Patient Observation: interactivity and graphics to enhance learning in serious games

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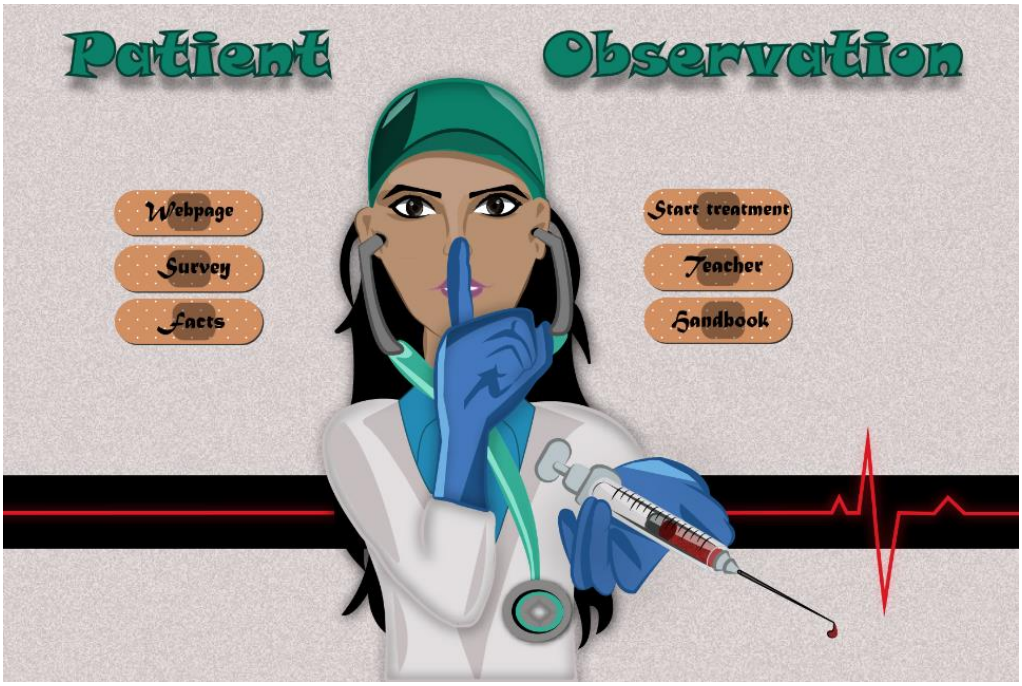

Abstract
Basic first aid is a subject which can be applied by anyone who does not necessarily own a medical degree. Although it can save people's lives by applying the principles, knowledge of basic first aid is still something that remains limited. Recently the dutch news channel indicated that people still do not recognize symptoms that indicate a stroke, which leads to waiting too long to go to the hospital[1]. Learning first aid by using simple text might be tedious and could be one of the reasons why little knowledge is obtained. A possible solution to this problem is offering a digital learning environment where basic principles of first aid can be learned in a fast and easy approach by using illustrations and visual effects. Serious games are games with an educational purpose instead of pure entertainment. This provides a method to learn subjects in a different kind of environment (Egenfeldt-Nielsen et. al., 2016). The focus of this thesis is to gain insight of how effective teaching and learning basic first aid is by using illustrations and visual effects in a serious game. This is achieved by creating an application, by using the XIMPEL framework, where the user is able to choose between three possible learning methods namely text-based learning, realistic-based learning and cartoon-based learning.

[1] https://www.rtlnieuws.nl/nieuws/zo-herken-je-de-symptomen-van-een-beroerte.,2016

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1. Introduction

Recently national news[2] indicated that people still do not know the signs of having a stroke. The symptoms that correspond with this medical condition can be easily learned by having knowledge of basic first aid. The question arises what is the reason that people are not willing to learn basic first aid? The lack of motivation to learn a subject which possibly could save a human life is due to the fact that people are having less time, or maybe find it too expensive. People want an easy and fast approach in learning a subject which does not consume considerable amount of time.

Learning a particular subject requires motivation. Independent variables are important here, since they offer a method to increase motivation by offering motivational manipulations (Cook, David A. et. al.,2016). Recent study indicate that serious games potentially enhance the learning ability and provide the proper motivation to learn. Serious games offer different aspects that might contribute to improve learning, for instance the interactiveness, illustration that is being used or even games with or without narratives. Another useful aspect is the feedback that is given directly by the game to inform the player of his progress. Not all aspects contribute to a higher performance, for instance it has been concluded that games with narratives will provide players with less knowledge than when these narratives are not available, also interactivity does not seem important enough to affect the learning ability. Video games have been known to be appreciated by people of all ages and therefor can be considered motivational (Wouters, Pieter et. al.,2009).

Serious games can also be considered a videogame but without the entertainment. Serious games requires certain design steps were amusement and learning needs to be joined. This can pose as a problem since games are originally focused on interaction and continuation in the game, for instance going through different levels, but considering serious games the player might feel the necessity to stop and reflect on the material which he or she is learning (Huynh-Kim-Bang et. al., 2010).

Serious games turned out to be efficient in different kind of branches, for instance military,corporate, education and health care organizations. But what makes serious games so popular? The reason is that people who are comfortable in a digital environment seek information which can be obtained quickly, but also multitasking and the process of illustrations and visuals before text are important aspects. These motivational manipulations can be found in many games, making them a suitable environment for learning and obtaining knowledge (Derryberry, Anne. et. al., 2007).

In this thesis the focus has been given to health applications, specifically first aid. There are many first aid serious games, but what makes them interesting or favorable? Considering the game Pulse!! the creators made use of a 3D world environment and realistic models. Other games made use of virtual reality given the player an even more realistic experience. They are

[2] https://www.rtlnieuws.nl/nieuws/zo-herken-je-de-symptomen-van-een-beroerte.,2016

considered to be useful and are used by medical students as training purpose (Francesco Ricciardi et. al., 2014).

The medical applications are created in order to prevent medical errors, but also to imitate certain steps that need to be repeated by patients (Guadalupe et. al., 2011). First aid serious games are developed with the purpose to learn the steps that need to be performed when dealing with a certain medical condition. This could be a burn wound, but also a dog bite. When the condition is minor the person can be providing basic first aid without the help of a professional until he or she arrives, therefore the application patient observation has been developed. This application is developed not only to give the proper knowledge to people but also to test what the best solution is for learning basic first aid. The research question that arises is: “can interactiveness and graphics in serious games enhance the learning ability in order to learn and practice subjects?” The application offers three different methods namely, text-based, interaction-based with help of illustrations or video-based seeing realistic event.

The application is created in the interactive player ximpel. The reason for this choice is that ximpel has an intuitive approach for having an interactive game. It seems like a movie which is being played with a layer on top of it giving the creator the opportunity to place questions or images on the movie. More about the technical part of ximpel can be found in chapter 2. The Application: Patient Observation can be played by using the following link: www.few.vu.nl/~pjg210

2 Background Information

In order to gain more insight on the question if graphics does have an impact on learning and remembering subjects and to answer the research question, several sub questions were created. An explanation about how serious games offer the solution of enhancing motivation for learning is described in this chapter.

2.1 Why is there still a problem in recognizing medical conditions when persons are having specific symptoms?

First aid could be useful in certain situation in order to save a person or to minimize the medical condition, for instance study has indicated that when Cardiopulmonary resuscitation (CPR) is given directly after the person observed the symptoms it can actually double survival rates. Chest compressions are given together with mouth-to-mouth breathing in order to thrust oxygen into the lungs of the person experiencing a cardiac arrest. CPR can be considered first aid since it can be used by the public without any need of a medical expert, but still the knowledge how to perform it when observing a cardiac arrest is less than 20% (Boada, Imma, et. al., 2016). Even though many trainings have been given to groups it still remains ineffective due to lack of motivation, also mass CPR training has been considered not cost-effective (Swor R et. al., 2004).

There are a several reasons identified why people did not feel the need to gain knowledge about performing first aid CPR, for instance some people indicated that they never thought about actually learning CPR. Reasons that were given by elders were that they find it troublesome to actually leave their house. Elder people think CPR training may have high cost, but also bad health made their choice of not learning CPR. Others mentioned that they did not feel the need because they could also call the emergency number. This might be true but being able to give aid to someone who needs it immediately before a medical expert arrive could decrease a bad condition (Messmer PR et. al., 1998).

Typical reasons that were given by people was simply because they felt that they did not have enough time or interest to learn CPR. People are working and when they come home they do not want to spend hours or even days learning something which will not get them paid but instead payment is needed. Also training is often given after working hours if work provides such training. Another possible reason would be that nowadays people are getting scared of being sued when for instance something goes wrong, this results of people not performing first aid when they actually could (C. Vaillancourt et. al., 2008). People might think that it is not likely a situation will appear where first aid is needed to be performed by the person, they have not engaged such situations or know any person who have.

2.2 Can serious games be used for teaching/training people in first aid?

The section above described how there is a lack of motivation upon people in order to learn basic first aid principles. To enhance this motivation a different method should be used to learn specific subjects, for instance serious games. It has been indicated that there are several reasons why learning digitally can make a difference, for instance standard text-based learning gives the person explanations while a serious game offers also action. This is because a person would need to push a button in order to get a reaction instead of just reading text. Another reason is motivation and satisfaction, because the user would get feedback when an action has been performed, for example when a question has been answered right, the user would get a reward which gives satisfaction. Also digital learning provide different approaches to learn a subject instead of just one approach. Furthermore obtained skills will become stronger due to digital learning which also offers an interactive environment where the user is urged to make decisions depending on the subject (M. Kebritchi and A. Hirumi et. al., 2008).

One of the problems that people indicated in the section above for not learning first aid is because people need to get out of the house. A solution to this problem is serious games which offer portability. Nowadays almost everyone has a smartphone with the possibility for games making it possible to learn wherever the person is, making it an ideal environment to learn. Games are usually not created with the same approach every time, for instance a game offers multiple levels and difficulties which differs from each other giving multiple approaches to learn a specific subject (H. F. O'Neil et. al., 2005). Offering different approaches in a game keeps the user interested and not having the feeling of repetition, which might be monotonous (Boada, Imma, et al., 2016).

Motivation has been an important concept in order to learn a subject because if there is no motivation the person would most likely not learn. The reason why serious games gives a person the proper motivation is because it does not provide high expenses, it is rather uncomplicated to use, but most important people of all ages have the preference of being entertained instead of learning. Even though serious games offer both enjoyment and learning in one application, the creation also depends on several other aspects, such as the design of the game and planning. Serious games acknowledgement is growing among people, but it is still seen as a potential method for learning instead of a legitimate alternative. This is because people are having the idea of games being pure entertainment instead a learning tool (Almeida et. al., 2015).

2.3 Is there a difference in text-based, realistic (using video) and interactive cartoon-based learning?

After analyzing the history of serious games through several articles a timeline could be established (see figure 1). In the 1900s people gain interest in games being a tool for education (Rice et. al., 2007). But it was in the 1970 that people thought there should be a change in the approach to learn students a subject. This was the back to basic teaching movement. They recognized that students were not performing optimal by using normal basic teaching equipment (Dr. Carole G et. al., 2002).

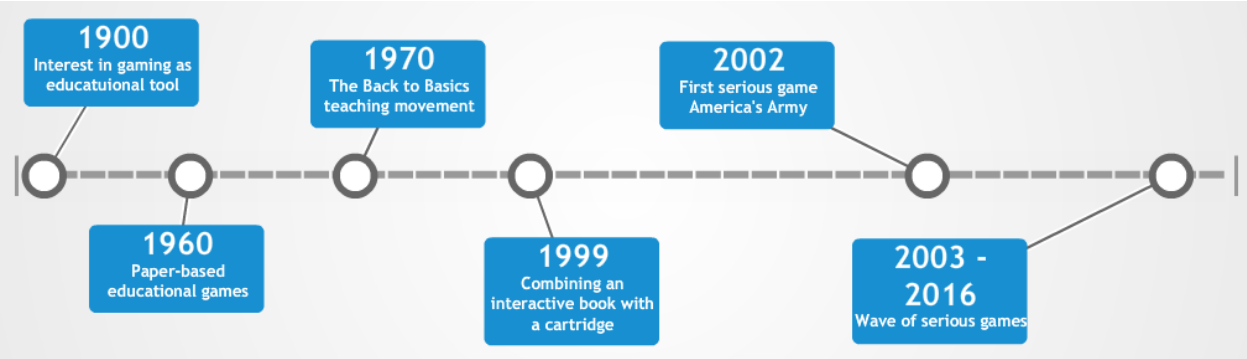

Figure 1: Timeline of the history of serious games (Gudmundsen et. al., 2006).

2002 became the starting point were serious games were actually developed like an entertainment game with a learning perspective (Djaouti et. al., 2011). It appeared that implementation of gaming elements and interaction, such as mini games were made for attractiveness (de Ribaupierre et. al., 2014). This article focusses on three different teaching methods for serious games namely text-based learning, cartoon-based learning and realistic learning. Professor Jack Richards[3] indicated that text-based learning is limited because creativity and personal expression are not available when having only texts as a learning tool. Also this method is possibly repetitive because there is only one way to learn a subject. Cartoon-based learning can be of use when people want to gain the attention and interest of the student. It is not only used for enjoyment but it can also encourage and motivate the student to learn a certain subject which would otherwise be tedious. Text-based learning indicated that it might get repetitive but cartoon- based could require the student to use his or her imagination making it less repetitive (Kleeman et. al., 2006). Another approach is realistic-based learning giving the student the experience of dealing with real world illustrations or videos. This gives a better understanding on how a actual medical conditions would look like in the real world.

[3] http://www.professorjackrichards.com/

2.4 What are the advantages and disadvantages of serious games being used as a learning tool?

After researching different articles in previous sections, there appears to be several advantages and disadvantages of having serious games as a learning tool(See table 1). In one of the articles it was stated that the development of such a game could come with high costs. This could be the case when a collaboration has been established with experts of a certain field, or with impressive game interface. There are also games developed with a low budget, but the game still offers an interesting gameplay with learning content. Another disadvantage is difficulty in scalability. This is when costs are high, making developers choose whether something is important enough to place in the game. The last disadvantage has been discussed in the previous chapter. However serious games has been gaining more acknowledgment and is being used in many different fields, such as a military learning tool, medical tool or even as a school tool (mathematics for example).

Table 1: showing advantages and disadvantages regarding serious games as a learning tool.

Advantages	**Disadvantages**
Gives more confident among people to help others (Bovopoulos et. al., 2016)	High developmental costs (FAS et. al., 2006)
Improving in performance (J. Torrente et. al., 2014)	Difficult scalability among game-based-learning (J. Clarke et. al., 2009)
Enhancing of motivation	Still not accepted as a realistic different approach to learning (scepticism)
Combining enjoyment with learning	
Portable	
Usually designed to be intuitive	
Fast learning	
Considered to be for all ages and gender	
obtained skills will become stronger	

3. The XIMPEL interactive media framework: between storytelling and gameplay

XIMPEL has been used in several different educational purposes, such as courses given in Universities but also high schools used the framework for workshops. It can be a powerful tool for educators to learn subjects to students. Serious games is a course which is given at the vrije Universiteit and makes use of the XIMPEL framework. Students are required to create a serious game by using the XIMPEL framework. During this course the application Movie science has been created where the student is challenged to solve different mathematical problems by first watching a scene from a movie. When the right answer is chosen another scene will be played, giving the user feedback that the answer is correct. The reason why there is a preference for using the XIMPEL framework instead of game engines is because of the intuitive approach which makes it possible to create prototypes fast, without losing any interaction capabilities.

The serious game “patient observation” has been created by using the XIMPEL framework. The reason for choosing this platform has been of its intuitive approach. This chapter will give a deeper insight of how XIMPEL works and explains its structure by using several examples from the project.

3.1 What is XIMPEL?

XIMPEL can be used for different kind of purposes, because it offers a method to make the created display interactive, by using a specific structure. This particular display is being specified through an EXtensible Markup Language (XML) file, for instance an image needs to be shown at a specific time, but also how this image needs to be shown. Also questions, scores and where a certain click button needs to be presented can all be specified in the XML file. In order to actually develop your XIMPEL project two separate files are needed namely, the playlist file, this is where the created display is being written in XML code, and the configuration file, here you can alter some option, such as if controls need to be shown on the screen by specifying true or false.[4]

3.2 The structure of XIMPEL

The XIMPEL structure is written in XML code (see figure 2). The code consists of several different tags starting with <ximpel>. This tag specifies that the display is created in XIMPEL. The next tag <playlist> is where the display is being specified. In the example shown in figure 1 the playlist shows a subject which is assigned with an id for further references. Furthermore the image for answering a question wrong has been added in <media> tags. The <playlist> tag also has a <overlay> tag. This is explained more thoroughly in the next section. Every tag needs to be closed with a closing tag.

[4] Ximpel.net documentation

```
<?xml version="1.0" encoding="utf-8"?>
<ximpel>
    <playlist>
        <!-- Here comes the information were and how something is displayed -->

        <subject id="q4wrong3">

            <media>
                <image src="media/q4wrong3.jpg">

                    <overlay startTime="0"  x="1515px" y="1007px" width="150px" height="20px" backgroundColor="" leadsTo="question4"/>
                </image>
            </media>
        </subject>


    </playlist>
</ximpel>
```

Figure 2: basic structure and example of project Patient observation created in XIMPEL by using XML code

3.3 ximpel overlay system

The overlay system in XIMPEL are components which can be clicked on and be placed over a certain image or video. For this project overlays are used in order to jump from one subject to another by using its subject ID name and the leadsTo attribute. The overlay system contains several overlays. The ones that were being used for this project can be viewed in table 2. The color and shape of the overlay has been altered in the CSS file, because here the appearance can be changed.

Table 2: Overlay attributes that were being used during the project

Overlay attributes	**XML code**
Position (x, y)	<overlay x="1180px" y="352px" />

color	.overlay:hover{
	cursor: pointer;
	background-color: red;
	opacity:0.2;
	}

Size (width, height)	<overlay width="160px" height="50px" />

Shape	.overlayOval, .overlayOval {
	border-radius: 50%;
	}

LeadsTo (jumps from one subject to another)	<overlay backgroundColor="" />
startTime (when the overlays is being displayed)	<overlay startTime="1"/>

In figure 3 the subject with subject id: subject2 has an image with three different overlays. The first overlay starts immediately and after it has been clicked on will jumps to the subject with subject id: subject4. The second and third overlays are basically the same except they are placed differently. This is because the y value has been altered. Also they jump to different subjects. The background color has been set to transparent and the size is for every overlay the same.

```
<?xml version="1.0" encoding="utf-8"?>
<ximpel>
    <playlist>
        <subject id="subject2">
            <media>
                <image src="media/start treatment.jpg">
                    <overlay startTime="0"  x="640px" y="340px" width="400px" height="50px" backgroundColor="" leadsTo="subject4"/>
                    <overlay startTime="0"  x="640px" y="480px" width="400px" height="50px" backgroundColor="" leadsTo="subject1"/>
                    <overlay startTime="0"  x="640px" y="590px" width="400px" height="50px" backgroundColor="" leadsTo="subject1"/>
                </image>
            </media>
        </subject>
    </playlist>
</ximpel>
```

Figure 3: XML code showing how overlays needs to be constructed.

3.4 Ximpel question system

XIMPEL also has a system to place questions on top of any media type whether this is video, image or audio media. Questions are place as an overlay. The startTime can be set, for instance first showing a video and after a few seconds the question appears. Each question can be assigned with options making it multiple choice, when this is not the case the question will be answered with true or false. Each question can be set with a certain time limit in order to answer the question. This is done with the attribute questionTimeLimit. Figure 4 shows an example of the aforementioned attributes of the <question> tag

```
<?xml version="1.0" encoding="utf-8"?>
<ximpel>
    <playlist>
        <subject id="subjectwash" leadsTo="subject1">
            <media>
                <image src="media/washhands.jpg">
                    <questions startTime="1" questionTimeLimit="5">
                    <question answer="true">
                        Does a animal bite needs to be washed with water and soap?
                    </question>
                    <question questionTimeLimit="10" answer="2">
                        Which of the following animals cause rabies?
                        <option>bat</option>
                        <option>bird</option>
                        <option>boa</option>
                    </question>
                    </questions>
                </image>
            </media>
        </subject>
    </playlist>
</ximpel>
```

Figure 4: XML code showing how questions are constructed.

3.5 Ximpel score system

The score system can be assigned in order to give a value, an operation and an id. By doing this, certain points can be given to answers that are being answered correctly or even lose points when answered wrong. Also multiply,division, power and set are available within XIMPEL to use for keeping score. For the project addition and subtraction has been used.

```
<subject id="correct10">
    <score id="scoreA" operation="add" value="10"/>
        <media>
            <image src="media/correct.jpg">
                <overlay startTime="0"  x="1525px" y="1007px" width="150px" height="20px" leadsTo="exam"/>
            </image>
        </media>
</subject>
```
Figure 5: Explanation of the score system by using options.

In figure 5 the <score> tag has been given a name “scoreA”, also the score operator addition has been used when a question is answered correctly because the overlay with the correct answer jumps to the subject with the <score> tag. Every Time a question has been answered correctly, the user will get 10 points, which can be assigned with the value operator. When a question is answered wrong no points are assigned to the score. In order to show the score in the application, the code : <showScore>true</showScore> needs to be set to true in the configuration file.

4. Project: Patient Observation

Patient Observation is a serious game specifically designed in order to learn the basics of first aid. The game consists of three different approaches namely text-based which is called “handbook” in the game. It consists of static text with no animation, interaction or illustrations, realistic based which is called teacher in the game and makes use of interaction during a short movie and cartoon-based which is called start treatment in the game making use of illustrations and interactions with animation.

4.1 Design choices

The game is developed by using several aspects as guidelines. The game covered all of the following aspects in order to make it successful (Escribano et. al., 2015).

4.1.1 Reliability

In order to analyze whether there were any programming errors or elements that were not functioning properly or performing a wrong action several tests were conducted. The game was checked multiple times if everything worked properly. People who played the game and also gave feedback by filling in the survey, indicated whether if something was wrong in the game.

4.1.2 Playful/engaging

The game should be enjoyable and engaging when being played. This condition was met by using attractive illustrations made with Adobe Illustrator, but also giving it several components making it interesting to play, such as giving different approaches. Another method to make the game more engaging is implementing a system (the examination) to give the user the opportunity to test what he or she has learned during the game.

4.1.3 Usability

It should be clear for a person who is not involved in the project what he or she needs to do. What kind of interactions are available should be made clear. This aspect has been fulfilled by using a set of instructions before playing the game, for instance when the button start treatment has been clicked on, a short movie will be displayed and afterwards a instruction screen will pop up explaining the user how to use the game. Also during the game there is a question mark button available for those who need extra assistance

4.1.4 Educational value

It is important for the user to know what he or she is learning and what goals are being achieved. To ensure the value of the information presented in the game, a collaboration with co-assistants of hospitals were conducted. Books were obtained and used for the project together with their expertise the educational value would be optimized.

4.2 The goal of the experiment

The goal of the experiment is to observe and gain knowledge of the behaviour of people playing the game. It will give more insight in which approach will be the optimal learning tool for memorizing information. The following hypothesis is conducted: Players will learn more efficiently when a form of graphics and interaction are included.

4.3 The experiment

For the application: patient observation an experiment has been conducted where 15 people played the game choosing between text-based learning, realistic-based learning and cartoon-based learning.The decision was made to make the control group the text-based learning group, because this is the most conventional method. The application is based on all age groups so no distinction has been made between age or gender. After they had played the game they were asked to take the exam and make the survey presented in the game.

4.3.1 Text-based learning

The text-based learning approach in the game consists of plain text with no illustrations for aiding in memorising or learning basic first aid. Before demonstrating the design of this approach in the application: Patient observation, a use case analyzed from another article (Escribano et. al., 2015) is presented to give information of recent research about text-based learning.

4.3.1.1 Case study 1: Text based learning

The goal of this case-study is to gain knowledge about the effectiveness of games with in-game adaptivity and to analyze if it enhances learning in contrast to games without adaptivity. Results are presented in table 3.

Table 3: results research to evaluate different approaches to enhance learning

	Approach	**Results learning effectiveness**
Text-based group	Textbook	No significant difference between non adaptive and out-of game.
Non-adaptive game group	Student learning style is not taken into consideration	No significant difference between text-based and out-of game.
Out-of-game adaptive game group	Learning style and characteristics of student are identified before game	No significant difference between non adaptive and text-based.
In-game adaptivity game group	Possibility of the learner to change learning style during the game.	Higher score than other groups.

4.3.1.2 Design approach text-based learning: Patient Observation.

In the section above four different approaches were taken into consideration. For the purpose of this article three different approaches were given in order to compare with text-based learning. These approaches are realistic-based and cartoon-based. The realistic-based and cartoon-based can be considered as the in-game adaptivity game group presented in the section above due to its interactiveness and the ability to use a different learning style while playing these approaches, for instance one can use the handbook (text-based learning) while being in the cartoon environment (cartoon-based).

In figure 6 the text-based approach of the game patient observation is demonstrated. No interaction is available, only static text. No illustrations or videos are implemented in this part. There is a return button in order to go back to the menu for choosing another approach. When the user is confident enough, the button examination can be clicked on to take an exam. Table 4 shows how the handbook is used by a particular user. Information provided in the handbook should make the user able to take the examination when the information is learned well enough.

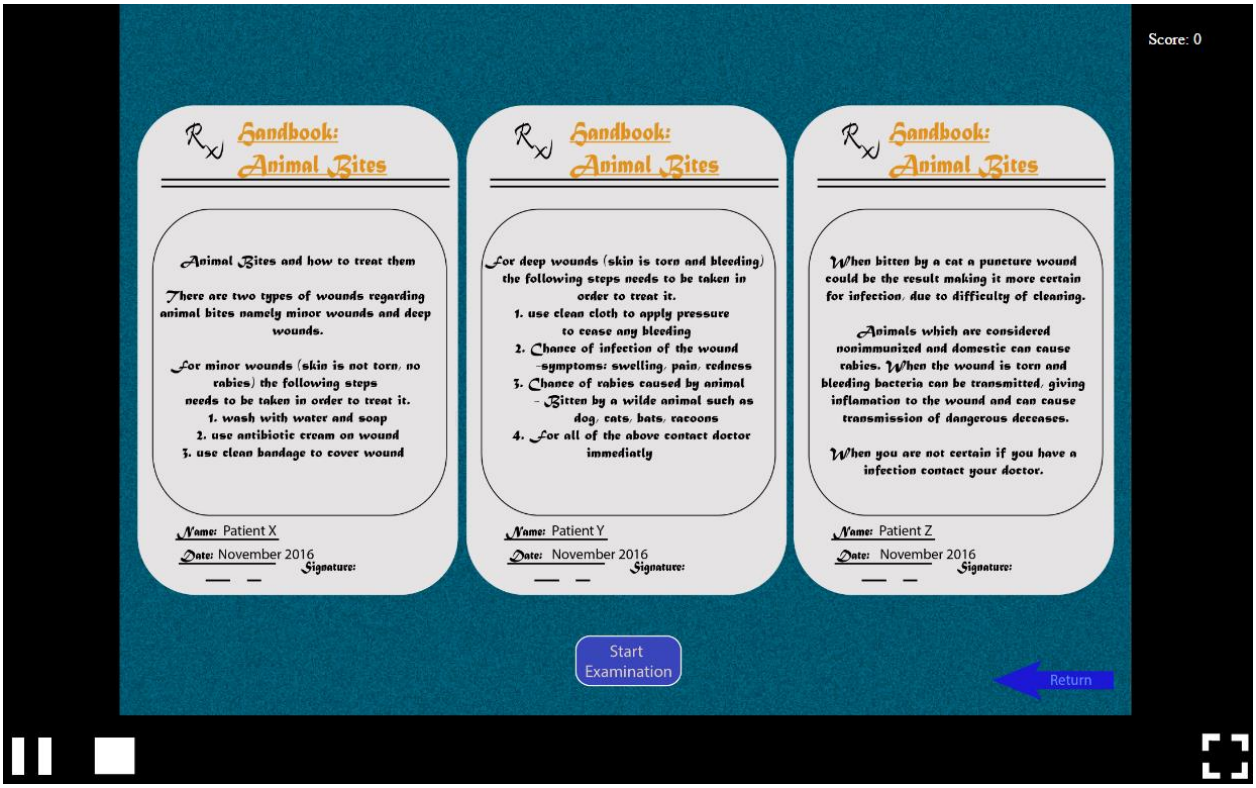

Figure 6: Screenshot of game: Patient observation handbook (text-based learning).

Table 4: Concrete use case scenario of learning text-based.

User action	Application response.
User goes to website of application	Application displays start screen with three options (start treatment, teacher, handbook)
User chooses option handbook	Application displays handbook screen with return button and examination button.
User reads and learns the information on the screen	Application does nothing. No interaction available.
User clicks on examination	Application displays examination screen

4.3.2 Realistic-based learning

The realistic-based approach makes use of a movie showing you a real person with realistic environments instead of cartoons or illustrations. Realistic-based could also mean simulation-based, making a specific environment like the real world but with interactiveness. The following use-case gives a better insight of the implementation of realistic elements.

4.3.2.1 Case study 2: Realistic-based learning

The goal of this case-study is to gain knowledge about the advantages (table 5) of realistic-based learning. The article (Lateef, Fatimah, 2010) discusses many advantages in order to use simulations for health professionals with a realistic approach. Specific aspects from the real world are replicated with the intention of having the experience of actually being in the real world.

Table 5: Advantages and disadvantages regarding realistic-based learning.

Advantages	Disadvantages
Protecting patients from risks and to scale down errors.	No cartoons, so it is not usable for every age group.
Realistic scenario's	Usually for gaming or professionals such as medical professionals or military.
Enhance performance in contrast to traditional teaching methods	
Feels familiar	
Gives confidence	
Realisme improves cooperative learning	

4.3.2.2 Design approach realistic-based learning: Patient Observation.

In figure 7 the realistic-based approach of the game patient observation is demonstrated. A video is displayed demonstrating how to treat an animal bite wound by using realistic events such as washing the hands with water and soap. During the video several questions will be displayed with a limited amount of time to answer them. When answered correctly the user will be rewarded with 2 points. (see figure 8).

Figure 7: Screenshot of game: Patient observation teacher (realistic-based learning).

Figure 8: Screenshot of game:Patient observation demonstrating question during movie

Table 6 demonstrates how the realistic approach has to be performed and gives a detailed description of the steps involved. Because of the interactivity more steps need to be performed than the text-based approach.

Table 6: Concrete use case scenario of learning realistic-based.

User action	Application response
User goes to website of application	Application displays start screen with three options (start treatment, teacher, handbook)
User chooses option teacher	Application displays teacher instruction screen with continue button.
User clicks on continue button	Application displays youtube movie
User watch movie	Application displays question
User answers question by clicking on false button	Application gives feedback by making the answer green and awards 2 points to score system.
User watch video till the end	Application displays examination screen after video finishes.

In figure 9 the code for making the question overlay on the youtube video is displayed. The First tag is called subject id and gives the name to the subject for references. The first subject displays the image for instruction. No startTime or duration has been set only a button to continue by using an overlay that jumps to the youtube movie.

The Youtube movie consists of several layers with questions. Each question is assigned with a startTime and duration. Two types of questions are used namely multiple choice and true/false questions. Also the correct answer is stated in order to assign 2 points using addition by using <score id=”scoreA” operation=”add” value=”2”/>. If the youtube movie is finished it jumps to the exam screen because of the following code: <subject id="realistic2" leadsTo="exam">. The movie itself has been set to start after 34 seconds. The question startTime has been set in such a fashion that the question will appear before the answer is explained by the teacher in the video, for instance the question is asked if the wound should be washed with water and soap, which can be answered with true or false. The question disappears again and the scene is played from figure 6.

```
45        <subject id="realistic">
46            <media>
47                <image src="media/intro realistic.jpg">
48                <overlay startTime="0"  x="900px" y="790px" width="150px" height="20px" backgroundColor="" leadsTo="realistic2"/>
49                </image>
50            </media>
51        </subject>
52
53        <subject id="realistic2" leadsTo="exam">
54            <media>
55                <youtube id="opIyVWm0vZ8" startTime="34">
56
57                <question startTime="10" questionTimeLimit="3" answer="true">
58                <score id="scoreA" operation="add" value="2" />
59                A animal bite can be cleaned with only water and soap.
60                </question>
61
62                <question startTime="20" questionTimeLimit="3" answer="false">
63                <score id="scoreA" operation="add" value="2" />
64                The wound does not need to be covered in case of minor bleeding
65                </question>
66
67                </youtube>
68            </media>
69        </subject>
```

Figure 9: XML code for developing the realistic-based method.

4.3.3 Cartoon-based learning

The cartoon-based approach makes use of illustrations created in adobe illustrator in order to make attractive illustrations. The interactivity in this approach is high since it is required for the user to click on several buttons in order to gain knowledge. It also promotes different learning styles referencing to in-game adaptivity games seen in table 5 by giving the option of jumping to the handbook while being in the cartoon-based environment (see red circle in figure 10). The following use-case gives a better insight of implementation of cartoons in serious games.

4.3.3.1 Case study 3: Cartoon-based learning

The goal of this case-study is to evaluate a cartoon-based teaching method in order to enhance learning. The article (Van Wyk et. al., 2011) indicated that economic teachers uses cartoons regularly in their presentations. The article concluded that there are several advantages for using cartoons displayed in table 6 and can be stated that it enhance learning than when used traditional learning methods.

Table 7: Advantages and disadvantages for cartoon-based learning

Advantages	**Disadvantages**
Humor plots	Not a realistic environment
Use of simple animations to explain a more difficult subject	On could found it childish, but this is not the majority of people
Cartoons improve constructive learning	Difficult subjects explained to easily with less details.
Cartoons improve cooperative learning	
High motivation for learning with cartoons	
Inspire skills in children	

Both realistic-based and cartoon-based learning improves cooperative learning, because it inspire users into discussions, making it also sociable. Also motivations seems to go upwards, because of the interactiveness of the game. The aspects of realistic-based and cartoon-based makes learning interesting but also creates critical thinking and reflectiveness, by using different approaches for learning a subject. This is essential in healthcare games since it is useful to critically think about a particular symptom or even describing a symptom needs to be critically done.

4.3.3.2 Design approach cartoon-based learning: Patient Observation.

Figure 10 displays a screenshot taken when cartoon-based learning is chosen. For making the game more interesting a short movie is viewed before going to the actual learning environment. The movie shows the user how an animal bite can be obtained in a humorous setting. Also a instruction screen is displayed after the movie giving the user information about what to do.

Figure 10: Screenshot of game: Patient observation start treatment (cartoon-based learning).

The icons at the top of the screen are buttons which can be pressed in order to get information. Each button gives other information and also might let the user do something different, for instance going back to the scene to click on the wound for additional information. The question mark provides information about the use of the application. The three other buttons on the right jumps back to the menu, instructions or even the handbook. Figure 11 illustrates that when an icon has been clicked, three options appears. When clicked on one of the options, information is displayed with a relevant illustration.

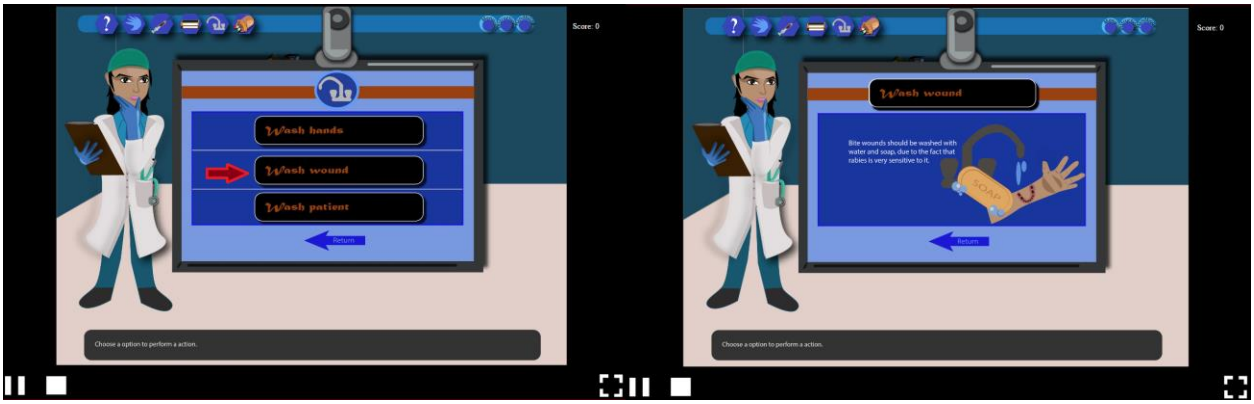

Figure 11: Screenshot of game: Patient observation choosing an option when clicked on the faucet icon.

The icons can be clicked by using overlays, which can be seen in figure 12. Options are available when starting cartoon-based (start treatment) learning. These options indicate which subject the user wants to learn. For the purpose of this project only the subject animal bites is available. The other subjects are future work (see chapter future work). When clicked on the subject animal bites a short movie is displayed. The movie is created in Windows movie maker and can be skipped by pressing the button in the bottom right.

```
<subject id="subject2">
    <media>
        <image src="media/start treatment.jpg">
            <overlay startTime="0"  x="640px" y="340px" width="400px" height="50px" backgroundColor="" leadsTo="subject4"/>
            <overlay startTime="0"  x="640px" y="480px" width="400px" height="50px" backgroundColor="" leadsTo="subject1"/>
            <overlay startTime="0"  x="640px" y="590px" width="400px" height="50px" backgroundColor="" leadsTo="subject1"/>
        </image>
    </media>
</subject>
<subject id="subject4">
    <media>
        <image src="media/scenebla.jpg">
            <overlay startTime="1"  x="323px" y="28px" width="50px" height="50px" backgroundColor="" leadsTo="questionmark" />
            <overlay startTime="0"  x="403px" y="28px" width="50px" height="50px" backgroundColor="" leadsTo="hand"/>
            <overlay startTime="0"  x="486px" y="28px" width="50px" height="50px" backgroundColor="" leadsTo="injection"/>
            <overlay startTime="0"  x="573px" y="28px" width="50px" height="50px" backgroundColor="" leadsTo="books"/>
            <overlay startTime="0"  x="652px" y="28px" width="50px" height="50px" backgroundColor="" leadsTo="kraan"/>
            <overlay startTime="0"  x="733px" y="28px" width="50px" height="50px" backgroundColor="" leadsTo="bottle"/>
            <overlay startTime="0"  x="1475px" y="40px" width="33px" height="33px" backgroundColor="" leadsTo="subject2"/>
            <overlay startTime="0"  x="1529px" y="40px" width="33px" height="33px" backgroundColor="" leadsTo="subject3"/>
            <overlay startTime="0"  x="1584px" y="40px" width="33px" height="33px" backgroundColor="" leadsTo="handbook"/>
            <overlay startTime="0"  x="460px" y="589px" width="33px" height="33px" backgroundColor="" hoverBackgroundColor="red" hover_image="media/1.jpg" leadsTo="symptoms"/>
        </image>
    </media>
</subject>
```

Figure 12: XML code for developing the cartoon-based method.

Table 8 demonstrates how the cartoon approach has to be performed and gives a detailed description of the steps involved. More steps need to be performed than the text-based approach and the realistic-based approach.

Table 8: Concrete use case scenario of learning realistic-based.

User action	**Application response**
User goes to website of application	Application displays start screen with three options (start treatment, teacher, handbook)
User chooses option start treatment	Application displays menu with three subjects (animal bites, burn wounds and stroke).
User clicks on Animal bites	Application displays an animation
User watch animation	Application displays instruction menu
User clicks on return button	Application displays scene
User clicks on a icon button (faucet) at the top of the illustration	Application displays three possible options. (wash hands, wash wound, wash patient)
User clicks on a option wash wound	Application displays illustration with information
User learns information and clicks on return button	Applications returns to scene screen
User clicks on examination button	Application displays examination instruction screen

4.3.4 The examination of the learned information

Every approach chosen in the application: Patient observation ends in making the exam by pressing the examination button. This will give the user the proper feedback to evaluate what he or she has learned during playing the game. Every questions answered right will give the user a short animation showing the answer is correct and rewards 10 points. If the question is wrong, the chosen answer becomes red and the user needs to continue to the next question (figure 13).

To make the examination interesting, animation has been used to give positive feedback. This would give the motivation to the user to give the right answer. Also the score systems should give motivation to the user since it is possible to gain 100 points when everything is answered right. If the answers are not right there is no possibility to see the right answer then doing the exam again. This gives repetition urging the user to learn the information.

Figure 13: Screenshot of game: Patient observation the examination. (left) the correct answer. (right) the wrong answer.

5. Evaluation

Results were obtained after conducting a survey with 7 different questions. The results will give more insight on the behaviour of the users and their preferences. This is a first qualitative evaluation and not a representative experiment, because information which is obtained by the survey is demonstrated in this chapter. The survey questions and answers given by users can be found in the appendix. The survey is made by 10 individuals anonymously and with no specific age group, gender or academic background. Table 9 shows the information of scores for each method and also with method obtained the most preference. Realistic-based got chosen by 4 users as their preference, whereas cartoon-based obtained 3. Text-based did not receive any preference. Users where explained what each type consisted of and what they could expect. The users then choose a specific type based on their gained knowledge.

Table 9: Results of the survey conducted by 10 different individuals.

Method	**User score**	**User score**	**User score**	**User score**	**Amount of users who prefers the method**
Text-based	30	70	60		0
Cartoon-based	90	90	80	20	4
Realistic-based	80	70	70		6

Table 10 demonstrates the arguments for choosing a specific method as preference. It seems that text-based got chosen because of the amount of time availability. Text were read fast and not focused, this resulted in a lower score value (table 9). Also users tended to choose cartoon-based over text-based because it is more engaging and fun to learn in such a fashion. Most of the users preferred realistic-based, but in the beginning the movie was not available due to problems with the youtube plug in within the application XIMPEL, making users to choose a different method.

Table 10: Results of the survey. Reasons for preferring a method.

Method	**Reason for preference**
Text-based	You first need theory before practice
	Not having a lot of time, go fast through the information
Cartoon-based	Easier to remember information
	More enjoyable
	It teaches you in an engaging way how to react to different accidents
Realistic-based	Easy to use, You just have to listen and answer questions and you do not have to read a lot

	Knowing exactly what to expect and how it would look.

Table 11 shows that only 2 people out of 10 have had first aid training. They all got mandatory training from work. The other users did not have any training but still they seemed to found the information useful. Explanation that were given in argument for not having any training is they never thought about it, or lack of time.

Table 11: Results of the survey. Usefulness and already obtained training information from the user.

Users who found the information useful	**Users who had first aid training?**
10	3

In order to take the application to the next level the users were asked if there could be any improvements. They are listed below in table 12.

Table 12: Results of the survey. Any improvements the application should have.

Method	**Improvements for the app given by users**	**Remarks**
Text-based	The questions and information stays simple, it could go deeper and more information can be given	It looks like good work and well made
	Text is too small on mobile screen	More subjects than just one
	More information of the subject	
Cartoon-based	Some of the text did not fit the boxes	Choose a more readable font
	After the exam you end up at the start of the exam again, with 0 pts.	
	Would be nice to see an extra screen with your final score, and end up at the main screen instead of the exam	
	Maybe having small games instead of only information given by illustrations	
	More languages then just English, such as Dutch.	
	Add more scenario's	
	Make it possible to always go back to previous screen	
Realistic-based	You can use pictures of real dog bites, to	Make the questions during

	show people how it actually looks like in reality	the movie go slower.
	Questions during the movie do not go anywhere you can answer them and receive points but when you take the exam the point amount starts at 0 again	
	Pausing the video while a question pops up, because it is hard to listen to the movie and focus on questions at the same time	

6. Discussion

Even Though research which was conducted for this thesis concluded that interaction and graphics gives higher scores in contrast to standard text-based learning. In the experiment that was conducted for this thesis with the developed application there was not a significant difference between the scores of the three methods text-based, realistic-based and cartoon-based learning. This is probably due to the fact it contains little information and sometimes simple questions which are not hard to answer. Basic first aid is not a difficult subject, but some things are needed to be learned in order to apply it. Also the text-based learning method contained not a lot of information this makes it easier to remember then having a few pages to remember, therefore when reading the text and making the examination results in high scores.

The three methods did differ in the amount of motivation the user has to play the specific method, for instance many users wanted to do the realistic-based learning method, but actually no user preferred the text-based learning method, because the lack of interaction and tediousness. In the chapter background information was stated why people did not have the tendency to learn basic first aid. It appeared that most of the users also did not received or have first aid training, with the same reasons given in other articles, such as lack of time and did not feel the need for it or did not thought about it, even though every user explained they see the need for it and it actually could be useful.

Motivation becomes higher when certain aspects are available such as interaction and enjoyment. But the experiment also indicates that many people did not have a lot of time and wanted the most easy, non-time consuming but still enjoyable approach, which was in this case the realistic based method. This was not something to be expected, because the cartoon-based method is the most engaging and interactive approach, but still people wanted to watch a movie instead.

Most of the people that have taken the survey are in their 30s and considering the fact that most of them wanted to play the realistic approach makes it question if the application is not meant for children. There were though people who preferred the cartoon-based method, which makes the application suitable for every age group. It might be helpful if also children knew basic first aid and know how to apply it, because when an accident happens they do not have to find a parent first but can take care of the situation in the mean time.

During the project some errors occurred which needed to be taken care of in order to continue, for instance at first the application was made in the old version of XIMPEL, which was used by flash. This was only in the beginning of the project, switching to html5 made it more user friendly.

Another error that occurred was placing videos in the application which were not linked to youtube appeared to be black on the screen. After some adjustment to the code the movie was displayed properly. It seems that the code was not written correctly which made it gave an error.

When users were asked to play the game and choose a method. Many people choose realistic-based but the video did not seemed to load from youtube. At first this was thought to be due to slow internet connection or the use of mobile phones but later it was found out that there was a problem with the support of youtube within the application XIMPEL. The problem was solved to put the youtube video in the folder for the web page. This does not fix the youtube support problem but it makes the video available again for potential users. Also the condition to go to a specific screen when having a specific score was giving errors. This was due to the fact lines of code were switched between each other, giving it nothing in return.

At first the application would cover every aspect of basic first aid, but after receiving a handbook by a co-assistant, this would go beyond the scope of the project. After consulting it was concluded that the project would consists of three methods and to let the user decide which method would have the preference. Only 1 subject is worked out completely instead of every subject, which is future work. For the project it was needed to have users make a survey. Therefore a link needed to be provided in the application which goes to the created survey. It became clear that XIMPEL does not allow links yet, and this needed to be programmed in order to use it. To solve this problem an illustration of the survey was placed in the application, but this gave problems since people were not keen on making surveys in the first place. Now they can not click on the link and needed to make a document of their own. To solve this only answers could be e-mailed.

The application Patient Observation could be enhanced by creating some extra additions, for example XIMPEL could be extended with a web graphic library (webGL) implementation. WebGL is a solution for not having to use any plug-in but still are able to render interactive 2D and 3D graphics within a browser by using HTML5 code <canvas>. Furthermore webGl can be split into two parts namely javascript code which is used for the control code and shader code which is used for any special effects. The webGL code can be combined with html code, making it possible to enrich a certain page or even a background.[5] This could be useful for the application patient observation to make it more 3D, for instance a cube could be created with texture on it and spins slowly around. The texture would consists of illustration or explanation about the subject making it more interesting to present information.

Another possible extension would be the use of D3. D3 makes it possible to interact with pages consisted of information by using a javascript library. Any data can be used in order to make a table or a graph by using HTML, SVG and CSS. By using this javascript library data will be visualised more powerfully. The method D3 uses it to combine any data with a Document Object Model (DOM), afterwards the data will be transformed in a specific visualisation of choice. Interaction with the data would also be available when using D3.[6] This implementation could be useful for making interactions with the information that needs to be learned.

[5] https://developer.mozilla.org/en-US/docs/Web/API/WebGL_API/Tutorial/Getting_started_with_WebGL
[6] https://d3js.org/

When considering the experiment that has been conducted, some aspects could be changed in order to get possible other results, for instance the time when information has been obtained. Someone learns the information by either text-based, cartoon-based or realistic based and then the person waits a day or two before doing the examination. The question is will the results still be the same, or is information that has been obtained forgotten by playing the game for only one time.

Movies would make a difference in the application. For now illustrations has been used and made into a movie with windows movie maker. But actually making a cartoon with adobe After Effects would make the game more interesting. Due to time shortage this has not been achieved yet, while this was planned. Learning such a concept takes time. Also adding sounds can make a difference and give more motivation for playing a serious game. A theme sound when the application starts should be added, but also when the introduction movie is playing or even when button are pushed in. At least more chapters should be added for the subject basic first aid. The application now only offers bite wounds, but in order to make an application successful subjects needs to be extended and perhaps with a different approach, otherwise it might get tedious, which will then result in people not interested in playing the game anymore.

7. Conclusion

Research conducted for this thesis indicates that serious games can be used for teaching/training people in first aid. It can be concluded that it give people the proper motivation to learn basic first aid. If the subject is not interesting for a person, serious games is the solutions since it offers an interactive and entertaining method to learn the specific subject. It can also be concluded that most of the users choose realistic-based because of not having to read as much as the other methods. This indicates that users want to do as less as possible but still learn the subject. Everyone found the information useful disregarding which method he or she used. Another reason why people wanted to choose realistic-based is that they can actually see how it in the real world looks like. This concludes why people strive to more realistic approaches in games, because they want the feeling of real world experiences. Cartoon-based seemed to be the most popular when time is available, because this method requires the most interaction. This also makes cartoon-based the most engaging, but because many people who were asked to play the game mentioned that they did not had a lot of time and choose another method for that reason. People chose text-based because it seemed the fastest method to go through the application. This might be true, but it is necessary to memorize and read everything before going to the examination. People tend to read it fast without focusing on what is actually written just to go to the examination as fast as possible resulting in a low score. This concludes that it is easier to skip a line of text than when you need to interact with for instance a icon.

The experiment that was conducted as purpose for this thesis concluded that learning in an engaging fashion improves motivation to learn. In the results can be seen that the users who did text-based as method appeared to have a lower score than the other methods, but that difference was not particularly high. There was an observable difference between text-based, realistic-based and interactive cartoon-based learning. The reason why there is not a big difference is because the information provided is limited and easy to remember.

There is still a problem in recognizing medical conditions when persons are having specific symptoms because not many people have done a first aid training. Only three people out of 10 did received basic first aid training but only because it is required for their work. Others mentioned they never thought about it or lack of time. This can also be concluded for this application, because a few people chose a specific method based on their time limit, even though everyone mentioned it is useful and having knowledge about basic first aid can actually help a fellow human being.

The advantages and disadvantages became clear after conducting the experiment. Users indicated that there are not disadvantages of learning by using serious games. There was only one disadvantage considering a specific approach, for instance the cartoon-based learning. Users indicated that by using cartoons it might not be clear enough to understand how a specific wound would look like in the real world, because it is drawn and not realistic. Furthermore they indicated that it is more enjoyable to learn by interactivity and it enhance motivation. Also by doing the examination the answers are remembered, because of repetition.

To conclude in answering the question can interactiveness and graphics in serious games enhance the learning ability in order to learn and practice subjects? The answer can be stated as yes it can, because research during this project also mentioned motivation is the most important aspect. This motivation can be enhanced by graphics and interaction. Users explained that the application is engaging and enjoyable, because of the features of being interacted instead of only reading. This can bes een in table 9 and 10. Users indicated that tekst-based is only used because of the simplicity and fast approach. If more information had been provided, for instance more pages of text, it will not be a fast approach anymore. After finishing the game users indicated that they now know how to handle when an animal bite occurs. This indicates that the application provided enough information for the user to be able to apply this information in the field.

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APPENDIX

APPENDIX A: The actual project: progress & collaborations

In this chapter the time management is being explained. Also external sources such as professionals have been involved in the project. This is explained in the second section of this chapter.

The project was divided into two aspects namely the creation of the application and writing the thesis. At first the focus went to creating the application, but before actually making it research needed to be conducted. Serious games is the main subject, but in order to create a serious game certain aspects needed to be taken into consideration. The design but the usefulness of the application needed to be determined. When this was established a storyboard was created for the application to visualize components such as the start screen but also the actual interaction screen.

Project aspects	Date	Explanation
Research about subject	June	- Basic first aid was chosen with research question. - Meeting with professor Anton Eliens to confirm subject.
Making storyboard	June	- Drawing sketches
Make start screen illustration	June	- Drawing in adobe Illustrator
Make other illustrations	July	- Drawing in adobe Illustrator
Read about ximpel and its possibilities	July	- Check other projects about the possibilities - Check own project of serious games.
Start coding in ximpel	July	- Using XIMPEL documentation
Make storyboard of which interactions needs to be implemented.	August	- Sketching ideas
Make more illustrations	August	- Drawing in adobe Illustrator
Write thesis	September	- Doing research - Reading articles
Make users take a survey with Finished application	Begin november	- Contact people to play the game and make the survey (social media)
Make any adjustments to application	Midden november	- Feedback from users - Finish the application for grading
Finish thesis	End of november	- Finish thesis for grading

Explanation involvement of external persons.

The project contains information that needs to be learned by the users, therefore it is important the information is reliable and useful. In order to get reliable information I contacted co assistants from hospitals to validate the project but to also gain material such as first aid books. I also had meetings to demonstrate my application to one of the co-assistants to get feedback. To make my illustrations more realistic I went to hospitals to see how for instance a hospital bed looks like.

In order to gain data about the project for the experiment several people were contacted. They also spread the word to other people to make the survey. Also social media were used in the process of contacting people.

Other people were involved in checking whether illustrations looks attractive and on point. When there were complains the illustrations were adjusted.

Help with XIMPEL was given by Winoe Bhikharie the assistant of the master project supervisor. When the project was stuck due to coding errors or when something was needed to be implemented but it was not certain how to do this, Winoe Bhikharie could be contacted and helped immediately.

Appendix B: Survey: User experience

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
80

3. Which out of the three methods do you actually prefer and why?
Movie want is makkelijker je luistered en antwoord die andere moet je veel lezen

4. Could there be any improvements?
Alles is perfect meerdere talen

5. Did you found it useful?
Heel leerrijk

6. Why have or haven't you learned basic first aid?
Moest voor werk

7. Any remarks
nee

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
30

3. Which out of the three methods do you actually prefer and why?
I tried only text-based because the video took so long to start probably due to the poor internet Connection I have here and I believe that to apply something you firstly need to know the theory behind the practical.

4. Could there be any improvements?
I think it is a good work and well made.

5. Did you found it useful?
It seems interesting and useful to learn how really those things work and maybe to have some more knowledge on certain situations.

6. Why have or haven't you learned basic first aid?
Because it can always be helpful to me or to someone else even if I am not so prepared in what I tried here (Animal Bites)

7. Any remarks
Great job

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
90

3. Which out of the three methods do you actually prefer and why?
Only tried the cartoon-based one, but I imagine it would be easier to remember than the text-based one. I might prefer the realistic version so you know exactly what to expect and how it would look. In these kinds of situations you don't want to be surprised because wounds look different from what you expect.

4. Could there be any improvements?
Some of the texts didn't fit the boxes. After the exam you end up at the start of the exam again, with 0 pts. Would be nice to see an extra screen with your final score, and end up at the main screen instead of the exam.

5. Did you found it useful?
With some more improvements it could be useful for instructions.

6. Why have or haven’t you learned basic first aid?
Because it's useful to know what to do in the given situation, instead of panicking you're contributing. And some aspects are mandatory for my work.

7. Any remarks
Choose a more readable font!

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
70

3. Which out of the three methods do you actually prefer and why?
Text-based for if you have not a lot of time and you need to know something fast. Cartoon-based for if you want to learn something with more fun.

4. Could there be any improvements?
The questions and information stays simple, it could go deeper and more information can be given.

5. Did you found it useful?
Yes, now I know what I should do when encountering a animal bite.

6. Why have or haven't you learned basic first aid?
I do not really know. I never learned it in school or elsewhere and I have not been searching for it myself.

7. Any remarks
Text is too small on mobile screen, I needed to zoom in all the time.

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
80

3. Which out of the three methods do you actually prefer and why?
I prefered the realistic one, because I wanted to see how it actually looked like instead of a drawing version.

4. Could there be any improvements?
You can use pictures of real dog bites, to show people how it actually looks like in reality

5. Did you found it useful?
Yes, easy to follow instructions and the video is good.

6. Why have or haven't you learned basic first aid?
I never thought about learning it and I do not have the time after work.

7. Any remarks
Questions during the movie do not go anywhere you can answer them and receive points but when you take the exam the point amount starts at 0 again.

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
90

3. Which out of the three methods do you actually prefer and why?
I liked the cartoon one, because it looked funny

4. Could there be any improvements?
Maybe having little games instead of only information given by illustrations

5. Did you found it useful?
Yes, Illustrations were good and there was enough information given to complete the exam.

6. Why have or haven't you learned basic first aid?
Work did not offer it.

7. Any remarks
Like I said in question 4, small puzzles should be added.

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
60

3. Which out of the three methods do you actually prefer and why?
The cartoon, but I did not have a lot of time so I did the text-based first.

4. Could there be any improvements?
Maybe more information

5. Did you found it useful?
Yes, Some of the information I did not know.

6. Why have or haven't you learned basic first aid?
Never thought of learning it.

7. Any remarks
The application should have more subjects than just one.

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
70

3. Which out of the three methods do you actually prefer and why?
Realistic-based because you did not have to read much

4. Could there be any improvements?
Not that I can think of

5. Did you found it useful?
Ja

6. Why have or haven't you learned basic first aid?
Never thought of it, never needed to do it for work

7. Any remarks
Make the questions go slower. I did not have enough time to read the questions, let alone
Answer them

Survey: User experience

www.few.vu.nl/~pjg210

1. There were three different methods to learn first aid namely text-based (handbook), realistic-based (teacher) and cartoon-based (start treatment). Which one did you do?

1. Text-based
2. Cartoon-based
3. realistic-based

2. How much was your score when taking the exam?
70

3. Which out of the three methods do you actually prefer and why?
Realistic, because cartoon is for children

4. Could there be any improvements?
Yes, maybe pausing the video while a question pops up, because it is hard to listen to the movie and focus on questions at the same time

5. Did you found it useful?
Yes

6. Why have or haven't you learned basic first aid?
I haven't learned it because I never been in a situation where I was needed to perform it so I did not feel the need for it.

7. Any remarks
Nice video