The Implementation of Serious Game Concept into "Forest's Ranger" Virtual Reality Game as a Gamification Learning tool

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This paper presents a conceptual framework for a Forest Ranger Game by applying virtual reality into it together with other classical learning techniques, to motivate the students and increase their learning performance. The implementation of a serious game has been included as this game not only to attract students into gamification learning but also creates awareness towards illegal logging. In addition, based on Bloom's taxonomy theory there will be a focus on application of increased student cognitive thinking by teaching and requiring high order thinking skills, especially from the analysis to creation level. Game based learning can be seen from the perspective of learning theories to invoke and underpin educational computer game design and use based on the four types of learning theories: behaviourism, cognitivism, humanism and constructivism. These new findings can enhance the results of previous studies with regard to the issue of learning-theory foundations in game-based learning. The contributions of this study for the issue of learning-theory foundations in game-based learning are discussed. This research also provides a strong motivation for students; helping them to increase their performance in the learning process and to improve their morale by value-adding to the teaching and learning environment.

Introduction

Gaming has been known from a long time as an entertainment for kids but from time to time it has also been proven that it is not only an entertainment any longer, but also can be used to educate this generation in order to improve their logical thinking and creativity. Furthermore, game based learning and serious games have been introduced to strengthen our educational institution learning through application it to course subject work. As we all know, currently Industrial Revolution 4.0 is a new era that has evolved our world to become more advanced especially in technology. Virtual reality and augmented reality are included in this industry.

Thus by applying this new technology into educational learning, not only can students' performance be increased but also their morale value can improve. This paper mostly focuses on the conceptual framework for a Virtual Reality Forest Ranger that currently is being developed by the researcher in order to create an awareness about illegal logging by making users, that is students in this research, experience the real world as a ranger that protects the forest from loggers. This involves activities such as apprehension by issuing a warrant and use of handcuffs to restraint perpetrators from continuing to destroy the forest. Focusing on serious game concept, this game not only acts as entertainment but also as adds value to make gamers realize that the forest is important to flora and fauna.

Serious Game

Serious games are exactly that; games that are "serious" or games whose purpose is to train more than to entertain. Serious games are games whose primary objective is not fun or entertainment but rather learning or practicing a skill. Its use has grown, particularly in such sectors as education, defense, aeronautics, science and health. Its purpose can be one of many: from training firefighter crews in emergency situations to training a sales team, teaching mathematics or practicing a language. In the field of education, one of the simplest games is Dragon Box Elements.

Here, players have to build an army, defeat the evil dragon Osgard and save Euclid's island. Designed for kids of nine years-of-age and upwards, to manage all functionalities of the game, they have to learn basic geometry and the theorems of Euclid himself. Dragon Box is a good example of a serious game: the students learn math while they have fun with a video game. This method that uses video games for learning purposes is known as game-based learning. The key lies in the fact that the content and the skills that you want to teach are not put delivered in a face-to-face class or in a book but rather through video games. Advocates of this innovative method of teaching think that video games can be a fun and effective tool at one and the same time, reducing the costs of training programs, increasing student motivation and facilitating direct practice.

The star products of game-based learning are precisely, serious games. The healthcare sector has enthusiastically welcomed this innovative method of teaching. An expert in nursing, Claudia Johnston, based her instruction on first-person shooting video games which reproduce the conditions of an emergency ward in a hospital. The use of a narrative, gamification techniques, simulators and feedback during the teaching process achieves numerous benefits when compared to face-to-face learning or e-learning. These are the five most outstanding advantages:

1. To increase engagement and motivation
2. To facilitate profound reflection
3. To facilitate real and safe practice
4. To improve memorization and retention
5. To make the world a better place

Virtual Reality

Virtual Reality (VR) has evolved in different manners becoming more and more similar to the real world. Two different kinds of VR can be identified: non-immersive and immersive. The former is a computer-based environment that can simulate places in the real or imagined worlds; the latter takes the idea even further by giving the perception of being physically present in the non-physical world. While non-immersive VR can be based on a standard computer, immersive VR is still evolving as the necessary devices are becoming more user friendly and economically accessible. In the past, there was major difficulty in using equipment such as a helmet with goggles, while now new devices are being developed to improve usability. VR, which is based on three basic principles: Immersion, Interaction, and User involvement with the environment and narrative, offers a very high potential for efficacious education by making learning more motivating and engaging.

An analysis by Lee, E. A. L., & Wong, K. W. (2014) shows a significant difference in the performance of low spatial ability learners in the experimental and control groups, but no statistically significant difference in the performance of high spatial learners in either group. The results signify that low spatial ability learners' performance, compared with high spatial ability learners' performance, appeared to be more positively affected by the desktop VR-based learning environment which is supported by the ability-as-compensator hypothesis, and can be explained by cognitive load theory.

In this paper (Palter, V. N., & Grantcharov, T. P. 2014), training on VR simulators has been shown to improve technical performance in the operating room (OR). Currently described VR curricula consist of trainees practicing the same tasks until expert proficiency is reached.

It has yet to be investigated whether the individualized deliberate practice, where curricula tasks vary depending on prior levels of technical proficiency, would translate into the OR.

The key findings obtained from this Merchant, Z., Goetz, E. T., Cifuentes, L., Keeney-Kennicutt, W., & Davis, T. J. (2014) were that games show higher learning gains than simulations and virtual worlds. For simulation studies, elaborate explanation type feedback is more suitable for declarative tasks whereas knowledge of correct response is more appropriate for procedural tasks. Student performance is enhanced when they conduct the game play individually rather than in a group. In addition, an inverse relationship was found between numbers of treatment sessions learning gains for games.

Augmented Reality is poised to profoundly transform Education as we know it. The capacity to overlay rich media onto the real world for viewing through web-enabled devices such as phones and tablet devices means that information can be made available to students at the exact time and place of need (Bower, M., Howe, C., McCredie, N., Robinson, A., & Grover, D. 2014). This has the potential to reduce cognitive overload by providing students with perfectly situated scaffolding, as well as enable learning in a range of other ways.

There are five components of the virtual reality (VR) concept which are analytically defined: 3-D perspective, dynamic rendering, closed loop interaction, inside-out perspective, and enhanced sensory feedback as stated in this paper (Freina, L., & Ott, M. 2015; Gu, 2018). It is argued on the basis of empirical data from a variety of sources that those components that improve performance by reducing effort may actually inhibit learning or long term retention. Closed loop interaction in contrast, while not reducing effort, appears to have a beneficial effect on retention. The importance for learning of directing users' attention to the link between the VR perspective and a more artificial perspective is also highlighted

Taxonomy Bloom

Bloom's taxonomy is a set of three hierarchical models used to classify educational learning objectives into levels of complexity and specificity. The three lists cover the learning objectives in cognitive, affective and sensory domains. The cognitive domain list has been the primary focus of most traditional education and is frequently used to structure curriculum learning objectives, assessments and activities. The terminology has been recently updated to include the following six levels of learning. These 6 levels (**Figure 1**) can be used to structure the learning objectives, lessons, and assessments of your course. :
1. **Remembering:** Retrieving, recognizing, and recalling relevant knowledge from long-term memory.

2. **Understanding:** Constructing meaning from oral, written, and graphic messages through interpreting, exemplifying, classifying, summarizing, inferring, comparing, and explaining.
3. **Applying:** Carrying out or using a procedure for executing, or implementing.
4. **Analyzing:** Breaking material into constituent parts, determining how the parts relate to one another and to an overall structure or purpose through differentiating, organizing, and attributing.
5. **Evaluating:** Making judgments based on criteria and standards through checking and critiquing.
6. **Creating:** Putting elements together to form a coherent or functional whole; reorganizing elements into a new pattern or structure through generating, planning, or producing.

Figure 1. Taxonomy Bloom Hierarchy
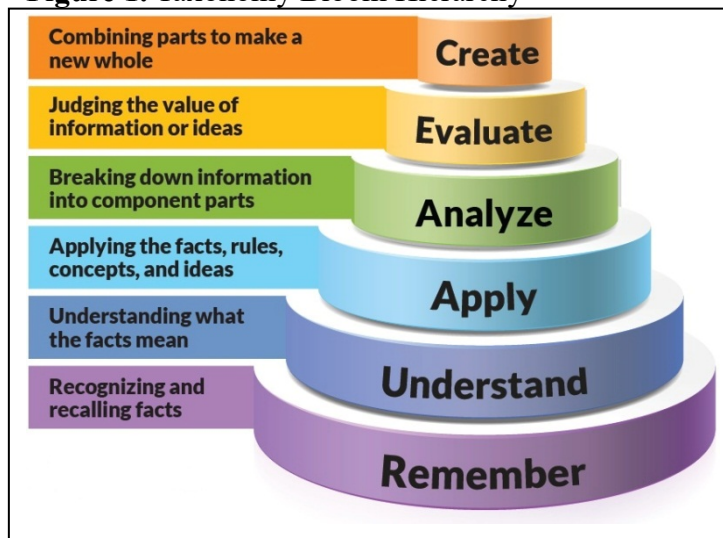
The Forest Ranger Game covers all of these levesl to enhance the students cognitive thinking and help them make a wise decision when the game starts to ask the user to solve problems that will decide the fate of the forest. If the wrong decision is made by them, the forest is instantly destroyed and that will be game over for them thus making the aims and objectives of this game to avoid that type of failure and the consequent destruction of the forest.

Learning Game Design

In recent years, evaluators of educational and social programs have expanded their methodological repertoire with designs that include the use of both qualitative and quantitative methods (Greene, J. C., Caracelli, V. J., & Graham, W. F.1989). Such practice, however, needs to be grounded in a theory that can meaningfully guide the design and implementation of mixed-method evaluations. These design elements encompass issues

about methods, the phenomena under investigation, paradigmatic framework, and criteria for implementation. In the empirical review of this study, common misuse of the term triangulation was apparent in evaluations that stated such a purpose but did not employ an appropriate design

A considerable number of serious games have been developed over the last ten years, with varying degrees of success. Due to a lack of clear standards and guidelines for game developers, it is difficult to justify claims that a specific game meets the learner requirements or expectations (Westera, W., Nadolski, R. J., Hummel, H. G., & Wopereis, I. G.2008). Educational computer games also known as serious games are a new method to teach students. Serious games are considered to be motivation in themselves especially for younger people and seem to be a suitable method to teach students in higher education. Bulander, R. (2010) and Guritno, Yuliando, & Dairo, (2016) present a conceptual framework of the computer game Innov8 - a business process modelling game to learn the notation BPMN and also how to model business processes. The purpose of the proposed framework is to measure the effectiveness of some aspects of the learning subject business process modelling.

Yusoff, A., Crowder, R., Gilbert, L., & Wills, G. (2009) present a framework for serious game design which aims to reduce the design complexity at conceptual, technical and practical levels. The approach focuses on a relevant subset of serious games labelled as scenario-based games. At the conceptual level, it identifies the basic elements that make up the static game configuration; it also describes the game dynamics, i.e. the state changes of the various game components over the course of time. At the technical level, it presents a basic system architecture, which comprises various building tools. Various building tools will be explained and illustrated with technical implementations that are part of the Emergo toolkit for scenario based game development. At the practical level, a set of design principles are presented for controlling and reducing game design complexity. The principles cover the topics of game structure, feedback and game representation, respectively. Practical application of the framework and the associated toolkit is briefly reported and evaluated.

Compared to instructional design, learning game design aims to create a much more exciting and engaging experience for learners. Designing a learning game is also different to designing a commercial game; the two are not one and the same. Commercial games like Call of Duty or Apple to Apples are designed to be fun. They incorporate challenges, rewards, collaboration, competition, and other game activities. Players may learn from a commercial game, but learning is not the goal. If any learning occurs, it is incidental to the goal of enjoyment. Learning games such as abcdeSIM are designed to be "fun enough" to engage the learner. They incorporate all the same game activities that people find fun along with one additional feature that is, they help players develop new skills or knowledge or help reinforce existing skills or knowledge. The goal of a learning game is to not only to engage learners

and immerse them in the learning process, but also for them to achieve a specific learning outcome. Typically, learning games rely on reality abstraction and elements of fantasy in the learning process and often are not an exact replica of a real-life situation. By simply altering mindset from instructional designer to game designer, the teacher can create more engaging and effective training. In the book, Play to Learn: Everything You Need to Know About Designing Effective Learning Games, Sharon and Karl present a nine-step learning game design process Instructional Designers can follow. The steps are shown in the figure below.

Figure 2. Nine-step process to design learning games by Sharon Boller and Karl Kapp
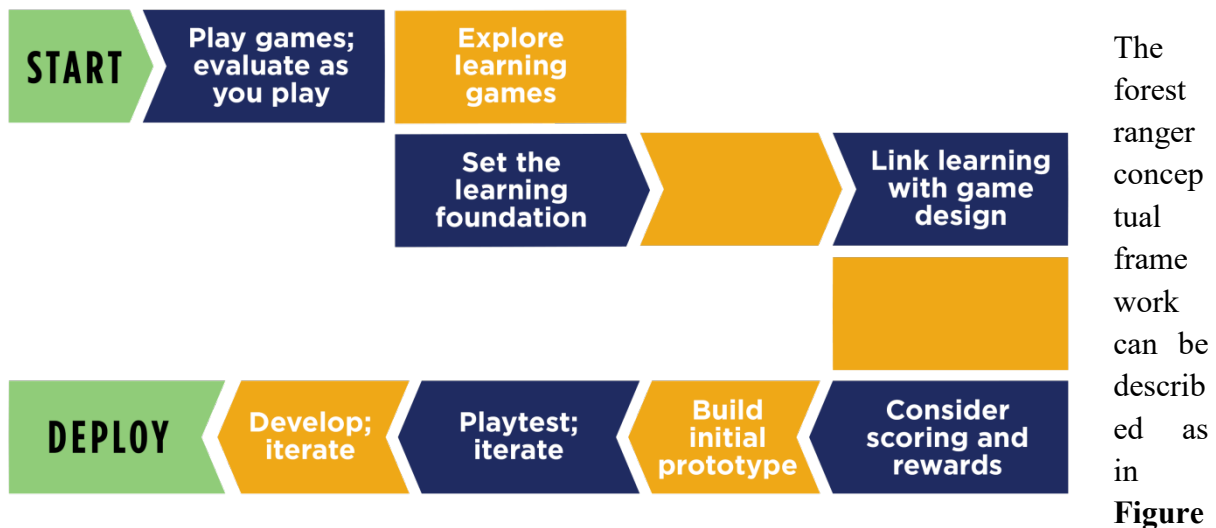
The forest ranger conceptual framework can be described as in **Figure 3**. The serious game been implemented through the learner capabilities which increase the cognitive and the creative thinking of the students using Bloom's Taxonomy. Also, through the learner's capabilities, this will create an awareness towards deforestation. The development of the Forest Ranger Game has mainly been effective in raising awareness of the moral obligation of students to protect the trees from being destroyed. A great way to

reinforce learnings is to make it more interactive and efficient by using games as the learner will do everything in a consequential manner, and this is effective when compared to convenional learning methods. An interactive game will encourage learner capbility thinking and make them more interested in the task at hand. An assesment will help learners to apply their knowledge and techniques or skills to real word obstacles and measure the learner's performance from the outcome of the learning. **Figure 4** illustrates the example of the concept of a virtual reality game that will be developed.

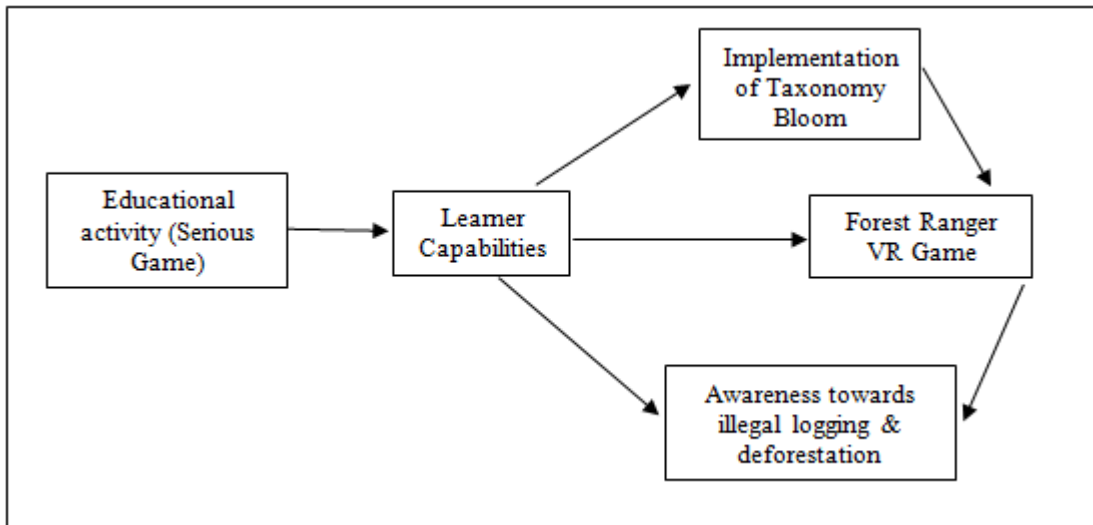**Figure 3.** Learning game design for Forest Ranger VR Game

Figure 4. Screenshot from The Forest game Screenshot from The Forest game

Conclusion

All these benefits have placed game-based learning at the vanguard of the revolution in education that the world of teaching and corporative training is experiencing at the moment. Many of these more or less sophisticated video games are used every day by millions of people (in many cases, without their realization). For example, in the United Kingdom, most players (33%) prefer video games to puzzles, word games or trivial pursuits. Although not all of them can be considered serious games, this is a good indicator of the growing acceptance of game-based learning throughout the world.

Serious games are also a very serious business. According to estimates made by the consultancy Market and markets, this sector will grow between 2015 and 2020 at an average annual rate of 16.38%, which will mean that last year the business will have reached 5.449 billion dollars. There is a growing demand for learning through video games and little by little, the market is responding to that demand. The reasons why game-based learning is so popular, are becoming much more well-known and are primarily due to: the improvement of student engagement and motivation, the fact that they afford direct practice without risk, and the facilitation of memorization and retention of knowledge.

While serious games have been around for centuries the social and technological changes of recent years are extending game-based learning to the four corners of the planet. Whether it is to improve the training of nurses, to help primary school kids learn geometry or to promote leadership skills among the employees of a company, serious games have become one of the most practical and effective teaching tools in the world today.

Acknowledgement

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