Serious Games for Reflective Learning – experiences from the MIRROR project

Pannese L., Prilla M., Ascolese A. & Morosini D.

imaginary srl, Ruhr University of Bochum, Germany

Reflecting on our personal experiences and emotions can be a great mechanism for learning how to behave and react in certain specific situations. Unfortunately there are many such situations that people either never encounter or avoid in their daily lives. This limits the opportunity to learn through such personal experiences but with new tools like serious games it is now possible to create ‘real new learning experiences’ in a safe virtual environment. In this way, serious games can provide these missing learning opportunities because they allow people to access a potentially unlimited pool of environments through which they can experience those situations in a risk-free way and thereby enlarge the spectrum of their knowledge. Furthermore, well developed serious games have the potential to induce in players a state of flow in which they are so involved in the game activity that nothing else seems to matter (Csikszentmihalyi, 1990). When players reach this state they are more motivated to learn and, by reflecting on their actions and consequences within the serious game, players can translate the knowledge acquired in this virtual environment into the real world.

This chapter describes some of the work carried out in the ‘MIRROR project’ which focuses on reflective learning where adults’ motivation to learn and reflect through games is being researched. It introduces briefly the project and the theoretical framework and then describes in detail the serious game that was created for research. The last part of this chapter focuses on users’ evaluations and describes some lessons learned about the importance of guidance and of a de-briefing session, thus highlighting the potential of serious games for collaborative knowledge construction.

1. THE MIRROR PROJECT: SCENARIO AND THEORETICAL FRAMEWORK

‘MIRROR-Reflective learning at work’ (http://www.mirror-project.eu/) is a Seventh Framework Programme project with the aim of encouraging human resources to reflect on previous experiences at the workplace and learn from them. The focus of MIRROR is the creation of a set of applications (‘Mirror apps’) that enable employees to learn lessons from their own experiences (as well as experiences of others) and thereby improve their future performance. One kind of apps envisioned in this context is serious games. A prerequisite for exploring innovative solutions in this context is the reliance on our ability to efficiently and effectively learn directly from tacit knowledge, without the need for making it explicit.

Among all the techniques explored by MIRROR, serious games have a special role as they provide virtual experiences to reflect upon. One of the main objectives of this project is to investigate how serious games can contribute to triggering reflection on one’s own experiences as well as supporting a willingness to share these experiences of reflection within a team.

Before describing the serious game that is being developed in this context, it is important to underline what serious games are and why they can be considered a great tool for triggering reflection. It is also important to describe in depth the meaning of the term ‘reflection’ and more specifically the concept of ‘reflection at work’ in the context of the MIRROR project.

1.1 Serious Game as a tool for reflection

Today, a consistent and generally accepted definition of the term ‘serious game’ has not yet been agreed upon. However, in general, a serious game can be defined as an interactive simulation which has the look and feel of a game but is actually a simulation of real-world events or processes or represents these in the form of a metaphor (Micheal & Chen, 2005; De Freitas, 2010). As one of the first to attempt a definition, Abt writes in 1970 of ‘serious games in the sense that these games have an explicit and carefully thought-out educational purpose and are not intended to be played primarily for amusement’. Although in this definition the entertainment aspect is put in the background, it is not said that serious games must not be entertaining.
Fun elements are in fact a key component of a serious game: they are the source of positive emotions as well as the engine of motivation. Furthermore, entertaining elements can capture users’ interest and curiosity, speed up the acquisition of content and skills and motivate learners to engage themselves in activities in which they have little or no previous experience (Shaffer, 2005; De Freitas & Griffith, 2009; Breuer & Bente, 2010).

An approach which most notably accommodates the idea of gaming and already describes the potential areas of application of serious games comes from Zyda (2005). He defines serious games as a ‘mental contest, played with a computer in accordance with specific rules that uses entertainment to further government or corporate training, education, health, public, policy, and strategic communication objectives’ (Zyda, 2005, p.25-32). According to this definition, the main intent of a serious game is imparting knowledge or skills through direct experience of carrying out a task (‘learning by doing’). Furthermore, serious games can support contemporary learning activities and foster intellectual growth (Prensky, 2007).

Thanks to these researchers it is possible to understand why, in recent years, the use of serious games has become increasingly popular. In fact generally speaking, a serious game always has one or more of the following main goals (Micheal & Chen, 2005):

1. to train and educate,
2. to inform,
3. to change attitude and behaviour.

Also, as previously stated, well-developed serious games have the potential to induce in players a state of flow in which they are so involved in the game activity that nothing else seems to matter. Csikszentmihalyi (1990) described the positive experience of being fully engaged in an activity as a state of ‘flow’. Thus, flow represents an optimal state of performance at a task, a sense of enjoyment and control, where an individual’s skills are matched to the faced challenges. This state derives from activities that are optimally challenging and in which there are clear goals and feedback, concentration is intensely focused, there is a high degree of control, and users are absorbed to the extent that they lose a sense of time and self. Csikszentmihalyi’s research (1990) identified eight major components of flow: a challenging activity requiring skill, a merging of action and awareness, clear goals, direct and immediate feedback, concentration on the task, a sense of control, loss of self-consciousness and an altered sense of time.

The concept of flow provides one perspective on the feelings of enjoyment and engagement that can be experienced by game users and this can be considered one of the main elements that can contribute to triggering reflection. At least it is possible to identify some key aspects that are very important to our understanding of how serious games could be considered as a new important way to support reflection:

1. A simulated environment, system or a realistically recreated role play scenario can allow learners to experience something that is too costly, too risky or even physically impossible to achieve in the real world, the so-called ‘experimenting with alternatives’ approach (van Woerkom et al. 2008).
2. Repeatability or learning by trial and error is also a key strength of a game or simulation-based approach. Learners can play out a particular strategy or adopt a certain approach. If they fail or do not quite deliver the desired outcome, then they can try again with a modified approach.
3. A serious game has to be considered as an experience because it allows people to live and experiment within real situations in a safe virtual environment. For these reasons, games engage people psychologically (they can be very emotional experiences) and also physiologically.

Reflective learning in the workplace entails a ‘there-and-then’ reflection intertwined with the work as well as reflection at some distance from the work, exemplifying the reflection-in-action and reflection-on-action observed by Schön (1983). A serious game provides unique opportunities to pace the simulated work process and the reflection sessions so as to achieve a good combination of reflection and action based on the learner’s needs. The next paragraph describes how a serious game is used in the frame of the MIRROR project as a tool for triggering reflection.
1.2 Theory reflection model

The understanding of the process of reflective learning, in the frame of the MIRROR project, is based on the model of Boud (1985), in which the learner re-evaluates past experience by attending to its various aspects (including affective ones) and thereby produces outcomes.

According to this model, a key aspect in making a reflective process happen is the presence of triggers that can be defined as unexpected situations, disturbances and perception of uncertainty but also positive situations like surprising success. In general, reflection seems to be triggered by awareness of discrepancy between expectations and the current experience. Specifically this process might be triggered by an external event or agent or might develop from one’s own thinking of a whole series of occurrences over time as an inner need to reflect. Furthermore reflection can occur incidentally or intentionally but most authors (Krogstie, 2009) agree that in both cases reflection is a conscious evaluation of experience that leads to a better understanding of the experience and allows for drawing conclusions that guide future behaviour. Of course, in order to reach this level, learners need to develop the ability to generalise and form abstractions from concrete experience.

Moreover reflection can take place individually and/or collaboratively (Krogstie, 2009), - either of which provide certain advantages and disadvantages and entail different needs of support. For reflection to be collaborative, the participants need to share experiences and relate to the experiences of others in their own reflection. The different characteristics of individual and collaborative reflection typically make it useful to combine both in workplace learning. For all these reasons the outcome of reflection can include cognitive, affective, and/or behavioural consequences.

With reference to the model of Boud et al. (1985), serious games provide particularly good opportunities to help a learner return to (and reconstruct) experience, the environment of the experience being captured within the game environment, and the events of the experience (e.g. the steps chosen by the learner) which are normally stored and available for replay. Re-evaluation of experience involves considering the experience in the light of alternatives and in the game environment there will be alternative options already incorporated in the game as well as the possibility to capture and replay the choices made by other learners. Work settings may entail situations that are emotionally challenging to handle. Returning to these emotional aspects is an important element of the reflective process (Boud et al. 1987). A serious game which successfully captures the aspects of work in a way that makes the user react emotionally in a similar way to that of the real work situation thereby holds the potential to support important aspects of reflection. In this way the serious game also serves as a tool for the learner to come to terms with the emotional aspects of the job and understand his/her own reactions, in this way becoming more prepared to meet them in the real life situation.

For all these reasons, serious games can be considered a useful way to trigger and support reflection.

2. THE ‘CLINIC’ SERIOUS GAME: EXPERIENCES FROM THE MIRROR PROJECT

Working with these theoretical backgrounds within the framework of the MIRROR project, the first serious game to foster reflection in learning and around learning at work and dealing with the topic ‘complex dialogues’ was developed for a hospital in Germany (Neurological Clinic Bad Neustadt). All the different phases and elements of the CLinIC serious game: the preparation, the structure, the reflection session and the evaluation are described in depth below.
2.1 Preparation of the CLinIC serious game

Building the prototype of the MIRROR serious game ‘CLinIC’ for the hospital in Germany was a very intensive activity distributed over a long period of time and characterised by a high interaction with the test bed. This “point and click” serious game is focused on difficult communication between nursing staff and patients and aims to foster reflection around different dialogues. Nurses in fact underlined the necessity to improve their ability to deal with complex situations and reflect about their own work behaviours and having the opportunity to experiment with different approaches and to share their experiences with peers.

As shown in Figure 2, the structure of the serious game is based on a branching story that was designed with a so-called ‘mind-map’ (representing the structure of the contents graphically). The game consists of 23 different scenes, 2 of which are descriptive and 21 of which ask the player to make a decision between different options, all of which are never obvious or evident. Overall, there are 71 different options. Every scene is determined by the previous choice, or sometimes randomly picked from a pool of possibilities, to make the user engage with the story even when playing again. For the graphics of this serious game the hospital wanted to have a realistic environment as an adequate frame for a realistic virtual experience. Therefore, they asked a professional photographer to take pictures of their hospital and some of these were chosen for the game and had to be graphically treated to be embedded as gaming scenario.

2.2 Structure of the CLinIC serious game to trigger reflection

Figure 4 shows the structure of the serious game in which users have the opportunity to experience different scenes of daily life at work. Nurses in a hospital have to deal with different patients, choose how to react to strange requests and balance their time and interventions among concurrent calls and needs. A ‘mood map’, based on the ‘Circumplex model of affect’ (Russel, 1989), was introduced into the serious game to capture the mood of players at various moments in time, typically at the beginning and at the end of the game. According to the chosen model, emotional experiences depend on two major dimensions, the degree of arousal and the degree of pleasure. During the game, whenever users feel it is relevant, they can record their emotional state (an icon to access the mood map is always displayed). Furthermore, in a couple of carefully chosen key situations of the game, users are invited to record their emotions in those specific moments, allowing the development of a user’s ‘emotional path’. The mood map works as an element able to trigger reflection: stopping for a short break during the flow experience, users are able to be aware of their emotional state and start to reflect on why they are experiencing that emotional state and how it relates to the ongoing situation. In this specific situation it is fundamental to record users’ emotions for at least three reasons:

1. the flow experience is strictly linked to positive emotions;
2. revising the experience together with the emotions connected to the specific action is a trigger for reflection after the game experience;
3. reflecting on the emotional path allows players to analyse relationships between emotions and behaviours. Due to the lack of an automatic system to recognise users’ emotions, this tool was chosen as being the least invasive towards the flow. To maintain flow in these games, reflection sessions were avoided. Instead it was decided to have a larger reflection session at the end of the dialogue. The reflection session is organised as follows.

2.3 Reflection session after the game play

Once the game is over, users have to do a self-evaluation based on pre-defined parameters (*Patient satisfaction, Quality of response, Response in relation to the patient, Time management*). Feedback based on the same parameters then comes from the system and a spider-web graph comparing the two (self-evaluation and feedback) is displayed. Finally, in order to be able to better reflect on the differences between the system and self-evaluations and on the experience, users are able to review the dialogues, where the thoughts of the patient are shown as well (these are not displayed while playing the game). This structure contains different elements which help to facilitate the reflective process:
- through feedback, users can check their behaviour during the game experience and reflect on it (see Fig. 5);
- with self-evaluation processes users are motivated to reflect on their actions and reactions during the game (see Fig. 6);
- the opportunity to see the thoughts of the patient allows users to compare different points of view (see Fig. 7);
- through different data sources, e.g. coming from the mood map, users can check their behaviour and reflect on it (see Fig. 8);
- final reports which help users to reflect on the whole experience they had during the game.

2.4 Evaluation of the CLinIC serious game

In order to evaluate the CLinIC serious game, a short questionnaire about ‘game, motivation and reflection’ was developed and administered to 11 nurses in the hospital. The first part of the questionnaire is about the flow experience: the CLinIC game described was offered together with two other sample games (one about safety at the workplace and one about goal orientation skills), to avoid having non-expert users perceive the CLinIC game as the only possible type of serious game (the other 2 games have a very different look & feel, a different interaction and way of presenting information).
In particular this part of the questionnaire is composed of 32 items that aim to investigate the 9 main elements of the flow experience (Csikszentmihalyi, 1990), namely:

1. Challenge–Skills Balance
2. Clear Goals
3. Unambiguous Feedback
4. Action-Awareness Merging
5. Concentration on Task at hand
6. Paradox of Control
7. Loss of Self-consciousness
8. Transformation of Time
9. Autotelic Experience

In analysing the collected results, attention was focused particularly on the first three of the nine features, as these three characteristics can be considered key elements in the study of motivation related to serious games.

Analysing the data from our sample of 11 subjects on a scale of 1 (min flow) to 5 (max flow) the following mean scores emerged:

- Challenge–Skills Balance $\rightarrow M^1 = 3.16; SD^2 = 1.40$
- Clear Goals $\rightarrow M = 3.39; SD = 1.06$
- Unambiguous Feedback $\rightarrow M = 3.18; SD = 1.10$

This data show how in general users evaluate the experience with game as an experience able to trigger flow. The second part of the questionnaire consisted of 18 open-ended questions. The questions were designed to investigate in more detail the whole experience with the serious game and underlined how positive and relevant this experience was. Majority of the users claimed to have experienced pleasure, regardless of the consequences and the potential rewards for their decisions. Also, almost all of the game player indicated that learning with a game that is strongly related to their working environment was preferable to a metaphorical one with a high level of abstraction.

Another important element relates to the topic ‘challenge and skills’. All users stated that their skills were sufficient to face the challenge of the game but most of them suggested that a more difficult challenge would have increased their commitment to the game. Some users also felt the need for greater support in terms of clearer feedback as well as a better introductory description of the goals.

<table>
<thead>
<tr>
<th></th>
<th>Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Challenge–Skills Balance</td>
<td>3.16</td>
<td>1.40</td>
</tr>
<tr>
<td>Clear Goals</td>
<td>3.39</td>
<td>1.06</td>
</tr>
<tr>
<td>Unambiguous Feedback</td>
<td>3.18</td>
<td>1.10</td>
</tr>
</tbody>
</table>

Table 1 - Average of NBN answers (N=11) in a scale with 1 min flow and 5 max flow.

1 Mean
2 Standard Deviation
In conclusion, the data shows how users generally tend to evaluate the experience with serious games as positive and pleasant; the scores of the quantitative part of the questionnaire, slightly over average, are somehow reinforced by the results of the qualitative part.

3. SERIOUS GAMES AS A BASIS AND TRIGGER FOR REFLECTION: DEBRIEFING GAME EXPERIENCES

As already said, the CLinIC serious game was in positively evaluated. Individual users were motivated to learn and reflect about their past experiences at work. They also commented on all the positive aspects of this new way of learning.

However, if users were left alone with the tool, it was difficult for them to relate the virtual experience and individual reflection results to their daily work and to their cooperation with others in the real world. For example, it was difficult for individuals to see why some answers they had given were not correct and what they could have done better.

Game debriefing has been found to be a viable mechanism of connecting experiences made in a game to real world contexts (Peters & Vissers, 2004), as learners can use debriefing sessions to engage in discussions and make sense of games experiences together (Ravenscroft, Wegerif, & Hartley, 2007). Adapting this concept to post-game reflection as the task for debriefing, a debriefing session was conducted at the hospital to collaboratively reflect on the experiences encountered in the game and to explore how the reflection within games can be connected to real world reflection. In particular, the aim was to explore whether games may trigger collaborative reflection and learning processes about work and whether reflection then relates solely to the game experience or also to real world practice.

3.1 Setting and course of the debriefing

The debriefing session was conducted with five participants. Among them there was the head physician of the ward the game was tested in, two head nurses and two normal nurses of the same ward. These participants were asked to engage in both individual and collaborative reflection of five scenes (see the guiding questions below for an overview of individual and collaborative parts) from the game which had been perceived as particularly important for the hospital, or especially interesting due to the variety of answers given in the game. Table 2 gives an overview of the scenes used.

<table>
<thead>
<tr>
<th>Scene</th>
<th>Name</th>
<th>Content</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Loud neighbour</td>
<td>A patient complains that the patient in the other bed of this rooms snores during the night.</td>
</tr>
<tr>
<td>2</td>
<td>Swallowing problems</td>
<td>As is quite common after a stroke, a patient has swallowing problems and is thus given a thickened drink. She complains because she wants a normal drink.</td>
</tr>
<tr>
<td>3</td>
<td>Angry patient</td>
<td>When the nurse enters a patient’s room, he immediately snarls at her, because in his eyes she is late.</td>
</tr>
<tr>
<td>4</td>
<td>Unknown nurse</td>
<td>When the nurse enters the patient’s room, the patient does not recognize her and asks who she is.</td>
</tr>
<tr>
<td>5</td>
<td>Lost valuables</td>
<td>The patient complains that he is missing the money in his purse and that he had it before he came into the hospital.</td>
</tr>
</tbody>
</table>

Table 2 - Scenes used as a basis and trigger for reflection in the debriefing session.

The debriefing explicitly included collaborative reflection for two reasons. First, group interaction has been found to be beneficial when it comes to connecting experiences from games to the real world (Peters & Vissers, 2004; Ravenscroft et al., 2007). Second, collaborative reflection has advantages over individual reflection in that is enables a group to include several experiences and perspectives into reflection and thus create a shared understanding (Hoyrup, 2004). This, in turn, most likely leads to collective knowledge such
as norms and rules for individual and cooperative behaviour (Daudelin, 1996; Prilla, Herrmann, & Degeling, 2012). Putting this into the context of nurses reflecting on treating patient, collaborative reflection is beneficial to agree on common ways to approach and interact with patients (Forneris & Peden-McAlpine, 2006).

In order to explore collaborative reflection on experiences from these scenes, participants were asked to conduct a series of simple tasks such as commenting on the practical occurrence of scenes from the CLinIC game, tell stories in which they encountered similar situations, discuss each other’s statements and derive solutions or actions to be applied in these situations. In particular, this was supported by a set of three guiding assignments, which were used iteratively for each scene:

1. Think about this situation: have you ever been in such as situations and if so, how many times did that happen and what did you do? (Relation to real life, individual task).
2. Tell a story you remember from such a situation to your colleagues and write down on a paper card how you reacted in this story and why you reacted this way (Individual, sharing with others).
3. Discuss the scene and your stories and tell the facilitator one or more correct reactions for this scene. Give reasons for your choice based on your stories. You may choose from the answers already existing in the game, but you may also provide new ones (Collaborative task).

In order to avoid external influences, the project manager of the hospital facilitated the workshop. He explained the overall task, took care of the time for answering the questions and structured the following discussions. To relate the articulations of participants stemming from answering these questions directly about the scenes discussed, the scenes were printed out and pinned to boards in the workshop room. Then all articulations of participants were written down by them on paper cards and pinned to the scene printout they belonged to (see Fig. 9 for an example). In addition, notes were taken on everything that was not written down on cards but was interesting such as e.g. interaction among people and arguments exchanged.

INSERT FIGURE 9 HERE

Figure 9 - Results from collaborative reflection on a scene from the CLinIC game.

### 3.2 Reflection and learning effects of collaborative game debriefing

Results from the workshop indicate that both the CLinIC game and the approach of debriefing have the potential to trigger and support collaborative reflection: participants overall assessed the scenes to be relevant for their daily practice, they told many stories related to the scenes and discussed each scene intensively even based on the guiding questions given by the facilitator. As a result, the participants identified new solutions for three of five scenes and brought up additional issues related to three scenes. Table 3 gives an overview of the activities and results from the debriefing session.

<table>
<thead>
<tr>
<th>Scene</th>
<th>No. cards</th>
<th>No. answers</th>
<th>New answers</th>
<th>Discussions / (new) solutions</th>
<th>Stories shared</th>
<th>Broader discussions</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>8</td>
<td>5</td>
<td>3</td>
<td>1 / 2</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>2</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>2 / 3</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>10</td>
<td>2</td>
<td>0</td>
<td>3 / 2</td>
<td>3</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>2 / 2</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>5</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>4 / 4</td>
<td>5</td>
<td>1</td>
</tr>
<tr>
<td><strong>Total (avg.)</strong></td>
<td><strong>41 (8.2)</strong></td>
<td><strong>22 (4.4)</strong></td>
<td><strong>9 (1.8)</strong></td>
<td><strong>12 (2.4) / 11 (2.2)</strong></td>
<td><strong>3 (0.6)</strong></td>
<td><strong>13 (2.6)</strong></td>
</tr>
</tbody>
</table>

Table 3 - Results of the debriefing/reflection workshop of CLinIC at the hospital.

Table 3 shows the results from collaboratively reflecting the scenes of the CLinIC game and also contains strong indicators of learning. For example, the number of stories related to the game scenes (especially scenes 3 to 5) shows that the participants perceived them to be relevant for their daily work and that they were able to relate real world experiences to them. In addition, the participants arrived at many new and agreed upon answers and solutions for the scenes discussed (1.8 new answers and 2.2 new solutions in). This
was even present in cases in which they did not find new answers to questions in the game but where they intensively discussed details of the scenes (see the discussions and solutions shown for scenes 3 and 4 in Table 3). This shows that not only their experiences but also the resolutions found were applicable to their daily practice. Moreover, the discussions of scenes were not only focused on the scenes displayed. For four of five scenes, reflection on other related issues was triggered as well. For example, during the work on scene 3 (‘Angry patient’), participants started to reflect on generally appreciated and polite behaviour on the ward. Likewise, during the discussion of scene 2 (‘Swallowing problems’), they reflected on how to support patients in asking the right questions during the ward round when a physician is present in order for the physician to clarify questions on swallowing problems.

Altogether, these observations show that the reflection triggered by scenes from the games did not stay within the game, but was related to real life context and resulted in ideas for changes for daily work. In addition, it also invoked discussions on details of the problems and on related issues. Therefore, it is strongly proposed that serious games and collaborative debriefing form an approach provoking fruitful reflection and learning on daily work.

### 3.3 Effects of guidance and collaboration for game debriefing

The description given above shows that relating real world experiences to scenes from games has huge potential to bridge the gap between the virtual ground of games and real life reflection. However, this might not happen on its own in the debriefing session. It needed a set of questions guiding the reflection process and triggering it. The description of the workshop also shows that this is not complex: three basic questions and material common to most organizations was used. In addition, the workshop was run by an internal project manager, which shows that it is easily applicable to other organizations as well. As an alternative, tools using prompts for users can also provide similar questions and assignments automatically and without a human facilitator. Whether this also produces the effects described above, however, is subject to further research.

The debriefing experiment also shows the advantage of collaboration – conforming existing work (e.g. Peters & Vissers, 2004; Ravenscroft et al., 2007) and extending it to the domain of reflective learning from games – in reflection on the scenes as it included results that can only be achieved together:

- **Mutual self-assurance:** when discussing scene 5 (‘Lost valuables’), the nurses told each other that ‘the introduction of badges for the suitcases of patients was successful’3 in terms of locating the patients’ property.
- **Insights on the importance of agreed upon behaviour:** during the discussion of scene 3 (‘Angry patient’), the nurses realised that besides avoiding mistakes they needed to support each other: ‘Mistakes also happen without influence of staff. Therefore, mutual safeguarding and control among colleagues is even more important!’.
- **Different options when dealing with problems:** in some discussions (e.g. scenes 3 and 5), the participants shared different stories and thus broadened the spectrum of possible reactions in the scene discussed by combining their experiences.

From these examples, it is obvious that the level of certainty and agreement among colleagues could not have been reached with every participant reflecting individually and only exchanging their individual results. Therefore, reflection through serious games should also be supported by creating opportunities to comparing players’ own experiences with that of others in the games, for example by showing the answers (and possibly comments on them) by others during and after gaming.

In addition to the guiding force of comparison with other data, situations were also observed in the debriefing session that led to the conclusion that more guidance needs to be given when serious games are used as a reflection aid. For example, in the discussion of scene 5 (‘Lost valuables’), one of the nurses stated: ‘There is a quality management standard for dealing with patients’ valuables’. Others stated that they were not aware of this standard or did not have it in mind during the game. As a result, the resolutions found were agreed to be preliminary and needed to be checked against the standard. This, and other examples, indicates

---

3 The statements were translated from German by the authors.
that there is a need to make people aware of other resources to be taken into account during and after playing a serious game in order to make the reflection on experiences from the games more helpful and realistic. This might also apply for access to other tools being used in an organisation.

Besides guidance to take into account existing resources and tools, hints on helpful guidance were also found during the games. For example, two nurses who were not familiar with scene 4 (‘Unknown nurse’) benefited a lot from the other two sharing their experiences on the corresponding situation with them. In addition, three nurses perceived scene 5 (‘Lost valuables’) to happen often, while one thought it was rather seldom. Collaboratively contextualizing and reflecting on these scenes helped a lot in the debriefing session and are therefore considered to be integrated in a policy for game debriefing to be part of a serious game.

3.4 Potential of collaborative game debriefing experiences and their support

Serious games, as described above, provide virtual situations likely to happen in real life and enable people to playfully and safely simulate them. This can be helpful in individual reflection, but as was experienced from our debriefing session with players, the game provide most benefit when reflection is collaborative.

This has two reasons which were also visible in the session described above:

- First, people made sense of the situation they encountered virtually and critically evaluated both the underlying scenario and the answers available in the game according to its importance for their daily work. This can be seen in the multitude of alternative resolutions collected in the debriefing session and in the surprising assessments of the scenarios being part of the debriefing. The result of this step then provides the basis for and supports the choice of scenarios for in-depth reflection of certain situations.

- The second reason for collaborative reflection of experiences from a serious game like CLinIC can be found in the virtuality of situations encountered in games: in the debriefing experiments, participants often felt the need to contextualize scenarios by providing corresponding stories from real life experience. In addition, some situations in the game included to-be scenarios and thus their resolution included plans for future behaviour, as can be seen from the description above. The intertwining of real and virtually acquired experience as well as the planning aspects of game reflection can therefore clearly benefit from multiple perspectives being available in collaborative reflection sessions.

Therefore, it is proposed that collaborative debriefing with a focus on reflecting experiences encountered in a game can enhance and should therefore be an integral part of the usage of serious games in organizations. As we found feedback pointing to the need of more guidance during games and their reflection and realized that this guidance can be decisive or at least helpful in many situations, a focus for further development will be set to establishing this guidance. On an organizational and facilitation level, this can be provided by a small set of guiding questions and should focus on certain scenes from a game – experiences from the debriefing session show that three questions were sufficient to produce good results. On a socio-technical level, as an extension of the situation applied in our experiment, it is planned to include usage data from the game such as individual and aggregated decisions in scenes into the reflection process, as they may support people in articulating their rationales for decisions and thus support the collaborative reflection process. Likewise, games will be connected to real world data such as the quality management documentation mentioned above and to applications available in the organization in order to better support players in intertwining real and game experiences.

4. SUMMARY

Serious games are an innovative concept for learning on the job, and usually unknown to the target groups. In addition, understanding serious games as an enabler to acquire experiences in a virtual world and reflect on such experiences in the context of the real world is an entirely new approach for learning at the workplace. This makes carrying out studies with serious games in this context a complex task and as such,
studies need to promote a new concept among potential users who might be sceptical as to whether gaming can improve their job performance, to evaluate the relevance of games for real work, and to explore the effects that game play actually have on daily work. However, the task is at the same time interesting and stimulating as it opens up new possibilities for individual and collaborative learning at the workplace – either directly from playing or from sharing experiences gained during game play.

In the study described in this chapter, after an initial phase of explaining and negotiating the utility of the games with the nurses participating in the study, it was found that the game was perceived positively: users in general evaluated the experience that they had with the CLinIC serious game as a ‘flow experience’ and this means that CLinIC was able to motivate people to learn and reflect. Analysing the collected data, it can be concluded that nurses are in general motivated to experiment learning with serious games and to reflect upon these learning experiences both as individuals and in a team. In addition, the study showed that an appropriate and well-organized debriefing session after playing the game can be a good way to transfer what the users have learned in the game into the real life and help them to reflect about this.

From the results described above, it can be concluded that serious games are a tool for allowing users to enjoy experiences in a safe virtual environment and to transfer these experiences to the real world. This can support reflection, leading to a better understanding of and support for different situations that users have to deal with. However, sometimes this connection is not immediate and it is not easy to bridge the gap between the virtual ground of games and real life reflection. As was illustrated in this chapter, there are two reasons for this. First, there is a tension between flow in the game and the step back needed for reflection: both individual and collaborative reflection breaks the flow and thus might spoil the game experience. Thus the challenge is to combine flow and reflection in games in a non-obtrusive manner that thereby retains the advantages of the game-reflection combination shown in this chapter. Secondly, players are experiencing difficulties in establishing and sustainably keeping up a relationship between games and the real world context. Therefore, a focus of further work will be set to better connect these two worlds on a data level as well as with guidance within and after the game.
REFERENCES


KEY TERMS & DEFINITION

Reflective Learning: The ability to return to experience through which the experience is re-evaluated in order to learn for future events and behaviour.

Serious Game: An interactive virtual simulation which looks like a game, but has a serious objective.

Collaborative reflection: A mechanism to enable a group to combine experiences and perspectives during reflection, thus create a shared understanding and learn together.

Flow: Represents an optimal state of performance at a task, a sense of enjoyment and control, where an individual’s skills are matched to the faced challenges.

Motivation: The willingness or desire to engage in a task. More specifically, motivation refers to an individual’s choice to engage in an activity and the intensity of effort or persistence in that activity.

MIRROR project: A project in the Seventh Framework Programme (FP7) with the aim to support people in reflecting on previous experiences at the workplace and to learn from them.

Technology enhanced learning (TEL): A research field that refers to the application of technological support of (different pedagogical approaches of) learning.
QUESTIONS AND ANSWERS

1. Why can serious games be considered tools for reflection?

There are at least four different elements:

- a simulated environment can allow learners to experience something that is too costly, too risky or even physically impossible to achieve in the real world;
- learning by trials and errors allow learners to play out a particular strategy or adopt a certain approach. If they fail or do not quite deliver the desired outcome, then they can try again with a modified approach;
- a virtual experience allows people to live and experiment within real situations in a safe virtual environment;
- multiple people playing a game can make the same (virtual) experiences. This supports them in referring to these experiences in later reflection and helps them learn for similar situations in their daily practice.

2. Which features of this game support the learner’s reflective process?

Inside the CLinIC serious game there are different elements which help to facilitate the reflective process:

- feedback to check users behaviour during the game experience and reflect on it;
- self-evaluation processes to motivate users to reflect on their actions and reactions during the game;
- the opportunity to see the thoughts of the patient to compare different points of view;
- different data sources, e.g. coming from the mood map, to check user’s behaviour and to reflect on it;
- final reports to help users to reflect on the whole experience they had during the game.

3. How can experiences from games be used to reflect on practice, that is, outside a game?

Situations in the games as described in the article are closely aligned to real life situations, which are likely to be encountered by workers. Therefore, making virtual experiences in a game and later on referring to these experiences in a debriefing meeting can encourage reflection about respective situations in real life and support learning for corresponding situations. The game then serves as a source of (virtual) experience and as a trigger for reflection.

4. Why has the ‘mood map’ been implemented in this serious game?

The mood map was introduced to capture the mood of players at various moments in time. This tool works as an element able to trigger reflection: stopping for a short break during the flow experience, users are able to be aware of their emotional state and start to reflect on why they are experiencing that emotional state and how it relates to the ongoing situation.
LESSONS LEARNED

This paper describes an ongoing case. At this stage different important results arose from the research. First of all, this study underlined the importance of the debriefing session. After playing the game, the debriefing can be a good way to transfer what users have learned in the game into real life and can help them to reflect about this.

Secondly, serious games seem to support reflection through the possibility to enjoy experiences in a safe virtual environment. This allows users to better understand their experiences and help them to transfer these experiences to the real world.

Future development within the frame of the MIRROR project will be to make the user as independent as possible within the serious games in order to reduce the need for external consulting and coaching support. The idea is to more deeply integrate coaching and guidance into the serious games with a ‘buddy-learning companion’ that supports users in the game experience. Furthermore investigation should be carried out into the role of collaboration and guidance within a multi-player game in which users have the opportunity to simulate a real meeting in a virtual environment and discuss important topics related to the experience that they have already had with game.
FURTHER READINGS


