The Impact of Gamification

A Recommendation of Scenarios for Education

Kai Erenli
Film-, TV- and Media Production
University of Applied Sciences bfi Vienna
Vienna, Austria
kai.erenli@fh-vie.ac.at

***Abstract*— Many students play (computer) games during leisure time. While playing those games they adopt skills which can be easily addressed when it comes to teaching of more sophisticated knowledge. Nevertheless many educators today dissipate this opportunity. Some others have already evaluated gaming scenarios and methods for teaching students and have created the term "gamification". This paper will describe the history among this new term and explain the possible impact on teaching. It will take well-researched facts into consideration to discuss the potential. Moreover scenarios will be demonstrated and evaluated for educators to use and adopt on their own.**

Keywords-component: gamification, definition, scenarios, achievements,

I. INTRODUCTION

When you take a look at young human beings or animals you may whiteness that learning of basic knowledge is done playfully [see 1]. This playful behavior continues as long as the animal is adolescent and it stops as soon as it becomes a grown up. When you compare this situation to young human beings such as students you may witness that education using playful elements stops predominantly after elementary school. Considering the fact that students have already adopted the skills to learn and advance using gaming scenarios it is not comprehensible why this method is not longer used for education.

Even more the gaming industry is generating revenues by the number of billions [2]. Young learners of today gain skills and a method to learn using games [3] in their everyday life but have to use other methods to be successful in school or at university. Somehow this situation can be put into question although teachers and researchers have recognized this fact for almost five years now using the term "gamification".

But the term „gamification" is a contested term [4]. Some think it is just a synchronism for a hype within the e-learning society, some think it has a negative influence on learners and some think it is the salvation of education as we know it. Maybe the truth about gamification is somewhere in between. This paper will demonstrate how the term "gamification" is used among the academic world and how different scenarios can be used for teaching so one can make up her/his own mind about the ongoing discussion.

II. GAMIFICATION – DEFINITIONS & FACTS

Since 2008 different approaches have been made to define gamification. This chapter will demonstrate what elements where chosen for each definition and how the term is defined throughout the gamification community. Moreover, facts will be mentioned which proof that a deeper discussion is inevitable for e-learners today.

According to a 2011 Gartner Research Report [5] e.g. „*it is estimated that by 2015, more than 50 percent of organizations that manage innovation processes will gamify those processes*". Recognizing this fact education has to prepare students for this scenario. But education institutions do not have to be afraid of this scenario since almost 97% [6] of young people play games in their everyday life.

As mentioned different ways to define gamification have been made so far. The ones of importance are described shortly hereafter and evaluated regarding their impact on educational scenarios.

Deterding, Dixon, Khaled and Nacke state that "*Gamification is the use of game design elements in non-game contexts.*" [4]. This statement is broad and simple but does not define the term "gamification" without further explanation. In order to know what "*game design elements*" are, we have to give preferential consideration to the definition of a "game" thus separating it from "*non-game contexts*".

The philosopher Wittgenstein defines a game as "*a range of disparate human activities that bear to one another only what one might call family resemblances*"[7]. This definition is old-fashioned and therefore does not seem to be applicable to a modern definition of the term "game". Moreover, it does not outline the term in a clear manner. Other definitions have to be taken into consideration. The definitions of Caillois and Crawford seem to be promising.

978-1-4673-2427-4/12/$31.00 ©2012 IEEE

Caillois defines a game as an activity that must have the following characteristics:

- ***fun****: the activity is chosen for its light-hearted character*
- ***separate****: it is circumscribed in time and place*
- ***uncertain****: the outcome of the activity is unforeseeable*
- ***non-productive****: participation does not accomplish anything useful*
- ***governed by rules****: the activity has rules that are different from everyday life*
- ***fictitious****: it is accompanied by the awareness of a different reality* [8]

The definition of Crawford, a computer game designer, shall be mentioned since the impact of software based games on gamification is crucial. He attempts to define the term using a series of dichotomies:

- *Creative expression is art if made for its own beauty, and entertainment if made for money.*
- *A piece of entertainment is a plaything if it is interactive. Movies and books are cited as examples of non-interactive entertainment.*
- *If no goals are associated with a plaything, it is a toy.* (He notes that a toy can become a game element if the player makes up rules, e.g. The Sims and SimCity are toys, not games.) *If it has goals, a plaything is a challenge.*
- *If a challenge has no "active agent against whom you compete," it is a puzzle; if there is one, it is a conflict.* (Crawford admits that this is a subjective test. Video games with noticeably algorithmic artificial intelligence can be played as puzzles; these include the patterns used to evade ghosts in Pac-Man.)
- *Finally, if the player can only outperform the opponent, but not attack them to interfere with their performance, the conflict is a competition. However, if attacks are allowed, then the conflict qualifies as a game.*[9]

Crawford's definition may thus be rendered as: *an interactive, goal-oriented activity, with active agents to play against, in which players (including active agents) can interfere with each other* [10].

Using the above mentioned definitions it can be stated that the term "game" cannot be defined using a one-sentence-answer. Regarding the definition of "gamification" the items "*fun*" and "*fictitious*" mentioned by Caillois shall be given more attention while the item "*non-productive*" must be negated using gamification in an educational environment.

Regarding the term "Elements" it is stated, that "*gamified applications use elements of games that do not give rise to entire games"* [4]. Therefore, the question if something is already a game or a gamified application is a question of personal point of view and individual usage of the element. In the end all elements (e.g. goals, rules) assembled together constitute a game [11]. It does make sense to link those elements to the definitions of the term "game" highlighted before. Therefore only elements that correlate with the term "game" can be considered "*game design elements*".

Finally a "*non-game context*" can be defined as "*gamification uses games for other purposes than their normal expected use for entertainment (asserting that entertainment constitutes the prevalent expected use of games).*"[4] It seems to be evident that the area of "*non-game context*" will change significantly the more gamification will increase. Once contexts with no or insufficient links towards games will be linked through gamified elements and therefore this definition has to be amended to "Gamification is the use of game elements in contexts that had originally no link to game related elements."

A whole different approach to define gamification has been made by the advertising industry. Even this definition is not consistent with the term gamification used in this paper it should be mentioned.

Many companies currently use leader boards for sales and loyalty programs for customers It has been recognized by businesses that it is becoming harder to retain their customers and engage their employees. The management of many businesses believe that gamification can be used to motivate engagement and certain behaviors for both, customers and employees. Finally, gamification is used for customer targeting. Using gamified elements they are able to recognize person's attention and loyalty while creating an identity for their brand or product. [12] This approach is important to recognize due to the fact that it can be applied to educational purposes. E.g. loyalty towards a class, study program or even university is important to retain motivation and (social) engagement.

In order to demonstrate the potential of games and therefore gamification the most interesting facts [13,14,15,16] regarding software based games will be mentioned hereafter:

- **People who play games are not only "youngsters"**
  - Average age of gamers in years: 37 (they also have been playing for an average of 12 years)
  - The average age of the most frequent game purchaser: 41 years
  - Percentage of youth playing computer & video games: 97
  - Percentage of gamers older than Fifty (2011): 29 (an increase from 9% in 1999; This figure is sure to rise in coming years with nursing homes and senior centers across the USA now incorporating video games into their activities.)

- **Games have already "invaded" people households**
  - 77% of American households own videogames
  - 68% of parents believe that game play provides mental stimulation or education, 57% believe games encourage their family to spend to time together, and 54% believe that game play helps their children connect with their friends.
  - Percentage of female gamers: 42 (In fact, women over the age of 18 represent a significantly greater portion of the game-playing population (37 %) than boys age 17 or younger (13 %).)
  - Percentage of gamers who play games with other gamers in person: 65
- **Gadgets have undergone a process of "smartization"**
  - 55% of gamers play games on their phones or mobile devices
  - 2,600,000 games are downloaded each year in Germany
  - Revenues of mobile games have been increased by 40% in 2012.
- **Games are addictive**
  - Gamers have collectively spent 5.93 million years playing World of Warcraft
  - Time spent gaming per day in the US: 215,000,000 hours
  - Highest proportion of active gamers by country in percentage of the population:
    - Germany: 66%
    - Mexico: 57%
    - Russia: 53%
    - UK: 52%
    - Brazil: 47%
    - USA: 42%
  - Largest number of gamers has China
- **Games are to be of value**
  - Gamers in Germany spent EUR 380,000,000 on Virtual Items and Services in 2011
  - Revenues of the Gaming Industry in the US are estimated to be beyond US-$ 22,000,000,000
- **Games are already present at the workplace**
  - 46.6% of surveyed German employees are playing games during working hours: daily 10.0%, several times a week 15.5%, once a week 7.0%, once per month 3.6%, less than once per month 10.6%
  - 61% of surveyed CEOs and CFOs are playing games during their working hours

Especially the last fact demonstrates that an important step has been made to help gamification: Stakeholders are familiar with the subject. Nevertheless, those facts also show that games can be hazardous to people since many show symptoms often addiction which of result in social isolation. This fact has always to be taken into consideration when applying game elements to educational scenarios.

Based on the definition and facts finally a set of scenarios for educational usage will be introduced for further evaluation and discussion.

III. SCENARIOS

"*Where games traditionally model the real world, organizations must now take the opportunity for their real world to emulate games,*" says Brian Burke an analyst for Gartner. In order to emulate you have to develop gaming scenarios within your everyday teaching. Therefore some offline as well as online scenarios will be described and evaluated. Scenarios described use:

- Leaderboards
- Badges
- Level-Systems
- Achievements
- Rewards
- Geolocation-Services

Businesses as IBM have already recognized gamification as an enabler and developed games to educate employees. Within the Virtual Environment "Innov8" players can learn how IBM operates Business Processes [17]. Inside Innov8 Online, one is able to encounter three different game scenarios:

- ***Smarter Traffic*** - Playerss have to evaluate existing traffic patterns and re-route traffic based on incoming metrics.
- ***Smarter Customer Service*** - Using a call center environment, players are able to develop more efficient ways to respond to customers.
- ***Smarter Supply Chains*** - Players have to evaluate a traditional supply chain model, balance supply and demand and reduce environmental impact.

IBM states that: "*Players quickly see how practical process improvements can help meet profitability, customer satisfaction and environmental goals while addressing real problems faced by municipalities and businesses today. And when they're done playing, they can compare scores with other players on global scoreboards."*

IBM addresses several topics with "Innov8". Preferentially they are able to introduce their way of Business Process Management to employees and Non-IBMers. Regarding their employees they are able to communicate their Business Process Management Model worldwide with no need to move employees which would result in high travel costs and time consuming travel time. IBM is also able to train people anytime without any restriction of a course schedule or availability of teaching Staff. Regarding Non-IBMers they are able to demonstrate professional behavior and a "coolness-

factor". Watching the Teaser on Youtube it can be observed that IBM wants to transport strong emotions and feelings [18]. Finally, wording used by IBM for marketing reasons such as "Smarter XY" is communicated to players. This wording is clearly linked to IBM Products and services and will be recognized by every player easily.

"Innov8" is already used academically by the University of Southern California [19]. Using a Leaderboard "Innov8" encourages players to compete one another. "Innov8" demonstrates how gamification software may be used in blended and distance learning scenarios.

Taken into consideration that gamification scenarios should be applied right at the start of a semester and also keeping in mind that a lot of soft-skill classes take place at the beginning of a Semester consequentially, gamification scenarios affecting team building seem to be interesting. Furthermore keeping in mind that a lot of students are already playing (computer) games although together during class (but with absolutely no relation to the subject of the class itself) it seems a good idea to lure them away from their notebooks. Therefore scavenger hunts are ideal and can be easily connected to educational goals.

To run a scavenger hunt an educator is able to form teams or let students search individually. It is possible to link the scavenger hunt to educational goals. E.g. for a class which has mathematical content it is possible to create equitations that point to a certain geographical position. Students will be able to see a certain viewpoint, building or even hidden object. Only those who can describe what they have seen or found can be considered of solving the equitation successfully. The students on the other hand will know about their success if they are able to retrieve the correct information or hidden object.

To further explain this idea an actual riddle is demonstrated. Many of those riddles can be found at "http://www.geocaching.com". The topics those riddles cover arise from all kind of different disciplines and are therefore suitable for every kind of education. The puzzle [20] demonstrated hereafter is a "*musical challenge that leads you to an historic area in Needham in search of a micro cache*.

The text of the riddle states:
Tom Lehrer (born April 9, 1928) is an American songwriter, satirist, pianist, mathematician, and singer. As a graduate student at Harvard University he began to write comic songs to entertain his friends. His style consisted of parodying the then-current forms of popular song. By the early 1960's Lehrer was employed as a resident songwriter for That Was The Week That Was, a satirical TV show. In the 1970's he concentrated on teaching mathematics and musical theater, although he also wrote for the children's television show, The Electric Company. In the early 1980's, Tomfoolery, a revival of his songs on the London stage was a surprise hit.

1. Go to: http://www.privatehand.com/flash/elements.html

Listen to one of our favorite songs where Lehrer sets the names of the chemical elements to the tune of Gilbert and Sullivan's, "Major General's Song".

2. Determine the answers to the questions listed below.

(Downloading the lyrics in PDF format will probably be helpful to accomplish this task)

3. Match the elements to their atomic number and discover the cache coordinates.

The coordinates listed at the top of this page will take you to the parking area for Village Falls Park. Although the area is child friendly, the dam area is not a place where small children should be allowed to go unaccompanied.

Cochrane Dam is a long stone dam across the Charles River with the stone bridge of South Street as a backdrop. The water falls about nine feet at this location and can be quite dramatic, especially during high water periods. Also on site are the masonry remains of the mill which once stood on this site. These include the concrete wheel pit and raceway. A little used railroad bed borders Red Wing Bay with wooden trestle over the nearby Charles River."

To solve the riddle the answers to the questions above have to be filled the following form:

Micro Cache:	42° AB. CD	71° E. FG

A	First element of the song's second set (the ones with the white letters outlined in black).
B	Comes after rubidium.
C	In good company with bismuth, bromine, lithium, and barium
D	The first element to fall off the bottom of the screen in the song.
E	Element that follows the ones that have their last two letters colored red.
F	The seventh element mentioned in the song.
G	The second element in the line that has all "s" elements.

Fig 1. Form to fill in Solutions with Coordinates

People who are able to solve the riddle will find a small plastic tube containing a logbook. To prove the successful mission they have to sign the logbook. The owner/educator may collect it after a certain amount of time and check who was able to solve the task.

Educators are able to create their own riddles or use existing ones at "http://www.geocaching.com". It is important to mention that students will have to have a device (such as a mobile phone) which is capable of receiving a GPS-signal and

displaying this information (on a map). It is also possible to give students certain hints at a special time. Therefore many students will be able to solve the riddle and find the cache. The educator will be able to evaluate the performance of each student or team individually.

To help incoming students getting to know the city "Multi-Cache-Riddles" can be used. Students will have to go on a Scavenger Hunt with their GPS-Device following a certain route. This is an example of a Mulit-Cache trough the City of London created by the Geocacher "frozboz":

From a Swan to the Canary

A series of riverside caches from Swan Pier to Canary Wharf using the Riverside (Thames) path. The journey will take you past the Tower of London, through the St Katharine Docks (a separate mystery cache "Katherine and Thomas" to try there), then through the Hermitage Basin of the old Western docks on to Shadwell Basin before rejoining the Thames past Limehouse basin before reaching Docklands. A wide variety of cache styles from nanos to regulars.

As with a lot of urban caches you'll need to be sensitive to local residents, passers by and gardeners. Be aware of potential watchers (whether in offices or via security cameras). However, if you are approached by either Police or Security Officers avoid acting suspiciously and explain what you are doing.

A good selection of pubs and restaurants around here.

When we set this series my friend was taking photos using a camera mounted on a tripod: a wonderful excuse to hang around a particular area without attracting too much attention!

Good public transport connections at either end, the Docklands Light Railway is generally not too far away in the section between St Katharine Docks and Lime House Basin.

No need to go into any private areas or onto flowerbeds etc for any of these. Generally flat and well paved throughout.

Small magnetic key box. Bring a pencil / pen.
The cache: Boozy Swan

This one is a simple multi cache at the extreme westerly end of the series. When I saw step three, I knew that I had to include it as a special bonus.

We'll end up a little north the river but the Thames path doesn't run riverside here either. There is a pedestrian footbridge adjacent to help you across the busy Upper Thames St dual carriage way if you prefer not to cross at the lights
This area is known as Vintry, after the Vintners' Company. The Vintners' Company, with its first Charter in 1364, is one of the Twelve Great Livery Companies of the City of London. The first three stages keep us near the grand Vintners Place.

As with many things British that have been around a long time, The Vintners' Company has a series of interesting and almost unique privileges. In medieval times it was within the gift of the Sovereign to allow Livery Companies the right to what was known as "a game" of swans on the Thames. In effect, this meant that a certain number could be culled for the Company's feasts. It is not known when the Vintners' Company acquired their "game", but the right to own swans on the Thames continues today, as it does for the Dyers' Company. It is therefore a myth to say that the Sovereign owns all the swans on the Thames, although the Crown does have ownership of all unmarked birds.

There is an annual ritual known as "Swan Upping". Every year, normally in the third week in July, the ancient tradition of Swan Upping takes place on the Thames between Eton and Abingdon. Swan Upping is the annual census of swans on that stretch of the river during which the cygnets are marked. Under the command of HM The Queen's Swan Marker, three teams of Swan Uppers, Her Majesty's, the Vintners' and the Dyers', row in six skiffs up-river catching and marking the cygnets. Until fairly recently, the birds were marked by cutting their beaks; one "nick" for the Dyers' and one either side for the Vintners'. Her Majesty's birds were unmarked. This practice stopped in 1998 and now the Vintners' and Dyers' birds have a ring on their left leg (the Vintners' with two Coats of Arms to replicate the two "nicks") while the Queen's have none. During the marking, the birds are also given a health check by The Queen's Swan Warden who is a Vet. You can find out more about the Vintners' long relationship with swans, including how they have contributed to the health and protection of these birds by looking on The Vintners' Company website.

Step One: N 51 30.607 W 00 05.586

The coordinates will place you in the middle of the road on Southwark Bridge. Clearly I wouldn't want you to stand here, so descend about 25' into Fruiterers Passage (steps either side of the Bridge if you do not possess sufficient super human powers to descend vertically).

Look at the various prints on the wall to see what this area was like many years ago plus selected engineering plans of both the old and new Southward Bridges.

Look for the large print, courtesy of the Vintners and Fruiterers, that shows St Pauls Church (rather than Cathedral) by CJ Visschar. Note the date of the original print.
1AB6

Step Two: N 51 30.665 W 00 05.580

Back upstairs. The coordinates will place you at the end of Queen St. However, it is not Queens we're after here, but their spouses. How many Kings have taken up residence here? (note they all live together in one house). This will give you C.

Step Three: N 51 30.663 W 00 05.644

Remember I mentioned Swan Upping in the intro? Well, here we see how the well dressed Swan Upper from the Vinters' Company attires themself.

How many barrels on each of the ten large buttons on the front of the jacket? This will give you D.

Final location

Not far to walk to the final location – just three or four minutes probably.

For the coordinates below, solve each bracket to give you a single digit. A, B, C and D are all single digits (i.e. 0 – 9 inclusive)

N 51 30.6(A + 3)(B + 4) W 00 05.7(C – 4)(D + 4)

****Just to help you as a sanity check, assuming that you are at Step Three: you will not cross Upper Thames St (the dual carriageway), Queen St, Lambeth Hill or Queen Victoria Street. ****

Buildings make for poor GPS reception around here. I had 16' accuracy reported plus checked location subsequently on Google Earth (wonderful tool!)

There are cameras here, but none appear to be focused on the cache. This can be a busy location during weekday lunch time and commute. Evenings and weekends are very quiet.

Have a look at what is growing on the fence near the cache. Not quite ripe when I set the cache, but they might be when you're passing by! Perhaps the Corporation of the City of London knows a thing or two about global warming that we don't. [21]

It can be observed clearly that this trip would introduce students to this certain area of town while also giving out tips where to go out for leisure time. Multi-Caches are available at almost every university city since most of the riddle-makers are students themselves. Therefore educators do not need to spend much time in the preparation of the hunt. This part can be outsourced easily.

Another possibility to perform a scavenger hunt is by using a QR-Code. A QR-Code can link to any webpage using a barcode scanner. Taking into consideration that most of the students own a Smartphone with a built-in camera and also taking into consideration that applications which are able to scan QR-Codes can be obtained for free this ability to create a scavenger hunt seems to be very convenient. An educator is able to place the QR-Code at any location he likes and link it to any webpage he finds considerable. On this webpage the educator may provide further tasks or information. These tasks or information may consist in another riddle or point to another location of QR-Code. The chain of QR-Codes is infinite and can therefore be treated freely by the educator.

Fig 2. A OR-Code

Another tool that is worth mentioning is "StoryTec" developed and maintained by TU Darmstadt. "*StoryTec has been conceptualized as rapid prototyping environment to facilitate the authoring process of interactive applications. Examples include, but are not limited to Story-based city and museum guides, classical Web-based training courses, game-based learning appliances for kids, students and families as well as process-oriented, individual and collaborative simulation and training environments for trainees and employees or personalized exergames to increase the motivation for a sportive and healthy life.*" [22]. StoryTec can be evaluated as a toolkit rather than a ready-to-use game. It can be used by educator or students to create their own storyboard and is able to serve all different kinds of educational fields.

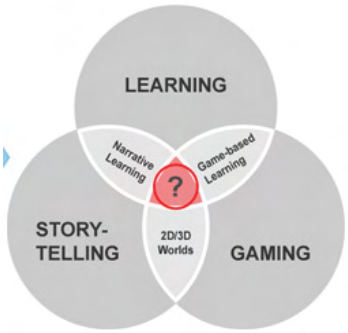

Fig 3. StoryTec

StoryTec is available for free for educational purposes and can therefore be tested extensively before usage in the classroom.

Finally, a way to motivate students to engage in sports activities is the Smartphone Application "Zombies, Run!" [23].

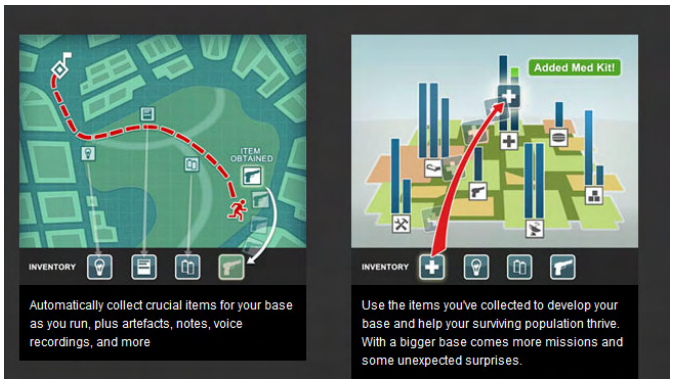

Fig 4. Zombies, Run!

"Zombies, Run!" is an "*ultra-immersive running game*" for Smartphones. Players are able to listen to a predefined story using their headphones. They will receive orders and voice recordings while running. After completing a run, they can build and grow their "base" with the items they have collected. The task is to save people from zombies. In order to do so they automatically collect items like medicine, batteries, and ammunition while running. These items can be assembled freely on the "Zombies, Run!" Platform.

For educational purposes "Zombies, Run!" records the distance, time, pace. Although the Application was just deployed it will be interesting to evaluate if the usage of the Application has an motivational influence on the running behavior of a person.

IV. CONCLUSION

Caillois definition, that games are non-productive and participation does not accomplish anything useful must be excluded since non-productiveness does not go along with educational goals. Gamification is able to aid the proof of the contrary. The definition of the term "gamification" should be amended to "Gamification is the use of game elements in contexts that had originally no link to game related elements." The more non-game related elements receive a gamificational treatment they drift towards game related elements. Therefore, gamification can be considered a virus. It will be interesting to evaluate if this virus is of positive nature. Although it is also important to give attention to the fact that games are addictive. Students who are addicted or easily tend to become addicted have to be treated differently. It does not make any sense to apply gamified content to them since they will happily take this opportunity to turn themselves away from the educational purpose. On the other hand it might be a chance to lure them away from their addictive behavior. In this case gamification can be a "bridge" to the real world again.

The facts mentioned before show that the gaming industry has a huge impact on the social society at large scale. The large number of players can be seen as evidence that most of the students are not only familiar with gaming but also find it to be a joyful thing. Moreover they are open minded towards gamified elements in educational scenarios. If students demand gamified education, educators should be able to respond in an adequate manner (even if they do not want to use gamification within their teaching).

Regarding the actual scenarios it can be stated, that scavenger hunts for team building purposes work best. They are easy to implement, to adopt and to develop to fulfill the educators demands. Software based tools are more sophisticated to design and demand a highly qualified developer even though they can be designed more individually. Educators who do not have the knowledge or resources to develop software based tools are able to rely on already existing tools which are free to use most of the time. E.g. generating a QR-Code is possible without further knowledge using a QR-Code generator like http://qrcode.kaywa.com. They can be linked to any existing webpage and are a flexible tool for education. To help incoming students to get familiar with the city educators can easily use already existing "Multi-Caches" found at http://www.geocaching.com.

The paper has tried to enumerate the statements made regarding gamification and to give the interested audience the possibility to easily transform the scenarios into their own teaching. Moreover the invitation is made to collaborate on further research on this topic. After all it would be a shame if educators will not be able to make teaching and learning a little bit more joyful. Especially when both do not have to learn a new skill in order to take part in a gamified educational class.

V. REFERENCES

[1] Rice, *Playful Learning*, Journal for Education in the Built Environment, Vol 4, Issue 2, December 2009 pp. 94-108.

[2] http://vgsales.wikia.com/wiki/Video_game_industry

[3] http://www.nytimes.com/2010/09/19/magazine/19video-t.html?_r=4

[4] e.g. Deterding, Dixon, Khaled, Nacke, *Gamification: Toward a Definition* or Corcoran, *The Gamification of Education, http://hci.usask.ca/uploads/219-02-Deterding,-Khaled,-Nacke,-Dixon.pdf*

[5] http://www.gartner.com/it/page.jsp?id=1629214

[6] http://www.newzoo.com/ENG/1589-Infograph_US.html

[7] Wittgenstein, *Philosophical Investigations*. Oxford: Blackwell (1953).

[8] Caillois, Roger, *Les jeux et les hommes* (1957).

[9] Crawford, *Chris Crawford on Game Design* (2003).

[10] http://en.wikipedia.org/wiki/Game

[11] Juul. *Half-real: video games between real rules and fictional worlds* (2005).

[12] http://adage.com/article/digital/world-s-a-game-brands-play/144154

[13] http://enterprise-gamification.com/index.php/en/facts

[14] http://www.newzoo.com/ENG/1589-Infograph_US.html

[15] http://www.faz.net/aktuell/technik-motor/ifa-2012/ifa-2012-vernetzte-geschaefte-11874901.html

[16] Focus (Magazine), 13.8.2012, pp 68-69.

[17] http://www-01.ibm.com/software/solutions/soa/innov8/index.html

[18] http://www.youtube.com/watch?v=hXplJ6ZNEs0

[19] http://www-01.ibm.com/software/solutions/soa/innov8/usc_video.html

[20] http://www.geocaching.com/seek/cache_details.aspx?wp=GCNDM3

[21] http://www.geocaching.com/seek/cache_details.aspx?guid=d14e4075-2ccb-41f4-9413-939f267fbd56

[22] http://www.storytec.de/index.php?id=49&L=1

[23] https://www.zombiesrungame.com/