SIMULATION AND SERIOUS GAMES FOR FIREFIGHTER TRAINING: CHALLENGES FOR EFFECTIVE USE

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Abstract

One of the main criteria of effectively managing emergency and crisis situations is good preparedness. Simulation and serious games (SSG) are often advocated as promising technologies supporting training and increasing the skills necessary to deal with new, complex and often unexpected situations. This paper is based on an investigation of why a seemingly appropriate SSG technology was not used long after procurement. We identified potential obstacles and challenges of SSG implementation in organizations responsible for societal safety. The focus is on firefighter training and is based on 33 interviews with major stakeholders from seven countries, from organizations with successful as well as unsuccessful experiences of SSG use. By contrasting the different incentives and views regarding the technology use, this paper contributes to a better understanding of challenges related to SSG implementation and use. The results confirm the possible benefits of SSGs, but also highlight an urgent need for new approaches to integrate these new technologies into organizational practices. Only by formulating local, organizational strategies with the SSG use can the technology be implemented successfully.

Keywords: Emergency management; training; technology introduction; simulation; serious games; gamification.

1. INTRODUCTION

The use of simulations and serious games (SSG) is increasing in emergency management (EM) training and education. SSGs are technologies that provide features that can support learning, and are often built on existing game technologies on which digital reality-like, visual scenarios can be constructed. Various levels of game elements such as tasks to accomplish, role-playing, or goals to reach can be included. Promises from SSGs to support everyday training activities are many. Using game technologies can mean keeping pace with rapid technical updates, and using game elements suggests more intuitive, easier, and engaging applications. SSGs promise increased motivation to train, provide better insight into new situations, and allow accessible training with greater safety and less harmful impact on the environment (Backlund et al., 2013; Chittaro et al., 2015; Crookall, 2015), or better support for decision making (Molka-Danielsen et al., 2015). During the last decade, the cost of SSG applications and technologies has decreased and the
technology has become more accessible (Ott et al., 2015). These benefits and promises often overshadow possible problems related to how implementation can be accomplished and how successful use can be achieved in user organizations.

This paper aims to provide a better insight of SSG technology use and non-use, by describing values SSG can produce for organizations having it, in the view of resources needed to manage it, and current technical development. By identifying potential key benefits and limitations, the focus is on user organizations and their opinions. The analysis is based on data from 33 interviews from seven countries with managers and instructors from user organizations, and with developers and researchers involved in current technical development.

The motivation for this study originates from the fact that there are organizations that invested in the rather costly SSG technology several years ago, but the organizations’ utilization of the technology is very limited. For example, utilization may be restricted to showing informative pictures or films exemplifying practices from unfamiliar places. Such examples can be created without expensive resources or licenses to SSG technologies and applications (Hammar Wijkmark et al., 2015). Procuring SSGs and not using them indicates recognizing the strategic importance at a top level, but not prioritizing it at the operational level. Technology resistance is not a new phenomenon, and such resistance may even be beneficial for an organization, for example if older technologies are replaced by newer ones without enough advantages to motivate the cost in terms of learning the new technology (see e.g. Adner et al., 2010). However, having a technology without clear reasons for it not being used is confusing (Toftedahl et al., 2012). To better understand the organizational mismatch between procuring managers and instructors responsible for training within the same organization is another purpose of this study.

The most common form of training EM is in classroom-like situations and via live training (Hammar Wijkmark et al., 2015). There are already proven methods at many organizations to develop and assess these training situations, even if this may require extensive resources of training personnel, specialized facilities and well-planned live scenarios. Both training forms are necessary in order to learn rules and regulations; to gain important knowledge and acquire routines and skills. Therefore, one important question when introducing SSGs concerns its role in relation to actual training: that is if SSGs can replace or complement the training methods used today? Therefore, we also address the questions whether user organizations experience any values using the SSGs, and if so, if the values concern classroom training, live training or something else.

The study reported on here, is initiated by actors from the Swedish Civil Contingencies Agency (MSB), which is responsible for the training of firefighters and incident commanders in Sweden. The agency recognized potential benefits of SSGs (Toftedahl et al., 2012), has procured SSGs, but still several years later the technology is not used as extensively as expected. MSB has not yet experienced the promised benefits of their investment (Hekdal et al., 2015). Therefore, an investigation of why the seemingly appropriate SSG technology has not been used was initiated.

The EM referred to in this paper concern handling accidents and incidents in the first instance, incident commanders on scene. The technologies are - in a broader sense – simulation and serious games, but may also include elements of gamification; so the SSG abbreviation is used in a broad sense. In our study we examine the main SSGs known to the user organizations, that are the following technologies: XVR, RescueSim, Fire Studio (mainly pictures on fire and smoke), and Vector Command. However, alternative SSG technologies where addressed in interviews with researchers and developers, which contributed to a broader understanding of SSG usage.

Another promised benefit of using SSG is to facilitate greater user experiences. Here we need to distinguish eventual confusions due the use of terminologies associated to user experiences. Presence, i.e. the sense of believing that you are in a computer-generated place instead of a real-life setting (Slater et al., 1997) often indicates user experiences in research from computer science or psychology. In the same field immersion often relates to the properties of providing surrounding experiences by technologies, and can be measured
objectively (Slater et al., 1997). Accordingly, a head mounted display or holodeck is more immersive than a computer screen. However, studies from the field of game research use the same word *immersive* to indicate high experience, also high presence and not necessarily the technical properties. This study applies the terminology from game research.

2. BACKGROUND

Firefighting is a physically and mentally demanding occupation, besides being potentially dangerous (Williams-Bell et al., 2015). Fire fighters have to make many time-critical decisions in possibly life-threatening situations where their task is to protect the safety of civilians, themselves as well as buildings and other valuable objects. Due to emergency situations being unpredictable, time-critical and high-risk situations, fire fighters have to go through extensive training in order to increase their preparedness for these demanding situations.

2.1 SSG FOR TRAINING

Since society is changing, EM also has to deal with new issues, and consequently EM training has to handle the new emergency situations. There are new infrastructures, transportation possibilities, housing, communications, and living habits. There are new materials in our houses, cars, and clothes. Even the magnitude of accidents is changing. Harbors cannot be closed to practice large ship fires (Jansen, 2014), and the same fire cannot be repeated hundred times in the same way to allow to prepare or to examine hundred firefighters in the same manner (Lamb et al., 2014). Many of the new societal changes can result in unexpected situations for rescuing. These are not possible or difficult to consider in classroom training or in training in live settings. An instructor can speak about new situations, but meeting these in simulated environments can offer more realistic experiences (Chittaro et al., 2015) or higher awareness for decision making situations (Molka-Danielsen et al., 2015). For example; an instructor can prepare to examine a hundred incident commanders in a live simulated scenario like a complicated traffic accident involving vehicles transporting hazardous goods. The scenario can involve fire, smoke, role-players and leaking gas. It is difficult to reproduce the exact same conditions and to conduct the examination in the same manner for all incident commanders.

If incident commanders have to be examined, it is important to be able to follow the same situation and allow commanders to experience their role, several times as similar to a real situation as possible. They will be examined on their problem solving skills which entails rerunning the same situation and discussing how they are thinking is the most important. This would be difficult without computer-based simulations (Mumma, 2016).

How to train for ‘the unexpected’ is far from obvious. Just planning realistic enough training situations requires extensive resources of training personnel, specialized facilities and well-planned even live fire scenarios (Chittaro et al., 2015; Williams-Bell et al., 2015). Hence, training for preparedness of emergency situations is an extremely challenging task, due to costs, all required equipment and personnel, and the need to collocate and coordinate learners for the training events. Accordingly, these events cannot be arranged as frequent as desired and run as many times as desired in an equal manner. For these reasons, SSG is often advocated as a complementary method for emergency service training. However, there are no scientific works arguing how SSG can complement exactly what live training in order to gain benefits.

Between the many impressive benefits of SSGs, there are also additional ones, e.g. enhancing the motivation to train, providing better insight into new situations, and allowing accessible training with greater safety or less harmful impact on the environment. This is motivated by easier access to information and to expert knowledge anytime and everywhere (Alklnid Taylor, 2014); by access to naturalistic training situations with safe training conditions (Molka-Danielsen et al., 2015); by distributed and group-based training and learning opportunities (Crookall, 2015); and by traceable actions and repeatable scenarios for debriefing and evaluation of a practiced event (Girard et al., 2013). The latter provides a learning
environment where learning from mistakes is possible, in contrast to real-life settings. Being able to use SSG technology for distance training is particularly attractive for many Scandinavian organizations due to the large number of small rescue services in rural locations.

One of the possible reasons for non-use of SSG can be the confusing message from research: Even though studies argue for additional values with SSGs (see e.g. Lamb et al., 2014; Jansen, 2014; Schaal et al., 2001) there are other, warning studies for possible negative effects of them. Examples for negative effects are: difficulties to provide as accurate and dynamic scenarios as one meets with real accidents (Williams-Bell et al., 2015), people learn wrongly or miss important situations needed to handle real accidents (Frank, 2014), how the instructors’ engagement and involvement influences learning outcomes (Alklind Taylor, 2014) etc. When some research argues for added values while other research warns for negative effects this can be confusing for potential, new users, especially if they already have established methods and evaluations showing actual, required effects with the training.

2.2. TECHNOLOGICAL ADOPTION

Using technologies in organizations can be strategically important and methods and models have been developed to assess technology usefulness. One of the most influential models that explain technology adaptations is the technology acceptance model (TAM) developed back in 1989 by (Davis Jr, 1986). He developed the model by focusing on the importance of understanding and differentiating and measuring the meaning behind the two concepts – the objective usefulness and the more subjective perceived ease of use. TAM has attracted a great deal of attention in recent decades. Davies developed the subject further and in several research papers discussed its validity and reliability (e.g. Davies et al., 1995). While there are papers discussing the reliability and impact of TAM for different areas (e.g. Hess et al., 2014) and summary papers examining its applicability (Chang et al., 2010) or relevance (Mihailescu et al., 2013). For instance, based on a review of 211 information technologies Liu, Min and Ji (Liu et al., 2008) found that TAM is the most influential among the theories employed, having been applied in 40% of the aforesaid studies. TAM is applied in many areas of use, such as training, software engineering, e-commerce, computing in organizations or the application of medical technologies (Bertrand et al., 2008).

In relation to studies questioning the reliability of the results obtained using the model Hess and her colleagues argues that TAM has less impact due to the use of variables from many in-between studies (2014), and questions the quantitative measurements used and adjusted by it (Chittur, 2009). TAM is also questioned for being a factor theory rather than a process theory since within the socio-technological system tradition technology implementation is understood as a social process in which the meaning and thus the usefulness of the technology is created and negotiated all throughout the use and is not a static property that is either achieved or not. However, we are not using the model to argue for adoption – rather we are using the model to guide our search for possible reasons of non-use, i.e. the lack of adoption, which on the contrary is a property that can be identified.

TAM in this study is not used to address technology acceptance, but to enhance recognized aspects needed to be during technology implementation and adoption. For us it can be beneficially since it differentiates two important phases, defined in one of the latest models based on TAM: the preimplementation and the postimplementation phases (Venkatesh et al., 2008). Non-use after procurement is an indication of problems with preimplementation and this phase is therefore important for this research. Examining this phase may highlight initial attitudes and beliefs that influence actual routines and habits and a willingness to tackle changes that are needed in relation to technology use (Venkatesh et al., 2008). Discussing these properties with users and non-users may highlight motivational factors why SSG is not implemented. By non-users we mean potential beneficiaries having the technology.
3. METHODOLOGY

In order to better understand reasons behind the non-use of the procured technology in the Swedish Agency, our approach included exploring the opposite situations, that is other organizations where the same type of technology had been successfully implemented and was used in their training programs. To obtain a picture of the use of SSGs for training in Sweden and Europe in civil protection and other similar activities, literature reviews as well as interviews were conducted with relevant stakeholders from organizations in seven different countries: Sweden, Estonia, the Netherlands, Norway, the United Kingdom, Denmark, and Singapore. In total there were 33 interviews divided on the following stakeholder groups: researchers (8), developers (6), managers responsible for procurement from potential user organizations (4) and managers and instructors responsible for training and education (15), see Table 1.

The study started by identifying the main actors involved in SSG research and development during 2014. This was achieved by interviewing researchers active in the field, and conducting a literature review of trends in SSG usage. Search terms for the review were inspired from the work done by Backlund and Hendrix and David Crockall (Backlund et al., 2013; Crockall, 2015), and refined after an interview with Per Backlund. Every interview ended by asking the interviewee if s/he knows other actors influencing the state of the art of developing SSGs or organizations, which procured SSGs. This study reports results from 33 interviews. Important patterns begun to emerge when summarizing data from these, but we by no means argue that we did not miss arguments from some representative actors. Furthermore, some individuals had different roles, e.g. we interviewed several managers who were instructors as well, e.g. Andres Mumma from the Estonian Academy of Security Science, researchers who were also involved in SSG development, e.g. Simon Engfeldt-Nielsen from Serious Games Interactive1.

Table 1. Data was collected via 33 interviews from managers (M), instructors or teachers (I), developers (D), and researchers (R) from the areas focusing on developing and using SSGs. The ‘+’ after the letter indicates that more than one interviews were performed.

<table>
<thead>
<tr>
<th>Countries</th>
<th>Data collected</th>
<th>From</th>
<th>Overall experiences</th>
</tr>
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<tbody>
<tr>
<td>Sweden</td>
<td>Interviews and observations</td>
<td>R+, D+, M+, I+</td>
<td>Non-use (or reduced use)</td>
</tr>
<tr>
<td>England</td>
<td>Interviews</td>
<td>R, M+</td>
<td>Positive</td>
</tr>
<tr>
<td>Eastland</td>
<td>Interviews and observations</td>
<td>M+, R, I+</td>
<td>Positive</td>
</tr>
<tr>
<td>Holland</td>
<td>Interviews</td>
<td>R+, D+, M+</td>
<td>Positive</td>
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<tr>
<td>Norway</td>
<td>Interviews</td>
<td>R+, M+, I+</td>
<td>Non-use</td>
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<tr>
<td>Denmark</td>
<td>Interviews</td>
<td>R, D, M+</td>
<td>Non-use</td>
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<td>Singapore</td>
<td>Interview and observations</td>
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The interviews were constructed around open-ended questions exploring the respondents’ views and experiences regarding SSG’s potential to support training and education; benefits and potential risks with using SSGs, and conditions required from eventual others at own organizations for meaningful use of the technology. Each interview lasted between 45 minutes and two hours.

1 http://www.seriousgames.dk/
4. INTRODUCING SSG

4.1. EXPERIENCES FROM EDUCATORS IN SWEDEN

The study reveals a somewhat hesitant attitude towards integrating SSGs into fire fighter training in the Swedish organization. The interviews revealed use of some smaller applications, often available for free or at a low cost that supported specific parts in the training program. Procurement and use were often initiated based on personal interest among the managers or teachers. These limited applications are considered beneficial to learning and the transfer of knowledge to other situations by the organizations. However, the readily available and more complex modern SSG tools are not used and are not integrated into training curricula.

The main benefits of using SSGs were recognized by almost all the interviewees, even if certain groups were not familiar with SSG definitions. At some places they used simulation, while at some others virtual reality or virtual reality systems. Managers and teachers from user organizations were not always aware of differences between SSG or e-learning. While the interviews acknowledged the need for more training and self-training for learners, many instructors also felt that they needed more instruction regarding training and education. For part-time firefighters in rural areas in Sweden in particular, the opportunity to train at home or at their home fire station and follow sections of the training on a distance learning basis would be essential. “Even if the participants come to campus meetings there is little time to do what needs to be done. More training would be needed.” A teacher expressed his wish to provide "multiplayer" settings, allowing team training with or without possible teachers present.

4.2. EXPERIENCES FROM AN INTERNATIONAL ARENA

Experiences from the organizations who successfully have implemented SSG for training purposes were that the perceived benefits are considerable. They also recognized that the success was exclusively dependent on a well-planned process and supporting resources for the introduction of the technology. Motivation was gained by formulating concrete improvement needs, by addressing otherwise “impossible” situations and by providing enough resources. An example for handling otherwise impossible situations is from the Port of Rotterdam in the Netherlands. They needed to train large groups in the light of the impossibility of setting up live training at a huge port that could never be shut down. Example for having enough resources available is the Estonian Academy of Security Sciences. They recognized the value of SSGs when they planned to build up an academic program for emergency management that was supported through EU funding.

While the study shows examples and conditions for successful use, it must be recognized that most of the successful use examples involved local organizations rather than nation-wide public safety agencies. The use consisted of integrating SSG in selected training elements and not into complete certified or formal education curricula (except for the example from the Estonian Academy of Security Sciences).

Interviewing users from different countries led to the observation that cost has different meanings for different organizations. The cost of simulation-based training phases at some places are compared to live training (Estonia, Cheshire in the UK, Port of Rotterdam) while in Sweden, for example, the cost also includes travelling costs from faraway places to one of the two training locations in Sweden, with additional costs for part-time learners. Accordingly, being cost effective means something else for the Cheshire Fire and Rescue Service, which in 2013 had 700 occasions for training and assessment with the help of a virtual platform. If compared with the cost of these training sessions live, this number represents a saving of several million pounds. The Oxfordshire Fire and Rescue Service trained all its 200 truck leaders, 25 officers and 15 specialists in hazardous substances on various training levels and in various scenarios for 1½ years. Cost effectiveness in Scandinavia, however, means much fewer ‘savings’ due the smaller number of people involved in the training situations. Even if there are many training situations at the training centre in the UK, resources for training can be problematic, which also influences developers:
Budget is the largest concern for Fire Rescue training today. In a troubled economy, many cities and states reduce budget to Fire Rescue making it difficult to get the right equipment needed for training. Fortunately, our software is also helpful in this regard because live training is often more expensive, especially when compared over the long term to what simulation-based training can provide. Additionally, mobile training is becoming more important as it allows a single person or unit to train several departments or station personnel, instead of each unit training on their own."

Similar comments on tight resources allocated for developing serious games is described by a developer from Denmark. He illustrated that reasons for procuring technologies do not take into account resources required for technology introduction. Accordingly, many customers order SSG applications as applications ready to be used, and not as frameworks needed to adjust to own training conditions.

The interviews acknowledged the need for a more coherent technology that not only supports training and learning but also different levels of competence development based on given situations and not taking into account the instructors’ competence. The role of the instructors is almost the most important for the introduction of technology, since aligning goals for overall objectives differs from aligning goals for "daily" use [5]. Especially for the latter, the instructor may require additional technical support. Furthermore, teachers need to receive continuous information about the person responsible for gathering information, for current updates and for accessing new opportunities.

4.3. DIGITAL COMPETENCE AND VARIOUS SSG TECHNOLOGIES

There are too many different technologies available at the different organizations. At the MSB one can find, for example, XVR (see Figure 1), FireStudio, Vector Command and several smaller SSGs. Too many and too different technologies can result in confusion.

![Figure 1. Using XVR to simulate a fire scenario in a building. Making this interactive simulation after a realistic description takes 10-15 minutes for an instructor familiar with XVR, but is impossible for an instructor not familiar with XVR or similar simulation technologies.](image)

When interviewing participants from emergency management (prehospital education) from Norway, for example, they expressed worries about handling too many different technologies or versions of technologies. Accordingly, their opinion on utilizing many technologies can take up more time and resources and can cause communication problems internally between the instructors. They believe that: 1)
Instructors needed to help each other out, need help with teaching and need to have roughly the same skills in managing technologies, 2) SSGs should not be too diverse since different technologies need to be handled differently and sometimes there is not enough time for this, and 3) technologies from different vendors should be avoided if possible, since potential problems and errors entail risks that service technicians from several vendors need to be on site and cooperate, which can result in delays due to coordination. This information from the users based on their experience contradicts the information from the vendors of the patient simulators.

Manufacturers claim the importance of acquiring various types of simulation solutions, since users do not necessarily need expensive patient simulators when sandbags are enough. Although manufacturers claim that various forms of higher-order simulation are needed to support the various elements, the users have difficulties learning these. They do not wish to obtain more technical skills than necessary to handle the simulators. However, they admit that it is difficult to determine where this level is, and how it varies over time. There were a few instructors with limited or no practical experience who expressed their fear of using SSGs. They considered games to be too complicated and too costly (see the examples from the next section). One person from the group of user organizations expresses a fear of building up a false sense of security by using SSGs:

[I can imagine there are…] "...possibly false security experiences based on simulations. Like training chemical spills. There is a risk that the learner does not really appreciate the seriousness when later he is standing there in a real-life situation."

Five of 16 instructors in the study believed that the greatest risk occurs when the instructor is not sufficiently trained to master the technology or the scenario training and assessment.

Cadets from the National Defence University studied use of commercial entertainment games in education Frank (2014). His findings show a phenomenon, as the author chooses to call gamer mode that needs to be considered by instructors for planning training and debriefing. This resulted in some students playing the game to win and they no longer maintained the same professional attitude to the game as they would in a real training session. The author defines gamer mode as a conscious attitude of the player to accept and not question the game rules and objectives and not accept the educational goals. The author emphasizes the importance of debriefing after the game as a learning opportunity.

Also this part illustrates the SSG introduction depends on the digital competence of the instructors which is not necessarily know by the managers at the organizations.

4.4. NECESSITY FOR SSG TRAINING: LONG-TERM PLANNING

To continuously develop illustrative examples, scenarios, for training while also receiving technical updates needs to be taken in consideration when using SSGs. One of the interviewees from a user organization in Estonia recognized the added value of SSGs and he has used it for the past four years with benefits in both training and assessment. He describes the risks that instructors can face. They are not necessarily good enough in their role and they are aware of this in subsequent updates and training. To provide training situations with increased user experiences requires the instructor to provide good counter play, injects, and present appropriate consequences for decisions and actions. He illustrated a few negative aspects of not working with professionals from the various areas.

“One, for example is that if you do not have a good team of instructors the games do not work together. They [the instructors] need to be very competent in their professions and know the learning methods and technologies. The wrong approach sticks in a student’s mind very easily. The development of those products is resource-intensive.”

Many instructors mention that learners do not accept new forms of training:
“Some people may be skeptical about simulation or use it as an excuse if they fail to pass an assessment. Frequently the term “I would have done this in the real world” is heard from candidates by our instructors. However, we are four years into using virtual training and candidates should be used to our organization’s training and assessment methods.”

As mentioned earlier, some of the respondents were not aware of the possibilities of SSG. These technologies are often treated as e-learning technologies. Since e-learning technologies are used by almost all organizations and the added value of SSGs is not known, there is an unwillingness to change to something that is unclear. This is an opinion described in Sweden, Estonia and Denmark.

5. CURRENT OBSTACLES AND CHALLENGES OF USE

While the interviews acknowledged the need for more training and self-training for fire fighters, many educators also felt that they needed more instruction regarding training and education with SSG. Obstacles and challenges that were identified during the interviews from the behalf of the educators, seem to origin from one of the following reasons: a skeptical attitude towards the technology, a mismatch of expectations, or insufficient competence affecting the willingness to incorporate the new technology into the teaching practice.

The attitude towards SSG was sometimes rather skeptical. It was expressed by the opinion that SSG is not an appropriate technology at all” Games and learning do not usually belong together. Maybe it’s a generational issue. From my perspective I may have a hard time to convince some people to use it ...“. Another respondent expressed the fear that SSG would give a false and possibly dangerous impression:

"[I can imagine there are] possibly false security experiences based on simulations. Like training chemical spills. There is a risk that the learner does not really appreciate the seriousness when later he is standing there in a real-life situation.”

There were also concerns regarding instructors’ competence and mismatch of expectations. There were a few instructors with limited or no practical experience that expressed their fear of using SSGs. They considered games to be too complicated and too costly. SSG software for training can be considered as an empty framework with a large number of available elements from which own, organization-specific training scenarios can be defined. This feature allows for local customization of training scenarios, in order to create highly meaningful learning situations. However, instructors did not consider scenario development as part of their job, due to lack of skills and time.

Another concern was raised which address the reliance of content as well as the competence of instructors: "[The scenario is] lifelike, but also not. It can easily be used in the wrong way. If you do not have knowledge about how it works, there is a risk that they will reject it after testing it a little. Not having a trained instructor is a risk.” The instructors’ competences were a main concern. Five of 16 instructors believed that the greatest risk occurs when the teacher is not sufficiently trained to master the technology or the scenario training and assessment.

6. EARLY LESSONS AND FUTURE WORK

According to the interview responses regarding experiences from some countries (Estonia, the Netherlands and UK), it is possible to experience higher effectiveness for training fire fighters by utilizing SSG. The responses also show reasons why certain organizations do not succeed. There are still hinders to overcome. To handle technology introduction as a process and not as a step at user organizations may resolve unconscious lockups and barriers to development. The pre-implementation phase is not only an important part of this process, but necessary. Instructors play a vital role, and should be involved from the start to support engagement and reduce the risk for mismatching expectations. This concern of instructors’ competence is aligned with several previous studies examining the role of SSGs for training and learning, for example (Alklind Taylor, 2014) and (Kolb et al., 2014). It should be acknowledged, however, that SSG
competence is different from general digital literacy since it also involves setting requirements for simulations, and may include scenario development and modification as well.

Prior to procurement, organizations need to realize that they must take an active part in adopting the SSG training technology to their own circumstances and current and future needs, in order to achieve appropriate learning material and by this potential learning benefits. The developers cannot be aware of all requirements from organizations at the beginning. Some of the effects of using technologies cannot appear before actual usage. This may result in failure of SSG utilization. Overcoming this deadlock is essential, since it limits both use and further development and thereby impeding a potential beneficial utilization of available SSGs.

Today SSG is not a "magic bullet" solution which per se contributes to learning after procurement. The result of using serious gaming for training purposes depends on the educational approach that forms the setting for the game and the actual gaming process. Information on the successful introduction of technologies differs between the different stakeholders. Common agreements regarding the benefits of what a technology promises overshadow possible problems related to how implementation can be accomplished and how successful use can be achieved at user organizations.

Further investigation into linking technology introduction to digital competence in an organizational context is needed. Earlier studies call for illustrative examples of non-use and problematic introduction, especially with regard to promising technologies.

The low fidelity of the SSG technology expressed in this study as revealed by the obstacles with attitude, expectation and competence, could be overcome if the training scenarios were perceived as more authentic and trustworthy. One way to achieve this, we propose, is to base the SSG scenarios on real, authentic data from previous incident. Rescue services are required to document every incident in standardized event reports. These previous event reports can be digitally analyzed and used for generating scenarios which is not only realistic but based on events that evidently have happened. Merely the knowledge that these scenarios are “based on true stories”, a type of “documentary simulations”, ought to affect the fidelity issue. In this way, the simulations can be seen as an illustrated true narrative, rather than an attempt to simulate complex unlikely situations. These scenarios can then be used for discussing how the incidents progressed, decisions that were taken, and alternative ways of action. The idea is to spread previous fire fighter experiences to many learners and raise a scenarios-awareness among less experienced fire fighters. This approach would directly address the challenge to be prepared for what could happen (or has happened in the past), by illustrative examples from the authentic reports or via techniques from serious games, e.g. considering sureties that always need to be represented, shocks or surprises that a firefighter could meet during the everyday work (Fencott et al., 2012). It will also address the problem that gaming technology is not yet capable of providing a real world scenario that is completely and faithfully accurate in a dynamic virtual environment (Williams-Bell et al., 2015), since the fidelity comes from the narrative behind the scenario, and not from the simulation per se.

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