

Balancing Three Different Foci in the Design of Serious Games: Engagement, Training Objective and Context

Anders Frank

Swedish National Defence College
Box 27805, Stockholm, SWEDEN
anders.frank@fhs.se

ABSTRACT

Serious games aim to be both fun and playable games but at the same time be useful for a non-entertainment purpose. This poses an interesting challenge to the design process; how can we ensure that the design allows both for fun and engagement while at the same time fulfilling the non-entertainment purpose? The game design for educational games (a branch of serious games) is dependent on the topic (training objective) and under what circumstances the game will be used. We propose a pragmatic design approach where three design goals are maintained simultaneously: (1) to create an engaging game, (2) to properly cater for the training objective, and (3) to allow the training context surrounding the game to influence design decisions. We will go through a range of design issues and show how the three design goals are interdependent and how a balanced design can fulfill all three. For instance, the training objective may impede a straightforward design of rules and goals. The training context will have an affect how the challenges are constructed and the way learning through games can be carried out. To illustrate this approach the design process of Foreign Ground, a serious game for training, is presented and discussed.

Author Keywords

Serious games, educational games, design, engagement

INTRODUCTION

Serious games are all around us, moving rapidly to be a hype-oriented phenomenon similar Artificial Intelligence and Virtual Reality in the last decade. The evolvement of the Serious Games field is natural consequences of the economic and technical developments of digital entertainment games in conjunction with the already established field of modeling and simulation.

Serious Games can be defined as the use games and game technology for other purposes than just entertainment [12]. The anticipation is to create a game that shares the attractiveness and motivational qualities of entertainment games but also have the capability to educate, train, inform or treat. The field is inherently wide and there are several branches and interconnected fields. Regardless of purpose the design of Serious Games is more challenging than

design of games in general since the design must not only take care of the motivational aspects (i.e. high degree of playability) but also contribute for the overall serious purpose. The risks are the serious purpose of the game will ruin the fun in the game or the game is engaging but useless with regard to the overall purpose.

We propose a pragmatic balanced design approach, where three design goals are maintained simultaneously: (1) to create an engaging game, (2) to properly cater for the training objective, and (3) to include the training context surrounding the game and regard it as part of the design aims alongside the actual produced game. Our approach is thus specifically aiming at the use of serious games for training purposes (even though same approach also is applicable for other purposes). A good balance will lead to a design that enables an engaging game and contributes to the overall training purpose. Having three design foci as approach will share light on the very close interdependency between design goals where choices made will have effect on other aspects of the design. As an illustration, we will analyze and discuss the design process behind Foreign Ground, a serious game developed for team training in cultural conditions.

BACKGROUND

Serious Games grew out of an interest to use games and game technologies for other purposes than entertainment. The Serious Games Initiative was founded in 2002 at the Woodrow Wilson Center for International Scholars in Washington, D.C [13]. When established it joined several fields in which games were created for training, education, treatment or to inform. Serious games are very similar in structure to simulations but there are differences. In simulations motivational factors may be excluded. There is often some preferred and pre-set player behavior encouraged through the simulation rules. Finally, goal-oriented activities are absent from simulations. Serious games, on the other hand, are more similar to entertainment games in these aspects but the intended overall goal of a serious game is of course not solely entertainment.

Theories of game design and especially serious games are starting to evolve to a more substantial form. Apart from the

Situated Play, Proceedings of DiGRA 2007 Conference

© 2007 Authors & Digital Games Research Association (DiGRA). Personal and educational classroom use of this paper is allowed, commercial use requires specific permission from the author.

literature on general game design where the main objective is to establish theories on the creation of engaging games [10, 11] there is an increased interest in design of serious games.

Games research and studies of games attracts people from a whole range of disciplines such as media studies, literature, technology, psychology. Games research is thus a highly interdisciplinary area which in turn means that there have been difficulties to find common definitions of different aspects of games as well as to create a vocabulary for the discourse of games. If we narrow in on educational serious games, it becomes even more problematic. Research on educational games is an emerging field that joins games research (which is an interdisciplinary field in itself) with education (a field with a longstanding research tradition and several branches). That is, the field becomes shared between two sets of researchers; educationalists and game researchers. To contributing to this field means that educationalists are forced to acquire knowledge of the deep structures of game elements and game researchers are forced to learn about educational theory [6].

Research on how to find a general approach to the design of educational games is currently mainly coming from educationalists [1, 4]. De Freitas & Oliver [4] proposes a framework to evaluate) games- and simulation-based education. Within this framework evaluation is carried out in terms of four different perspectives on the designed game: (1) context, (2) learner, (3) internal representational world and (4) processes of learning. The first perspective deals with where the play/learning takes place and how that influences how the game will be played. The second dimension focuses on the learner or learner group, studying how e.g. their background influences their learning. The third dimension aims at the game itself, i.e. how well the game world establishes interactivity, immersion and the level of fidelity used. Finally, the last dimension deals with learning methods, models and frameworks used to support learning practice.

Even though this framework is mainly focused on the evaluation of games and simulation, a similar approach may be used to assist the design of new applications. But a shift from evaluation to design also requires a closer look at the relationship between the dimensions. For instance it is not clear how the learning objective and context factors affect how the internal representation world should be represented – something that we wish to address below.

Amory [1], proposes a theoretical framework primarily aimed to support development of educational computer games. As production of educational games is both complex and technically challenging, Amory introduces a framework where design is seen as consisting of interrelated components. By defining less complicated design units, dependent and related to each other, the framework model is developed to support concepts that educational games should. For instance to be relevant, explorative, engaging

and support authentic learning. As a general approach this model highlights very thoroughly several aspects of learning and motivational aspects in games but it is not evident on how units in the model influences each other in the final design. It is furthermore not evident how situational and contextual factors surrounding the actual use of the educational game should influence the design. What is being taught (the training objective) and the surrounding factors (context) will both affect the design of the game. As noted in the movement of situated cognition [14] how learning occurs is highly dependent on “situated” issues. This means a design of an educational game must also take in consideration the intended use of the game.

The overall problem with approaches to design where it is prescribed as a strict method or treated as an engineering practice is that a lot can be lost. Design is a creative process unique to each situation, there is no such things as a recipe for design that guarantee success, instead approaches to design needs be as open as possible to enable creativity for each particular case. This is holds for design in general and especially serious game design where artistic aspects are blended with an intended non-entertainment usage. We propose a more open framework to design that will help steer the design process without necessarily prescribing each design solution in a mechanistic way.

BALANCING THREE DESIGN FOCI

Our main argument here is that serious game designers have to have parallel foci on three different design goals when creating a serious educational game. The three design goals are (1) creating for an engaging game, (2) making sure that the subject/content of the game is relevant to the training objective and (3) designing for the whole context of use, including learning methods and domain specific constraints.

The proposed design approach makes two assumptions on the pre-conditions of a serious game project: first, that there already is an ambition to create an engaging game and second that the game will be used for training and educational purposes.

Design goal one: The motivating and engaging game

Serious games should hold the same qualities as entertainment games but with the extra ambition to be used for a pre-defined and non-entertainment purpose. This means in other terms that serious games need to have motivational characteristics as described by Malone & Lepper [8] and later Garris, Ahlers & Driskell [5]. These characteristics are described by Garris et al. through six dimensions (described in detail below); fantasy, rules/goals, sensory stimuli, challenge, mystery and control. Addressing these categories or dimensions when designing games will spur motivation [5, 8] and improve the training outcome [5]. In an experiment Garris et al. found that adding game features to a simulation (rated by users to hold the six dimensions above) improved performance and training outcome to the experiment group compared to a control

group using a simulation where game features were excluded.

Garris et al. claim that the six dimensions or categories provide a common vocabulary for the development of games – something which is badly needed and useful in further creation of serious games. Using these six dimensions we provide a review below of each and discuss how they relate to the two other design goals (i.e. the training objective and the context of use):

Fantasy: Player action in a game takes place in an imaginary world that has little or no impact on the real world. Fantasy is defined as the mental images evoked by the user through the game environment [8]. There have been indications in studies that a strong fantasy world experience leads to greater student interest and increased learning. Using fantasies, or what others name safe environments, is one of the predominant positive features of a good simulation. A good fantasy experience enables users to “interact in situations that are not part of normal activities, yet they are insulated from real consequences” [5].

Rieber [9] noted that fantasy contexts can be exogenous or endogenous to the game content. In an exogenous fantasy context the learning activity is not explicitly obvious, as in, for instance, learning logistics through organizing an ant colony. In an endogenous fantasy, the learning is closely interwoven explicitly with the fantasy world, as in, for instance, learning physics by applying physical rules to a ship in outer space. For serious games an ability to hide learning as part of the fantasy context may enhance the engagement but should be used very carefully since it may interfere with the relevancy dimension – described in the design foci of training objective below.

Rules/goals: All games have rules. They limit the players actions are explicit, shared, fixed, binding and are repeatable. By this rules acts as the formal structure of the game, they are the fixed abstract guideline describing how a game systems functions [11]. Furthermore game rules can be viewed as existing on three different levels [11]. On the first level we find constitutive rules which basically are the mathematical rules normally implemented in the game code. They do not however describe how the player will enact these rules. Therefore rules may be viewed as operational rules found in the second level where rules are described as guidelines how to play the game. Operational rules are often found in manuals of a game, i.e. they act as illustrating the intended use of the game. On a third level we find implicit rules. These are all the “unwritten rules” of a game. Even though rules are fixed and made explicit to the players every game also are surrounded by one or many implicit rules. Implicit rules can be etiquette, sportsmanship and how to behave when playing the game. As they are not made explicit they could be seen as being negotiated between participating players.

Another characteristic of games are explicit goals. Clear and specific goals understood by the player are necessary in games for the player to judge their performance. If these performances (actions and efforts) does not meet established goals or are progressing towards goals, results yields that there is an increase in efforts and performances in the individual [5]. Therefore clear goals can be seen as a key for enhanced motivational aspects. Often games use reward systems like scores and points as feedback mechanism to explicitly indicate player performance is advancing toward goals. Other games do not indicate performances by any quantifiable measurements but instead make use of changes in the environment to indicate progression. This is common in adventure and puzzle games where visual objects and sounds indicate player’s advancement towards the goal state.

The objectives of a serious game have a lot of impact on the choice of rules and goals. The training objective needs to be transformed into set of rules and goals enabling player behaviour in accordance with the objective. Without careful attention the rules may enact a player behaviour clearly violating the intended use. Games for entertainment purposes may permit wide range of different actions whereas it can be devastating for training games where the wide range of actions enables a player behaviour impeding the training objective. This is not to say training games are to restrict actions in the sense of enforcing a pre-set range of operational procedures (as seen in simulators). It is a tradeoff between permitting a rich set of player actions and to ensure behaviour which is in accordance with the intended use.

Goals also need careful attention when designing training games. Goals needs to be made explicit and the game system should constantly feedback indications of progress to the player. But an analysis of the training objective can complicate a straightforward approach when designing goals and introducing reward systems as we will see in the use case below.

Sensory Stimuli. Visual and/or audio appealing game environments stimulate our senses. It can be attention grabbing and thus lead to stronger motivation [5, 8]. Not surprisingly many of the commercial games are evaluated in terms of their ability to render realistic graphics and audio. If we aim to make serious games share the characteristics of a good game it is of vital importance to create for rich sensory stimuli. The question how much and where sensory stimuli is to be applied is highly dependent on the training objective and the context. Adding sensory stimuli like sound effects, music and visual effects enhances the sensation of the user but will affect the training objective. For instance, if the training objective is to acquire knowledge and familiarize with of strange environments (hazardous and exotic places etc) enhancement of stimuli unnatural to the environment may impair this objective. On the other hand if the training objective is to learn a skill through performing tasks visual images and sound effects

enhance attention by clearly indicating error or successful actions.

Challenge. The challenges a player are faced with should in normal cases be neither too hard nor too simple. This is a common approach when designing games to enable engagement. The challenges can be defined by the goals of the game and is thus closely related to the training objective. Due to issues in context perspective these challenges may be presented in various ways. If the serious game is aimed to be played with a single player setting the challenges must be designed inside the game – not through the social setting with other gamers – which means that the game design has to deal with the delicate problem of balancing the challenges to user capabilities. This is usually done by introducing easy challenges in the beginning and then increasing difficulty as the player progresses in the game. The game system must recognize player's ability to cope with the challenges. Introduction of scoring and division of goals into several sub goals are approaches to recognize player's ability. If player solved a sub goal or reached certain score the player may progress to next level or difficulty.

But if the context (and/or subject) perspective leads to a multiplayer game design with instructors joining in the game process, the challenges can be both defined and introduced dynamically as the game progresses. The instructor has the ability to recognize players' abilities to complete challenges and on the fly introduce harder tasks at appropriate time.

Mystery. Garris et al. [5] make a distinction between mystery and curiosity. Mystery is an external feature of the game itself and while curiosity resides with the individual player. The relationship is that mysteries presented in the game can evoke curiosity in the individual, pushing a desire for knowledge [5]. This means the game may have elements of mystery and unexpected events pushing the player to overcome information gap between these events and the existing knowledge. Mystery and curiosity is closely related to other dimensions in designing a game for engagement. We are striving for introducing mystery to invoke curiosity in the player presented as challenges and defined by rules which are not too simple nor too hard. So dimensions of mysteries are as dependent on the training objective and context as rules, goals and challenges. It can be tempting to prioritize mystery dimension compared to other dimensions and, for instance, make use of exotic and fantasy contexts where player will enhance skills. It will surely stimulate curiosity as the player tries to make sense of this fantasy context but it must be balanced with training objective and choice of scenario described in next design focus.

Design goal two: The training objective

The primary incentive in the creation of a serious game is some overall goal or in this case a training objective playing the game will achieve. By analyzing the objectives several

choices must be made with regards to scenario, information, relevancy and validity.

Scenario. The choice of scenario is one of the more fundamental questions any developer for serious games must take into consideration. Due to the huge variation between training objectives very different serious game applications are being developed. The scenario should in a best case be the result from analyzing the training objective as well as addressing the motivational factors. If the subject is to enhance knowledge about history, a suitable candidate for scenario is clearly a game placed in a historic setting. But if, on the other hand, the goal is to teach situational awareness or business processes (management, logistics, etc.) the choice of scenario can be one of many. For instance, teaching of basic military tactic or strategy may very well be situated in historic settings, but it could equally well be set in a contemporary or futuristic scenario. It could be tempting to use an exogenous fantasy world described above to enable motivational aspects but this choice may violate overall objective with respect of relevancy to the training objective.

Also the choice of representing and introducing information contributing to the training objective can vary. Educational games are best used for acquiring procedural information compared to episodic and factual information [2]. Procedural knowledge is acquired when learners perform a task, episodic information is acquired when they observe a task and finally factual information is acquired through for instance reading texts in the game [2]. This means there are several ways knowledge may be acquired by the learner through games but it is best used when the training objective is transformed into challenges and tasks. But even though the game enables learning by making the player perform tasks the choice of scenario cannot be arbitrary since a bad choice may violate dimensions of relevance to the player.

Relevancy. The relevancy dimension describes how the intended player and learner perceive the scenario to be relevant in relation to the training objective. There is (often) a predefined group of learners with a specific focus (military, health, politics) the training objective is addressing. Pushing the motivational aspects of the game too far, for instance through creating a sci-fi fantasy world to teach military tactics, may lead to players learning to play the game and not to transfer their skill to the real world. It can be the case that this particular sci-fi game encourages the exact same player behaviour described by the training objective but the player has problems to transfer this skill to their profession.

On the other hand, syntactically relevant scenarios may violate the training objective if the chosen game rules do not address the training objective in a good way. This is the case for many commercial war games that have unreal features like spawn points (resurrection of a dead avatar) and health power-ups (immediate recovery of health). They

may enable rich game flow and balance inconsistencies in the game, but they are in most cases promoting faulty behaviour vis-à-vis the training objective and reality outside the game.

Validity. Validity of the information in the game concerns how well it represents the real world phenomenon. Regardless of the accuracy and fidelity of games and simulations one must keep in mind that they are all simplifications and abstractions of real world phenomenon. In serious games any simplifications should preferably relate to real world phenomenon in a consistent, even if somewhat simplified, way. Or rather, the simplifications and abstractions need to relate to the training objective in a consistent way. After analyzing the training objective it is thus permitted to use simplifications or even exclude factors not relevant to the training objective. If the objective is to train how to manage an angry mob in urban area we do not have to implement each and every computer controlled character in that mob with state-of-the-art Artificial Intelligence since we can make assumptions on how the mob behaves on an aggregated level.

Designing for the training objective will also affect on how the game is supposed to be played in the training situation (the context). If the purpose is to teach business processes or basic strategy a suitable solution is to design a single player game, whereas if the purpose is to learn staff procedures or team training the game is preferably designed as a multiplayer game.

Design Goal three: Context

The context perspective will provide answers on the intended use of the serious game as well as all the surrounding factors. For whom, where and under what circumstances are questions that will affect the design of the serious game.

Research on education games yield results that external and contextual factors are as important as the actual game itself. Egenfeldt-Nielsen [3] denotes a third generational approach to educational games in where learning is seen from a broader context than just the game and the learner. In this 3rd generation approach, which takes a socio-cultural standpoint, the role of the teacher becomes central as the facilitator of balancing the educational game experiences to other practices. For the teacher to become a facilitator means, in design terms, he or she must be involved in the game experience itself, either participating in the game or as a close observer. One direct approach is to include a defined role for the instructor in the game design. The context varies enormously between different domains. Research on educational games and their value often focus on children and school settings but conditions are sometimes very different in other domains. Within the military the role of tutors, instructors and teachers are clearly defined. Not to challenge the idea that teachers does not have a defined role in school settings but within the military the role and the pedagogy used witness of a long

tradition with games. For instance, where research point on the importance of debriefing for deep learning to occur the military have been used After Action Review (AAR) in practice for a very long time. Also the way exercises are conducted within the military bare witness of a practical use of experienced based learning defined by Kolb [7]. Kolb's theory on learning is often referenced in discussions on how games can be used for learning. So the contextual factors for the domain (e.g. military) contribute in this case to a relative small transaction cost to introduce serious games. However, already established pedagogical frames such as the ones within the military influences the design of games. The introduction of new serious games which is based on learning theories incompatible with the ones already established may lead to unmotivated complications. Analysis on the learning practice used will provide answers on how and how much the context perspective will affect the design.

Other contextual factors are time available, analysis of the learners and cost. Time available to use the serious game has huge impact in the way challenges are to be designed. Training sessions with games may only be allotted small time slots pushing the challenges in the game to be less time-consumable than desired. How to maximize learning through these small time slots will affect the way game is designed well as how the use is conducted.

Analysis of the learners will provide answers how well they are prepared to use educational games. Do the learners have prior experience with games in this category? Have they played games at all? In other work on evaluating serious games de Freitas et al. [4] describe the importance to focus on learners attributes (age, background, styles and preferences). This is in line with context discussed here. However, promoting the idea that different learners within a context will have capability to an individually based learning (i.e. different game design) is mostly considered a luxury with regards to cost, time and practical reasons.

Cost is for natural reasons a vital issue when creating serious games. Games development is a costly activity which affects the final product a great deal. Serious games development in general does not share the economic luxury to be designed and developed from scratch. Instead resources available will be factors to direct development into utilize existing platforms, tools and games in order to cut costs. The features of these tools and platforms will act as constraints to the overall design.

USE CASE: FOREIGN GROUND – CULTURAL TEAM TRAINER FOR INTERNATIONAL MISSIONS

To further illustrate how a balanced design approach through three different foci will lead to several choices this section describes the Foreign Ground project.



Figure 1: In-game image from Foreign Ground with an African scenario.

Foreign Ground was developed within the Swedish military R&D program to demonstrate the use of serious games to train and prepare soldiers for international missions where Peace Support Operations (PSO) is one of the primary activities. Three basic ideas lay the foundation for Foreign Ground; a game based team trainer, international mission as scenario and being able to illustrate cultural conditions. We wanted the application to have capability to go beyond how simulators normally are used within the military. Therefore the concept of a First Person Thinker was evolved as opposed to First Person Shooter. We wanted to promote the idea that the genre of first person games could be used by the military for other purposes than just combat. Fighting and combat is permitted but it is not the core game idea in Foreign Ground. Instead players will be able to train normal PSO procedures at a squad level. The scenario is that the squad is deployed in the outskirts of a typical west-african city. Below is an illustration on how the balanced approach through three design foci meant for Foreign Ground. As there is no prescribed order in which the three design goal should be applied we start with training objective.

Design goal: The training objective

The overall training objective is to establish a game for team training under cultural conditions. The team is soldiers about to be deployed in a mission area with unfamiliar culture and environment. The game will be used as a complement to normal education and training.

Team training is a costly activity and a game could reduce these costs and at the same time introduce situations otherwise not practically accessible to the players. In the case of Foreign Ground the intended training environment was a foreign culture where the soldiers would be exposed to locals. The intended players are soldiers in a team on squad level and the game will train the team on incidents

that can occur on their normal patrol. Patrol operations can be categorized as social patrol or robust patrol. In social patrol the objective is walk around in a predefined route communicating with locals and show presence. In robust patrol there is an imminent threat or disturbance that needs to be taken care of. The game needs to be able to deal with both of these categories. Furthermore, the game is supposed to stimulate participating team with several different challenges and tasks. By iterative use the team enables to cope with challenges of varying difficulty enabling a trust and self esteem at individual and team level.

Design goal: The motivating and engaging game

By using the six dimensions described by Garris characterizing a motivational we made following design choices:

Fantasy. As this game is aimed to enhance team training skills in a PSO mission there is little or no point to use a scenario different from the mission itself. The fantasy context is thus an endogenous fantasy with a realistic world (outskirt of a west-african city). We anticipated that a realistic rendered game world with environment specific sound would both trigger player interest and enable a sensation of safe environment where actions would be insulated from real consequences.

Rules/goals. The goal of the game was narrowed down to a routine patrol task on squad-level exposed to incidents with the local community that the player has to negotiate and solve. The training objective is to prepare soldiers for situations that might occur on these patrols. The game introduces a goal before the player embarks on a mission and after a scenario has been acted out a new goal is introduced. One of the training objectives is to enhance a team's ability to establish and understand the goals introduced in the game

The rules are adopted from standard procedures in a way they where more implicit rules. The game system does not restrict the players to perform any action (apart from moving beyond the game environment). Players can, for instance, shoot whenever and whoever they want. But a faulty behaviour will naturally not lead to completion of the goals. Similarly the game system has no explicit reward system with scores. Introduction of scores and points would jeopardize the training objective as the game system is not the judge of proper behaviour. For instance, the use of violence is highly dependent on the specific situation and how the soldiers recognize threats. There are no set answers to civil disobedience and a game system can thus not enforce this by promoting "right" behaviour through points. Instead the progression is fed back to players by visual and audio cues indicating a decrease or increase level of threat (or reaching a goal).

Sensory stimuli. Since we mimic a real patrol mission in the game common sound and visual images was designed

for a west-african city. A lot of effort is made to create environment trustworthy enough of this particular region.

Challenges. As goals was treated dynamically with a goals in the beginning and new goals introduced as players engage in the game the right and proper choice of challenges is up to the instructor. The instructor is participating in the game as a director. As a director the instructor can observe the team ability to cope with challenges and introduce new threats and incidents in runtime.

Mystery. Incidents happening in the game are part of the game's ability to evoke curiosity in the players. The intended use of the game is that every game session is supposed to be unique in that sense incidents or series of incidents are not known beforehand. In this way players must be prepared for any occurrence of threats and situations to happen relying on their own ability to solve incident from their own training and expertise.

Design goal: Context

As the game is intended to be used as complement to normal training end education there is pre-set training context this game needs to replace. There are however many contextual issues to take into consideration. The military uses a pedagogical framework in line with 3rd generational approach to educational games described above. In this the learner, the application and the instructors are equally important to create the learning environment. The instructor(s) normally follow exercise and training sessions by participating in the teams. By this it is easier for them to identify progression as well as linking soldier experiences to the training objective in debriefing sessions. The military extensive use of debriefing enables soldiers reflection on their own behaviour as well as a team. This has to be taken into consideration in the design of the game.

In Foreign Ground we introduced an in-game role for the instructors. As a director the instructors would be responsible for the incidents and challenges. As a director the instructor can then not only introduce challenges but also decide when challenges are to be resolved. The game is then highly dependent on the ability and competence of the instructor. On a positive note, in the debriefing session, the instructor can participate and discuss issues differently then in situation where the game system calculate the outcome. The instructor then shares experiences with the players and has opportunity to act as a facilitator to learning linking expertise to players' experiences.

CONCLUSIONS

The approach described in this paper is aimed to view the design of serious games through three design foci to enable both engaging game and to support the training outcome. Even though this approach is specifically aiming at training and educational purposes it can be viewed as a general approach to serious games design. The approach takes a pragmatic standpoint from three design foci and goals; (1)

the engaging game (2) the training objective and (3) the contextual factors.

Several other frameworks exist with similar approaches. De Freitas et al. [4] propose a four-dimensional framework to help tutors evaluate the potential of using games and simulator based learning in their practice. The framework is primarily aimed to be used in evaluating and is thus not completely comparable to the approach proposed in this paper. Nevertheless the fourth-dimensional framework includes components similar to this approach but is divided differently (i.e. context, learner, the game representation and processes of learning). What is lost if using this fourth-dimensional framework in designing educational games is the underlying assumption that all games create engagement and leads to motivation in the player. This is of course not the case. As the use of educational games (and serious games in general) wants to utilize the engagement and motivation aspects in games for learning these aspects need to be taken into consideration. It is a complex task to design for engagement in games and mixed with ambitions to use games for educational purposes it becomes even more problematic. The proposed approach in this paper tackle this problem by introducing a separate design goal where the aim is to design for engagement. In addition this paper is not prescribing any strict methodology to ensure engagement and learning but is instead presented as an open approach acknowledging design to be a creative process.

REFERENCES

1. Amory, A. "Game object model version II: a theoretical framework for educational game development", In *Educational Technology Research and Development* vol. 55, 2007.
2. Belanich, J. Sibley, D. E. and Orvis, K. L. "Instructional Characteristics and Motivational Features of a PC-based Game", Research Report 1822. U.S. Army Research Institute for the Behavioral and Social Sciences, April 2004.
3. Egenfeldt-Nielsen, S. *Beyond Edutainment: Exploring the Educational Potential of Computer Games*, Ph.D. dissertation, IT-University Copenhagen, Denmark, 2005.
4. de Freitas, S. and Oliver, M. "How can exploratory learning with games and simulations within the curriculum be most effectively evaluated?", In *Computers and Education* vol. 46, 2006.
5. Garris, R. Ahlers, R. and Driskell, J. E. "Games, motivation, and learning: A research and practice model", In *Simulation & Gaming*, vol. 33 No. 4, Sage Publications December 2002.

6. Kirriemuir, J. and McFarlane, A. *Literature review in Games and Learning*. Futurelab Series. "www.futurelab.org.uk/research/lit_reviews.htm", 2004
7. Kolb, D. A. *Experiential learning: experience as the source of learning and development*. Englewood Cliffs, N.J: Prentice-Hall, 1984.
8. Malone, T. W. "What makes things fun to learn? Heuristics for designing instructional computer games" In *Proceedings of the 3rd ACM SIGSMALL Symposium*, (Palo Alto, California, United States, 1980).
9. Rieber, L. P. "Seriously considering play: Designing interactive learning environments based on the blending of microworlds, simulations and games". In *Educational Technology Research and Development*". Vol 44, 1996.
10. Rollings, A. and Adams, E. *Andrew Rollings and Ernest Adams on Game Design*. New Riders Publishing, 2003.
11. Salen, K. and Zimmerman, E. *Rules of Play Game Design Fundamentals*. The MIT Press, 2004.
12. Serious Game. 2007. "http://en.wikipedia.org/wiki/Serious_game". Accessed March 01. 2007.
13. Serious Games Initiative. 2007. "<http://www.seriousgames.org/about2.html>". Accessed March.01. 2007.
14. Suchman, L. *Plans and situated actions: the problem of human-machine communication*, Cambridge University Press, New York, NY, 1987.