention methods used for MRSA
- To produce a game that appeals to both adults and children in terms of quality and design.
- To produce a game that is easy to learn by both adults and children

3.7.3 Task Breakdown

The design and development sections will be divided into smaller sections so that all areas of design and development are fully analysed. To do this I will be using a Top down method. This is design method is commonly used when designing software. To begin this method Bell (1997) describes that the overall objective needs to be broken down into a series of simpler tasks, then broken down further (1997, p5). The main features are then identified and then broken down into elements.

3.7.4 Milestones
### 3.7.5 Other Deadlines

**Table 4 - Other deadlines**

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Human Computer Interaction c/w AAD c/w</td>
<td>22\textsuperscript{nd} January 2007</td>
</tr>
<tr>
<td>AAD Phase Test</td>
<td>31\textsuperscript{st} January 2007</td>
</tr>
<tr>
<td>Adv Soft Eng c/w</td>
<td>12\textsuperscript{th} February 2007</td>
</tr>
<tr>
<td>3D Design c/w 1</td>
<td>31\textsuperscript{st} January 2007</td>
</tr>
<tr>
<td></td>
<td>21\textsuperscript{st} March 2007</td>
</tr>
</tbody>
</table>

### 3.7.6 Contingency Planning

Contingency planning allows for extra time in case during the project life cycle unexpected circumstances arise that push your project stages back.

This project has been allocated one week’s contingency time. This will allow proof reading and final checks being done to the project.

### 3.8 SUMMARY OF NEW IDEAS
As adventure games provide the player with a number of different skills by solving a number of problems and challenges the player will use a great deal of thought processing and should learn different behaviours from this genre as a result.

After analysing the requirements, accessibility and availability of the development tools, Macromedia Flash was selected to develop the game. Smith and Mann (2002) discuss the question about the interface model, whether the interface dimensions affect the amount of realism because powerful graphics, sound and physical models provide high fidelity environments. However, they cite that Low (2001) argues that such realism may distract from the interaction rather than enhance it. So to first prove that this game can affect the behaviour of the public, educating them about MRSA prevention methods, this game will serve as a prototype. If successful results are achieved, then the game could then be developed in a 3D environment.

The management methodology decided upon was the Waterfall model as this method follows a simple linear structure.

The aim of this game is to show players how to prevent getting infected from MRSA through a series of scenarios. After these tasks are completed the players should have an increased awareness of MRSA, in particular how and where MRSA can be contracted and prevention techniques that they can perform when in hospital.

Also this game has to appeal to both adults and children in terms of quality and design and be is easy to learn to use so that both groups learn these prevention techniques.
4 SOFTWARE DEVELOPMENT

As stated in section 3.6, the design methodology that will be applied to this project is the Waterfall model or the Software Development Life Cycle (Boehm, 1981).

4.1 SYSTEM/INFORMATION ENGINEERING AND MODELLING

From section 2.7 it has been found that the software implemented must cover the following:

- The game must make the player more aware of the different techniques and products (so that they can apply what they learn to real life situations.
- The game information has to be presented in an eye-catching and memorable way. As one of Prensky’s (2001) theories of learning states, “Learning comes from doing...you can’t learn unless you fail...people learn through feedback...” (Chapter 3, p12). By making this new prevention technique an interactive game where players can fail and receive feedback (being visual or sound), it encourages more people to acknowledge the information presented in this game and will make them learn more about the prevention techniques.
- This game needs to be available to people outside these environments so that more of the public can have access to it. By implementing this game using the Flash environment, makes it possible to easily distribute this game to all computers contained inside or out of hospitals or medical centers.
• Not restricting this game to people which have internet access so it is fully available to all of the public.

• This game should target all age groups not just those who are more susceptible to the infection. This is because MRSA has begun to affect age groups that were not initially thought at risk.

• This game needs to be free or cheap.

• The game needs to be implemented quickly (within six months or less) so the amount of cases can start to reduce.

• The game should not unintentionally increase the spread of the infection during implementation.

4.2 SOFTWARE REQUIREMENT ANALYSIS

The hardware required to play this prototype of the game is a mouse. But as mice are also hard to clean, this may also possibly increase dusty areas where MRSA can spread. By implementing this game using a touch screen monitor will be easier to clean.

Flash 8 was chosen as the development environment for this game because it is the most recent version of Flash, it is easily available to the author and the Flash player is easy to obtain because it can be downloaded from the internet and lastly, the Flash player system requirements are not high, so this will reduce the amount of money hospitals need to spend upgrading their computers.

4.3 SYSTEM ANALYSIS AND DESIGN

4.3.1 Top-down method
This method was selected because as you apply it to your design phase it identifies a logical and organised development cycle which can be applied to the coding and testing phase to ensure that all parts have been made and tested (see Appendix F). Using this method, the following current prevention methods were analysed.

Table 5 – Prevention techniques identified and groups they are relevant to

<table>
<thead>
<tr>
<th>Prevention Technique</th>
<th>Groups relevant to</th>
</tr>
</thead>
<tbody>
<tr>
<td>1  Wash hands regularly (before eating/after using the toilet)</td>
<td>Public/Hospital staff</td>
</tr>
<tr>
<td>2  Use sterile, disposable gloves when operating or examining patients</td>
<td>Hospital staff</td>
</tr>
<tr>
<td>3  Use alcohol rub dispensers</td>
<td>Public/Hospital staff</td>
</tr>
<tr>
<td>4  Dressings that create barriers from infection</td>
<td>Hospital staff</td>
</tr>
<tr>
<td>5  Flat Keyboards</td>
<td>Hospital staff/Management</td>
</tr>
<tr>
<td>6  Wearing MRSA destroying uniforms</td>
<td>Hospital staff</td>
</tr>
<tr>
<td>7  Cleaning surfaces and areas thoroughly</td>
<td>Hospital staff</td>
</tr>
<tr>
<td>8  Check under bed for no dust</td>
<td>Public</td>
</tr>
<tr>
<td>9  Avoid sharing objects with post operation patients</td>
<td>Public</td>
</tr>
<tr>
<td>10 Avoid contact with other patients</td>
<td>Public</td>
</tr>
<tr>
<td>wounds/contaminated dressings</td>
<td></td>
</tr>
<tr>
<td>11 Wash hands before and after seeing patients</td>
<td>Hospital staff</td>
</tr>
<tr>
<td>12 Using antiseptic toiletries</td>
<td>Public</td>
</tr>
</tbody>
</table>

The game would focus on the prevention methods because by learning how to prevent the spread of infection the number of MRSA cases should decrease.
As the main task of the game is to create increase awareness of MRSA prevention techniques within the general public, the sub-tasks will be the prevention techniques. Depending on who this game would target (specific age groups, specific professional groups or groups of the general public) would determine the prevention methods focused on for this game.

This game would target the general public, therefore the techniques that will be focused on are:

*Table 6 – Prevention techniques identified and groups they are relevant to*

<table>
<thead>
<tr>
<th>Prevention Technique</th>
<th>Interactions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Wash hands regularly (before eating/after using the toilet)</td>
<td>Use sink in toilets/wash hands</td>
</tr>
<tr>
<td>2 Use alcohol rub dispensers</td>
<td>Use alcohol rub</td>
</tr>
<tr>
<td>3 Check under bed for no dust</td>
<td>Check under to check for dirt/dust</td>
</tr>
<tr>
<td>4 Avoid sharing objects with post operation patients</td>
<td>Take items for patients</td>
</tr>
<tr>
<td>5 Avoid contact with other patients wounds/contaminated dressings</td>
<td>Dialogue with other characters</td>
</tr>
<tr>
<td>6 Using antiseptic toiletries</td>
<td>Use soap after washing</td>
</tr>
</tbody>
</table>
As there is a time limit for the gameplay, not all of the prevention techniques can be included within this prototype. The techniques that were simplest for players to remember after playing the game were included. These were techniques 1, 2, 4 and 6 as shown in table 6. The alcohol rub technique was also included because of its successful trial (see section 1.2.).

The next task was to assess the setting of the game. This game will be set in a hospital environment as people are more likely to contract MRSA here than in any other environment. So the prevention techniques highlighted within this game will be relevant to a hospital environment. After the setting was established, scenarios and assets for each prevention technique were devised. Details of the scenarios can be found in Appendix E. Flow charts of the game and frame navigation were then made (see Appendix F). Preliminary designs of each scene were sketched in order to get an initial idea of each frame (see Appendix E). Characters in each scene were then formulated and any dialogue that the characters had. Lastly, sounds both effects and constant scenes sounds were evaluated and a short list was generated.

4.3.2 Human Computer Interaction

Human Computer Interaction (HCI) provides an understanding of both the human user and the computer system in an effort to make the interactions between the two easier and more satisfying (Faulkner 1998, p1). HCI is used within this project to determine the best way to design the game in order to appeal to different players and to investigate the best course of interaction styles to be used.
4.3.2.1. **Screen Layout**

The screen layout is laid out in a standard way throughout the game. The menu is consistently placed at the top of the screen (see figure 11) so that the player is more likely to remember its location. Any dialogue is displayed in the centre of the menu as changes to scenes are more noticeable in peripheral vision (Smith, 2006). Any changes to the menu will be noticed immediately.

The navigational components (the directional arrows and the ‘close’ symbol) are always placed at the edges of the menu. This is also because changes to scenes are more noticeable in peripheral vision.

![Figure 11 – the first hallway of 'Preventing MRSA'](image)

1 – Navigational arrows

2 – Help Menu shortcut

3 – Door buttons
4 – Object buttons

**4.3.2.2. Colour**

The doors have been coloured brown with transparent squares on them (representing windows) so that the player will recognise they are doors. Familiar colouring has also been used on the fire extinguisher (coloured red), no smoking signs and hospital beds (grey, representing a metal frame). This use of familiar colouring is used to convey the meaning of each object without explaining using text (Oxland, 2004). These are everyday objects so all players should recognise the familiar colours and immediately know what the object is supposed to represent and/or understand its meaning.

The background of this game is split into three colours: white for the information panel, pale yellow for the walls and grey for the floor. These saturated colours were used instead of darker ones so that all objects and text will stand out clearly to the user.

Any messages or dialogue used in this game has been written using dark colours. This is because dark text on a light background is easier to read than light text on a dark background (Smith, 2006).

**4.3.2.3. Font**

Faulkner (1998, p23) suggests that serif fonts are easier to read than sans serif fonts. When reading from printed text, the removed shape from serif fonts decreases speed and accuracy.
Serif fonts are found to be easier to read from computer monitors, although it is argued that depending on what type of font the user is used to seeing, they will find easier to read. This is why a serif font has been used in this game even though this goes against Faulkner’s suggestion.

4.3.2.4. Graphics
So as not to make the game more complex the graphics used to this game will be clearly recognisable by the player. This will make navigating through the game easier for the player to learn.

4.3.2.5. Interaction Styles
There are different types of Interaction styles that will need to be considered throughout the development of this game. These different types are: Initiative, Flexibility, Complexity and Direct Manipulation.

4.3.2.5.1. Initiative
Different types of initiatives are involved with interaction styles: computer initiated, user initiated, variable initiated and mixed initiative (Smith, 2006).

This game has adopted a user initiative. This initiative was selected so that the player will only require a short amount of time to learn to use the game. This will mean the game will have a small amount of text required to be read by the player in order to learn the different functions of the game. This also suggests that the learning period will be shorter.

4.3.2.5.2. Flexibility
Adding levels of flexibility into software allows the differences between user requirements and user preference. But because this game is supposed to target a wide age range it is important that added levels of flexibility, such as short cuts or different movement options, will not confuse the user or increase the learning period. This is especially important in this game as we don’t want to distract the player from the game and have them learning these different flexible options. Although incorporating some shortcut keys into this game will benefit the user, in this release it is not necessary as the prevention techniques are what the player should focus on.

4.3.2.5.3. Complexity

As this game is supposed to be aimed at a wide age range it is important not to over-complicate the game. As in section 4.6.5.3 we do not want the player to be distracted learning how to control and navigate through the game and not focus on the prevention techniques that they should be learning.

4.3.2.5.4. Direct Manipulation

Faulkner (1998, p23) states that direct manipulation is a type of interaction that provides a continuous graphical representation of current objects of interests that are physically manipulated by some sort of pointing choice. Faulkner (1998, p79) also states that direct manipulation also reduces that learning time required and is more visually appealing. This is why direct manipulation has been used instead of ‘normal’ buttons when designing the functionality and navigation of this game. Objects from the library have been converted to buttons in order to incorporate direct manipulation into this game. When using normal buttons text descriptions and labels have to be used in order to explain the use of the button. This increases the time a player requires to learn to play the game.
4.3.2.6. **Navigation and controls**

The navigation in this game is determined by the directional arrows placed at the edges of the menu panel. Additionally in some scenes there may be a ‘close window’ object which allows the player to exit the current scene and return to the previous scene (see Appendix F).

The game has been designed to use a mouse to interact with objects of the game. It is not mouse button specific so whether the player is left or right-handed they will be able to play this game.

4.3.2.7. **Feedback**

Feedback provides players with positive and negative information as they play. It lets them know if they are continuing on the right track (Faulkner, 1998).

Feedback in games is usually visual and audio based. The visual feedback used in this game is provided by different visual components. The confirmation text will be shown whenever a player hovers over a button. This will inform the player the consequence of their action and will provide them in-game information as they need it.

The clock which counts down shows the player that they have a set amount of time in order to solve the scenario’s problem. It also gives the player a sense of urgency and makes them panic about what will occur when the clock finishes counting down.

Other forms of visual feedback are the messages provided to the player via the ‘message output’ box. These messages are worded as hints and are intended to
guide the player in the correct direction through without walking them through the game.

4.4 CODE GENERATION

The following workflow was followed during the code generation phase:

1. Make scenes – reception, hallway 1, hallway 2, bed area, toilets, rub dispensers, lunch cart, death, main menu, game complete, health booklet and help menu.
2. Make assets
3. Make characters
4. Make buttons
5. Make movie clips
6. Make dialogue
7. Code sections
   a. When buttons have been pressed, add confirmation messages.
   b. Make sure the player cannot enter Hallway 1 unless they have read the health booklet. If they try to, display a HINT.
   c. Once booklet has been read allow player to move to Hallway 1. Show message so player knows they can move on.
   d. If the player tries to enter Hallway 2 or Bed Area without using the alcohol rub, start the stop clock and put a HINT to assist player of what to do. If player uses the alcohol rub, then increase their health score.
   e. Show health message.
   f. If player uses toilet and exits toilet without washing their hands, start the stop clock and provide a HINT message.
g If player exits toilet and only uses the sink, increase health score by 10. If player exits the toilets and uses the sink and soap dispenser, increase score by 35. If player exits the toilets and uses the sink, hand dryer and soap dispenser, increase score by 55. Show health message.

h Stop player from increasing health score by repeatedly selecting the soap dispenser, sink, alcohol rubs or hand dryer by putting checks on these assets.

i Attach sounds to the toilet assets.

j When entering Bed Area and speaking to old woman dialogue starts. Make the wrong answer go to death scene and right answer show health message.

k After the toilet, rub and old woman scenarios and completed, change bed area to lunchtime.

l Check alcohol navigation from this point and back to the lunchtime scene.

m If player clicks on trolley and selects food without washing hands, don’t let them take any food.

n Make appropriate checks on the sink, hand dryer and soap dispenser.

o Once player has completed scenario, show health message.

p Go to game complete screen.

Aspects used to cheat and increase their health score by continually pressing one asset were considered, so checks were placed on the assets which rewarded the player with increased health scores. This stopped them from receiving the reward more than once.
4.5 TESTING

Galin (2004) states there are a number of software testing strategies (p179). A black box testing strategy has been applied to this game. Galin cites that the following IEEE (1990) definition regarding Black box testing. “(1) Testing that ignores the internal mechanism of a system or component and focuses solely on the outputs generated in response to selected inputs and execution conditions. (2) Testing conducted to evaluate the compliance of a system or component with specified functional requirements.” (p187).

As this project focuses on the player’s interaction and the impact that this game has on the player’s behaviour instead of internal mechanisms, a similar output correctness test will be performed on this game. As the player will can complete the different scenarios it is important that the test cases cover all possible in outcomes.

The way that this phase was attempted was to split it into scenes and to first test the different asset functions, i.e. check all the buttons work and take the player to the correct scene, check movie clips were playing and stopping correctly and that scenarios were performing accurately (see Appendix G).

During the development of this game a few errors were encountered. Firstly, when interacting with the old woman and selecting an option (either ‘yes’ or ‘no’) the selection was saved. But if you started the game again and tried to select the other option, the game would carry out the opposite choice. This was solved using the code below:
on(release)
{
    if (_root.yes > _root.no)
    {
        _root.yes = 0;
        _root.gotoAndPlay(6);
    }
    if (_root.yes < _root.no)
    {
        _root.no = 0;
        this._parent.gotoAndPlay(1);
    }
    else
    {
        this._parent.gotoAndStop(1);
    }
}

After selecting one of the options, i.e. ‘yes’, this would set the yes variable to 1. When the player then presses the ‘close scene’ button, two ‘if’ statements are carried out. If yes is bigger than no then the player is brought to the death scene and the yes variable is then reset. The second if statement carries out the same function on the ‘no’ option, but brings the player back to the bed area.

Secondly, if the player completed the alcohol rub scenario so the clock stopped at 5 seconds, once player entered the toilet scenario the clock would continue to count down from 5 seconds reducing the player’s time limit to solve the scenario. This was solved by the code below:
if(_root.scenarioRub == "complete")
{
    _root.gotoAndStop(4);
}
else if (_root.scenarioLunch == "start")
{
    this._parent.clockHallway1.stop();
    this._parent.clockHallway1._visible = false;
}
else
{
    this._parent.clockHallway1._visible = true;
    this._parent.clockHallway1.gotoAndPlay(1);
}

Whenever a scenario was entered it made the clock visible and started the clock from frame 1 of the movie clip so that the player had the full 10 seconds to solve the scenario.

Lastly, when playing through the lunch scenario, and selecting any of the assets in the toilet to complete the scenario, instead of outputting one message, the message would be output twice. This was solved using the code below:

on(press)
{
    if (_root.scenarioToilets == "complete" && scenarioLunch != "start")
    {
        _root.sink = "used";
        trace("oldYou wash your hands in the sink.");
    }
    if (_root.scenarioToilets == "started")

{ 
    this._parent.clockHallway2.stop();
    this._parent.clockHallway2._visible = false;

    _root.healthScore = _root.healthScore + 10;

    _root.scenarioToilets = "complete";
    _root.sink = "used";
    trace("You wash your hands in the sink.");

    this.gotoAndPlay(2);
}

if(_root.scenarioToilets == "complete" && _root.scenarioRub == "complete" &&
   _root.scenarioWoman == "complete" && _root.scenarioLunch == "start")
{
    if (_root.scenarioLunch == "start")
    {
        _root.hands = "washed";

        _root.healthScore = _root.healthScore + 10;
    }
}
}

The problem was that both of the statements were being entered so both messages were being output. By re-ordering the code, only one message was output to the player.

### 4.5.1 Evaluation Methods
Evaluation methods can be applied at various stages in the development lifecycle: analytic, expert, observational, survey and experimental.

For every evaluation carried out, certain usability goals must be defined in order to judge the success of the evaluation. This game has the following goals:

- 95% of players should rate the design of the game as 3 or more on a 5 point scale where 1 = bad and 5 = excellent.
- 95% of players should rate the game easy to use as 3 or more on a 5 point scale where 1 = bad and 5 = excellent.
- 80% of players should feel that playing this game has increased their awareness of MRSA and the prevention techniques.

Usability information is required from the users to determine how their current level of knowledge will affect how critical they are when participating in an evaluation of the game, for example if they have a background in medicine or games.

The usability information that is required for this game is the age of participants, their level if knowledge about MRSA and the how familiar they are playing a game.

The participant age is required because it may take longer for an older player to learn how to navigate through the game if they’re not used to playing computer games.

4.5.1.1. Survey Evaluation

This usability evaluation will be used to evaluate the system during the testing phase of development. Survey evaluation requires participants; therefore, it is important that participants used are representative of the intended players. If any
changes are made to the game as a result of this evaluation, the changes will positively affect the players’ use of the game.

It is also important that the participants are tested in an environment similar to where the game will be played. This is so the player can evaluate what using the game in that type of environment is like and so appropriate adjustments to the system can be made according to any distractions in the environment.

Any evaluation method that requires participants should also use a large number of participants. Carrying out an evaluation with a larger number of users will yield more data and should detect anomalous results more easily than with a smaller number of users. The more participants you use, the better your results, however, the cost for using a large amount of people in evaluating this game at this level is not limitless. Therefore a sensible amount of participants should be used in order to gain accurate results and also staying within budget.

Survey evaluation gains opinionated results and will highlight participants attitudes towards the system (see Appendix C).

4.6 MAINTENANCE

If this project was successful and was to be introduced into hospitals the issue of maintenance will arise. The information used to construct this prototype may get out of date (or if new scenarios are to be added) so it will need to be updated. The easiest way to overcome this minor maintenance problem is for a team or system to be set in place to have the knowledge and skill about how to update this game. To
assist with this eventuality any areas of code that are not clear have been commented.

Although a thorough test plan was applied, if any undiscovered errors occur the initialisation variables are all set within the ‘actions’ layers on the main time line so that the person fixing the errors knows how many variables are included in this game.

4.7 SUMMARY OF SOFTWARE DEVELOPMENT

As there was no standard design methodology to apply to the development of this game the SDLC was applied. This method was a suitable choice as the waterfall model meant that all aspects of one phase were analysed and thought through before advancing to the next phase. But when the Code Generation phase was reached, it was more effective to develop one section of the game and then test all of the features within that section before proceeding to develop the next part. This was because the error messages from Flash are not very accurate when highlighting incorrect syntax. If one section is made then tested it is easier to pin point and correct the incorrect syntax. This type of iterative method (developing then testing) was very effective and reduced the amount of time spent during the testing phase.

In order to provide feedback to the player by confirming any buttons clicked, confirmation messages were generated. But, to reduce the size of the game and to utilise the existing functions in Flash, these messages were fed back to the player via the Flash output window. Presenting these messages in the output window still convey the same information and provide the same feedback to the player.

In conclusion, the development of this game was successful and completed to schedule.
5 RESULTS AND DISCUSSION

5.1 OUTCOME

The initial objectives for this game were to:

- To increase awareness about MRSA, in particular:
  - How and where MRSA can be contracted
  - Prevention methods used for MRSA
- To produce a game that appeals to both adults and children in terms of quality and design.
- To produce a game that is easy to learn by both adults and children

The first objective was to increase awareness about MRSA focusing on how and where it can be contracted and the prevention methods used against MRSA.

This project has highlighted that MRSA can be contracted both in hospital environments and in home either by direct contact with the bacteria or by contact with carriers. Although this project outlined these facts, the game didn’t focus on this type of information as it was felt that to provide the player with this information would distract them from learning about the prevention techniques. As it would be the prevention techniques being used to reduce the spread of MRSA, the focus was taken off of the history of MRSA and placed on the prevention techniques. In this game four simple prevention techniques were covered in four scenarios for the participants to complete.
My pre-test results showed that over 53% of the people that took part in the survey were not aware of the prevention methods used within hospitals. Another survey was taken after the game was developed and played. In this survey, 100% of the participants answered that playing this game taught them about the prevention methods of MRSA (see figure 12).

![Figure 12 - Has this game taught you about the prevention methods of MRSA?](image)

Although ways of contracting MRSA were not made clear to the players, it would suggest that if the prevention methods were not followed that they could contract MRSA. For example, the first scenario is to clean your hands with the alcohol rub before you enter the hospital ward. The fact that if you do not clean your hands by the time the time limit expires, you die suggests to the player that this is a possible way of contracting MRSA.

5.2 SUITABILITY OF THE USER INTERFACE AND HCI ASPECTS
The second objective was to produce a game that appealed to both adults and children. A wide range of ages took part in the post test survey to see whether this objective was achieved. This objective was judged using the following usability goals and applying them to the results gathered from the post-test survey carried out:

- 95% of players should rate the design of the game as 3 or more on a 5 point scale where 1 = bad and 5 = excellent.
- 95% of players should rate the game easy to use as 3 or more on a 5 point scale where 1 = bad and 5 = excellent.
- 80% of players should feel that playing this game has increased their awareness of MRSA and the prevention techniques.

**Design**

47% of the participants of the post test survey were 20 years old or older. So the results would not be biased towards any age group.

100% of the post-test survey participants answered that their opinion of the screen layout was 3 or above, however, some of the comments by the older participants suggested that they would prefer a 3D design for the game as the 2D version looked as though it was aimed at a younger audience and not a variety of ages (see figure 13).
Another aspect that was commented on was the arrows used in the Help Menu. One participant was confused with the labelling used on the arrows (see figure 14). They found that the arrow pointing to the left was noted as the next arrow and the arrow pointing to the right as the previous arrow. Usually the arrow pointing to the left is assumed to be the previous arrow because it is pointing backwards, but as the scenes are arranged so that you have to go towards the left direction to get to the next scene, without knowing the initial layout of the game, this may confuse the player.

Another comment made was that in the Lunchtime scenario, you are advised to clean your hands before you eat. This is slightly misleading, as some of the
participants stated that because you are not specified what to clean your hands with, they assumed that using the alcohol rubs in the bed area would suffice. When they found they could not move on, it delayed them completing the game, as they thought that this was an error.

**Gameplay and ease of use**

The final objective was to produce a game that would be easy to learn by both adults and children. As there were a range of ages participating with the post test survey this was a reliable mix of ages to evaluate whether this objective was achieved.

*Figure 15 - How easy was the game to use on a scale of 1 to 5, where 1 is extremely difficult and 5 is extremely easy.*

As this game was aimed at all ages and experience (in terms of gameplay), the complexity of the game would have to be low (see figure 15), however, although this game was rated as easy to use by all of the participants, this made the gameplay suffer. The design was focused too much on the prevention tasks instead of finding a balance between the prevention tasks and a suitable level of gameplay. This would keep more experienced players satisfied and interested. Instead, over 90% of the participants found the game boring (see figure 16).
Participants also commented that the game didn’t last very long (see figure 17). This could be a problem because even though over 71% of the participants in the post test survey answered that they will remember to adopt these techniques if the game was too easy they will not fail, therefore they won’t learn anything. Although, because the simplest methods were chosen there is a good chance that they will remember these techniques. A further post survey would need to be conducted in order for this to be proved.

As this game was not tested on participants within a hospital environment it is difficult compare the amount of improvement my game has over the techniques and methods currently being used, however, 71% of the participants answered that by playing this game they will remember and adopt these prevention techniques. A further survey should be carried out to prove that these techniques are easy to remember and that the participants’ behaviour did change as a consequence of playing this game.

5.3 LIMITATIONS OF THE SOLUTION

There are some limitations to this game. The output messages are only visible when using the flash environment, so this prototype can only be played through
Flash. If this version of the game was to be used in hospitals it would require a license to be bought from macromedia as the flash player does not show the output window.

The fact that this prototype was developed in a 2D environment did not appeal to some of the older players. They thought that the game seemed to be aimed at a younger audience even though the adults did like the layout.

The game provided limited feedback to the player as there was only visual content and no sounds or sound effects.

The player can only view their health score at the end of the game. This means they cannot keep track of their progress throughout the game. If they can see what actions they perform will help them increase their health score, they will learn and remember these ways of increasing their score and do it more. As the health scores are only rewarded for prevention tasks being carried out correctly this will teach them the prevention techniques for MRSA as they will repeatedly play through the game to increase their score.

The level of complexity is too easy and although some of the older participants played the game the gameplay was rated as 3 or below.

### 5.4 ERROR PREVENTION

The error prevention used in this game is linked to the messages output to the player. For example, to prevent the player from walking around the hospital and ignoring the receptionist and the health booklet in Reception, a check has placed in the arrow to the next scene. This limits the choices of where the player can go and guides them to the correct way of entering the hospital. To make sure that they know they must remain in that area until they have completed what they need to, a message is output to the player. Instead of an unexpected event occurring, such as
being taken to the wrong scene, the message output to the player is used in this place.

In the event that players will complete the game and then start again automatically from the Main menu, all of the variables are reset when any of the exit routes are used. This again, avoids unexpected occurrences for the player.
6 CONCLUSIONS/FUTURE WORK

6.1 SUMMARY OF RESULTS

The initial aim of this project was to show players how to prevent getting infected from MRSA. The initial objectives of this project were to increase awareness about MRSA, in particular how and where MRSA can be contracted and the prevention methods used for MRSA. To produce a game that appeals to both adults and children in terms of quality and design and to produce a game that is easy to learn by both adults and children.

The usability goals that were assessed via survey evaluation are to determine whether objective 2 was achieved were:

- 95% of players should rate the design of the game as 3 or more on a 5 point scale where 1 = bad and 5 = excellent.
- 95% of players should rate the game easy to use as 3 or more on a 5 point scale where 1 = bad and 5 = excellent.
- 80% of players should feel that playing this game has increased their awareness of MRSA and the prevention techniques.
Objective 1 (Usability Goal 3)

Although the game did not include how and where MRSA can be contracted, the game was evidently successful in informing the players about the prevention techniques used as 100% of the participants in the post test survey answered ‘yes’ to this question. This is compared to the 53% of participants from the pre test survey who didn’t know about the current prevention techniques used in hospitals. The third usability goal was that 80% of players should feel that playing this game had increased their awareness of MRSA and the prevention techniques. This goal was fulfilled.

Objective 2 (Usability Goals 1 and 2)

As 100% of the participants in the post-test survey rated the design of the game as 3 or more, this fulfilled objective 2. The first usability goal was that 95% of players should rate the design of the game as 3 or more on a 5 point scale where 1 = bad and 5 = excellent and the second usability goal was that 95% of players should rate the game easy to use as 3 or more on a 5 point scale where 1 = bad and 5 = excellent. From the post test survey, the participants rated the game as 3 or more. This fulfilled the first and second usability goals.

Objective 3

The last objective, which was for the game to be easy to learn to use was also fulfilled as 100% of the participants in the post test survey rated the game as 3 or more.

In conclusion, the aim and objectives were achieved, but in order to appeal to a wide age range the level of complexity has to be raised.
6.2 FUTURE WORK

This version of the game proved quite successful in achieving all of it’s aims and objectives, however, in order to appeal to a wider age range and a more experienced game player, the following additions could be made.

Alternative Evaluation methods

Another evaluation method that could have been used was observational evaluation. This form of evaluation method can be used in future work to further prove whether this game was successful. An observational technique that could be used is Video Recording. This involves three cameras filming the participants: one focused on their hand, one on their face and one on the screen. It could be used to gather attitudes towards the interface and gameplay experienced by the player captured via the camera focused on their face. This type of evaluation would provide results at the time of use and will be very reliable because having a time delay between using a product and evaluating it by a survey may mean some details are forgotten. Also participants aware that they are being recorded may act differently. This is known as the Hawthorn effect (Smith, 2006). This passes once the participant gets used to the cameras and accurate results can then be gained, but it is not certain when this point is so there is no way of knowing when accurate results are being gained, however, using this technique is more accurate than Direct observation.

Another technique that could be used is Software Logging. This captures the keystrokes of a program. Participants are not aware of this so Hawthorn’s effect does not affect the participants. Using a combination of these techniques used will
mean that the usability goals can be evaluated fully to see whether they have been achieved.

Conversion to 3D
Developing the game in a 3D engine will appeal more to the adult audience. This will mean that more people will receive this information about prevention techniques and the continual increase of MRSA may decline.

After a revised version is produced, prototype should be tested within a hospital environment to ascertain the response of staff and patients regarding the game. It will also keep visitors entertained and be able to be tested by a large number of people. This hospital could then be used as a test subject to see whether the introduction of the game into the hospital has had a positive effect on the number of MRSA cases diagnosed.

More Interaction
More ways to interact with the environment and characters in the hospital should be introduced. This will make the structure of the game more flexible and interesting to the player.

Levels of Difficulty
Introducing levels of difficulty into the game will encourage players to continue playing in order to reach and complete these more difficult levels. It will also target different experienced game players, so the less experienced players can still learn about the prevention techniques while the experienced players don’t get bored by the simplicity.
Where to place the game later – hospitals, gp surgeries

**Prevention Techniques**
As this version of the game didn’t take a long time to complete, adding more prevention techniques to the game would increase the completion time and also introduce the player to alternative methods of preventing the spread of MRSA.

**Sounds and effects**
Adding sounds and effects to this game will increase the amount of feedback to the player providing them with more information about their progress throughout the game. Using sound effects may also reduce the amount of message output to the player. For example, if a certain sound was used to symbolise that the player cannot not progress any further until a certain action is performed. Also, the clock ‘ticking’ will continually remind the player that they only have a limited time in order to solve the problem in the scenario, this will provide the layer with a sense of urgency and may increase their excitement when playing the game. This should not be made an essential feature of the game so any players that may have hearing disabilities, will still be able to complete the game.

**Visual Health Meter**
By placing the health meter constantly on the screen the player can monitor what actions they need to perform in order to help them increase their health score. As the health scores are only rewarded for prevention tasks being carried out correctly this will help them learn the correct ways to perform the prevention techniques.

**Different Environments**
As MRSA can be contracted from different environments other than hospitals, it would be illustrate this fact better to the public if the game was placed in different environments other than hospitals. This will make them more aware of superbugs outside of hospitals and will encourage them to use the prevention techniques more often.
REFERENCES


A   APPENDIX A MRSA QUESTIONNAIRE

This is a questionnaire to ascertain the amount of knowledge the general public has about MRSA, the prevention and treatment methods used to control it.

This is being carried out as a primary source of information for the final year project Game-based Learning: Helping to prevent the spread of MRSA.

These questionnaires are anonymous. All the information used in this questionnaire will be solely used in this project and will not be passed to any third party organisations.

I understand that some of these questions relate to sensitive information, so you are free not to answer any questions that you feel uncomfortable with, however, I will appreciate it if you can answer all questions to the best of your ability as it will provide me with more reliable and a wider range of information.

Thank you for taking the time to take part in this questionnaire. Please ensure that this questionnaire is returned to the person that issued it to you. This is to ensure that all information is accounted for and that I gather can collate the results more quickly.

I apologise if any of the questions were emotionally difficult to answer.
Section 1 – General Information

1  What age range do you lie within?
   Under 20  □  20 – 29  □  30 – 39  □
   40 – 49  □  50 and over  □

2  What is your profession?
   ____________________________________________

3  Have you heard about MRSA? (If yes, go to question 3a. If no, please go to section 6).
   Yes  □  No  □

   a  Where did you hear about it?
   ____________________________________________

4  Do you know where you would obtain information about MRSA?
   Yes  □  No  □

5  Do you know when MRSA was discovered?
   Yes  □  No  □
Section 2 - Contraction

6 Did you know what it means to be a ‘carrier’ in terms of MRSA?
   Yes ☐ No ☐

7 Do you know how MRSA is contracted?
   Yes ☐ No ☐

8 Do you know who is most likely to be infected by MRSA if exposed to it?
   Yes ☐ No ☐

Section 3 – Treatment and prevention methods

9 MRSA can also be contracted inside the home. Do you know what methods you
   can use to prevent the spread of MRSA in your home?
   Yes ☐ No ☐

10 Do you know about the current methods being used to prevent the spread of
    MRSA in hospitals?
    Yes ☐ No ☐

11 Do you know the current methods used to treat MRSA?
    Yes ☐ No ☐

Section 4 – Your contact with MRSA
12 Have you ever been infected with MRSA? (If no, go to question 14).

Yes ☐ No ☐

a Do you know what treatment methods were used? (If no, go to question 12c).

Yes ☐ No ☐

b What treatment methods/techniques were used?

- Antibiotic cream ☐
- Antiseptic lotion ☐
- Antiseptic shampoo ☐
- Course of antibiotics ☐
- Other ________________________________

13 How long did it take for you to recover?

- Under a month ☐
- 1 to 2 months ☐
- 2 to 3 months ☐
- 3 to 4 months ☐
- 4 to 5 months ☐
- 5 to 6 months ☐
- Over 6 months ☐

13 Do you know anyone that has had MRSA? (If yes, go to question 15).

Yes ☐ No ☐

a Do you know what treatment methods were used? (If yes, go to question 13c).

Yes ☐ No ☐
b What treatment methods/techniques were used?

- Antibiotic cream □
- Antiseptic lotion □
- Antiseptic shampoo □
- Course of antibiotics □
- Other ________________________________________________________

c Did they recover? (If no, go to section 6)

- Yes □
- No □

d How long did it take for them to recover?

- Under a month □
- 1 to 2 months □
- 2 to 3 months □
- 3 to 4 months □
- 4 to 5 months □
- 5 to 6 months □
- Over 6 months □

Section 5 – MRSA Background Information

Methicillin-resistant Staphylococcus aureus (MRSA) is a bacterium from the Staphylococcus aureus (SA) family.

SA is a common bacterium found on the surface of people’s skin or in their noses. This can occur without the carrier contracting an infection, however, if the bacterium manages to break through the skin it can cause infections, such as boils. If the bacterium enters the bloodstream, being now able to spread to all areas of the body, the effects can be more severe, such as septicaemia, meningitis and
pneumonia. According to the NHS Direct Health Encyclopedia, 2006, approximately 1 in 3 people are carriers of this bacterium. These patients are known as being ‘colonised’ with the bacterium.

Most types of SA can be treated with methicillin (a type of penicillin), however, there are some types that can have developed a resistance to methicillin. These are known as MRSA.

To prevent the contracting MRSA you can do the following simple things:

A2 Regularly wash your hands after using the toilet and before eating.

B2 Regularly dust and clean your homes as MRSA can spread in dusty surfaces.
What age range do you lie within?

What is your profession?
Have you heard about MRSA?

Where did you hear about it?
*Do you know where you would obtain information about MRSA?*

*Do you know when MRSA was discovered?*
Do you know what it means to be a ‘carrier’ in terms of MRSA?

Do you know how MRSA is contracted?
Do you know who is most likely to be infected by MRSA if exposed to it?

Do you know what methods you can use to prevent the spread of MRSA in your home?
Do you know about the current methods being used to prevent the spread of MRSA in hospitals?

Do you know the current methods used to treat MRSA?
Have you ever been infected with MRSA?

Do you know what treatment methods were used?
What treatment methods were used?

How long did it take for you to recover?
Do you know anyone that has had MRSA?

Do you what treatment methods were used?
What treatment methods/techniques were used?

Did they recover?
How long did it take them to recover?
C APPENDIX C USABILITY QUESTIONNAIRE

This is a questionnaire to ascertain whether the game has made the player more aware of MRSA and the prevention techniques they should use when entering hospitals, whether they are satisfied with the design of the game and whether playing this game will lead the player to use the prevention techniques.

This is being carried out as a primary source of information for the final year project Game-based Learning: Helping to prevent the spread of MRSA.

These questionnaires are anonymous. All the information used in this questionnaire will be solely used in this project and will not be passed to any third party organisations.

I will appreciate it if you can answer all questions to the best of your ability as it will provide me with more reliable and a wider range of information.

Thank you for taking the time to take part in this questionnaire. Please ensure that this questionnaire is returned to the person that issued it to you. This is to ensure that all information is accounted for and that I gather can collate the results more quickly.
Section 1 – General Information

1 What age range do you lie within?

- Under 20 □
- 20 - 29 □
- 30 – 39 □
- 40 – 49 □
- 50 and over □

2 What is your profession?

___________________________________

3 Have you played a serious game before?

- Yes □
- No □

Section 2 – Ease of Use

4 Did you find the game easy to use?

- Yes □
- No □

a Please indicate how easy the game was to use by circling the appropriate number below.

<table>
<thead>
<tr>
<th>Extremely Difficult</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>Extremely Easy</th>
<th>5</th>
</tr>
</thead>
</table>
5 How long did it take you to learn how to navigate through the game?

- Under 1min □
- 1 – 2mins □
- 2 – 3mins □
- 4 – 5mins □
- More than 5mins □

6 Did you find it easy to identify all of the objects?

- Yes □
- No □

Section 3 – Design and Layout

7 Did you find the labelling on the buttons clear?

- Yes □
- No □

8 Please indicate your opinion of the screen layout by circling the appropriate number below.

<table>
<thead>
<tr>
<th>Not appropriate</th>
<th>Just Right</th>
<th>Very appropriate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>5</td>
</tr>
</tbody>
</table>

9 What is your opinion about the size icons used?

- Too small □
- Just Right □
- Too Big □

10 What do you think about the size of the labelling used?
Too small □ Just Right □ Too Big □

11 What do you think about the font size used?

Too small □ Just Right □ Too Big □

Section 4 – Errors

12 Did everything behave as you expected? (If yes, go to question 14).

Yes □ No □

13 Did any errors occur when you were using the game? (If yes, go to question 13a).

Yes □ No □

a How many errors occurred?

1 □ 2 □ 3 □ 4 □ 5 □ 6 □ 7 □ 8 □ 9 □ 10 or more □

Section 5 - Mistakes

14 Has this game taught you about the prevention methods of MRSA?

Yes □ No □
15 Do you think that by playing the game you will remember and adopt these prevention techniques?

Yes □  No □

16 How long did it take you to complete the game?

Less than 10 minutes □  10 – 20 minutes □
20 - 30 minutes □  More than 30 minutes □

17 Did you find that reading the health booklet helped you to solve the problems of each scenario?

Yes □  No □

18 Please indicate how helpful the health booklet was by circling the appropriate number below.

<table>
<thead>
<tr>
<th>Not Helpful at all</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>Very Helpful</th>
</tr>
</thead>
</table>

19 How would you describe the gameplay?

<table>
<thead>
<tr>
<th>Very Boring</th>
<th>Boring</th>
<th>An even balance</th>
<th>Exciting</th>
<th>Very Exciting</th>
</tr>
</thead>
</table>
20 Did you think the environment was appropriate for this issue?

  Yes  □  No  □

Please use the space below to add any other comments:

Thank you for taking the time to fill this in.
E  APPENDIX E DESIGN AND DEVELOPMENT DOCUMENTS

INTRODUCTORY MATERIAL
This will be the MRSA booklet that the player will receive when sitting in the waiting room.

CLOSING MATERIAL
A summary screen showing the players score in each scenario and a health message after each score, either stating what they could do to improve their score or congratulating them on a perfect score.
SCENARIOS

Scenario 1

TASK - Before getting into bed, player must use alcohol gel dispenser to clean hands.

1 Play animation of player going to bed without using alcohol dispenser.
2 Splash screen of health message shown.
3 Then die.
4 Start scenario.
5 TIME LIMT - Find what you can use in the room to protect them from the MRSA bacterium.
7 Congratulations message.

IF COMPLETED SUCCESSFULLY... - If the player uses the dispenser their health score will increase (health message shown).

INTERACTIONS - Use gel dispenser

Scenario 2

TASK - Before getting into bed, check under bed and around on surfaces for dust. Player must alert nurse if dust found (health message shown).
1 Play animation of person getting into bed.
2 Splash screen of health message shown.
3 Then die.
4 Start scenario.
5 TIME LIMIT starts – Find what to use
6 Player clicks on ‘check under bed’.
7 Goes to frame of a dusty floor under bed.
8 Return to BED AREA frame and player presses button to call nurse.
9 Nurse comes in and cleans dust (animation).

IF COMPLETED SUCCESSFULLY… - If the player checks under the bed their health score will increase. If the player alerts the nurse their health score will increase.

INTERACTIONS - Press button (to call nurse).
Look under bed

**Scenario 3**

TASK - When the toilet meter goes red, the player must go into toilets. The player must then go into the cubicle and use the toilet. Once they have exited the toilet, the player must wash their hands using the antiseptic soap dispenser and turn the taps on. Turn the taps off and exit the toilets (health message shown).

1 Play animation of needing to go to the toilet and not washing hands..
2 Splash screen of health message shown.
3 Then die.
4 Start scenario.
5 TIME LIMIT starts – Find what to use.

6 Press soap dispenser. Play animation of pressing soap dispenser and rubbing hands.

7 Turn taps. Play sound of running water. Play animation of turning taps on and rubbing hands under water (two different animations – one with soap, one without soap).

8 Turn taps. Stop sound of running water. Play animation of turning taps off.

9 Use hand dryer. Animation of drying hands.

10 Exit toilets and go into bed.

IF COMPLETED SUCCESSFULLY... - If the player uses the toilet their health score will increase. If the player washes their hands their health score will increase. If the player uses the antiseptic soap before washing their hands, their health score will increase.

INTERACTIONS - Use toilet
Use soap dispenser
Turn taps on
Turn taps off

Scenario 4

TASK - The player goes back to the bed and a nurse will come to examine you. The player must watch to see if the nurse cleans her hands with the alcohol gel. The nurse will not clean her hands and before she examines you she will ask if it is alright to examine you (yes/no). If the player answers no, the nurse will then ask what the problem is. It is here the player can ask the nurse to clean her hands and
she will go and clean them. She will then examine the player (health message shown).

1 Play animation of nurse coming in and walking towards bed.
2 Splash screen of health message shown.
3 Then die.
4 Start scenario.
5 Nurse – “Hi [player]. I’m just going to do a quick examine. Is that alright?”
6 Player – If ‘Yes’, then die. If ‘No’, then continue conversation.
7 Nurse – “Is there a problem?”
8 Player – If ‘No’, then die. If ‘Yes’, continue with conversation. “Can you please use the alcohol rub before you examine me?”
9 Nurse – “Of course.”
10 Play animation of nurse walks to alcohol gel dispenser and presses it. Nurse rubs her hands and walks back to examine [player].

IF COMPLETED SUCCESSFULLY... - If the player says the nurse cannot examine them their health score will increase. If the player states correctly what the problem is their health score will increase. The player must get both correct in order for their health score to increase.

INTERACTIONS - Say you’re not alright

Say if there’s a problem

**Scenario 5**
TASK - The player can speak to the old man in their room. He will tell you why he’s in hospital and that he’s just came in from an operation. He offers you his newspaper/magazine to read. Player has the option of accepting or declining the newspaper. Player should not take the newspaper (health message shown).

1. Play animation of talking to old man and taking magazine.
2. Splash screen of health message shown.
3. Then die.
4. Start scenario.
5. Player – “Hi.”
6. Old man – [moaning about magazine]
7. Player – “Are you alright?”
8. Old man – “What are we going to do with this Health Minister?” Play animation of old man putting down magazine. Old man introduces himself and says that [player] can have his magazine.
9. Player – If ‘Yes please’, then die. If ‘No thanks. I don’t like reading magazines it depresses me’, continue scenario.
10. Play animation of player walking back to bed.

IF COMPLETED SUCCESSFULLY... - If the player doesn’t take the newspaper their health score will increase (the player gives an excuse why he’s rejecting the paper).

INTERACTIONS - Speak to old man

Scenario 6
TASK - Player goes back to own bed. Lunch cart is brought around. The old man gets served. While the old man is getting served the player must proceed to the toilets to wash their hands. Once their hands are washed they can choose some lunch.

1. Play animation of talking to old man and taking magazine.
2. Splash screen of health message shown.
3. Then die.
4. Start scenario.
5. Lunch cart is brought in by nurse and nurse walks to old man.
6. Play animation of old man talking to nurse.
7. Player walks to the toilet. TIME LIMIT starts – Find what to use.
8. Play animation of pressing soap dispenser and rubbing hands.
9. Turn taps. Play sound of running water. Play animation of turning taps on and rubbing hands under water (two different animations – one with soap, one without soap).
11. Use hand dryer. Animation of drying hands.
12. Exit toilets and walk towards lunch trolley.
13. Goes to frame of lunch trolley so that player can select food, frame changes to BED AREA frame and game ends.
14. Summary screen appears about the player’s health status at the end of the game.

IF COMPLETED SUCCESSFULLY... - If the player washes their hands their health score will increase.
If the player uses the antiseptic soap before washing their hands, their health score will increase.

INTERACTIONS - Pick up <food>

The scenarios in bold and underlined are extra scenarios designed for expanded versions of this game.
FRAME SKETCHES

Main Menu

Health Messages
Table Alcohol Rubs

Bed Alcohol Rubs
Lunch Trolley

Help Menu
<table>
<thead>
<tr>
<th><strong>ASSETS LIST</strong></th>
<th>Movie Clip</th>
<th>Button</th>
<th>Graphic</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Food and drink</strong></td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
<td></td>
</tr>
<tr>
<td>(sandwiches, roll, orange juice, bottle of water)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Cutlery</strong></td>
<td></td>
<td>![Checkmark]</td>
<td></td>
</tr>
<tr>
<td>(forks, knives, spoons, bowls, plates and napkins)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Newspaper</strong></td>
<td></td>
<td>![Checkmark]</td>
<td></td>
</tr>
<tr>
<td><strong>Magazine</strong></td>
<td></td>
<td>![Checkmark]</td>
<td></td>
</tr>
<tr>
<td><strong>Lunch cart</strong></td>
<td>![Checkmark]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Folder with medical notes</strong></td>
<td>![Checkmark]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Soap dispenser</strong></td>
<td>![Checkmark]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Toilet cubicles</strong></td>
<td>![Checkmark]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Toilet roll</strong></td>
<td>![Checkmark]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Sink</strong></td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
<td></td>
</tr>
<tr>
<td><strong>Hospital bed</strong></td>
<td>![Checkmark]</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Alcohol rub dispenser</strong></td>
<td>![Checkmark]</td>
<td>![Checkmark]</td>
<td></td>
</tr>
<tr>
<td>Item</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>-------------------------------</td>
<td>---</td>
<td>---</td>
<td>---</td>
</tr>
<tr>
<td>Hospital chairs</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Small table</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Stack of magazines</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Hospital map</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Drinks machine</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Plant</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Toilet Door</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Payphone</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Ward sign</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Reception desk</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>MRSA booklet</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Hand dryer</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Toilet sign</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
<tr>
<td>Leaflets holder</td>
<td></td>
<td></td>
<td>✓</td>
</tr>
</tbody>
</table>
POSSIBLE CHARACTERS

1. Players character – it would be more useful to use a person more susceptible to MRSA in hospitals but to appeal to a wider audience a man in his late twenties/early thirties will be sufficient (other versions with different aged people to appeal directly to a certain age group).
2. Examination and Lunch time Nurse (npc)
3. Receptionist
4. Old man in adjacent bed
5. Reception people – an elderly couple, a teenage girl, two women and two men.

CONTROLS

Depends on:

- Expense
- Ease of use
• Easy to learn to use
• Will it increase the spread of MRSA

**Mouse** - Hard to clean (and if not cleaned properly) may also increase the spread of MRSA, however, most people are used to using a mouse.

**Touch Screen** – Easy to clean, but may be complex for older/younger players. It will also be difficult to adapt a touch screen to be used to navigate through a game as most touch screens are used for gathering single/multiple choice pieces of information. This may also be too expensive for the hospital and/or may not be cost effective as only one game will run on it.

**Flat Keyboards** – Easy to clean and use, but inexperienced players may find it difficult to navigate to different areas or interact with objects. May also be too expensive for the hospital to purchase, or may not be a valid reason to use this hardware for a game.

**SOUND EFFECTS AND MUSIC**

**Bed area**
Hospital machines
Squeaky lunch cart wheels
Paper rustling

**Waiting room**
People coughing
Papers rustling
People making whispering noises

Toilets
Toilet flushing
Water running

Hospital announcement
F  APPENDIX F FLOWCHARTS

STORYBOARD FLOWCHART

Start Game

Player enters RECEPTION

Talk to receptionist

Player goes to Hallway 1

Player reads leaflet

Get MRSA leaflet

Scenario 1

Scenario 2

Scenario 3

Scenario 4

Scenario 5

Scenario 6

End Game

KEY

Flow of prototype

Flow of possible future scenario additions
TOP DOWN METHOD

Main Task → Identify sub-tasks → Reduce prevention methods identified → Determine environment

- Character List
- Dialogue for characters
- Assets for each scenario

- Scenes for each scenario
- Scenarios and Health messages

- Sounds


## APPENDIX G SOFTWARE TESTING

### MAIN MENU – BUTTONS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Start Game</td>
<td>Brings the player to the introduction frame of the Main menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Help Menu</td>
<td>Brings the player to the Help menu</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

### INTRODUCTION - BUTTONS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>To next scene</td>
<td>Brings the player to the next frame of the Introduction in the Main menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>To Reception</td>
<td>Brings the player to the Reception.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

### RECEPTION - BUTTONS
<table>
<thead>
<tr>
<th>Object</th>
<th>Description</th>
<th>Does It Work?</th>
<th>Changes Made</th>
</tr>
</thead>
<tbody>
<tr>
<td>Health Booklet</td>
<td>Bring the player to the health booklet movie clip.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Magazine stack</td>
<td>Bring the player to the health booklet movie clip.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Entrance/Exit</td>
<td>Bring the player to the “Are you sure you want to exit scene?”</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Receptionist</td>
<td>Brings the player to the Receptionist scene</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Help Menu</td>
<td>Brings the player to the Help menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Next scene</td>
<td>Brings the player to Hallway 1 if the player has read the health booklet.</td>
<td>N</td>
<td>Variable corrected.</td>
</tr>
</tbody>
</table>

**RECEPTIONIST - BUTTONS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Receptionist next scene</td>
<td>Takes the player to the receptionist scene.</td>
<td>N</td>
<td></td>
</tr>
<tr>
<td>Receptionist close scene</td>
<td>Moves the scene back to the previous part of the receptionist dialogue.</td>
<td>Fixed so that the player returns to the Reception.</td>
<td></td>
</tr>
</tbody>
</table>

**“ARE YOU SURE?” - BUTTONS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Brings the player back to the Main menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>No</td>
<td>Brings the player back to the Reception.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**HALLWAY 1 – BUTTONS AND MOVIE CLIPS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next scene</td>
<td>Brings the player to Hallway 2.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Previous scene</td>
<td>Brings the player back to the Reception.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>To Bed Area 1</td>
<td>Brings the user to the Bed Area.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>To Bed Area 2</td>
<td>Brings the user to the Bed</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Table rub Area.</td>
<td>Brings the player to the Table rub scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Help Menu Brings the player to the Help menu.</td>
<td>Y</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Hallway 1 Clock Counts down from 10 to 0 by rotating, then brings the player to the Death scene when it reaches 0.</td>
<td>Y</td>
<td>n/a</td>
<td></td>
</tr>
<tr>
<td>Health Message 1 To appear over the scene after the rub scenario has been completed and to disappear.</td>
<td>Y</td>
<td>n/a</td>
<td></td>
</tr>
</tbody>
</table>

**BED AREA – BUTTONS AND MOVIE CLIPS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bed Rub 1</td>
<td>Brings the player to the Bed rub scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Bed Rub 2</td>
<td>Brings the player to the Bed rub scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Old Woman</td>
<td>Brings the player to the old woman scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>-----------------</td>
<td>-----------------------------------------</td>
<td>-----</td>
<td>-----</td>
</tr>
<tr>
<td>Lunch Trolley</td>
<td>Brings the player to the lunch selection frame.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Help Menu</td>
<td>Brings the player to the help menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Previous scene</td>
<td>Brings the user to Hallway 1.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Health message 2</td>
<td>To appear over the scene after the old women scenario has been completed and to disappear.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Health message 3</td>
<td>To appear over the scene after the lunch scenario has been completed and to disappear.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**TABLE RUBS– BUTTONS AND MOVIE CLIPS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rub bottle</td>
<td>Set scenario variable to complete.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>NAME</td>
<td>FUNCTION</td>
<td>DOES IT WORK? (Y/N)</td>
<td>CHANGES MADE</td>
</tr>
<tr>
<td>--------------</td>
<td>-----------------------------------------------</td>
<td>---------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Rub bottle</td>
<td>Set scenario variable to complete.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Close scene</td>
<td>Exits bed rub scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**BED RUBS – BUTTONS AND MOVIE CLIPS**

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bread roll</td>
<td>Sets the variable to select the roll and outputs a confirmation message to the player.</td>
</tr>
<tr>
<td>Orange Juice</td>
<td>Sets the variable to select the juice and outputs a confirmation message to the player.</td>
</tr>
<tr>
<td>Tomato soup</td>
<td>Sets the variable to select the soup and outputs a confirmation message to the player.</td>
</tr>
</tbody>
</table>
Sets the variable to select the water and outputs a confirmation message to the player.

Sets the variable to select the ham roll and outputs a confirmation message to the player.

Sets the variable to select the cheese roll and outputs a confirmation message to the player.

Checks whether the player has washed their hands before eating. If they have, a message is output confirming the player has taken the food/drink. If they haven’t, a HINT message is output. Player is then returned to Bed Area.

**OLD WOMAN – BUTTONS AND MOVIE CLIPS**
<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Yes</td>
<td>Brings the player to the next scene in the Old Woman dialogue flowchart (see Appendix F).</td>
<td>Yes, but when exiting game and starting again the same variable was set so you could never set choose the ‘No’ option.</td>
<td>The code was amended to make sure that the variables were reset when exiting the game every possible way.</td>
</tr>
<tr>
<td>No</td>
<td>Brings the player to the next scene in the Old Woman dialogue flowchart (see Appendix F).</td>
<td>Yes, but when exiting game and starting again the same variable was set so you could never set choose the ‘Yes’ option.</td>
<td>The code was amended to make sure that the variables were reset when exiting the game every possible way.</td>
</tr>
<tr>
<td>Next frame</td>
<td>Brings the player to the next frame in the Old Woman dialogue.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Close scene</td>
<td>Closes the scene and if the player chooses ‘Yes’</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>
brings them a death scene. If the player chose ‘No’, it brings them back to the Bed area.

### HALLWAY 2 – BUTTONS AND MOVIE CLIPS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Help Menu</td>
<td>Brings the player to the Help Menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Toilet Door</td>
<td>Brings the player to the Toilets scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Previous scene</td>
<td>Brings the player back to Hallway 1.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

### TOILETS – BUTTONS AND MOVIE CLIPS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Toilet</td>
<td>Sets the variable to ‘used’ and outputs a message.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Sink</td>
<td>Sets the variable to ‘used’, outputs and</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Item</td>
<td>Description</td>
<td>Y/N</td>
<td>Notes</td>
</tr>
<tr>
<td>-----------------------</td>
<td>-----------------------------------------------------------------------------</td>
<td>-----</td>
<td>-------</td>
</tr>
<tr>
<td>Soap dispenser</td>
<td>Sets the variable to ‘used’ and (when in the scenario) increases the health score. Also outputs a confirmation message.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Hand dryer</td>
<td>Sets the variable to ‘used’ and (when in the scenario) increase the health score. Also outputs a confirmation message.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Previous scene</td>
<td>Brings the player to</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>NAME</td>
<td>FUNCTION</td>
<td>DOES IT WORK? (Y/N)</td>
<td>CHANGES MADE</td>
</tr>
<tr>
<td>------------------</td>
<td>---------------------------------------------------------------------------</td>
<td>---------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>Hallway 2.</td>
<td>If the player has used the toilet but not washed their hands, the clock is made visible and starts counting down.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Clock</td>
<td>Counts down until the scenario is solved.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Health message 4</td>
<td>To appear over the scene after the old women scenario has been completed and to disappear.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Help Menu</td>
<td>Brings the player to the Help menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

**HEALTH BOOKLET – BUTTONS AND MOVIE CLIPS**
DEATH – BUTTONS AND MOVIE CLIPS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit</td>
<td>Brings the player back to the Main menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Game over text</td>
<td>Appears and remains on the scene.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

GAME COMPLETE – BUTTONS AND MOVIE CLIPS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exit</td>
<td>Brings the player to the Main menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
</tbody>
</table>

HELP MENU – BUTTONS AND MOVIE CLIPS

<table>
<thead>
<tr>
<th>NAME</th>
<th>FUNCTION</th>
<th>DOES IT WORK? (Y/N)</th>
<th>CHANGES MADE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Next scene</td>
<td>Brings the player to the next frame of the Help menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Previous scene</td>
<td>Brings the player back to the previous frame of the Help menu.</td>
<td>Y</td>
<td>n/a</td>
</tr>
<tr>
<td>Help menu.</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
APPENDIX H USABILITY QUESTIONNAIRE

RESULTS

What age range do you lie within?

What is your profession?

Have you played a serious game before?
Did you find the game easy to use?

How easy the game was to use on a scale of 1 to 5, where 1 is extremely difficult and 5 is extremely easy.

How long did it take you to learn how to navigate through the game?
Did you find it to easy to identify all of the objects?

Did you find the labelling on the buttons clear?

What is your opinion of the screen layout on a scale of 1 to 5, where 1 is not appropriate and 5 is very appropriate.
What is your opinion about the size icons used?

What do you think about the size of the labelling used?

What do you think about the font size used?
Did everything behave as you expected? (If yes, go to question 14).

Did any errors occur when you were using the game?

No errors were found by the players so no pie chart was produced for question 13a.

Has this game taught you about the prevention methods of MRSA?
Do you think that by playing the game you will remember and adopt these prevention techniques?

How long did it take you to complete the game?

Did you find that reading the health booklet helped you to solve the problems of each scenario?
How helpful was the health booklet on a scale of 1 to 5, where 1 is not helpful at all and 5 is very helpful.

How would you describe the gameplay on a scale of 1 to 5, where 1 is very boring and 5 is very exciting.

Did you think the environment was appropriate for this issue?
I APPENDIX I USER DOCUMENTATION

HOW TO RUN THE GAME

In order to run this game you must have the Flash 8 environment or a version of Flash player installed on your computer, making sure that your computer can run either program (please see figure 6 and 7 respectively).

To run the game through the Flash Player, select the Flash movie (.swf) icon. To run the game through the Flash environment, select the Flash document (.fla) icon.

Once flash has loaded up press CTRL + ENTER to run the game.
1. INTRODUCTION

1.1. Project Scope

The title of this project is Game-Based Learning: Helping to prevent the spread of MRSA. This project concentrates on MRSA, why it is continually spreading and how serious games can be used to help reduce the MRSA infection from spreading.

1.2. Background

Methicillin-resistant Staphylococcus aureus (MRSA) is a bacterium from the Staphylococcus aureus (SA) family.

SA is a common bacterium found on the surface of people’s skin or in their noses. This can occur without the carrier contracting an infection. However, if the bacterium manages to break through the skin it can cause infections such as boils. If it enters the bloodstream the effects can be more serious. According to the NHS Direct Health Encyclopedia, 2006, approximately 1 in 3 people are carriers of this bacterium.

Most types of SA can be treated with methicillin (a type of penicillin), however, there are some types that can have developed a resistance to methicillin. These are known as MRSA. Some reasons why the number of people diagnosed with MRSA has been increasing are:
Patients not finishing the full course of antibiotics they have been prescribed. This allows some bacteria to survive and develop a resistance to the antibiotic. They then proceed to multiply.

Antibiotics being overused. This allows bacteria to develop a resistance to a wide range of antibiotics.

1.3. Rationales

Since the discovery of MRSA the rate of infection has been increasing and yet as our awareness of MRSA increases, the amount of people being diagnosed with the infection has not been decreasing. This suggests a lack of distributed information about MRSA and how to prevent the infection from spreading. But how do we help to distribute this information? A route that hasn’t been looked into is Serious Games.

Wikipedia, 2006 states that “Serious games are computer and video games that are intended to not only entertain users, but have additional purposes such as education and training... The main goal of a serious game is usually to train or educate users, though it may have other purposes, such as marketing or advertisement, while giving them an enjoyable experience.”

Using a serious game to provide this information to the general public is effective as it appeals to all ages, therefore should educate a large amount of the population about MRSA. It is also a fun way of learning about a serious issue so the information is more likely to be retained.

Recent studies (www.socialimpactgames.com, 2003) have shown that similar games have been produced with the aim of teaching children the importance of
asthma and diabetes management. After playing these games, studies found that the number of asthma emergency visits, diabetes emergency visits and urgent-care visits decreased by 40% and 77% respectively.

Playing this game should increase the player’s awareness of MRSA. After the results of this game are analysed placing this game into environments, like a doctor’s waiting rooms, will be one way of making sure that this game is played by more people. It is in these types of environments that you will be able to witness the impact of this game on a wide range of the public and whether it has any positive effects.

2. **AIM AND OBJECTIVES**

2.1. **Aim**

The intention of this project is to identify a reason why MRSA is continuing to spread. Once that reason has been identified, a serious game will be developed focusing on this reason with the main aim of reducing the spread of MRSA.

2.2. **Objectives**

The objectives for this project are:

- To increase awareness about MRSA, in particular:
  - What is MRSA and how it was discovered
  - How and where MRSA can be contracted
  - How it is diagnosed by doctors
  - The effects of MRSA
  - Treatment used for MRSA
  - Prevention methods used for MRSA
1. To design and develop an educational game that accurately illustrates the reason for the continual spread of the MRSA infection.

2. To complete the project by 2nd May 2007.

3. **MAIN TASKS, MILESTONES AND DELIVERABLES**

3.1. **Main Tasks and Deliverables**

<table>
<thead>
<tr>
<th>Task</th>
<th>Deliverable</th>
<th>Allocated Time</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Registration/Proposal</td>
<td>Narrow down an area of computing to concentrate on for the final project and produce a project proposal.</td>
<td>1 week</td>
</tr>
<tr>
<td>Project Planning Document</td>
<td>A plan to work from for the project.</td>
<td>4 weeks</td>
</tr>
<tr>
<td>Research</td>
<td>Obtain information for the Introduction and Limitations sections of the project from various sources of information.</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Design</td>
<td>Obtain information for the New Ideas section of the project and finalise the game design.</td>
<td>3 weeks</td>
</tr>
<tr>
<td>Development</td>
<td>Produce a finished game focusing on the reason why MRSA is spreading.</td>
<td>12 weeks</td>
</tr>
<tr>
<td>Testing</td>
<td>To use a suitable testing method to identify any errors or changes that need to be made in the game and to</td>
<td>7 weeks</td>
</tr>
</tbody>
</table>
Results/Discussion

Results of how successful the game represented the reason why MRSA is spreading and whether awareness of this issue has increased in players.

Conclusion and Future work

Based on the Conclusion section, to generate some ideas for future work within this area of computing.

References, Bibliography and Appendices

Two separate lists detailing the sources of information that have been used through the project and a collection of any additional information for the project.

Proof Reading

To re-read the project document to check and correct any mistakes or add omitted information.

Extra Time

To have extra time left after the project has finished in case any task overruns.

3.2. Milestones

<table>
<thead>
<tr>
<th>Milestone</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Registration</td>
<td>27th October 2006</td>
</tr>
<tr>
<td>Project Planning Document and RP1</td>
<td>24th November 2006</td>
</tr>
<tr>
<td>RP2</td>
<td>16th February 2007</td>
</tr>
<tr>
<td>Project Deadline</td>
<td>2nd May 2007</td>
</tr>
</tbody>
</table>
4. SOURCES OF INFORMATION AND RESOURCES REQUIRED

- **Books** – Game design process
- **Journals** - Similar health projects and results
- **Previous papers** - Similar health projects and results
- **Information packs and leaflets** - MRSA
- **Internet sites** – Game design process, serious games, social impact games and software tutorials.
- **Department of Health** – statistics about MRSA, previous and new legislation
- **Experts** – Medical staff (possibly from the QMC).
- **Animation Software** – Macromedia Flash
- **2D Design Software** – Photoshop
- **3D Design Software** – 3D Studio Max
- **Game Engines** – Source Engine, other Open Source game engines.
- **Lecturers**

5. PROJECT RISKS

**Bad Time Management**
A way to prevent this from affecting the project is to plan out the stages involved.
By planning all the stages it will show the project is on target to be completed for the deadline.

**Illness**
To deal with illness (if it does affect this project), the schedule will include a short amount of time (possibly a week) at the end of the project before the deadline in the case that anything makes the project overrun there is extra time to deal with the problem.

**Christmas Holidays**

This will limit the amount of resources used in this project. A way to prevent this from affecting the project will be to carry out the research before Christmas. Failing this, the resources that will not be available over the holidays must be used before access to them is restricted.

**Decreased programming ability**

To prevent this from affecting the project various things could be done: Use resources that need little or no programming ability, revise the required language needed to use the resources, do tutorials online or from the Virtual Learning Portal, attend extra surgeries or ask lecturers for assistance.

**Lack of familiarity with resources**

To prevent this from affecting the project, the time required to learn to use the resources needs to be included within the project schedule so that the project does not overrun.

**Other Commitments**

Other commitments like part time jobs and extra curricular activities will need to be accounted for, as these will limit the amount of time that can be spent on the project. To prevent other commitments from affecting the project, the schedule will
take these other commitments into account, as they will also reduce the amount of
time that can be spent on the project.

Computers crashing
To prevent this from affecting the project there are a few things that can be done.
Saving work regularly with different version numbers will mean that if any
information is lost, the previously saved document can be recovered and updated.
Another way is to try and save work on more than one source, like a home
computer and the home drive at Nottingham Trent, in case one version gets
misplaced or mistakenly deleted.

Programs needed may not be compatible with others
To prevent this from affecting the project, the resources that will be needed for this
project will have to be researched to make sure that the programs learnt are
compatible when importing objects between the programs.

Development taking too long
To prevent this from affecting the project the amount of time allowed for completing
the development stage needs to include an extra couple of weeks just in case this
does take longer than expected.

6. PROFESSIONAL ISSUES

Inaccurate Information
It is important that all information included in this project is accurate and correctly
referenced. If someone imitates or follows anything from the game that is based on
inaccurate information, and is injured as a result, the author will be liable and may get sued.

**Copyright and Trademarks**

It is important that any structures, names, text, symbols, logos and characters used in the game are not previously owned by another company. If used, the author will need to gain permission from that company.

**Copyright Ownership**

It is important to consider the ownership of this project. The university has copyright ownership to this project because it is a final year project. Any attempt to sell this product under the name of the author would lead to legal action being taken by the university.

**Content Laws**

This needs to be taken into consideration because it involves what type of information will be included in the game implemented from the project. The content contained in the game will particularly focus on this issue as it will stipulate what information can be included depending on what age range the game is targeting.

**Where does the responsibility lie?**

If there has been an increase in MRSA victims this clearly indicates that the majority of the public are not receiving information about MRSA. But is it the responsibility of a computing student to try and tackle this problem? It would make more sense if someone from the medical profession (or someone closely linked to it) to take on this project as they would have better access to medical resources and information. Serious games are a new resource to be explored, so maybe it would be best if a
computing student managed the project using medical professionals as sources of information.

**Increasing the fear of MRSA**

By increasing the awareness of the MRSA making people aware that it’s not just spread throughout hospitals may lead to an increased fear of MRSA. It has to be taken into consideration not to present the information to the public in a negative way or in a way that can lead to a negative result. For example, some people may overdo cleaning in an attempt not to catch the bug. This may lead more people to become susceptible to other infections.

**Issue not took seriously**

A problem that may arise when using a game to represent a health issue may be that the issue may not be taken seriously or may even be ignored because of it being presented using a game.

**Misinterpretation**

If any of the information provided to the player can be misinterpreted, the purpose of the information within the game may also be misinterpreted. This may lead to legal issues.

**Parental Guidance**

The issue being dealt with in this project is serious and will be based on factual information. Some parents may feel that some aspects raised will be unsuitable for children. It is important that a warning be integrated into the game so that parents can decide whether the content will be suitable for their children.
Anonymity of questionnaire candidates

It is important that if any information is gathered through surveys or questionnaires that the participant’s identity stays anonymous. Unless the participant has given consent to be identified during this project, they must remain anonymous. As this project may also deal with a range of ages, it is important that any participant under 16 has consent from a legal parent/guardian in order for them to take part in the survey. This is to protect any personal information that might be used by external sources.
### 7. Gantt Chart

<table>
<thead>
<tr>
<th>Task</th>
<th>Week Beginning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Project Registration</td>
<td>23/10/06</td>
</tr>
<tr>
<td>Project Proposal</td>
<td>30/10/06</td>
</tr>
<tr>
<td>Project Planning</td>
<td>06/11/06</td>
</tr>
<tr>
<td>Review Point 1 (RP1)</td>
<td>13/11/06</td>
</tr>
<tr>
<td>Research</td>
<td>20/11/06</td>
</tr>
<tr>
<td>Design</td>
<td>27/11/06</td>
</tr>
<tr>
<td>Development</td>
<td>04/12/06</td>
</tr>
<tr>
<td>Review Point 2 (RP2)</td>
<td>11/12/06</td>
</tr>
<tr>
<td>Testing</td>
<td>18/12/06</td>
</tr>
<tr>
<td>Results/Discussion</td>
<td>25/12/06</td>
</tr>
<tr>
<td>Conclusion and Future work</td>
<td>01/01/07</td>
</tr>
<tr>
<td>References</td>
<td>08/01/07</td>
</tr>
<tr>
<td>Bibliography</td>
<td>15/01/07</td>
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<tr>
<td>Appendices</td>
<td>22/01/07</td>
</tr>
<tr>
<td>Proof Reading</td>
<td>29/01/07</td>
</tr>
<tr>
<td>Extra Time</td>
<td>05/02/07</td>
</tr>
<tr>
<td>Project Hand In</td>
<td>12/02/07</td>
</tr>
<tr>
<td>Project Demonstration</td>
<td>19/02/07</td>
</tr>
</tbody>
</table>

*Note: The chart shows the timeline for project tasks with specific weeks assigned for each task.*
8. REFERENCES


