Game Based Life-Long Learning

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Abstract. Digital Games as a means of learning have become more important in recent years. Infrastructural and sociological developments have created fertile grounds for game innovations, making use of latest technology and being welcomed by new generations of learners. This chapter focuses on an overview of the current state of the art of learning games, explaining different perspectives. As the gamers' generation has now grown up, the educational contexts for life-long learning like higher and vocational education are moving into the scope of game based learning and therefore deserve special attention.

Keywords: Game Based Learning; Game Design; Patterns; Instructional Design; Learning Context

1. Introduction

One of the striking observations when looking at game-based learning is that its definition and background oddly go beyond the human aspect of learning sciences. Animals (in essence, all placental mammals) have the ability and the drive to learn through play (Burghardt, 2005). Zoological research illuminates the importance of play for young animals to learn essential skills (Hawes, 1996). Gaming, hence, is a very natural way of self-directed learning during a phase in life, which is the stage of most rapid cognitive development. Therefore it is safe to assume that game-based learning has existed for a very long time going back to prehistoric

times. Being a subspecies of the class of placental mammals, also young humans engage upon their drive to learn by gaming. The natural drive to learn through play, however, is coerced by modern society. Acknowledging the obvious demand for games that is a culturally universal phenomenon, the notion of learning through games, though, has a somewhat unserious flavour, especially from the perspective of formal educational systems.

In life-long learning, however, education is usually not formally imposed on the learner. There is a high degree of "ownership of learning" that turns the situation around (Wilson et al., 2006). The learners themselves are now the main motivational instance and equipped with a fair deal of initial self-motivation. Much like subscribing to a gym, this initial motivation can, however, decrease quickly when they discover disadvantages, like getting bored or overtaxed.

The main objective of a game-based learning approach for life-long learning is thus the sustenance of this motivation and helping learners over the hurdle of getting truly comfortable with the overall learning process they have engaged upon. While this may seem like a noble goal, the challenge is far from trivial.

For several years experts in the field of education have made thousands of games designed for education, however, mostly the advantages of such an approach have remained obscure, and the factors required to successfully create a learning game out of a situation are seemingly random (O'Neill, Wainess & Baker, 2005). In this chapter we explain the advantages of using a systematic approach that makes use of game design patterns (Bjork & Holopainen, 2004). These can be used for the following purposes:

- Identifying hidden game elements in a non-game-based educational scenario
- Making a game out of a non-game-based scenario
- If there is nothing to build on, designing a game from scratch.

On a general note, also we can subsume that the latest technological developments (Johnson, Levine & Smith, 2009) have created an enormous potential for learning games to be revisited. The arrival of the Web 2.0, semantic web technologies, as well as cinematic computer graphic and mobile technologies have opened the gates to a world of possibilities we do not want to miss out on.

2. Current State-of-the-Art

The state-of-the-art of games in life-long learning is difficult to pinpoint, as scientifically relevant results on the exact intersection of the two spectra are scarce. However, there exist some approaches that can be placed in the topical proximity of our focus, showing very promising perspectives. We picked a couple of examples coming from different directions in order to provide a certain deal of coverage.

One of the more notable approaches, for example, can be found in the field of mobile learning games dealing with the life-long learning of the homosexual minority in India (Roy, Evans & Sharples, 2009). The targeted people have the societal disadvantage of being pushed into obscuring their sexuality from daily life, which makes it difficult for them to access relevant knowledge that could help them avoid related problems such as HIV infection or drug abuse. While the learning game as such makes use of the pattern of role play, hence enabling a good deal of identification with the game character, it is also a way for the target group to stay anonymous: the game is realized as text message based quest game, moderated by anonymized "peer educators". The users can play the game accessing relevant educational content without revealing their personal attitudes to their social surroundings: operating a mobile handset is nothing that draws a lot of bystanders' attention.
While this example may seem very specialized and unique, it illustrates the enormous potential of a game-based life-long learning approach.

Another, less recent example but with more generic properties is the "UniGame" described by Pivec & Dziabenko, (2004).
In this approach several teams collaborate on a simulated project, for example the building of a tunnel. The team that produces the best project plan to offer to an imaginary stakeholder wins. Each team gets a certain amount of "chips" which need to be used to allocate limited resources for emphasizing certain topics over others.
By this example it is demonstrated how social skills and knowledge management can be trained.

Another example (Sigurðarson, 2008) is a web-based personal glossary and quizzer module for a popular virtual learning environment. The glossary offers support to create on the fly a

quiz from either a single user's glossary or all users' existing glossaries, to test their skills at translating words from one language to another. A choice is made on how many words to include in the quiz, and after completing one, the users are able to see how fast they completed it, the percentage of right and wrong answers, as well as which words they translated correctly and which not. Other indicators can for example make use of the "high score list" pattern, visualized as a current placement indicator, akin to those found in racing games, displaying "3rd" or "1st", depending on a player's current position. Their words per minute might even be displayed with a mock speedometer.

Another series of games with a big potential for use in education are location based games making use of latest mobile technology. According to Grohé (2009), already a small but fair choice of games exist that make use of location based services, using the Global Positioning System. The games mentioned are "Fast Foot Challenge", "Geocaching", "GPS:Tron", "REXplorer", "Gowalla", "Mobile Dead", "The Go Game" and "Metal Gear Solid: Portable Orbs", all of which make use of the possibility to monitor the player's geographical location in relation to other game elements (other players, objects). The possibility to use these games for learning emerges from their social and geographical dimensions: being able to experience real life situations creates a strong immersion factor, while the virtual mobile indicators augment those situations with important information needed for the game experience. For example Geocaching, the oldest and most widely used location based game of the lot, uses a quiz pattern for people to figure out the coordinates of a cache (a physical treasure hidden somewhere). Here, we already have to deal with a sub-game which can be used for learning. After that, the exploration and cooperation pattern is being extensively used to put together a team of explorers who head out to find the cache, which might even be hidden in locations that are very difficult to access: For example, there are caches on Antarctica, Mount Everest or under water.

Another interesting rather scenario-based approach is the EMERGO methodology (Nadolski et al., 2008) that is essential an authoring toolkit for serious games making use of adaptive storytelling and role play.

Here is where adaptivity becomes of interest and the learning game approach finds relation to adaptive hypermedia (Brusilovsky & Maybury, 2002). The story being told can change according to the actions of the player, and depending on the skills of the learner, in terms of problem solving; the game may be lost or won, or won with according delay. The system was specifically developed to facilitate the authoring of learning games, so the actual design of a

learning game depends on the game author. Even though the approach technically so far only accounts for single user games a competitive or collaborative pattern could be introduced as so-called “extra-game pattern” for example by two players taking turns trying to reach the goal of a quest more quickly than the other. The approach is designed for higher education training but can also work for a life-long-learning purpose.

3. Advantages of games in Life-Long-Learning

Although above examples show a big potential, it might not be immediately clear what makes learning games specifically attractive for use in the life-long learning context. The reasons are of practical nature: people who are already working in a full-time job ideally combine their life-long-learning activities with recreational activity, which is in line with the notion of informal learning (Coffield, 2000; Foreman 2004).

On the other side of the coin, especially in times of world economic crisis people lose jobs and often have to start over, trying to get qualified in different areas or getting back to school to get the degree they never completed. This is how life-long learning and formal education encounter and create a potentially painful combination. Especially for people who already have been in a workplace and gathered professional experience, getting “back to school” may be perceived as big throwback.

Especially under these conditions, but also in general, learning tends to reside down in the lower end of the scale, while games and other frivolous activities rank higher. A reason for this could be that learning is usually understood by authorities, and experienced by people as the passive act of "receiving" knowledge from a speaker, text or video in a formal setting (of a school or institution). Enjoyable side-activities happening within this context, such as socializing or even playing games are usually discouraged or forbidden, a state which increases their scarcity, and thus their value. However, the pleasurable value of learning is greatly decreased by the stark contrast to the individually more valuable, discouraged activities happening in between lessons or classes (Schank & Cleary, 1995).

Due to these very reasons, many researchers in the field of pedagogy have struggled for years to show that what is happening within the classroom is not "really" learning (Illich, 2000). It is simply a structured way of delivering information, in the hope that through a process of content delivery, and repeated exercises, with their respective mistakes and successes, the

participants get a proper understanding of the topic at hand. This system roots in the introduction of factories during industrialization (Keegan, 1994), and by now many educators believe that a more flexible approach, harnessing the power of the Internet and computers, for example, clearly offers better alternatives.

We acknowledge and build upon the fact that formal education is perceived by most as an unpleasant activity, and a great many learners spend most of their cognitive power "playing the system". This is a problem we refer to as Naeve's knowledge emulation problem (Peña-López & Naeve, 2007) and seems to be centred around the testing aspect of formal education. Tests, usually few of which will have an actual impact on a learner's grading, are spaced out far enough from each other, to give the teacher ample opportunity to design the tests, as well as to review the student's scores. The possibility of repeating an exam or a test of the same nature is rarely offered, causing many learners to struggle finding ways of emulating the knowledge at all costs, since failure is not an option. According to Naeve and Peña-López this behaviour unfortunately means that many learners avoid reflective thinking or contemplation on their subjects, as they are more concerned with passing these "rare" tests and avoiding any delays in their career, than mastering their subjects. This presents one of the major challenges for modern educators, to break free of the factory-mentality of formal education, and restore fun and discovery to the learning process. One way to accomplish that is to add gaming elements to an existing learning activity; how to do so with some of the more effective generic game patterns is explained below.

Games by their very nature are often simulations of real world activities, or simply "naïve" problem solving enhanced by instant gratifications in various forms: points or audio/visual "rewards". A simple method for turning exercises into a game is the introduction of a scoring system. A scoring system allows a learner to gauge their performance from exercise to exercise, as well as enabling comparison to their peers and thus competition.

Even the most simplistic scoring system may revitalize a learner's efforts as they offer easy alternatives to the sparsely taken and heavily weighted tests mentioned earlier. In stark contrast to those, learners are put in charge of personally reviewing their own performance in each task, reflecting on it, and possibly redoing the task to improve their performance. This reflection and the critical thought involved in analysing a past performance, what went wrong, or what may be improved, is a critical part of the learning process. In many formal

educational scenarios this is suppressed by knowledge emulation, which suggests that a life-long learning context is a more fertile environment for our direction.

4. Identifying motivation drivers: Competition, Collaboration and Indicators.

Psychological research has revealed several factors influencing human performance both positively and negatively in relation to gaming (Becker, 2005). These factors are either in line (positive) or in conflict (negative) with the findings of educational research on motivation theory (Keller, 1983), experiential learning theory (Kolb, 1984) and instructional theory (Gagné, 1965). Considering how these approaches complement each other, we believe that there are only few main drivers responsible for games being as engaging as they are, and people are not equally affected by them.

One of these factors is the ability to see progress in an obvious and continually available manner. When users are able to gauge their progress and realize the effects of their actions with regard to any type of measurement (usually realized as "points" in a game) this introduces the first and most basic form of gaming: *the ability to compare performances*. This first factor holds true whether the person is alone, comparing their performance to their own previous ones, or in a group and comparing with others. The moment we, however, introduce more people into the activity, a myriad of possibilities appears as many are more easily motivated in direct competition with others, than just with themselves. Competition between people can take many forms, the simplest of which is already realized by the first factor: the ability to compare your performance to others.

Things start becoming interesting when actions of a player can influence the performance of others. This paradigm is common and at the core of most competitive games. Examples from a few different styles of games:

- In a first person shooter video game a possible influence is to destroy other players' avatars, and thus causing them to lose their weapons/items they have

accumulated, as well as increasing own score, for example by picking up items dropped by another player who got "destroyed".

- In a game of competitive Tetris, by eliminating the gaps in a line on the screen, a player causes a new line of blocks with random gaps to appear on the other player's screen.
- In a game of soccer, each player is able to intercept the ball whenever it is passed around the field, and even to intercept players of the opposing team and outplay them for the ball.

This would be the second basic factor: *the ability to affect the performance of others*. Now, this may seem like a factor, which is not too easy to include in simpler settings, but as we will demonstrate there are several patterns or ways to achieve this kind of competition. In scenarios where there are more players than two, this pattern introduces another aspect of gaming, which is the opposite of competition, namely collaboration. While, generally, the element of competition stays the ultimate driving force of a game, collaboration between players can provide so much mutual benefit that players who choose not to play as part of a team are greatly disadvantaged. Upon forming of teams in games, there is also an element of in-team collaboration that has a competitive aspect of players of the same team comparing their stats, forming a sub-game out of the overall game.

A third and very crucial factor is the challenging role of *being in charge*. Game worlds have a high potential to simulate the notion of control and ownership to the player. This especially notable in role play scenarios where the identification with the game character is fostered. However, consequences remain in-game and have no effect on the player in terms of real risks, which therefore gives the player more freedom to try out different tactics and develop own ways to solve problems.

Finally and most obviously the *"game content"* itself is an important factor. If a certain innovativeness and aestheticism is warranted the gaming experience is more attractive and the player enjoys exploring (Kiili, 2005).

These simple additions to any activity are powerful ways to motivate participants in exciting new ways. A common problem many medium to large enterprises possess is a varied workforce in terms of age, gender, originating cultures and professional abilities. There are definitely those within each workforce which are threatened by the idea of competing with their co-workers, especially in a learning scenario. Maddock, (1999) states that mostly males

under the age of 50 enjoy pure competition, while other groups either prefer competing with their own performances, or, as we theorize, working and competing in teams. In a team scenario those who do not necessarily believe they are the best, may still play an important role.

Game-based learning has the potential of introducing fun and engaging ways for improving personal performance. Facilitators of game-based learning activities in a life-long learning scenario should take care that the patterns they introduce to their learning scenarios to embed them with gaming properties, do not cause participants to feel pressured or intimidated, rather mildly stimulated.

In the text above we briefly mentioned indicators and the important role they play in providing one of the basic elements required for gaming: a scoring system. Scoring systems may however be constructed in a variety of ways, ranging from a simple dichotomy, where a participant is either successful or not, to the more common "points" system, where a linear number denotes performance, to the most complex scoring systems, where a score is given in any number of different areas of game-play. Examples of these more elaborate scoring systems are, for instance, found in many strategy games, where players are awarded a number of points in areas such as resources, how well they exploited the resources available, unit production, unit destruction, building production, and destruction. A very elaborate system of scoring each match is being deployed in many multiplayer action games, such as Halo 3 (Piggyback, 2007). In Halo 3 different scoring systems apply depending on the type of game being played, but as well as each player receiving a general score for performance based on the number of times a player destroyed another player, there are many rewards to be achieved, and after a match is completed players are able to review and reflect upon their "kills/deaths" ratio, their accuracy or favoured weapons, and even which opponents they most often clashed with successfully or unsuccessfully.

It is a fact that humans give objects value based on their scarcity, so a reward for an "excellent" performance should be hard enough to achieve for it to be valuable, while not being unattainable and thus demotivating. A prime example of the relationship between scarcity and value is that of a gemstone: its value is directly linked to its scarcity, to the fact that not everyone can obtain it. The same is true for virtually anything, points or rewards in a gaming scenario are only worth the effort involved with acquiring them: the lesson we learn is that even if a reward has no real value, it will be valued simply due to its scarcity. In fact it

may be argued that when turning real-world tedious activities into a game, rewards programmed into the game should not be valuable in the real world, and if so only as a token. Increasing the stakes too much will decrease the gaming factor.

Now we have established one aspect of indicators, and one of their main functions: to indicate a player's score. Additionally, the indicators themselves may have reciprocal properties. An important dimension of any indicator in a technology-enhanced scenario is the timing of display. When engaged in an interactive activity which may or may not be competitive, the factor of whether or not the performance may be gauged in real time is an important one for the overall experience, as seeing a clear indicator of your performance at each given time may encourage or discourage depending on the person. This may be viewed similarly to a speedometer or an odometer, or both. Seeing the current speed and total distance travelled while cycling, for example, is very useful for cyclists who know they need to cycle 20 kilometres in one hour, so as long as their speed is 20km/h or more, they may feel secure and motivated to keep their pace, if they are unable to keep such a pace however, this indicator could affect their performance.

5. Generic Game Learning Patterns

There is already in-depth research done on design patterns for learning purposes, for example as conducted in line with the EU Kaleidoscope project (Mor et al., 2006). However, under the notion of game patterns we understand game design patterns (Björk & Holopainen, 2004) as used in conceptual game design in its broader sense (theoretically also including non-digital games). They are used for matching learning scenarios with implementable game elements to enhance the scenario. To conceive this, we suggest a content based approach that gives us the possibility to come up with an instructional design in connection to the story line of a respective game. The possibilities for this are context dependent, relating to what is the desired main educational outcome. A choice derived from fundamental pedagogical theory as described in Robinson's (1998) learning goals can be subsumed as:

- The acquisition of information
- The practice of tangible skills
- Training of problem solving and collaboration

Depending on this classification, it is decided what kind of game should be used (Quest type, real world simulation, highly reactive multiplayer game, etc.) and what will be the respective game elements. To do so, game design patterns are chosen that form the actual game design by being combined with each other, for example resource patterns, stating the score of players' attributes, able to be traded, lost or gained. The fundamental difference between software design patterns used for building learning environments, such as suggested in (Retalis et al., 2006), is that game design patterns are in fact used for an earlier stage than actual application development. The patterns are meant to help a conceptual game designer to spawn a combination of game elements that works well to achieve a learning objective.

On a whole scale, according to Björk and Holopainen (2004), game design patterns are grouped into the following classification:

- Actions and Events Patterns: These patterns describe the most granular level of game elements, such as simple player actions and reactions of the environment.
- Patterns for Narrative Structures, Predictability and Immersion: These patterns describe the storytelling of a game and the identification factors of the player's character enabling the users to identify themselves with that role.
- Patterns for social interaction: These patterns describe the specific properties of a multiplayer gaming environment.
- Patterns for Goals: These patterns are needed for the end of a game or its subdivisions. Once a goal is achieved a certain special event occurs that indicates so.
- Patterns for Goal structures: Goals can be modified during gameplay, which is described by these patterns.
- Patterns for Game sessions: These patterns describe the overall characteristics of player participation in a game.
- Patterns for Game Mastery and Balancing: These patterns described the abilities and kills of a player in the game.
- Patterns for Meta Games, Replayability and Learning Curves: These patterns describe factors outside the game, such as possible contextualizations.

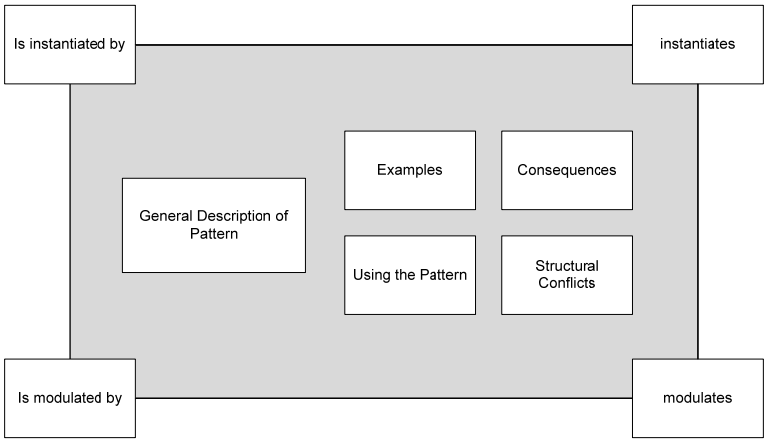

Fig. 1. General structure of a game design pattern.

As sketched in figure 1, game design patterns consist of different structural components. First, the core of the pattern describes its functionality, what element of a game it represents, how it is used and what the consequences are. Also possible conflicts with other game elements are indicated lest they appear in the same game together. Relating to this, a metric of combination rules applies: patterns can be combined by modulation (one pattern influences the other), and instantiation (the existence of one pattern leads to the coexistence of another). In theory this construct leads to "game based" compound learning objects such as described by Boyle, (2003), however in a less concrete form. It is, however, important to stress that a single game pattern does not suffice to create a whole learning game. Therefore it should be argued that the metrics for combination are of paramount importance for a sound game design. The specifics of software design, derived from a conceptual design, can be extended to fulfill the requirements for implementation by using a layered composition of elements as suggested by Boyle. Another point is that the reverse engineering of existing game-based learning scenarios may elicit game elements that have already shown to be of educational use and can then be mapped to form the appropriate contextualized taxonomy of game patterns for learning (Becker, 2007).

In our approach we focus on the social interaction patterns, such as competitive patterns and collaborative patterns.

Example: The "Cooperation pattern": *Players cooperate, i.e., coordinate their actions and share resources, in order to reach goals or sub goals of the game.*

To form a game out of this starting pattern, it is necessary to instantiate into more specific patterns that state fact about how in detail the cooperation is conceived. “Alliances”, “Team Play” and “Shared Rewards” could be possible sub-patterns.

Example: In juxtaposition of aforementioned pattern, the “Competition pattern” is of relevance: *Competition is the struggle between players or against the game system to achieve a certain goal where the performance of the players can be measured at least relatively.* This pattern for example is instantiated with the “Enemies” pattern, “Player Elimination” or “Incompatible Goals” patterns, only to name a few self-explaining examples.

As pointed out above, an important element is the reflection of the player’s progress or status, which can be achieved by making use of resource/score patterns, raising the awareness of success and failure, especially when it comes to social comparison.

Finding the right selection of game design patterns according to the classification mentioned above (acquisition of information, practice of skills, collaboration) can be systematized in conjunction with the pedagogical processes relevant to the learning scenario, and comparing these requirements with the description of the game design patterns in question. For example, the acquisition of information (a process critical for learning) can be reflected in-game by the “gain information” pattern, a pattern which is described as *the goal of performing actions in the game in order to be able to receive information or make deductions.* To foster collaboration, the “shared rewards” (*The players who were involved in some way in reaching a goal in the game share the reward*.) pattern may be of use, while the practice of a tangible skill could be reflected back to the learner in terms of progress and success indicators, such as “score” or more specifically “high-score-lists” as such introducing a competitive element.

While this procedure illustrates how one pattern leads to another, it is important to balance the game patterns in such a way that a residence within the bandwidth between engagement and on the other hand content is achieved: Learners should be motivated and “drawn” into the game, but not be overly distracted from the learning goal. It is a matter of ongoing research to find out which learning functions best profit from what game design patterns calculated over the broad range of suitable domains and contexts as well as target audiences. A way to do this according to our preliminary findings is to match game elements with pedagogical processes, using pedagogical taxonomies as intermediary step.

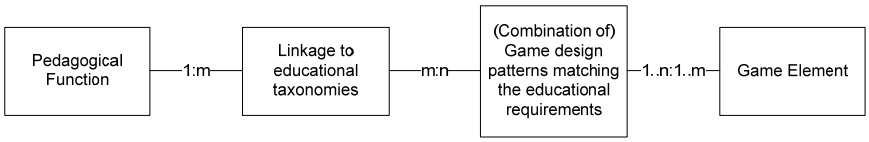

Fig. 2. The mapping between pedagogical functions, educational taxonomies, game design patterns and finally the corresponding game element after implementation. Note that a game element can be composed of a combination of game design patterns.

Figure 2 shows how such a mapping is carried out. The pedagogical taxonomies mentioned are largely based on the theories by Gagné (1965), Keller (1983), and Kolb (1984). Additionally, the classification of Heinich et al. (1999) (educational design theory), and Robinson (1998) (pedagogical goals) can be considered. Indeed, comparing these taxonomies with above mentioned classification of game patterns, a striking similarity becomes obvious. Almost all game design patterns can be directly mapped to instances or concepts of those pedagogical taxonomies.

Example: With respect to dealing with prior knowledge in an educational scenario the pedagogical concepts associated with this entity are *tutorial, demonstration, presentation* (Gagné, 1965), *stimulating recall of prior learning* (Robinson, 1998) *self-awareness of knowledge construction, ownership of learning* (Heinich et al. 1999) *observation* (Kolb, 1984) and *relevance* (Keller, 1983). These concepts can be mapped with the game design pattern *reconnaissance* (known areas in the game and detection of changes).

The pedagogical taxonomies mentioned comprise a very large spectrum of all kinds of learning activities fit for various domains and contexts. Limiting the focus on social interaction patterns may be rather ideal for domains where communication and collaboration are of critical importance.

In a nutshell the approach is meant to help an educational game designer find game patterns to build a game either from scratch or out of a non-game based learning scenario. In life-long learning, especially well designed games that follow a logical and structured lead, help to avoid irregularities that can quickly become frustrating. Finding and choosing game patterns on their own is not always required, sometimes a course designer may instantly see options for introducing a game pattern to an existing activity, but browsing through the wealth of existing game patterns is likely to spark some creativity and help with future applications of the technique. Indeed the application of game patterns in innovative ways, and their utilization in contexts beyond their examples, and the documentation of such applications should be

considered valuable input to the ongoing research of game patterns and their application in a learning context.

Furthermore, a pattern-based approach helps to streamline the design process of a learning game from a software engineering point of view: conceptual patterns can be transformed into actual software modules more easily, while heeding important requirements like reusability and interoperability (Mor et al., 2006), (Winters & Mor, 2009).

6. Future Research Directions

The current projects with relation to game based learning indicate that the approach is taken seriously not only scientifically, but also politically. At the EU level various projects have been initiated, such as the ELEKTRA and the 80 Days projects (Elektra Project, 2009; 80 Days, 2009) as well as sub-initiatives of various other EU projects on Technology Enhanced Learning. The approach yields discoveries to be made, not only due to the many variables to be accounted for research-wise, but also due to the fast-paced innovation development of the gaming sector as such. New technologies continuously emerge, and the state of the art proves an exciting field to master and participate in. While our approach of systematic pattern based learning game design might seem somewhat schoolmasterly, it is noteworthy that the discovery and addition of new patterns or pattern structures is greatly welcomed, and will be of highest relevance to the research field, enabling a sound and up-to-date matching with current educational practices. It is also our own aim to continuously contribute new mappings between education and game design and experiment with those, which will be our focus in upcoming publications following this chapter.

New dimensions of gaming are introduced every year with advances in the video gaming industry. Recent interesting additions which greatly enhanced options for educational content development would be the significant advances in human interface technologies that are heralded by the arrival and popularity of the Nintendo Wii. With the advent of Microsoft's "Project Natal" (Project Natal, 2010), all the major gaming consoles offer a level of motion interaction, of which Project Natal is currently the most advanced. Its capabilities of capturing a person's movements as a wireframe have the potential of enabling a whole host of new learning capabilities, for example learning activities that involve teaching movements and interactions, with minimal material costs or overhead.

Another aspect of learning games obviously comes with mobile and location based technologies, breaking with the prejudice of games being screen-locked. The most powerful 3D graphic engine is in fact the real world which is available without programming effort. By augmenting the real world with mobile indicators, not only do we save time and effort in creation of learning games, but we also enhance the overall experience of the digital world. It was inconceivable only a few years ago that playing computer games actually could ever involve physical exercise, fresh air, sunshine and socializing; factors we find especially attractive for use in life-long learning scenarios.

Even though these new possibilities may be highly stimulating with respect to the spawning of new types of learning games, at the same time it is of interest to explore and keep track of which types of learning can best be supported by which mode of gaming. This is why the game pattern approach is important and needs to be constantly updated and extended, as well as continuously used for validation of "gaming/learning" hypotheses that emerge at the same pace as new game technologies.

7. Conclusion

Our intention in this chapter was to argue for the use of gaming patterns in life-long learning and to demonstrate some simple ways in which a normal learning activity can be made into a game. By illustrating the latest incentives in the field we hope to have laid the cornerstone for a meaningful approach that will benefit learners and course developers from all different fields. While we have to acknowledge that institutional learning cannot only be "fun", it is clear that games can help motivate learners and turn tedious or seemingly mundane tasks into enjoyable ones. By introducing the gaming aspect it is possible to tap into that raw human emotion, the competitive (or team collaborative) spirit, where those previously frowned upon or "useless" activities come to life with the urgency and joy with which our survival instincts react to competition. Although this might be in conflict with the element of collaboration, forming competing teams, it bears the same challenges as a purely singular competition while additionally providing the element of social responsibility which elevates the urgency even more.

Self-motivation is a critical factor especially in the more informal setting of life-long learning where "ownership of learning" is of high importance to the learner. Considering that many

life-long learning programs being offered are distance based, or mixed on-site and off-site, self-motivation must never be underestimated as a factor for success of such a program. In such a scenario a learner might be well advised to try out novel ways of learning, such as game-based learning, because many of the classical factors contributing to appreciation and quality such as social factors offered by peers, direct guidance, and motivation and support by a teacher are missing. Indeed it may be argued that adding game patterns, especially competitive ones, to existing learning activities in a distance learning context, could affect the social experience of learners in a positive way as they would cause students to gather within the learning environment at the same time, greatly increasing the chances of them socializing, which the extreme popularity of social network sites in the last few years has demonstrated is a very agreeable online activity.

It is our conclusion that facilitators and developers eager to increase the rate of success in their life-long learning programs, would do well to examine options for including a game-based activity, or to redevelop an under-appreciated activity by adding some gaming elements . A possible starting point to do this is the pattern-based design approach we presented here. The key criteria to judge in game-based enhancements are appreciation and learning outcome. By using a systematic approach it can be traced which pattern or which combination of patterns have measurably positive effects – a method which will continuously improve the research society's understanding of why, how and when learning games work, or not.

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