Game-Based IL Instruction – A Journey of Knowledge in Four Acts

Kathrin Knautz, Lisa Orszullok, and Simone Soubusta

Heinrich-Heine-University Düsseldorf, Department of Information Science, Universitätsstr. 1, D-40225 Düsseldorf, Germany
{Kathrin.Knautz,Lisa.Orszullok,Simone.Soubusta}@hhu.de

Abstract. Growing up in a world shaped by rapid technological development and innovations, the students of the 21st century need a new set of skills, such as critical thinking, problem solving and information literacy. New pedagogical approaches are necessary to develop these abilities in today's technology-enabled knowledge society. Based on the fact that playful learning was a successful concept for the intellectual development of humans all along and that the passion for gaming is a characteristic of the digital natives, we present an approach to game-enhanced information literacy instruction.

Keywords: Information literacy instruction, knowledge representation, digital natives, gamification, game mechanics, e-learning.

1 "Level Grinding" - Increasing Necessary Skills and Abilities

Today's society is often referred to as a knowledge-based society because knowledge increasingly forms the basis of our social and economic system. There has been a fundamental structural change from the formerly prevailing industrial society to a knowledge society. Therefore professionalized and technically skilled knowledge workers are needed to understand and apply new information infrastructures. As a result, it is necessary to impart a new set of competencies, such as information literacy, constructive interaction and critical thinking.

In transmitting the new 21st century skills it should be noted that with the advent of the knowledge society, a new generation of learners, often called 'digital natives' [1] or 'Net generation' [2], has emerged. They are growing up with the ubiquitous possibility of using new technologies like the internet, smart phones or videogames. Thus they have been immersed in technology all their lives. According to [1-2] today's students familiarity with and reliance on information and communication technology (ICT) influences their learning behavior tremendously. Through the massive interaction with new media this new generation of students is often bored of traditional teaching methods [3-4]. Therefore, former education models have to be enriched with all possibilities of the 21st century by using relevant tools, technologies and methodologies.

These findings lead to two conclusions: First, we have to impart 21st century skills like information literacy and second, the technological possibilities of the digital age

S. Kurbanoğlu et al. (Eds.): ECIL 2013, CCIS 397, pp. 366–372, 2013.
© Springer International Publishing Switzerland 2013

should be used to create a motivating learning environment. But how can we design such an approach in the field of education so that gaining specific knowledge goes hand in hand with a joyful experience? A deeper look at play research provides an opportunity: learning through play. Based on this, we will present an approach of game-based information literacy instruction. For this purpose, a brief look into the field of learning theory and the place of play is necessary.

2 "Fair Play" - Learning through Play

For thousands of years human beings have been learning important patterns to secure their survival through play. Of course, playing has always been a natural instinct for humans. From the moment we are born we have a desire to play. It is a fundamental way in which children acquire knowledge. It diminishes, unfortunately, as we grow older, but never disappears completely. The fact that all humans - especially all children - play, is the starting point for educational interest in play.

The first modern consideration on play in education regards play as a native drive satisfaction and an instinctive act [5-6]. The main idea of these approaches is to use the child's anthropological drive reduction for learning purposes and furthermore for preparing for the future. In this case the play is functionalized and the pedagogical intent concealed. These considerations were groundbreaking for the educational work of Friedrich Froebel [7]. Froebel was the first who presented a uniform game theoretic concept of education specifically for early childhood. In his work, Froebel made a case for the child's play. According to him, play is the highest level of child development and so of human development. Along with art and work, Froebel thought of play as a basic form of human "self-expression".

In the 19th and early 20th century a number of influential scholars developed comprehensive theories on play. Evolutionary theories of play considered the causes for play on the basis of various similarities between the behavior of children and animals. The most influential theory is the surplus energy theory of play. It goes back to the ideas of the German philosopher Friedrich von Schiller [8] and the scientific formulation of the theory by the English philosopher and sociologist Herbert Spencer [9]. It is assumed that every human expends a certain amount of energy for gaining food, shelter or a living. Children build up an excess of energy when they don't need it for these purposes. Spencer defended the view that learning has to be made enjoyable like play. Other influential scholars regard play as an undergoing of cultural stages, as a way of reliving the history of the species (recapitulation theory) [10], as a possibility to restore energy for the purpose of learning new tasks (recreation or relaxation theory) [11], or as preparation for adulthood by developing skills (pre-exercise theory or instinct-practice theory) [12].

All classical theories try to reduce the nature of play to one explanatory model. The 20th century theories on play cannot be absolved from this, either. Recent research in this field can be categorized by the specific perspective and interest of the scientists. Psychological and psychoanalytical analysis considers the role of play in personality development, learning theory, mental health and other areas. According to Freud [13],

play helps to relieve various forms of anxiety by giving children a sense of control and a competence to resolve problems that occur in their lives. In cognitive theories, play reinforces learning that has already taken place. It provides a relaxed atmosphere in which new learning is possible [14]. Sociocultural approaches provide a framework for the relation of children's development to their participation in cultural activities. Hereby, play is seen as a way to understand and learn the social roles and rules of society [15]. Phenomenological approaches focus on the nature, phenomenon, of play. The description and observation of play and of the range of different play activities and the reflection on play through the ages are the focus of these studies. The most famous phenomenological theory is probably the one of the historian and cultural theorist Huizinga [16]. In his work *homo ludens* Huizinga considers not only the importance of play in the field of learning, but the role of the play element for culture and society in their entirety.

Play and games are examined in various studies and disciplines to this day. In the media driven world of the 21th century, play is still important for the human development. Games, especially video games, are part of the social and cultural environment. Therefore, it is hardly surprising that an examination of video games and a use of game mechanics increasingly becomes a focus in education.

3 "Spawn Point" - Instrumentalization of Play and Games

With the digital age, video games in particular have done quite a lot to make playing games popular. Video games are designed with the major purpose of entertainment. The reason that people spend so much time playing games is that gaming often causes the so-called flow experience [17]. Flow is a mental state of intense concentration where work seems effortless and we reach the sweet spot between challenge and skill utilization. An outcome of this is that gamers manage to solve frustrating challenges, master difficult tactics and spend hours improving their skills at a particular game. The aim of creating a balance between challenges and skills is an ongoing process. Growing experience and skills require an increasing difficulty to avoid boredom. In order to get an optimal flow experience different and more complex challenges are needed. The hard work and concentration that people put into gaming are nothing less than astounding.

For this reason, people have been trying to emulate certain aspects of games in order to profit from some of these positive aspects. This process is called gamification and describes "the use of game mechanics in non-playing contexts" [18]. The focus here is on the use of game-based mechanics and dynamics to engage people and solve problems [19], to motivate action and drive participation [20] or to promote learning [21]. Based on these considerations, gamification does not claim to turn life into a game but to use aspects of games effectively in other areas. Table 1 shows which game mechanics increase motivation and engagement by satisfying human desires like the need to get rewards and status, achievements and competition. It can be seen that all game mechanics (e.g. points) address one primary human desire (reward), but each of them also covers other desires (status, achievement, competition, altruism).

Gamification is, for obvious reasons, already being employed in the realm of education. Game mechanics and principles from both digital and non-digital games are incorporated at all educational levels with the aim to engage and motivate students [e.g. 21-22]. There is also high interest in using this pedagogical strategy in the field of information literacy instruction [23]. University libraries make use of gamification and game-based learning in order to teach students how to do research, evaluate information and apply knowledge to new situations or create new knowledge [24]. In this way, traditional instructional (library and classroom) offerings are enhanced and meet the demands of the new generation.

Table 1. Interaction of basic human desires and game mechanics. The "x" signifies the primary desire a particular game mechanic fulfills, and the "•" indicates other affected areas (Source: Bunchball, 2010, p. 9)

	Human Desires					
Game				Self		
Mechanics	Reward	Status	Achievement	Expression	Competition	Altruism
Points	x	•	•		•	•
Levels		x	•		•	
Challenges	•	•	x	•	•	•
Virtual Goods	•	•	•	x	•	
Leaderboards		•	•		x	•
Gifting & Charity		•	•		•	x

To sum these findings up, we have a new generation of students, who have grown up in an environment dominated by technology (see 1). These students have a wide range of social activities, a finely structured social network and enjoy working in teams. Because of their massive interaction with new media students get easily bored by the traditional teaching methods. A look inside the field of game studies and learning theory shows that effective learning is firmly connected with playing (see 2). Play has determined life from time immemorial and is a successful concept for the intellectual development of humans. However, traditional educational concepts relegate playing to the leisure time of students. Using game mechanics in the context of education offers new possibilities (see 3). Together with today's children's and student's preference for computer games, gamification seems to be a playful and entertaining method to make learning more efficient and more successful. The following project shows how such game-based processes can be used to promote learning motivation and provide information literacy as one of the key skills for 21st century.

4 "Let the Games Begin"- Game-Enhanced IL Instruction

The main topics of the university module on knowledge representation are retrieval strategies (efficient and effective access to information), selection and organization of information (critical and competent evaluation), and knowledge generation (accurate

and creative use of information). The target group consists of undergraduate students. In its original form the module consists of a lecture and a tutorial, which repeats the contents of the lecture. Furthermore, the methods and skills in the area of information literacy are deepened at home. In order to engage today's students in the area of information literacy, the tutorial was fundamentally restructured as a game-based practical lab and an online platform was added. The lecture, consisting of 22 chapters on information literacy, continues to exist as before.

The project (called *Legend of Zyren*) has three main objectives: imparting information literacy as one of the key skills of the 21st century, using innovative teaching methods and technological resources and creating a motivating learning environment. The restructuring of the tutorial was implemented by a master degree course on information science. The creation of an interesting and exciting story and the integration of tasks on information literacy in this story were fundamental points. In order to offer the students enough room to develop their own ideas, we provided only a little information concerning the basic outline of the different parts of the story. This ensured a very dynamic and spontaneous design process. To plan such a project effectively with students, we used a combination of the storyboard concept as shown in [25] and classic storyboarding as a creative technique. Storyboards are an approach to anticipate, plan and control didactic designs in educational environments. The idea of representing, processing and refining didactic knowledge through simplicity, clarity and visual appearance is an important factor. The need for this arises from the fact that all content of the course has been implemented not only as an e-learning platform, but additionally with the help of game mechanics and an epic story. Restructuring the former seminar resulted in a two part learning system:

- an online platform where the majority of the game takes place and where students solve exercises (*quests*) or embark on adventures and
- a practical lab where questions are answered, the material is reinforced and where students can solve some tasks in groups (*guilds*), thus making the lab part of the game.

The whole story takes place in four acts, each comprising four main *quest lines* (associated quests) and four side quest lines for the given 22 topics of the lecture. The main quest lines are linear and obligatory for students to complete. Additionally, there is the opportunity to solve more tasks in side quest lines. All quests improve information literacy skills. Students have to apply their theoretical knowledge on information literacy by identifying, locating, evaluating and using information in the context of the problems depicted in the story and the quests.

In the beginning, students choose an avatar from four races (elves, goblins, orcs or humans) to level up on the online platform. Reaching level 11 is required to pass the course, higher levels grant an additional bonus. However, the effort and work required to reach level 14 doubles in comparison to the requirements for level 11. A higher level can be reached by earning experience points. Those are gained for every successfully solved quest and inform the students as well as the teacher about current rank, status and abilities. Successfully achieved experience points give students a feeling of having done something right instead of being punished by deduction of points for wrong answers (like it is done in an exam). They are an immediate motivational game mechanic. The accumulation of points can serve as positive

reinforcement to motivate students to initiate further tasks. An analysis of point distribution and task status allows teachers to detect knowledge deficits of students and retarget problematic topics. Furthermore, high-achieving students benefit from special and more difficult tasks in side quests. Another implemented possibility of motivating students is unlocking achievements. Achievements reward them for specific activities or reaching certain milestones. Similar to points, achievements act as positive reinforcement. However, they motivate those students who have already unlocked an achievement more than those who have not. It is thus important to award the first achievement for reaching a simple goal. In *Legend of Zyren* students get their first achievement ('*self-awareness*') by creating an account and choosing an avatar. Overall 75 achievements and meta-achievements with both visible and secret requirements are available for the students. The practical lab is used to answer questions and to review the subject matter by playing games. For each practical session we designed special quests where guilds have to battle each other. Games like Jeopardy, Jenga or Taboo have been adapted to the information literacy context. Additionally, every guild quest takes place at a specific point of the story. So before starting the game, soft music is turned on and a prolog is read aloud. In this way a stronger relation between online platform and practical lab is established.

To sum it up, the *Legend of Zyren* is a kind of text adventure which is placed on an e-learning platform. The tasks are solved online and generate an instant feedback for the student. Additionally, a practical lab deepens the knowledge by playing games.

5 "That's All Folks"- Summery and Outlook

Traditional educational concepts relegate playing to the leisure time of students. However, playing is important for intellectual development of humans. With the emergence of the digital revolution, games (in the sense of video games) undergo a renaissance. The potential of video games has also been recognized by other areas besides the entertainment industry. Nowadays, aspects of play and games increasingly pervade every part of culture and everyday life like marketing, finances, sports or education.

By restructuring a course on knowledge representation we show how information literacy can be taught with the help of game mechanics and dynamics. We have developed a next-generation learning environment based on specially structured class lectures as well as an implemented online platform. Essential elements are rewarding students for correct problem solutions and giving them a constant overview of their skills and knowledge on information literacy. Points, levels, achievements, etc. are mechanics to provide feedback on what they have achieved and to target human needs like competition or status.

The course "*game-enhanced knowledge representation*" will take place in the upcoming months and an extensive evaluation will be carried out subsequently. The use of game mechanics in the area of information literacy instruction allows us to break up rigid educational structures and provide the opportunity to make learning more interesting, to arouse curiosity and thus to successfully provide essential knowledge. It stands to reason that today's generation of students, which has grown up in an environment dominated by technology, ought to be accommodated in this way.

References

1. Prensky, M.: Digital Game-Based Learning. McGraw-Hill, New York (2001)
2. Tapscott, D.: Growing Up Digital: The Rise of the Net Generation. McGraw-Hill, New York (2001)
3. Oblinger, D.: The Next Generation of Educational Engagement. Journal of Interactive Media in Education 8, 1–18 (2004)
4. Prensky, M.: Digital Natives, Digital Immigrants. On the Horizon 9 (2001)
5. Locke, J.: Some Thoughts Concerning Education and of the Conduct of the Understanding. Hackett Publishing Co., Indianapolis (1693, 1996)
6. Rousseau, J.J.: Emile ou de l'éducation. Duchesne, Paris (1762)
7. Fröbel, F.: Die Menschenerziehung, die Erziehungs-, Unterrichts- und Lehrkunst, angestrebt in der allgemeinen deutschen Erziehungsanstalt zu Keilhau. Wienbrack, Leipzig (1826)
8. Schiller, F.: On the Aesthetic Education of Man - in a Series of Letters (first published in 1795). Frederick Ungar Publishing, New York (1954, 1977)
9. Spencer, H.: The Principles of Psychology. Appleton and Co., New York (1873)
10. Hall, G.S.: Youth: Its Education, Regimen, and Hygiene. Appleton and Co., New York (1906)
11. Patrick, G.T.W.: The Psychology of Relaxation. Houghton Mifflin, New York (1916)
12. Groos, K.: The Play of Man. Appleton and Co., New York (1901)
13. Freud, A.: The Psychoanalytic Treatment of Children. International Universities Press, New York (1968)
14. Piaget, J.: Play, Dreams and Imitation in Childhood. Norton, New York (1962)
15. Vygotsky, L.S.: Play and its Role in the Mental Development of the Child. Soviet Psychology 5, 6–18 (1967)
16. Huizinga, J.: Homo Ludens. A Study of the Play Element in Culture. Routledge & Keagan Paul, London (1949)
17. Csíkszentmihályi, M.: Flow: The Psychology of Optimal Experience. Harper Perennial, New York (1991)
18. Deterding, S., Dixon, D., Khaled, R., Nacke, L.E.: From Game Design Elements to Gamefulness: Defining "Gamification". In: Mindtrek 2011 Proceedings. ACM, New York (2011)
19. Zichermann, G., Cunningham, C.: Gamification by Design: Implementing Game Mechanics in Web and Mobile Apps. O'Reilly Media, Sebastopol (2011)
20. Bunchball, `http://www.bunchball.com/gamification101`
21. Sheldon, L.: The Multiplayer Classroom: Designing Coursework as a Game. Cengage Learning, Boston (2012)
22. Papastergiou, M.: Digital Game-Based Learning in High School Computer Science Education: Impact on Educational Effectiveness and Student Motivation. Computers & Education 52, 1–12 (2009)
23. McDevitt, T.R. (ed.): Let the Games Begin! Engaging Students with Interactive Information Literacy Instruction. Neal-Schuman Publishers, New York (2011)
24. Smale, M.A.: Learning Through Quests and Contests: Games in Information Literacy Instruction. Journal of Library Innovation 2, 36–55 (2011)
25. Jantke, K.P., Knauf, R.: Storyboarding for Playful Learning. In: Proceedings of World Conference on E-Learning in Corporate, Government, Healthcare, and Higher Education, pp. 3174–3182 (2006)