Serious Games to support Reflection in the HealthCare Sector

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Abstract

This paper describes two serious games designed for care homes and hospitals in the frame of the MIRROR project. The games aim to empower and engage employees to reflect on past work performances and personal learning experiences in order to learn in 'real-time' and to creatively solve pressing problems. The games, designed for new nurses and carers, were tested with more than 200 users with different methods (quantitative and qualitative). Results collected so far seem to underline how the various gaming characteristics and supports offered by the Virtual Tutor (within the games) create favorable conditions so as to allow learners to adopt a reflective attitude towards their own past/present acts and experiences.

Keywords: *serious games, reflection, learning by reflection*

1. Introduction

Games for the health and care sector are a rapidly emerging market and games for health alone have expected revenues of $7 billion in the coming years [1]. There is increasing evidence that utilizing games to train and educate is effective [2] [3] [4] [5] both in direct patient care/therapy and in health education, policy and management [6]. Despite this there are hardly any examples of games that focus on issues of promotion of good practice in health and social care in disciplines that require highly customized solutions [7] and there is still a lack of scientific evidence of how serious games relate to reflection, which is one of the pillars of learning.
In addition, training in the health and care sectors cannot entail only medical content, but must take into consideration also the relationships between staff and patients. This part of the training is particularly sensitive in several areas, such as a group of UK care homes specializing in dementia. This was one of the two targets that were considered in this case study. The other one is a German hospital, specifically the stroke unit. A common area was identified in the management of difficult dialogues that can even lead to challenging behavior. These two case studies are reported in the paper as known examples, because the need for the afore-mentioned topics is indeed widely spread across different work sectors and domains.

2. 3D serious games to support reflection

2.1. Requirements and specifications

The requirements and specifications to design and develop the games were collected both with the customers (care home in UK and hospital in Germany) and with end-users (carers and nurses). Particularly the care home in UK and the hospital in Germany were looking for a tool able to train new employees to deal with difficult and stressful situations that could occur with patients/residents. Specifically, they were asking for a tool able to teach employees the importance of the balance among the time management and the patients/residents satisfaction. Further they were really interested in offer their employees a tool able to support and conducted their reflection processes in order to allow employees to learn from their past experience. Customers liked also the idea that more experienced staff can share their work experiences with others, in order to offer new employees the possibility to learn directly from the experiences of their colleagues.

In addition, the hospital wished to have a realistic look and feel of the game environment while the care home were more interested in a graphic representation of their work environment.

On the other hand, nurses and carers were looking for a tool easy and fast to use due to their general unfamiliarity with technology. At the same time they were looking for something immersive and able to simulate their working processes in order to increase their confidence and familiarity with their work.

2.2. Architecture and structure

In order to match the above described requirements, 2 twin serious games were developed. These games are web-based and are set in a 3D virtual environment developed with the Unity software and show different graphical styles according to the customers' requests (see Fig.1 and Fig.2).

Figure 1. 3D Virtual Care Home

Figure 2. 3D Virtual Hospital

Inside the interface of the games there are some icons/tools that help users to deal with their tasks:

- the map icon: users have the possibility to know where they are and how to reach a particular room or place;
- the timer: users always know how much time is left in order to complete all their tasks;
- the score: at any time of the game users can be aware of their overall score and of the specific score related to different parameters (time management and patients/residents satisfaction);
- the tablet icon: users have the possibility to access a series of instruments that are particularly important for supporting the reflection process inside the game.

Particularly, inside the tablet (see Fig.3) users can have access to several tools:

- the agenda: users can find inside it all the tasks that they have to accomplish during the game;
- the residents/patients history case: users can find here all useful information in order to deal with residents and patients;
- the notebook: users can use this tool to take notes about their feelings and thoughts whenever they want during the game;
- the tutor's icon: users can use this tool to ask for tutor's help;

Figure 3. The Tablet

A Virtual Tutor was implemented within the games with the aim to guide users during their games' experiences. According to the vygotskian theory and based on the 'peer-to-peer' learning model, the Virtual Tutor enables learners to extend their own knowledge. In particular the figure of the Virtual Tutor was implemented into the game as a:

- valuable and trustable colleague of learners;
- colleague without any position of authority;
- colleague able to modify and extend current learners' capabilities (through feedback), and build new understanding (through the possibility to ask for tutor's help).

According to these characteristics, the intervention of the Virtual Tutor occurs at different levels:

- Pull: learners can ask for tutor's help whenever they feel it is relevant (through the 'tutor's icon' in the 'tablet') (see Fig.4).
- Push: in some precise situations, Maria is shown inside the game through a pop-up window to help users deal with difficult situations through some feedback (see Fig.5).

Figure 4. The tutor's tips

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Figure 5. The tutor's feedback

Moreover, at the end of the game a global feedback informs users about their performance during the game with respect to the different parameters described above: time management and patients/residents satisfaction. After the game experience learners are also able to read all the notes they have collected during gameplay into a learning diary, and reflect about their experience.

Finally, to allow users and their colleagues to enrich the game with personal work experiences and best practices, a wizard tool was developed within the games. This tool is based on the interaction of users with so-called Non-Playing-Characters (NPCs) that have been added in the serious games environment. A Non-Player-Character (NPC) in a game is any character not controlled by a player with which the player can interact. Each NPC has a personal description: they differ by sex, age and years of experience to allow users to choose the one closest to their personal characteristics. Thus, users have to decide to which character best fits the content they want to insert.

2.3. Gameplay

Within this structure, 'CLinIC' and 'Think better CARE' are two resulting 3D immersive serious games focusing on difficult communication between nursing/carer and patients/residents. These games aim to foster reflection and to maximize learners' ability to self-regulate their training with the support of a Virtual Tutor inside the game [8].
From a methodological point of view it is the same game; to catch the two specific situations, different contents and graphics have been created specifically for each of the two cases, according to their needs and expectations.
Nurses in a hospital, as well as carers at the care homes, have to deal with different patients or residents, choosing how to react to various realistic requests and how to balance their time and interventions among concurrent calls and needs.
The core of the games is to explore situations in order to gain better knowledge of what to do, in what order (when), and why. The games are built on this simple principle, provoking reflection by posing questions that create dilemmas. The objective is to prepare carers as well as nurses to make a good instant decision when confronted with a similar real life occurrence. Reflection on the real life experience could lead to further improvement in the quality of the next decision taken in similar circumstances [9] [10]. Specifically learners have to work through a full shift, which represents an overarching narrative, talking and exchanging knowledge with colleagues, taking care of residents/patients and reflecting over their actions. Equipped with a tablet containing the agenda of the day with tasks to be accomplished within the shift, the list of residents/patients and an access to their case history files and a personal notebook, the learner is confronted with a series of mini-games representing tasks to be completed, as well as with dialogues with residents/patients calling for them, within a given time.
The mini-games represent small learning units and it is up to the learner to interact with these. After each dialogue with patients/residents users are asked, in fact, to choose if play or not a mini

game. Of course, players would gain expertise, but on the other hand they would lose time. In addition, during all the gameplay, immediately after each choice of action, the Virtual Tutor gives users a qualitative feedback explaining them how to improve their behavior in order to increase their score. The different choices would give players different final results and feedback with respect to different parameters, specifically time management and patient/resident satisfaction. Particularly users at the end of the game could receive a positive, a neutral or a negative feedback according to their performances. Further, at the end of each game play, users can consult a learning diary, where all the notes and the most important actions conducted in the game are collected.

3. Supporting dynamic addition of contents

On the home page of each serious game, users can decide whether they want to play the game directly or add new content (i.e. best practices, experiences) to the game (see Fig.6).

Figure 6. Access page to the game and the wizard tool

The 'wizard tool' is based on the interaction of users with so-called Non-Playing-Characters (NPCs) that have been added in the serious games environment. Each NPC has a personal description (see Fig.7) and users have to decide to which character best fits to the content they want to insert.

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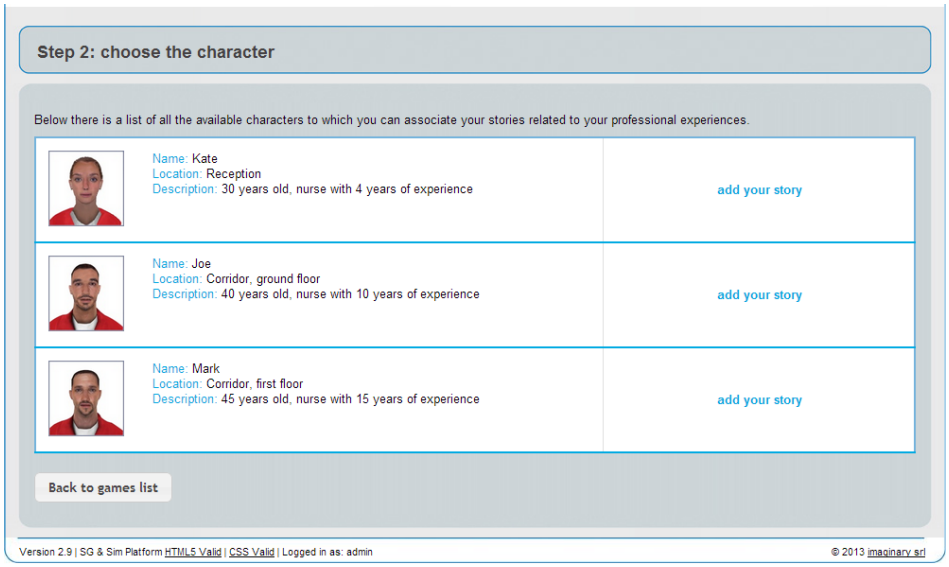

Figure 7. Select your characters

Once users insert their own content in form of a story, this is collected in a database to be shown randomly during the game. When users meet one of these Non-Playing-Characters for which at least one story was added, they can interact with it and one of its stories will be displayed (see Fig.8). Some of the best practices and suggestions that have been inserted in the games are: 'when a resident is confused or angry, try a walk in the garden', 'try to reflect on what you have done today in your break', 'try to make on each shift to reflect on your work and patients as individuals'.

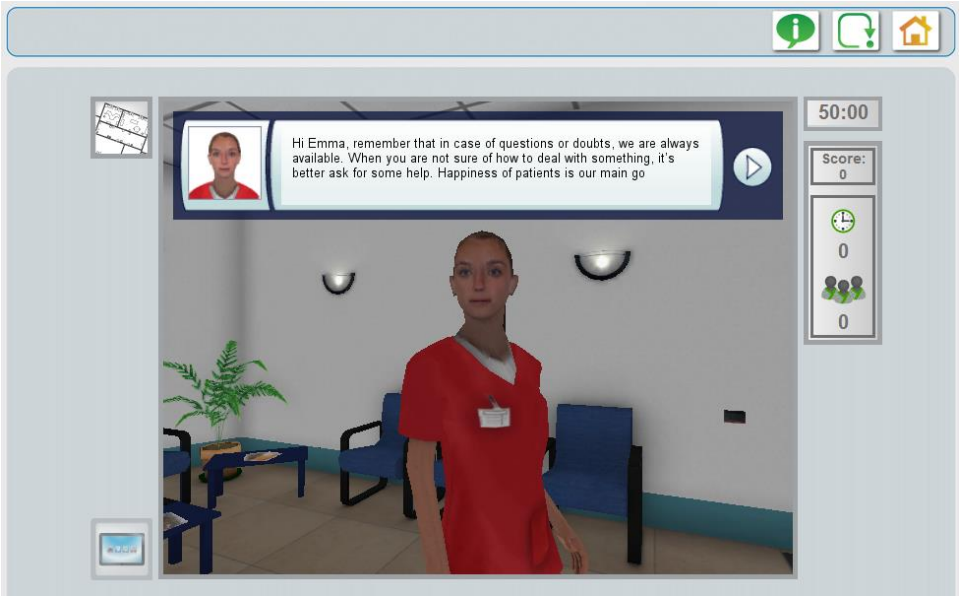

Figure 8. NPC showing users' content

Further, this tool added to the games represents an area for cooperative learning as the serious games can be continuously enriched with new experiences or stories by peers who might for example have more experience [12]. Thus cooperation consists in making experiences and reflections available for new employees or less experienced resources on the one hand and in exploiting this shared knowledge on the other hand. In a certain way, this tool is a simple but effective technological counterpart of the 'coffee machine' where colleagues discuss and share experiences which normally get lost or are only exploited by the people present at that moment. Through the wizard tool, shared information is there for the benefit of all at any time.

With the same logic, a supervisor or a manager can decide to use this tool to insert a set of behavioural 'best practices' on which users can reflect and from which they can learn, always within the flow and narrative of the game which is not broken.

4. Evaluations

In order to gain useful results that can prove not only users willingness to interact with this kind of games, but also their effectiveness in supporting learning, their potential to engage users as well as their capacity to trigger reflection about behaviors, the games have been experimented also with other groups, which were not the entities for which they were built.

Specifically the games were tested during the 4 years of the project with more than 200 users and different methods were used according to time and resource constrains of the different organizations that hosted the evaluations. Games were used during some trainings in nursing schools, care homes, universities and even with groups of users that do not work in the health or care sector. Below the main results collected during the whole project are summarized. In particular among all, two evaluations are described in details.

4.1. Experimental procedure

The game 'CLinIC' was tested with a group of 16 students who were attending the second semester (first year) of the nursing bachelor degree course at the University of Bergamo. Specifically the demographic of this group was so characterized:

- 16 nursing students, 10 males and 6 females, 7 were aged lower than 19 and 9 were aged between 20 and 29, all of them were students from the second semester of the first year of a nursing bachelor degree course and none of them had a practical experience as a nurse.

The goal of this short term evaluation was to find out if the serious game has the potential (i) to trigger reflective learning on an individual level, (ii) to increase the users' awareness about the topic difficult and stressful situations with patients and (iii) to increase the users' awareness about what could happen if they were already working as nurses.

The evaluation at the University of Bergamo was conducted at the beginning of March 2014 in a computer room that was offered by the University. The evaluation lasted about 3 hours and no control group was included in the evaluation design. A short presentation about the Mirror project and the serious game as a new tool for training was given to the students by one researcher from imaginary. Afterward, each student had the possibility to play the game and once finished they were asked to fulfil a post-app usage questionnaire. The questionnaire used for this evaluation was on a scale of 1 (completely disagree) to 5 (completely agree). Further, some additional open questions were added to the questionnaire.

The game 'Think better CARE' was instead introduced to 7 care homes as part of their week's induction process of new recruits, each month from November 2013 to March 2014.

These groups, with between 4 to 6 care staff, were shown the game (by one of the care home's consultant), or a description of the game was presented – depending on the equipment at the different locations. Due to time, cost and technical constraints in care homes, the game was made available remotely to the carers, allowing them to play it where and as many times as they preferred. To facilitate this process, each user received a personal username and password to play the game and URLs for:

- YouTube video as an introduction to the game;
- YouTube instruction to the keyboard navigation keys used in the game;
- a 'pre-use' on-line questionnaire (to be fulfilled before testing the game);

- a ‘post-use’ on-line questionnaire (to be fulfilled after testing the game).

No control group was included in this evaluation design.

Even if more than 30 participants were involved in the serious game evaluation, only 17 users fulfilled the pre and/or the post questionnaires. Specifically, the demographic of the participants who attended the ‘Think better CARE’ serious game evaluation, was so characterized:

- 17 participants, 1 male and 16 females, the median age was 30-39, most of them were working as carers or nurses, 15 were working full-time while 2 were working part-time, all of them were really newcomers to that position (i.e. Time in current job in years M=0.03 SD=0.05; Years in current department or team M=0.03 SD=0.05) but some of them have already some experiences from other care homes (Time doing this job -all places- in years M=4.14 SD=4.40).

Participants of this evaluation were asked to fill a pre and a post game-usage questionnaire.

According to all the data collected with these and other evaluations, the most interesting results are listed below:

- Serious games are able to increase users’ awareness (specifically about stressful situations at work) (see Table 1).

Table 1. Serious game evaluation with nursing students

	University of Bergamo students
The app helped me to imagine what kind of difficult situations I could be confronted with during my work.	M=4.06; SD=0.25
Using the app made me more confident of performing my work successfully.	M=3.81; SD=0.75

- Serious games are able to make users reflect on their behaviors, envisaging potential outcomes and situations they might expect (see Table 2).

Table 2. Serious game evaluation with carers

	carers evaluation
The serious game helped me to reflect on experiences from work.	M=4.16; SD=0.76
The serious game helped me by reminding me to reflect.	M=3.94; SD=0.44
The simulation of events in care work helped me to think about these events.	M=4.00; SD=1.22

- Serious games are a good tool to recruit new workers and volunteers (see Table 3).

Table 3. Serious game evaluation with nursing student

	University of Bergamo students

I think the app is useful for professional training and human resource development.	M=4.31; SD=0.70
I see the long-term advantage of using the app in the work of medical staff.	M=4.00; SD=0.73
Playing the game helps me to better imagine what the jobs as a nurse looks like.	M=3.88; SD=0.89

Further, some of the most relevant and interesting comments collected during the evaluations from the users who tested the game, are listed below:

- 'CLinIC' serious game: *'before to test the game I was skeptical about this tool, now that I tested it I have to admit that I completely change my mind', 'this tool is really useful for my work', 'I think it would be really useful for the training of new nurses'.*
- 'Think Better CARE' serious game: '*I would like to see more procedurals challenges', 'really nice serious game but I think there is the need for more situations to be solved', 'the game was easy and fun to use but there are still few content', 'I see a great potential in this game and I think that with more problems and situations to be solved that game will be amazing'.*

5. Conclusions

Summarizing the whole work conducted around the serious games presented in this paper, it is possible to state that users really appreciated this tool as a useful instrument to support their reflection processes. Participants also stated that the games helped them to feel more confident about how to perform their work successfully thanks to the games' ability to simulate real work scenarios.

With the growing pressure on health service funding from global health issues, tools such as the 'CLinIC' serious game can provide useful assistance with staff and patient orientation and productivity. Several universities and institutions have already expressed their interest in using the virtual hospital as a training unit within their regular programs.

Further, the ability to use serious games as a 'filter for new recruits' in order to try to weed out unsuitable candidates also has great potential and the market for this is very big. This use of serious games can not only improve the recruitment and assessment process and thereby reduce staff wastage, but it can also serve as a career advisory application for students and the unemployed to 'try before buy' when looking for potential employment in what can be a demanding environment.

A video of the presented games is available online at:
https://www.youtube.com/watch?v=mqUC2dcllWA

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