Immersion into the World of Gaming: An Approach of Introducing Gamification in an Educational Context

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Abstract: The use of game elements in the real world is part of a trending topic in science, called "gamification". Game developers and companies are using gamification tools and the knowledge about player types and their characteristics, to successfully affect the behaviour of their players or customers. The success of apps like "Adidas Running" and "Pokemon Go" (Niantic) and their millions of constant players tell us, that gamification can work. But the potential of gamification goes beyond selling healthy lifestyles or marketing strategies, it also finds its way into the educational system. The paper takes a closer look at definitions of gamification and different player types. Furthermore, it investigates the topic in an educational context where the authors concentrate on motivational aspects of learning environments as well as downsides and risks of gamification. In a pilot study in two classes at a secondary school, the authors investigated different gamification tools to motivate students to increase the participation in class, do more off-school assignments and finally improve their grades.

1 INTRODUCTION

Playgrounds are not only found in parks and city centers, but also in kindergartens and elementary schools. The benefits of play and its role in the early childhood as well as in education have been acknowledged a long time ago. But when children enter middle school we do not find any playground or play areas. Suddenly unstructured play is no longer part of the school day. Students may take part in physical education classes or play during break periods but nothing more (IRMA, 2018). Studies show that early adolescents still have the urge to play and it is suggested that those students continue to play, especially as they undergo significant changes during that important lifetime (Millar et al., 2010).

Another interesting detail to take a closer look at, is the neurological change during puberty. This period involves increased excitability and sensitivity to dopamine and noradrenalin (IRMA, 2018). Gruber, Gelman & Ranganath (Gruber et al., 2014) stated that dopamine is also involved in curiosity, attention, learning and memory.

All in all, schools have already installed the basic concepts of gamification into their classrooms. Students get points when they complete tasks and those points are then transferred to grades. Furthermore, students are rewarded for desired, and punished for unwanted behaviour. If they finish well, they "level up" at the end of the academic year (Lee and Hammer, 2011).

The paper takes a closer look at definitions of gamification and different player types. Furthermore, it investigates the topic in an educational context where the authors concentrate on motivational aspects of learning environments as well as downsides and risks of gamification. Besides, section 4 outlines different tools for educational gamification, such as "Classcraft", "Kahoot!", or "Khan Academy". Section 5 focuses on the pilot study that was conducted in a secondary school in two different classes and different subjects.

2 DEFINITION OF GAMIFICATION

Deterding et al. define gamification as "the use of game design elements in non-game context" (Deterding et al., 2011). Game elements or game mechanics specify for instance different key properties of games like goals (e.g. finite end or infinite play), rules (e.g. team playing) or settings (e.g. leaderboards

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or badges) of the game (Robson et al., 2015). The use of these game elements in a learning environment is called "gamification of education" (Simoes et al., 2012).

Ifenthaler (Ifenthaler, 2019) created the "ABC-model of game design" (see figure 1) where he declared three important components for designing educational games: Affect (A), Behaviour (B), and Cognition (C). The affective (A) design components specify emotional engagement. Accordingly, educational games always require features that nurture satisfaction, relatedness, choice, and curiosity. This could be integrated causing negative or positive effects: *Investigation*, *fantasy* or *exploration* are (A) design components that have a positive learning effect, whereas *confusion* and *disappointment* are (A) components as well, but foster negative feelings. Behavioral (B) design factors refer to behavioral engagement. Those components require real-time feedback during gameplay to maintain the students' interest. The (C) design component (cognition) specifies declarative, procedural, strategic, and metacognitive knowledge that is required to play the game. For instance, it is very important to determine the prior knowledge of the students to create games that are neither too easy nor too hard. The major part of the game design literature focuses on the (A) components because if students are emotionally involved, the intrinsic motivation rises. But when creating games, one must not forget to consider the other design components as well (Ifenthaler, 2019).

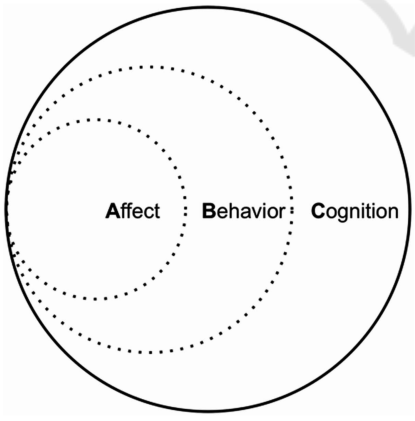

Figure 1: ABC-Model of Game Design (Ifenthaler, 2019).

Considering game elements and motivation, it is important to take a closer look on different player types. Bartle identified four different player archetypes – killer, achiever, socialiser and explorer – and their behavioral traits in Multi User Dungeons (MUDs) (Bartle, 1996), which describe a multiplayer real-time virtual world. His taxonomy declares, why different users act differently in the same game and why players are attracted by different game elements. The four player types are described best by considering the graph in figure 2. The axes represent the source of the players' interest in the game. The x-axis describes the emphasis on players (left) to the emphasis on the environment (right), whereas the y-axis goes from acting with (bottom) to acting on (top). While "killers" are playing the game to doing things to other people, for example in *acting* on other *players*, "socialisers" are interested in *interacting* with other *players*. "Achievers" want to *act* on the designed *world* and their goal is to master the game. They are proud if they can finish the game or reach a high status in a short time. "Explorers" on the other hand are interested in having the game to surprise them, so they want to *interact* with the virtual *world* (Bartle, 1996).

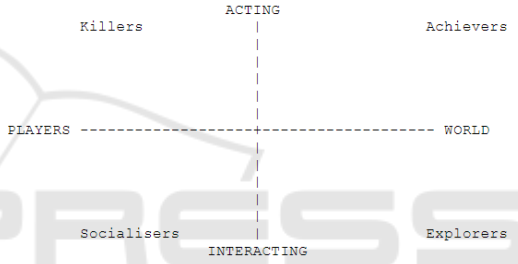

Figure 2: Players' Interest in a MUD (Bartle, 1996).

Although those four player types are presumably the leading ones in literature, there also exist various other definitions. Another taxonomy is the player satisfaction model "BrainHex", which defines seven different archetypes (seeker, survivor, daredevil, mastermind, conqueror, socialiser, and achiever) and is based on insights from neurobiological findings (Nacke et al., 2011).

3 GAMIFICATION IN EDUCATIONAL CONTEXT

By adding game-design elements like rewards, leaderboards, and badges to the classroom, it is not only possible to provide differentiated instructions, but also significant challenges for learning (IRMA, 2018). The so-called "PBL-triad" (points, badges, & leaderboards) should be found in each and every lesson that implements educational games (Gabriel, 2018). A gamified curriculum could introduce the freedom to fail without penalty and the opportunity to explore multiple identities and experiences. Yet

the evidence for these powers is lacking. What is shown is that the application of gamification in school may or may not work depending on the pre-planning phase, design, and development of the gamified lesson. Nonetheless, gamification enters the educational system and with this numerous barriers result, such as logistics of game-school integration and the lack of support for teachers to integrate games into the curriculum (IRMA, 2018).

Several studies have shown that students develop more efficient strategies to solve problems when playing games compared to other classroom activities. Games enable it to take on new personalities and allow "learning by doing". Furthermore, it is observed that children easily gather new information when playing games, like remembering the names of all the characters, analyzing game-structures or connecting related concepts. In addition the act of creation is believed to be one of the highest varieties of learning because students must not only remember but also apply and use newly gained concepts to build something that does not exist yet. This concept can also be transferred to gamified lessons (IRMA, 2018).

Another important finding is that games can combine "soft skills" with social learning. Klopfer, Osterweil, and Salen (Klopfer et al., 2009) observed that games naturally build up 21st century skills like metacognition, development of ethical understanding and collaboration in teams as well as positive social interaction.

3.1 Motivational Aspects

When we speak of gamification we also have to take a look at motivation. If the motivation is primarily driven from the learner, this is called "intrinsic" motivation. Vice versa "extrinsic" motivation derives from an external factor (Knapp, 2012) . Taylor et al. (Taylor et al., 2014) show that intrinsic motivation plays an important role in predicting school achievements. Their findings also highlight the particular importance of intrinsic motivation for the future academic success of high school and college students (Taylor et al., 2014). Knapp (Knapp, 2012) applied the four-factor "ARCS" model developed by Keller (Keller, 1987), to examine the motivation of learners regarding gamification. This model represents "attention", "relevance", "confidence", and "satisfaction" (Taylor et al., 2014)(Keller, 1987):

- *Attention:* In the world of gamification it should not be an issue to stimulate the curiosity of the learner by presenting the given task as a role play or hands-on experience. By varying the assignments the learners' attention can be maintained.
- *Relevance:* There are different methods to identify what is relevant for the learner and what is not. One suggests that the goal is presented to the learner beforehand, to increase his or her motivation. This is a common concept in gamification, too. Another method is to provide familiar elements during the studying phase, like coins, awards or lives in game playing.
- *Confidence:* This represents the learners' expectation to achieve success. One way to help the learners in this, is to clearly state the tasks and requirements beforehand. In gamification this would represent for example a map that has to be followed, where users can see the way to reach their final destination.
- *Satisfaction:* Learners have to get the opportunity to apply their new knowledge in a real or simulated setting, to experience positive encouragement and maintain intrinsic motivation.

According to the self-determination-theory the most self-determined form of behavioral regulation is intrinsic motivation (Dicheva et al., 2019) (Ryan and Deci, 2000). According to this theory humans have three fundamental psychological needs: *autonomy*, *competence* (ability to perform behavior), and *relatedness* (social connections). If all of those three factors are satisfied, intrinsic motivation is very high (Dicheva et al., 2019).

In summary, it can be stated that if teachers gamify their lessons they should consider these theories to increase the motivation of their students.

3.2 Downsides and Risks

Gamification is just a framework that offers a variety of possibilities. But like every other framework it just offers the tools. How to use them lies in the responsibility of the person who wants to use it. Gamification platforms may give a preset of tools and target a special audience. But if the developers or teachers are not aware of the possibilities and limits of gamification, it is not hard to make wrong decisions (Cugelman, 2013). Without a careful monitoring and controlling process, there is a chance to avoid unwanted side effects, caused by the usage of the wrong game elements or the wrong settings, like lowering the self-esteem by choosing goals that are too difficult (Stefanidis et al., 2018).

Andrade et al. identified three problems by adding game elements without the appropriate consideration (Andrade et al., 2016). If the gamification system offers mechanics, which are unassociated to the educa-

tional outcome, the student could get distracted. The possibility to customize the own avatar or to communicate with the group members via built-in chat can help that users spend more time playing on the platform or interacting with the system, but it increases the possibility for spent time without learning and leading to off-task behavior.

Leaderboards are one of the favourite gamification elements and used often. Commited and gifted students may get a motivation boost to keep the first place or to reach it, which can help to increase productivity. But when the light of the first places vanishes, the darkness of the last places appears. Students with low performance are forced into a competition with their peers at the far end of the leaderboard. This undesired competition can reduce their engagement and interest on the system. Systems that try to change the players' behavior with rewards, can also create dependence. Furthermore, addiction in gamified learning systems could lead to loss of the ability to learn without getting extrinsic motivation.

4 TOOLS FOR EDUCATIONAL GAMIFICATION

The tool used in the pilot study was "Classcraft" which is a cloud-based platform that requires no installation. It operates on a real-time web engine like any other online video game. With this tool the teacher can transform the classroom into a role-playing game where students can create their own avatars (see figure 3) (Crx4Chrome, 2019).

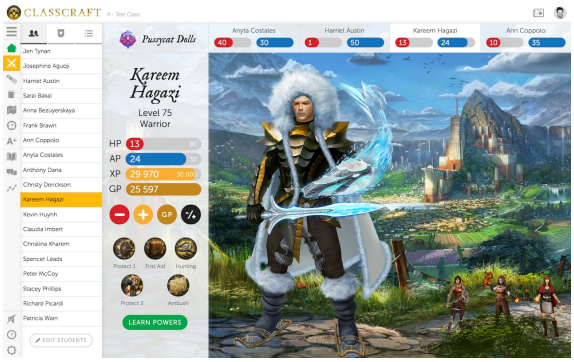

Figure 3: Screenshot from Classcraft Avatar (Crx4Chrome, 2019).

Inspired by the popular role-playing game "World Of Warcraft", the avatars are placed in teams by four to six players that divide into Mages, Warriors, or Healers (see figure 4). Warriors are equipped with more Health Points (HP) than the other characters and have powers to protect other players. Healers have less HP than Warriors but more than Mages but are the only ones that can refill other players HP. Mages have the least HP but the most dominant powers.

Figure 4: Characters in Classcraft (Classcraft, 2019).

Students are able to gain Action Points (AP) or Experience Points (XP) by their behaviour in school or during classes. These points help students to level up or acquire powers. They even earn Gold Pieces (GP), to customize their avatars (Sanchez et al., 2017).

Figure 5: Screenshot from Classcraft Tools (Classcraft, 2019).

Classcraft comes with a built-in set of class tools (see figure 5), which gamifies different situations in class. The "Wheel of Destiny" randomly picks one student or one group. The "Riders of Vay" chooses an event (like one team gets 200 XP or all students loose 10 HP) randomly of a pre-built list. Each event appears just once and the list can be changed by the teacher. "Makus Valley" shows the current volume. This tool requires a microphone, hence it was not used during the pilot phase, because there was no microphone at the computer in class. "Boss Battles" are revisions of subject matters wrapped in a battle versus a big boss. If the students know the answer to the given question, the boss will be destroyed. If they do not know the answer, each student looses health. "White Mountain" is a built-in timer. The stopwatch "Forest Run" and the grade converter "Treasures of Tavuros" were not used during the pilot phase (Classcraft, 2019).

Classcraft uses maps (see figure 6), to guide the students on their journey to knowledge. The teacher

Figure 6: Screenshot from Classcraft Map (Classcraft, 2019).

sets quests and determines possible ways between those quests. The quests also form a guideline through the lessons and contain the major part of the background story to form a game.

5 PILOT STUDY USING "CLASSCRAFT"

5.1 Methodology

This pilot study was part of the PhD Thesis of one of the authors who is also a teacher. The research question, leading to this experimentation is defined as the following: Can gamification improve the lessons in school? The tested hypothesis was: Gamification can improve all parts of the lessons (e.g. the grades, participation during the lesson and the presence of the students) and can maintain these improvements over a longer trial period.

The experiment was conducted in a secondary school in Austria in two different classes and different subjects. Group one consisted of 25 male students at the age between 12 and 14. The final group decreased to 23 students, hence one student left school during the first semester and one did not take part in the second test and the major part of the lessons in second semester. The two subjects taught were history and political education and the lessons were held twice a week for one teaching unit (50 minutes) each. Group two consisted of 12 male students at the age between 13 and 15. The subject taught was computer science and was held once a week for two teaching units.

The study concentrated on the first group and was divided into three parts. Part one was a questionnaire to determine the "BrainHex" player types and the frequency, how often students play computer games in their spare time. The second part consisted of one semester of gamification gentrified teaching. The third and last part was a second questionnaire to determine the "BrainHex" player types again and a subjective grading of the students, if gamification helped them. The pilot phase lasted the whole second semester of the school year. As mentioned in section 3, the platform "Classcraft" was chosen to be used in this phase. Every student could choose an avatar and was part of a self-chosen group. During the lessons, the students could win XP (Experience Points), AP (Action Points) or GP (Gold Pieces) for predetermined actions and use the special power of their avatar. Other elements of Classcraft were used as well.

In the following subsections the active cooperation, homework and grades are discussed. Active cooperation was recorded every lesson and classified in three categories: 1 (active cooperation), 0 (no cooperation) and -1 (disrupted class). Homework was also rated in these three categories, 1 (great work and submitted in time), 0 (homework with some mistakes or submitted too late) and -1 (not submitted or wrong). In Austria, there are five different grades: very good (1), good (2), satisfying (3), sufficient (4), and insufficient(5). Hence the classification was made in these five categories.

5.2 First Results

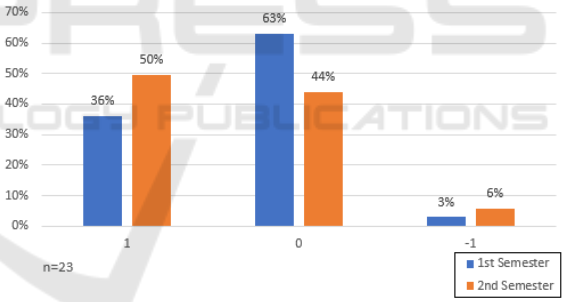

Figure 7: Active Cooperation in Class.

Figure 7 shows the active cooperation in class during the whole school year. In the first semester, approximately every third student had a good and active cooperation during the lessons. About two out of three students did not participate actively during class. In every lesson, there was in total just one out of the 23 students who actively disrupted the class. In the second semester the distribution changed. Every second student participated actively and in a positive way in the lessons, while every other remained quiet during class. On average two out of 23 students disrupted class. The classification into the three categories 1, 0 and -1 enables the opportunity to calculate the average participation. Taking a look at the first semester and the individual lessons, there was not even one lesson with a negative average.

Furthermore, figure 8 shows that all lessons, except five, got an average value of active cooperation in class between 0.5 and 0.

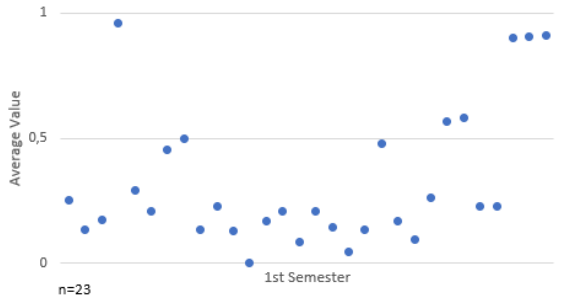

Figure 8: Average Active Cooperation in Class – 1st Semester (without Gamification).

Figure 9 shows, that during the second semester, there were eight lessons above 0.5 and two below 0.

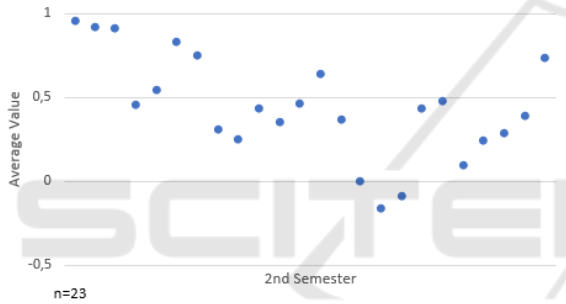

Figure 9: Average Active Cooperation in Class – 2nd Semester (with Gamification).

Figure 10 shows the overview of homework during the whole school year. Both values for "not handed in or bad" as well as "too late or not good" decreased over the year, whereas homework graded with "in time and good" increased.

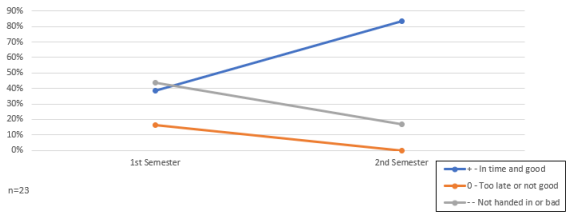

Figure 10: Overview Homework.

Figure 11 shows the quantity of submitted voluntary homework. Since each submitted voluntary homework was rated "very good", there were no qualitative differences.

During the first and second semester, there was one test each. Figure 12 shows the test grades. In the

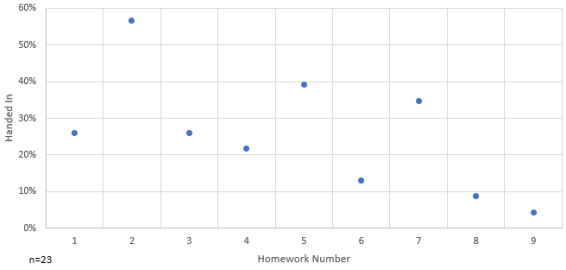

Figure 11: Voluntary Homework.

first semester without gamification 3 out of 23 students reached "very good", 3 students "good", 7 students "satisfying", 6 students "sufficient" and 4 students failed. Whereas in the second semester that implemented gamified lessons, 5 out of 23 students got "very good", 10 students "good", 5 students "satisfying", 2 students "sufficient", and only one failed. Concluding, the arithmetic mean went from around 3.22 (first semester) to 2.30 (second semester). The median rose from 3 (satisfying) to 2 (good).

Figure 12: Test Grades in 1st and 2nd Semester.

5.3 Discussion

During the first semester, the class split into a mix of active students, non-active students, and students that disrupted class. While few students were actively disrupting the lessons, most of the students were passive recipients and only few clever students were enriching the lessons with their questions and corresponding answers. In the second semester the biggest part of the students (passive recipients) split up. One third of the group could catch up on the active students with better grades by active cooperation. Two thirds stayed in the same peer group. For the most part of the first semester, the active cooperation kept stable. Beside two weeks during the general exam time, the average active cooperation rose in the second semester and decreased only slowly during the rest of the semester.

The number of noticeable positive grades increased from one third of the group in the first semester to half of the group in second semester. The lessons changed more and more from a teacher cen-

tered speech to a conversation, where the students explored the new topics.

The results have to be interpreted with caution. On the first glance one can summarize that the introduction of gamification in the second semester lead to the improvements of grades and active cooperation in class. But there are also various other factors to consider. First, the teacher was new both in school and in class and students need time to adapt to a teaching style. Furthermore, most of the students' grades increase towards summer, because they want good end results.

6 CONCLUSION AND OUTLOOK

In summary, it can be stated that there is no one-size-fits all design for the successful installation of gamification into a lesson. Diverse player types have various traits and react different to the used game elements.

Pedro et al. show that game mechanics in a particular game have different effects for students with different genders (Pedro et al., 2015). They studied female and male students in standard educational systems versus virtual learning environments (VLE). While girls felt more pressure during the the gamified lessons, boys were more motivated and received better scores compared to the standard educational system. Overall, one can summarize that in educational context it is important to consider gender differences to draw better conclusions about the impact on motivation and learning (Pedro et al., 2015). There was not a single female student in both of the classes of the pilot study. This is why in future research we have to concentrate on female students as well.

As it turned out, the concepts of gamification helped this particular class in the pilot study to enhance their grades. The next step will be the evaluation of the "BrainHex" player types and the possible correlation of the player type and the educational achievements of the corresponding student. Furthermore, it is planned to take a closer look at the second group of the pilot phase as well. Those students had their lesson just once a week and the group was significant smaller. A detailed analysis of their participation in class and grades, as well as the comparison of both groups may provide further information of how flexible the applied gamification platform and game elements are and how they perform on different player types.

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