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Educational Games:A Basic Understanding and Effective Uses

By Kaitlin Kirkman

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Abstract

Since the invention of video games, many people would perceive these digital games as just entertainment. Increasingly there has been a shift into taking video games and turning them into educational programs to help people learn. In this paper, I discuss the different forms of educational games which are serious games, it's subcategory serious educational games, and educational simulations. I compare and contrast the differences as well as provide examples. I also discuss effective ways to use educational games so that they can be more understood as an effective method for teaching. The concepts I discuss about effective educational games include, discussing which games are better suited for training and skills, the more life like something is the more learning happens, how instructional input could affect the effectiveness of learning through educational games, the discussion of gamification vs. game-based learning, the difference between extrinsic and intrinsic motivation in students, and lastly the concept of playing in order to learn. All these findings contribute to how effective educational games can be with learning.

Keywords: educational serious games, serious games, educational simulations, effective uses of educational games, play to learn, gamification, game-based learning, motivations

Educational Games:A Basic Understanding and Effective Uses

Within the last 100 years, technology has become a part of our daily lives. With our current access to the internet and our ability to get answers to questions at our fingertips, knowledge has never been more accessible or important. Along with this boom in technology, also came much distraction, multitasking, and problems with focusing. Educational games are a great route to keep students focused and learning while also providing some form of interest or entertainment. Over the last few decades digital educational games have become a popular way of teaching material. This paper discusses the types of educational games such as serious games, serious educational games, and educational simulations and provides examples of each of those types. Along with forming an understanding of the categories, this paper also discusses the effectiveness of learning by playing educational games by explaining a study, the concept of learning through play, intrinsic and extrinsic motivation, and understanding gamification and game-based learning.

Serious Games

Serious games are one of the main categories of educational games. These games are designed for a broad range of audiences that use real-life examples to develop skills (Lamb, Annetta, Firestone, and Etopio, 2018). These games are not designed for pure entertainment purposes, but to learn or practice a skill. "...The objective of the computer game is not to entertain the player, which would be an added value, but to use the entertaining quality for training, education, health, public policy, and strategic communication objectives"(Wouters, Van Nimwegen, Van Oostendorp, & Van Der Spek, p. 250). *SimCity* is an example of a serious game because it uses strategy and skill to build a large city and keep the people in the city happy. This

allows players to make their own creation without specific goals and levels. Another example of a serious educational game is *Fate of the World* which overall talks about global warming and climate change. During the game, the player gets told about different scenarios happening around the world such as the oil crisis, and must make decisions to help the Earth and help the needs of a fast-growing population.

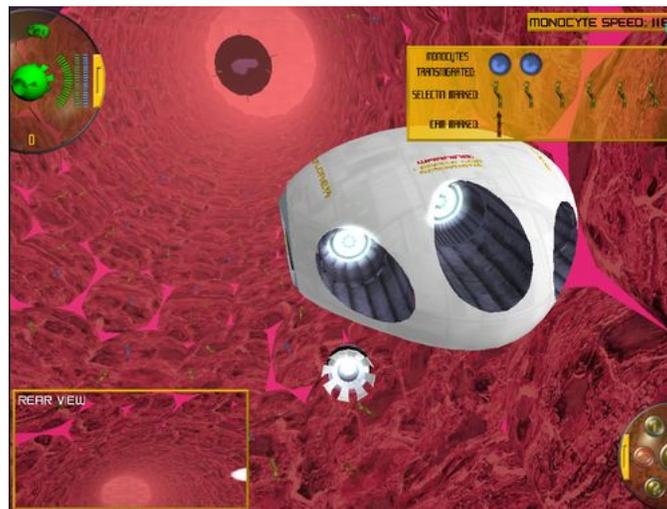


Fate of the World is a serious game that allows players to see the different environmental scenarios in the world and the dilemma of helping the planet and supporting the needs of the people.

Serious Educational Games

Serious educational games are within the category of serious games, but are more focused on education and learning theories and thus make it easier to implement as a tool for the classroom. Specifically, serious educational games “...deals with a very specific approach in which one defines learning outcomes as a function of content, cognitive change, and or skill-based growth; not just change in isolated skills alone” (Lamb et al., p.160). Within these games are more models of educating and therefore is not just about being entertained, but

learning content. An example of a serious video game is *Immune Attack*. This game is about an immunodeficient teen who teaches his immune system to function properly and each level a different infection occurs. “The human body serves as a playing field and immune cells face off against bacterial and viral infections ” (Annetta, p. 230). This game makes it helpful in order to understand the components of the immune system and what happens during different viral and bacterial infections.



Immune Attack is a great way to use serious educational games in order to teach about the immune system.

Digital Games vs. Simulations

In a digital game there are more layered components while a simulation is “... designed to model real systems as closely as possible” (Lamb et al., p. 160). Simulations focus on one particular concept in order to make it as clear and realistic. “While educational simulations seek to follow rules that are as realistic and focused as possible, serious games are enriched by additional rules, visual metaphors, imaginary stories, and challenging controls” (Imleg-Iten & Petko, 2018). Simulations allow you to make mistakes and play with different ideas in an

environment much like a role-playing game, where you can safely make mistakes and learn from them without it hindering your learning or confidence. Video games are similar in that sense, but there are more features involved such as rules, narrative, etc. that can influence the gameplay.

Educational Simulations

Another form of educational game is an educational simulation. An educational simulation is defined as “a group of technologies supporting highly engaging, often two-dimensional, interactive virtual environments between limited variables” (Lamb et. al., p. 160). These simulations are made to look as real as possible and allow the player to manipulate and play with the environment on the screen. When designing the education simulations, the intention is so people can learn from a life-like environment and isn’t solely made for entertainment purposes. An example of an educational simulation is the *Lunar Lander* landing simulation. In the simulation you control the spacecraft and are given details such as altitude, horizontal speed, vertical speed, score, time, and fuel. This game models the real system as similar as possible so people can practice and understand what it’s like to land a spacecraft.



Lunar Lander is a great example of an educational simulation due to its limited interactions, but still understanding the concept of landing a spacecraft on the moon.

Empathy In Educational Simulations

Educational simulations can also be used as a powerful tool to create more empathy and understanding. Simulations provide the ability for people to see different realities and make choices within that reality with not just physical items, but can also provide social and emotional learning as well. An example of this is the *In Her Shoes* movement which is anti-domestic violence advocacy that's main effort is to develop tools to increase empathy around abusive relationships, difficult choices made by women in these relationships, and to "close the gap between cultural perceptions and lived realities" (Adelman, Rosenberg, & Hobart, p.1451). This way of teaching specifically "... emulates a social system (i.e., the contours of a community) and invites participants to embody stakeholders (i.e., victims and survivors of domestic violence) as they navigate a dynamic social process (i.e., seeking safety) with limited and situated knowledge (i.e., person profiles and constrained choices distributed at community stations)" (Adelman et al., p. 1457). The *In Her Shoes* movement created training kits (shown below) to help others with this journey of understanding and empathy. The kit includes the simulation, character cards with different scenarios, and materials on how to facilitate the training. With the use of these simulations, we are able to help people understand more about others and also give them an opportunity to work on their social empathy in order to create more societal change.



In Her Shoes Training Kit

Effective Ways to Use Educational Games

Educational games can be effective if they are understood and implemented in the right ways. In a metaanalysis article, where the authors compiled 52 peer-reviewed articles and studies with a focus on cognition, affect (emotion), and/or student achievement outcomes a few understandings of the three types of educational games were made. From the compiled findings, one finding was that serious educational games and serious games have a more positive effect to train skills compared to simulations (Lamb, et. al., 2017). This understanding could be because simulations are life-like and interactable, but not really made for problem-solving or task managing like serious educational games and serious games are. Another finding is that serious educational games also have a greater effect when it comes to (affect) emotional and skill-based learning while simulations give a greater cognitive effect (Lamb et. al., 2017). Lastly, a key finding is that “SEGs and SGs both make use of three-dimensional immersive environments. Using three-dimensional immersive environments seems to provide greater cognitive

stimulation, immersion, realism, and task authenticity increasing the participant's ability to practice and learn content, relationships, and problem-solve in a broader context" (Lamb et al. p. 165). The idea is that the more life-like a game is, the more effective the game is with learning outcomes.

Increasing Effectiveness Study

An experiment conducted where 150 German students ages 13 to 17 years old were divided into two groups, an experimental group, and a control group. Both groups were told to play a game called *1916* that teaches them important events in Germany's history. The difference between the two groups is the instructional input before playing the game. The experimental group was told to learn as much as possible while playing the game. The control group was told to play the game and have fun. They tested many hypotheses during this study and the majority of them were not significant or able to prove to be true. They conducted recall tests after playing the game and the overall finding is "...explicit learning instruction is not the method of choice for employing educational games in a school and learning context. In our study, a majority of students perform better without it" (Hawlitcheck & Joeckel, p.84). Although this finding is only a small piece of the puzzle in how to make educational games more effective, it shows that putting pressure on students by telling them they need to pay attention to the details of the game, doesn't make them perform better recall. If a student is playing the educational game and having fun, then they will be able to remember more than if a student is told to remember the game.

Gamification vs. Game-Based Learning

Gamification uses game features and structures to increase engagement in a game. Examples of gamification are the use of points and leaderboards to make a game more competitive. It could

also be shown in the form of rewards, narratives, achievements and successes, different levels, etc. Game-based learning tries to tap into the concept of experiential learning. For example if you use an educational simulation to teach a concept, it allows individuals to practice and receive personal feedback. The engagement is more of intrinsic value in that you are getting feedback to improve and continue to work towards getting better at something. “Where gamification risks co-opting, trivializing, or misaligning game elements for the sake of ‘gameness’, a game-inspired approach can use methods...to structure a learning environment without having to worry about any additional game layer”(Holmes & Gee, p.9). Gamification is engaging but may take away from the learning experience as opposed to game-based learning that allows personal feedback to improve your own understanding.

Intrinsic vs. Extrinsic Motivation

Motivation is vital to keep students learning activities and developing their knowledge and skill. Two key types of motivation are intrinsic and extrinsic motivation. Intrinsic motivation is the interest to pursue something because of what is believed to be an interesting subject. In game-based learning, the intrinsic motivation is that the player is getting personalized feedback to improve and therefore makes problem-solving and learning easier. Game-based learning tailors the game to the player or student. If educational games take an extrinsic motivation approach which is more like gamification, it is motivating students by the competitive nature of high scores, or winning prizes, or reaching higher levels for example. In a study where they examine whether using educational games with extrinsic incentives, will negatively or positively affect motivation and cognitive processing, they discovered that.. “...extrinsic incentives undermine the intrinsic motivation of individuals” (Hawlitcheck & Joeckel, p.81). If educational

games are pushed by extrinsic motivation, it is likely due to thinking that the results are more important than just enjoying the activity.

Play to Learn

Children while growing up often use the concept of play to learn. Play meaning using play as a form of practice and understanding their connections to the world around them and formed relationships. As children grow to adults, play is increasingly taken out of the equation, and adults are expected to learn other ways such as by lectures, PowerPoint presentations, and readings. “If early childhood already witnesses the use of play for educational purposes, it is also the time for building this structure” (Annetta, p. 232). By including educational games into the mix of learning methods, it allows the opportunity to play with concepts and ideas and make connections in the virtual world that translates to our reality. To get the most out of play in games the game needs to be contextualized meaning “...the kinds of cooperative and collaborative learning activities embedded in gameplay, and the quality and nature of debriefing are all critically important elements of the gaming experience” (Annetta, p. 232). By incorporating more play into learning curriculum children and adults can master the art of play and learn effectively and efficiently.

Conclusion

Games have been around for thousands of years. With the modern world living in a period of time where technology is used daily and games are no longer physical, but digital, the increasing use of digital games in education is changing how we thinking about learning. Through this paper, many topics around educational games are discussed such as serious games, serious educational games, and educational simulations. Along with those discussions are

examples of games that have been created for each of those categories. The topics of using educational games as a tool for effective teaching are also discussed such as how educational games are introduced in the classroom can affect how students do on their performance of recalling information later, the difference between intrinsic and extrinsic motivation, and learning through play. Although there is much research to be done, educational games specifically digital games provide a new method for learning by playing and experimenting with different ideas and concepts in order to effectively learn.

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