

Game Based Learning – a way to Stimulate Intrinsic Motivation

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Abstract: Using games in educational contexts is an old concept that got a renaissance in the 1980s when Thomas Malone did an analysis of computer games and why they are fun and motivating. Later Malone discussed his findings with similar results extracted from studies by Mark Lepper in a merger that resulted in the *Taxonomy of intrinsic motivation*. How well designed digital games can support intrinsic motivation has often been discussed in research during the last decades, but less has been written on course design that stimulates learning for learning's sake. In today's blended learning with an increased part of distance education there are several reasons to build courses on mechanisms that strive for more than just having students to answer multiple choice questions. The aim of this study is to explore how the various parts in the Taxonomy of intrinsic motivation might be used in course development to design blended learning and online courses that motivate students without the traditional carrots and sticks. This case study is based on a course in Games Based Learning (GBL) where students build their own learning games based on presented and discussed GBL theories. Data has been gathered from group discussions with students at examination seminars, evaluation questionnaires, and online discussion fora in the virtual course platform. Findings show that the basic components from the Taxonomy of intrinsic motivation have a potential to stimulate students both on the level of internal motivation and on the level of interpersonal motivation. Ideas and theories for learner motivation might also be presented to the students to stimulate the design of the game prototypes. However, if a course built on the concept of intrinsic motivation is given simultaneously as a course with sticks and carrots as prime motivational ingredients, the extrinsic motivation design in the latter course will override the intrinsic motivation.

Keywords: intrinsic motivation, games based learning, GBL, course design, digital games

1. Introduction and aim

To involve games and game mechanisms in education has been practised since way back and examples of old games used in teaching and learning activities are Chess and Kalah/Mancala. The game Kalah, or sometimes Kalaha, has African roots and is a member in the board game group called Mancala. This kind of games was played in Egypt as early as in the period between 1500 – 1150 B.C (Barnes, 1975). Like Chess the Mancala games have devotees with strong gaming habits. The idea of using games in education got a renaissance the 1980s when Thomas Malone (1981) did an analysis of why people find computer games fun and motivating.

Based on his findings Malone developed a model for looking at motivation in games build on the components that makes game playing fun. The three key elements in Malone's model named *the theory of intrinsically motivating instruction* are challenge, fantasy and curiosity (Malone, 1981). To make a game challenging the game goals should have uncertain outcomes and if the goals are too obvious and easy to achieve the player will not be motivated. Identified game mechanisms for making the goals uncertain are various difficulty levels, multiple level goals, randomness and hidden information. Goals should also be personally meaningful and stimulate the player's self-esteem (Kapp, 2012). The importance of a broad range of challenges divided into different difficulty levels is a way to stimulate intrinsic motivation has also been pointed out by Csikszentmihalyi (1979).

In Malone's theory a fantasy inducing game environment is a one that *"evokes mental images of things not present to the senses or within the actual experience of the person involved"* (Malone, 1981). Furthermore fantasies can be divided into extrinsic fantasies and intrinsic fantasies where extrinsic fantasies depend on the use of skills and not on the fantasy itself. Intrinsic fantasies are the ones that Malone sees as more interesting and more instructional since these fantasies also depend on skills, but that the skills at the same time are depending on the fantasy (Malone, 1981) The cognitive advantage of using intrinsic fantasy is that the evoked images or metaphors often help the learner to apply earlier knowledge in the process of learning new thing (Kapp, 2012).

Finally Malone lists curiosity as a key ingredient underpinned by earlier research by Piaget (1951) and Berlyne (1965). The basic idea is that environments providing an optimal level of informational complexity have the potential to stimulate curiosity (Malone, 1981). Similar ideas have been presented by as important for the Flow theory that a person that participates in an activity should be able to obtain increasingly complex

information (Csikszentmihalyi, 1979). Malone divides curiosity into sensory curiosity and cognitive curiosity where the former could be evoked by multimedia effects and the latter by learning structures that the learners could elaborate themselves (Kapp, 2012).

Another researcher that earlier in the 1970s started to explore how playing could motivate learning and motivation was Mark Lepper (1975). His main findings and how they later were combined with Malone's ideas in the creation of the Taxonomy of Intrinsic Motivation will be presented in *Background*. Many researchers have analysed digital games (Papert, 1980) (Gee, 2003) (Kiili, 2005) and pointed out the potential of games and gaming to stimulate learning and intrinsic motivation. Less has been written about how the recognised key factors that supports intrinsic motivation should be implemented in course content and course activities.

1.1 Aim

The aim of this study is to explore and discuss how the various parts of the Taxonomy of intrinsic motivation might be used in course development to design blended learning that might motivate students without the traditional use of carrots and sticks.

2. Background

To use games as tools for learning at university level was introduced in the 1970s by pedagogical ideas by Jean Piaget (1973) and Lev Vygotsky (1978). There are several researchers that have found that digital games can be strongly motivating (Papert, 1980) (Malone, 1981) (Gee, 2003) but there is still no model for integrating educational theory and game design. Some researchers have investigated how the Flow theory might be combined with learning theory in computer games (Paras, 2005) (Kiili, 2005) (Fu et al., 2009). The use of Game Based Learning (GBL) in education has generally increased in the 21st century but with a risk for negative consequences when stereotypical gamification is implemented without alignment to the learning outcomes (Kapp, 2012).

There are at least two different approaches for GBL where the first one is based on the idea that students learn to program by constructing their own digital games. By building their own executable computer games they will at the same time learn useful programming techniques and GBL theory. In the other approach, students learn by playing games that can be Commercial of the Shelf (COTS) games, educational games or serious games. COTS are not explicitly aligned to any learning outcomes while educational games are created for learning. In a wide definition educational games might be described as games that are developed to teach someone something (Moreno-Ger et al., 2008). Serious games should be designed for distinct aims and not for pure entertainment (Kapp, 2012) and they have also been defined as: *"... a mental contest, played with a computer in accordance with specific rules, that uses entertainment to further government or corporate training, education, health, public policy, and strategic communication objectives."* (Zyda, 2005)

A common criticism though of serious games is that they might tend to be too serious and not particularly motivational (Brusse, Neijens & Smit, 2010). There also exist several examples when concepts and mechanisms from COTS games have been combined with learning objectives. If this is not carefully designed the results risk to be so called *Shavian reversals* that combines the less attractive elements from the two mixed worlds. GBL Shavian reversals have been described by Papert (1998) as *"offspring that keep the bad features of each parent and lose the good ones – are visible in most software products that claim to come from a mating of education and entertainment"*.

2.1 Extrinsic motivation

Extrinsically motivated activities are the kind of activities where students can achieve rewards and try to avoid punishment. The sticks and carrots are not directly related to the activity itself and examples of carrots in education are grades, credits, certificates, prizes and diplomas. An exemplification from the world outside the university is if someone is offered to wash a car for a certain amount of money. Even if the person finds the washing process boring the work is done to get the money which in an educational context could be translated to a student completing a course just to get the credits without enjoying the process (Kapp, 2012).

Mechanisms for extrinsic motivation are often combined with the intrinsic motivation design that is described under 2.3, but there are studies that shows that children that achieves extrinsic rewards show less interest in

the activity in the long run (Lepper et al., 1973) (Lepper & Greene, 1975). Adult surveillance of children working with tasks made the same difference whether the surveillance was partly or permanent. Sticks and carrots seems to make children complete tasks faster but extrinsic incentives may undermine their intrinsic motivation (Lepper & Greene, 1975).

2.2 Intrinsic motivation

Intrinsic motivation is like gaming for gaming's sake or learning for the sake of learning when someone reads a book for self-fulfilment without any external rewards or assessment. If students are intrinsically motivated they tend to be more aware of complexities, inconsistencies and unexpected possibilities (Kapp, 2012). Intrinsically motivated students may spend more time and effort learning something and also that they feel better about what they learnt afterwards with a tendency to use the knowledge in the future (Malone, 1981). Learners need time and freedom to make choices and to gather their own information if activities should lead to deeper understanding and creative results (Kapp, 2012).

Two other factors supporting intrinsic motivation suggested by Malone are choice and surprise. Choice both in the sense that the gaming or learning environment needs structure (Malone, 1981) and also in the aspect that giving people a choice, or just the illusion of choice, can increase increase motivation which earlier has been investigated by Zimbardo (1969) in his research on cognitive control of motivation. Surprise is suggested to be part of the feedback process where surprises should be combined with informative and constructive feedback (Malone, 1981).

Importance of learner control is also one of four main pillars in Mark Lepper's *Instructional Design Principles for Intrinsic Motivation*. The other three are contextualisation and, like in The Thomas Malone Model, challenge and curiosity (Lepper, 1988). Regarding challenge Lepper's opinion is close to Malone's conclusions, goals should be uncertain and feedback is a key to success. Lepper's argumentation for curiosity is also close to the ideas by Malone described above (Kapp, 2012). Lepper's concept of contextualisation where he argues that activities can be presented in realistic settings as well as in fantasy contexts could be aligned to Malone's ideas on the importance of fantasy. Lepper sometimes stresses the utilitarianism of learning meanwhile Malone's theory has a closer relationship to gaming and games but the similarities are more obvious than the differences.

2.3 The taxonomy of intrinsic motivation

With several common findings Lepper and Malone later combined their ideas in The Taxonomy of Intrinsic Motivation. The taxonomy is, apart from what is described above on internal motivation, also extended with a section on *Interpersonal Intrinsic Motivation*. Anyhow with just two sections it is a straightforward and comprehensible taxonomy:

- Internal motivation
- **Challenge** in terms of goals, uncertain outcomes and performance feedback
- **Curiosity** in terms of sensory and cognitive inquisitiveness
- **Control** in terms of contingency, choice and power
- **Fantasy** with emotional and cognitive aspects interwoven
- Interpersonal Motivation
- **Cooperation** in terms of players working together to achieve goals
- **Competition** where players compete against each other to achieve goals
- **Recognition** in terms of making achievements available for others

(Malone & Lepper, 1987) (Kapp, 2012)

3. The case study and methods for data collection

The main strategy for this research is a case study, with case study strategy defined as an inquiry investigation of a real world phenomenon (Yin, 1989). A case study should also use methods where an activity, a process or an unit is explored in depth using a mix of data collection methods (Creswell, 2009) where the combination of

different data sources should strive to generate a deeper understanding of the analysed entity (Remenyi, 2012). Case studies should have focus on one (or a few) instances of the studied phenomenon with the aim to provide an in-depth description of events and concepts in the particular instance (Denscombe, 2003).

This case study is based on a course in GBL where the author is the subject matter expert, the instructional designer as well as the course developer. The course name is *Games Based Learning / Spelbaserat lärande* (Swedish) and was developed during 2013 and given for the first time in September – November 2013. The round 50 students that took the course are following the programmes for Game construction and Digital Media at the Department of Computer and System Sciences at the Stockholm University. In the Digital media programme the course is mandatory and for students from the Game construction programme it is an elective course.

The course syllabus is based on 10 lectures, 5 assignments and a project where content and examination is a mix of theory and practical work. Guest lecturers have been selected to give a broad perspective of gamification and GBL that also involves pedagogical and accessibility aspect. Some assignments are practical where the students build games, others are theoretical studies where short essays are posted and discussed online. Discussion fora and course content including recorded lectures are available in the *Moodle* virtual learning platform. Most students take the course in some blended learning mode but one participant completed everything except the final seminar by distance. 7,5 credits (ECTS) correspond to 5 weeks of fulltime work but the course span is 10 weeks since it runs in parallel with another course that is mandatory for both student groups.

Examination is a mix of assignments with given instructions and open tasks where students are free to create their own solutions. The more closed assignments are given as training in HTML5, CSS, JavaScript, jQuery and game creation techniques. In the final project students are given a lot of freedom as long as the result could be classified as a learning game prototype. In the grading originality and creativity are rewarded and game prototypes that are elaborations of the course assignments are given lower grades. For the higher grades the project submission should consist of a tested and playable learning game, documentation of the development process, a game design that is aligned to a pedagogical or motivational theory/model and a demonstration video. The game idea should also be presented in the students' ePortfolio that has been created in one of the mandatory assignments as well as in the Moodle platform before the actual implementation starts. Finally students' assignments and project prototypes are presented and discussed in five examination seminars where students also can give feedback on teaching sessions and course design.

Data has been gathered from course evaluation questionnaires and discussions with students and teachers. Student discussions are a combination of group discussions with students at examination seminars and postings online discussion fora in Moodle. Some of the online discussions are mandatory since they are part of the examination. An example of discussion subjects are "*What have you learned in your earlier gaming*", another is "*What theories can be applied in learning games*". Students post their essays that answer these questions and comment on other students' essays. An analysis has been made on course statistics in the department's course management system where factors like pass rate and students' prerequisites have been compared. Finally there have been informal discussions with the coordinators for the two involved bachelor programmes.

4. Findings and discussions

4.1 Use of internal motivation in the GBL course

Challenge has been implemented with clear learning objectives as goals, complex grading criteria as uncertain outcomes and iterative feedback or feed-forward during the course and examination seminars at the end of the course.

Curiosity is supported in a mix of the Malonian sensory concept of involving multi-media and stimulating cognitive inquisitiveness by assignments and discussions on contemporary research.

Control has not been a main focus but facilitation sessions face-to-face and online in combination with differentiated grading criteria for making students more confident. Open choices for group formation and project design to give students freedom.

Fantasy in the emotional aspect brought up in assignments and discussions on course participants earlier gaming experiences and favourite games. The cognitive fantasy aspects are interwoven with similar activities where participants discuss what they have learnt from playing games and how this can be applied in new contexts.

4.2 Use of interpersonal motivation in the GBL course

Cooperation integrated with the possibility to work in groups with assignment and projects except for the assignments where students should describe their earlier gaming experience or create their personal e-Portfolio. However, students always have the choice to work alone which often is the choice for students that took the course more or less by distance.

Competition where course participants compete in the achievement of goals has not been strongly emphasized. The main reason is that it might not be fruitful to put extra pressure on students from the Digital Media students when it comes to programming where they have less pre-knowledge. All competitions are on a voluntary basis and the rewards are mainly the possibility to show off. Some of the best learning game prototypes will be extended and participating in an international completion for learning games in Germany.

Recognition is implemented in a way that the learning game prototypes should be presented in a multimodal mix. Games are demonstrated live on examination seminars as well as in submitted demonstration videos. Descriptions of the workflow and how game design is aligned to learning theory is presented in the students' own-developed e-Portfolios.



Figure 1: *Stealing Beauties* – a game prototype where the player learns about art history by stealing paintings from museums. Lepper's realistic and fantasy contexts are interwoven when art aficionados are forced to work for mafia boss Don Conny

In the same way that most courses at university level use traditional face-to-face learning combined with technology enhanced learning they also mix of extrinsic and intrinsic motivational techniques. The grading is there as a carrot and students that not complete courses will later be punished when the credits are needed for other courses, diplomas or financial support. The studied course in GBL is no exception but compared to the course in Scientific writing that the students take simultaneously the emphasis is on intrinsic motivation. An analysis of the seminar discussions shows that students tend to prioritise tasks with extrinsic rewards and surveillance even when they dislike the given assignments. In the course on Scientific writing extrinsic motivational mechanisms and surveillance are more explicitly a part of the course structure.

However, most students say that they find the more open and free assignments in the GBL course more stimulating and exciting despite the fact that many of them have prioritised the more regulated examination in the parallel course. Other students say that they got stuck in the open ended activities in the GBL course and sometimes forgot about that there was a parallel course. Some students also quitted the course in Scientific writing to be able to work more focused with their game prototype in the GBL course. In the 2014 spring semester some of the prototypes in the GBL course will enhance their submitted solutions in a course on Software development projects. Game prototypes should then be enhanced to full-fledged tested learning games where the plan is that the best games should compete in the 2nd International Educational/Serious Games Competition at the 8th European Conference on Games Based Learning.

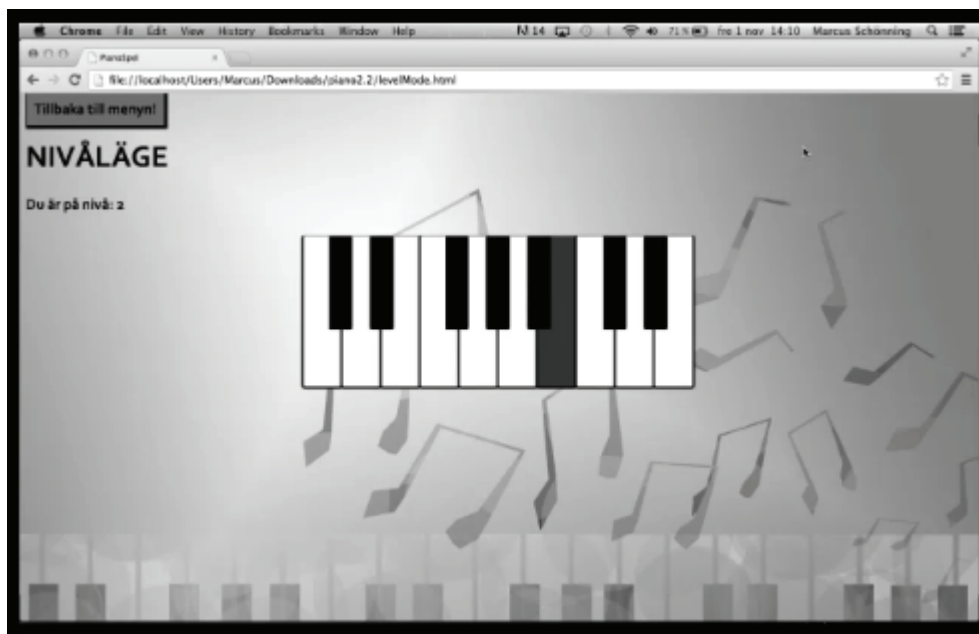


Figure 2: *The Virtual Piano Teacher* – learning piano scales and chords in a game design with Lepper-Malonian-Csikszentmihalyian levels of challenge

5. Conclusions

As suggested by Thomas Malone (1981) models for intrinsic motivation could be used as checklists in the design of instructional environments which could be an interesting general idea and congenial for courses on GBL. When playing and building digital games are used as course activities most concepts from the Taxonomy of Intrinsic Motivation seem like natural mechanisms to increase the students' motivation. However, it is harder to create learning for learning's sake than to achieve playing for playing's sake.

If a course developed to stimulate intrinsic motivation runs in parallel with another course with extrinsic rewards and surveillance the latter course activities seem to block the more open ended activities in the former. The effects from extrinsic rewards and surveillance on intrinsic motivation that Mark Lepper and David Greene (1975) discovered in a study with preschool children seem to be a fact for university courses as well. Tasks given with surveillance and extrinsic motivating conditions are prioritised and carried out first, but assignments created to support intrinsic motivation are tasks that students want to elaborate on also after a completion of the actual course. Ideas and theories for learner motivation should also be disseminated to the students for further implementation in their game prototypes.

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