

Game-Driven Learning in the Digital Age: A Systematic Review and Meta-Analysis

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Abstract: Learning is the base human need. We are living in a modern and mobility world which require more and more changes and in the study process especially. The knowledge has to be deeper and more special, but it's getting process has to be invert – more quickly and ease. This article considers the educational aspects in the Digital age which are based on games. Games play a significant role in the process of keeping a new knowledge. The contemporary time proposes specific possibilities for existing entertainment activity for study. The aim of the article is to investigate the condition of education in the era of digital technologies, in particular, with references to the lessons based on the gaming practice. The methodological basis of the research consists of systematic methodology, method of interpretation, analytical method, comparative and generalizing methods and meta-analytical method. It is very important to explore this phenomenon as long as game study in the 21 century becomes a new alternative for education and, in general, a qualitative stage of development.

Keywords: education, game, digital age, new technologies, hyperreality.

1. Introduction

Contemporary time has a lot of original and interesting features. A significant role plays the paradigm shift of the XXI century and the involvement of people in this course of reality. The main characteristics are as follows: inconsistency, rhizome of being, simulation, abstractness, irrationality, unpredictability. All these moments clearly distinguish us from previous epochs, temporal dimensions (Veermans & Jaakkola, 2019). Dudukalov & Laptander (2015) claim that information flows including their content and intensity can have an impact on the formation of human resources since the generation of these information flows is one of the characteristics of the developed information society. That's why it is necessary to describe the above aspects and to analyze their significance and impact on the living plane of humanity and in particular, what interests us most in this work - the educational layer.

Inconsistency. Volatility is a fairly prominent vector in the life of the world. Such a unit of activity demonstrates sudden changes, unpredictability and the inability to predict quite often what may happen next. Of course, there is practically nothing stable, unchanging in the world, because man is also energy, like all other organisms, and over time, this energy wears off and there is a constant dying. But modern life seems to be something that does not force or impose any canons and rules (for the most part; however, this should not be reduced to the ultimate truth). Man acquires a new image and color. Man is a mechanism that is exposed to the external environment (Veermans & Jaakkola, 2019). The inability to confront reality, and rapid adaptability, the ability to properly and clearly adjust oneself, to delve into the system - is a paradoxically important determinant of the "new man and the new era."

It is a very popular epithet — *new media*. L. Manovich in his book «The language of new media» (Manovich, 2002) reflects on the question of what new media really is, how to understand that it has really become new and how it actually differs from the previous ones. The author points out that new media is what the press thinks it is: Internet, websites, multimedia technology, computer games, virtual reality, and so on. He says that the modern media revolution, like the industrial revolution, can significantly affect society, for example, through the dissemination of data and communication through computers and other gadgets. In general, this can be equated with events such as the invention of the printing press or photography in the 15th and 20th centuries, respectively (Sergeeva, 2018).

The rhizome of being. G. Deleuze and F. Guattari in their research «A thousand Plateaus» (Deleuze & Guattari, 1987) [18] developed their own concept, which was based on the concept of *rhizome* (translated from French, rhizome means rootstock). An interesting feature of such a rhizome is that it opposes linear structures, which in turn means connection, heterogeneity, multiplicity, a small gap, cartography, decalcomania (Negri, 1995).

Simulation. Simulation is an important criterion for characterizing the life of modern man. It can help to avoid annoying mistakes in different life cases: in chemistry, physics, pharmacy, or education (Kupchishin et al., 2018). If we turn to previous epochs, in time, to the epoch of antiquity, then there we can see that man was completely and utterly open to the surrounding reality. A person did not hide anything and did not hide from anyone. At that time there was a connection with nature, which, in turn, does not tolerate deception and pretence. Humanity fully understood his feelings, they felt in moderation but could find the cause of behavior, immersed in true nature (Cai, Goei & Trooster, 2016). The man of the 21st century, on the contrary, quite often rejects this ability, restrains himself in all its true manifestations, tries to hide himself, his whole life, to disappear behind the scenes. Of course, simulation (copying, parodying) is not fully manifested in this, but reproduction, the image of someone other than yourself - quite often prevails in the surrounding reality. There is such a phenomenon as a simulacrum (copy of a copy), which hides the truth. The author of this concept is the French philosopher, sociologist, culturologist J. Baudrillard (1994). He notes that the modern age is an era of hyperreality. It is characterized by a sense of loss of reality.

In a way, we can compare and correlate the concepts of decalcomania (Deleuze & Guattari, 1987) and simulacrum (Baudrillard, 1994). Because decalcomania is the same transfer, the imprint for later use and copying. However, if we talk about the same rhizome, the situation is more complicated. If we deal with a simulacrum, then there should be a beginning, a basis from which everything begins, but dealing with rhizome leads us to even more complication - there is no beginning and no end, everything is confusing and interdependent.

Abstractness, Irrationality, Unpredictability. In a way, we can reduce the concepts of abstractness, irrationality and unpredictability to a single criterion that will allow us to notice a number of common and core elements of these phenomena. First of all, it is the absence of a rational (mind), clear, precise basis. Modern society perceives information in part, we can even say in clips. Because it perceives information better and, in general, perceives information with pictures and thanks to pictures (Fox, Pittaway & Uzuegbunam, 2018). The modern world is not able to dive into a deeper space for further analysis. Its mind is alienated, superficial, chaotic and spontaneous.

We turned to the previous characteristics, not in vain. Understanding the general picture, the situation with its internal features will allow us much more fully to analyze the issues of learning in the era of digital technologies and in general to understand what are digital technologies, as possible learning through games in this era. Therefore, the aim of this work is to analyze the features of learning based on games in the era of digitalization (i.e. in the era of digital technology).

Many scholars have turned to this theme. We can write down here such authors as Csikszentmihalyi, M. (1975), Baranauskas, M., Neto, N., & Borges, M. (1999), Kiili, K. (2005), Aşkar, P. (2013), Barr, M. (2017), Kosmas, P., Ioannou, A., & Retalis, S. (2018), Zhonggen Y. (2019), Mayer R. (2019), Almeida, F., & Simoes, J. (2019), Sabirli, Z. E., & Coklar, A. N. (2020), Shaw, P. (2020) and others.

2. Materials and methods

Using the right methodology in the study is an important criterion for finding the answer to a question. Because the method is the way which helps to discover or find the necessary explanation. During the research *systematic methodology* was used for generalizing information and forming harmonic structures. *Method of interpretation* is a concomitant element of any study. *Analytical method* allows for analyzing the algorithms for the development of a particular issue. In this study, this can be traced through the formation of a general picture of the plane of digital technologies, its functioning and maturation against this background of the educational spectrum with its game add-on. *Comparative and generalizing methods* are included in the list of important elements of research by means of which there is a process of construction and formation of the integral scientific analysis. *The meta-analytical method* as well as the systematic review was a basic for our research. Because with their help it is possible to consider questions considering various researches, statistical results for check and finding of the only correct variant.

In the course of the research, we turn to various scientific works. And last but not least, such analysis is multifunctional and interdisciplinary. Because the dilemma of learning in the age of digital technologies based on games is at the intersection of different scientific studies. Philosophers, sociologists, culturologists, educators, analysts, etc. have addressed and are addressing this issue.

In our research, the basic materials are the works of Pivec, M., Dziabenko, O., & Schinnerl, I. (2003) where they analyze the phenomenon of games and education through the games. They propose some examples of creative and interesting learning. The research of Csikszentmihalyi, M. (1975; 1991) is significant for us because of his understanding experience of the players. Webster, J., Trevino, L. K., & Ryan, L. (1993) pay attention to the interaction between computer and human in the process of the game.

3. Results

It is important to notice that man is an active and mobile organism. Humanity builds different schemes and rules, tries to do something and supposes that our life is a serious structure with unknown and confusing situations. But this is not entirely true. Our life in some way is a game where everyone has its own role. First of all, we should understand what is a game and how does it work. The game is a simplified transformation of reality. If we trace the historical development of humanity and in particular the individual, we can see that in the course of its evolution, man learns reality in the form of a game. There are a lot of different kinds of games: children games, salon games, simulations, sports games, puzzle games, board games, gambling, electronic and role games, computer games. When a child begins to play, it perceives the game as a serious reality. It seems to realize that this is a so-called false activity, but man is involved in this process completely, and in this case, he/she loses the understanding that such a game is fictional, invalid.

Nowadays there are a dozen amounts of educational projects, ways and opportunities for study. Using this we can better learn and assimilate information. Digital technologies postulate themselves as best practices. It is usual for our understanding that games are equated with having fun. Games should provide reflection, test different variants, construct a hypothesis and be the way of solving the problem. Games are designed to create/improve a positive result in players and help to gain a new experience (Gros, 2007). Csikszentmihaly explored people involved in such activities as rock climbing, chess and dance. His experiment showed that learning through game or interactivity has positive impact on studying because modelling of some processes teaches how to act correctly, trains and, last but not least, is a trial option that protects against wrong decisions (Csikszentmihalyi, 1975). The challenge that a player faces in the game world is matched with the skill level of the actor. Rollings and Adams (2003) propose several types of challenges that can be applied to educational games. First of all, it is players as problem solvers. Holyoak supposes that the capacity to resolve questions is a significant testimonial human skill (Holyoak, 1991). The second one is experiential learning. Experiential learning builds upon the work of Piaget, Lewin, and Dewey (Nielsen-Englyst, 2003). Experiential learning is based on the conceptualization of a particular issue, generalization, summarizing and forming hypotheses about the study.

A significant role plays a design. Educational aspect with help of well-designed games gains popularity and momentum. The most important criteria in this sphere are storytelling, game balance, appropriate graphics and sounds.

4. Discussion

The original activity which is connected with movement (for example, physical exercises – running, playing football etc.) diverges from activities performed with computers. Obviously, we can say the difference between them is in tools using which is possible to play and solve imaged puzzles. The first variant is: the body is involved in the process of gamification and takes part in the activity. When we play a computer game, the situation is not entirely similar. In this case, your mind is an active player and your physical position is a state. Intrinsically significant issue is the immersion of game participants in the simulated process of reproduction of reality. Thanks to modern technologies, in the age of digital technologies, we are able to study, for example, some topics, problems with the help of computer games, where the available information is vividly and quite often veiled on the screen. The participant has to start the game, solve some tasks, read the clues he comes across, try different options, thus learning, memorizing, performing different roles and taking extraordinary positions, showing and in turn developing the creative apparatus.

It is important to add that games have some specific characteristics. It can be interactivity (Tornton & Cleveland, 1990). The next elements are challenge and risk (Baranauskas, Neto & Borges, 1999), fantasy,

curiosity, challenge and control (Malone, 1981). All these criteria can apply to both computer and regular games. Such characteristics define the game as an interesting and educational phenomenon. Necessity quite often motivates the activity and changes. As a result of human transformation in the process of the game, there is not only training of knowledge and acquisition of the new through crisis and unknown circumstances, but also to acquire new roles, get more responsibility (Pivec, Dziabenko & Schinnerl, 2003).

Aşkar (2013) proposes the digital advancements of the 21 century in the educational sphere. These issues are possible to use in the game sphere too: learner mobility, lifelong learning, market-based competition with the new education providers (Saykili, 2019).

Ease and play in the form of learning allows us to talk about such difficult historical terms as the Holocaust with the youngest students (Arnseth et al., 2018). The Holocaust and war, in general, are non-childish topics, but it is so important to talk about them so that this does not happen in the future (Palamarchuk et al., 2019).

There are many educational systems that try to find the most common, interesting and effective way to share knowledge, information, experiences with children or elder people. In the practice, many teachers use the method of game activity. In a relaxed and natural atmosphere, the process of memorization and comprehension is more pleasant and interesting. Of course, there must be a measure in everything. However, the constant presentation of material to students by the teacher does not always benefit students. On the other hand, if listeners are immersed in the game space, a kind of virtual space, because any game, regardless of whether it is a computer or real, requires a complete presence in the virtual reality, switching their attention to the so-called imaginary world. Examples of games in educational activities can be various debates, round tables, conferences, games for the development of creative thinking (metaphorical, associative cards) (Squire, 2003).

If we focus on learning in the age of digital technology, it can be based on the use of various multimedia tools: presentations, quiz games, that is, what can be done or created with the help of computer technology. Our time allows us to develop lessons or any event at the highest level. Quite often, computer games perform an important function of education and training dimension. Although the vast majority of games may be unacceptable for children, there are quite useful and exciting programs (Stefan, Stefan & Gheorghe, 2016).

Digital games are very important since they can promote challenges, co-operation, engagement, and the possibility to solve problems. The research of computer games is not yet very well explored but it continues improving. It is important to notice that videogames are great tools for learning specific ways of behavior, in other words - the invention of the strategy (Subrahmanyam & Greenfield, 2001). Also, it helps to learn cultural and social information. With help of games, it is possible to explore the specific, particular content.

Another skill progress in computer games is the capacity to read images (pictures or diagrams). Not less significant is keeping attention on several subjects at the same time. We should notice that the main difference between e-learning and games applies to the content. In e-learning content is the most important feature, while the experience is more significant for games.

5. Digital games in the educational process of learning a language

By applying traditional language learning strategies, learners gradually lose interest as well as motivation to learn not only English, but any language or culture. Consequently, scholars have begun looking for technological learning strategies, such as learning languages through digital games, to motivate students and improve academic performance.

Among the information and communication technologies there is the NewSlov computer program (program automated compilation and processing of vocabularies, author M.V. Litus). It belongs to the components of e-learning. It is designed to create concordance, that is, an alphabetical list of all words of a text indicating the contexts of their use (Burdina, 2019).

This article summarizes the findings, presents empirical studies on the effectiveness of the use of meta-analytical gaming digital technologies in language lessons.

Recent empirical research has focused primarily on testing effectiveness by analyzing language learning outcomes, motivation and student interactions.

Overall, students reported that they were interested in language learning when digital games were involved, however, there was also weak motivation due to game design and / or individual preferences. The most effective method used to stimulate an interactive language learning process has proven to be the use of meta-analytical digital gaming technologies.

During the research, the following questions were studied:

(1) What are the advantages of the inclusion of meta-analytical gaming digital technology in comparison with the conduct of additional language courses?

(2) How does using of the digital games improve learning motivation?

(3) How does the use of digital games provide interactions that enhance complementary language learning and education?

The effectiveness of meta-analytic digital gaming in language learning is a complex process influenced by various factors ranging from individual preferences to learning strategies. Furthermore, the criteria used to measure learning outcomes are also controversial.

The introduction of digital games into language learning makes this situation even more difficult. For instance, “the use of digital games is usually supplementary to the main course of study, and therefore it is difficult to control all the variables that can influence the final result.

There is a positive correlation between language learning and socialized intense interaction, engagement, and other affective factors such as motivation and willingness to communicate.

However, the results of language learning in this way were not evaluated and illustrated in detail until some experimental research was carried out in recent years.

In a learning environment based on digital games, it is difficult to investigate advances in language learning because other variables stimulated by digital games cannot be controlled.

The effectiveness of language learning for some is, to some extent, related to the fact that games provide an opportunity to interact in the target language and stimulate motivation to learn or support cognitive development, or a combination of these advantages.

We analyzed 14 experimental studies and compared the overall performance of language learning outcomes calculated for two different play-based learning environments, namely:

(1) Action-based learning / practice environment.

(2) Meaningful and engaging environment.

Using statistical methods to calculate the overall effectiveness of learning, meta-analysis suggests that learning in a “meaningful and engaging environment” allows for more effective assimilation of information.

However, without a detailed description of the collected papers, their studies cannot illustrate which learning outcomes are assessed and which metrics reliably correlate increased learning. The problem with developing final dates is that the language is learned through multiple prisms, which include linguistic content and practical communication skills.

Linguistic content can refer to understanding grammar, vocabulary, pronunciation and spelling, while practical communication skills include skills such as listening, reading, and speaking.

For research, a 3D simulation game was developed to observe the correlation between digital games and language learning. The findings show that play contributed to significant development of vocabulary and listening skills. In addition, the students also reported that their motivation remained at a higher level.

In practice, language learning through the use of MMORPG games is applied in primary schools in Korea. Comparing the control and experimental groups, the researchers concluded that experimental students who studied English using self-developed MMORPG games performed better on the reading and writing tests.

Motivation and participation are dependent variables that are influenced by digital games and which in turn affect language performance.

Both the psycholinguistic and sociolinguistic frameworks emphasize the importance of affective factors such as motivation and interaction in language learning.

Students are more likely to achieve better learning outcomes if they are highly motivated, positive, more confident, and less stressed. Accordingly, mechanisms in digital games - including virtual environments, characteristics and design principles - are perceived to be capable of creating a relaxed and engaging learning platform.

Thus, games can improve language learning propensity. Numerous studies have focused on the benefits that digital games bring to affective factors:

- involvement of students;
- motivation;
- cooperation and socialization.

Commercial MMORPGs can support the learning environment, and research has shown that students' readiness to communicate has improved significantly.

Other achievements have been based on social interaction and communication, such as greetings, requests, and questions.

A total of 579 people took part in the research. Three studies have been carried out in the primary education sector. 112 people took part in them. One study was conducted in the context of secondary education and involved 96 people. The remaining five studies focused on university education and involved 371 students.

Five studies were conducted in Taiwan, where Mandarin Chinese is the first language. The other four studies were conducted in Germany, the United States, and New Zealand with students whose first languages were Turkish, Arabic, Spanish, Chinese, Japanese, German, Hokkien, Russian, and Vietnamese.

A total of 497 students took part in the comparative experimental study: 183 students in the experimental groups and 314 students in the controlled groups.

The numbers in the experimental and control groups differ because several studies have designed more than one control group to manipulate variables to investigate the effectiveness of digital game learning.

For example, one study developed three experimental conditions:

- (1) Based on questions.
- (2) Based on the model and terms of the letter.
- (3) Using digital gaming technology.

To compare different learning outcomes, two control groups, a conventional learning group and a board game training group, and one experimental group, a digital board game training group, were designed to determine the differences in the gradual scheme.

Divided by purpose, the nine games can be divided into two groups: seven serious games aimed at educational purposes and two serious games originally intended for entertainment.

Moreover, five games were developed independently and two were modified. In the process of their development and implementation, one could also observe the theoretical foundations that separate gamification and language learning - the hypothesis of cognition, the theory of motivation and the structure of interaction.

In addition, most of the research on serious play was done in the classroom, so a certain pedagogical framework was also followed. Two studies examined the same video game: World of Warcraft, MMORPG.

The objective of the study was to assess how social interaction can improve language learning. However, it was found that the most difficult to evaluate the research results in the effectiveness of language achievements.

Recent meta-analysis studies have used coding and statistical techniques to calculate the overall performance of language learning by synthesizing data from various studies. However, even after the coding rules have been illustrated, there is still no clear answer as to which aspect of digital game integration has proven to be most effective in improving language learning. To ensure data reliability, only comparative studies are used. The results are shown in Table 1

Table 1. Results of the comparative studies

| Learning outcomes | Positive evidence | Neutral evidence | Negative evidence |
|-------------------|---|---|---|
| Vocabulary | Students with low academic performance in the | A handheld sensor-based vocabulary game developed with a scaffolding strategy | Students who only did the exercises retain vocabulary better than |

| | | | |
|---------------|---|--|---|
| | experimental group did better than in the control group. | failed to help students retain the memory of their learned vocabulary. | students who did play practice in the long run. |
| Pronunciation | <p>Students with game practice achieved greater speech improvement than those who only practiced the exercises during the experiment.</p> <p>The instruction set on the digital playground provided better learning efficiency compared to conventional instruction and blended learning in “a board game”.</p> | | |
| Writing | <p>The more students complete the game lessons, the more likely they are to use keywords in the written assignment. Vocabulary acquisition did not have an obvious effect on target use of words in this study.</p> | <p>There were no statistically significant differences between gaming and traditional forms of practice.</p> | |

In terms of learning outcomes, recent research has mainly focused on three areas: vocabulary, speaking and writing.

Learning games are ineffective for long-term preservation of vocabulary. There has even been a negative effect of vocabulary retention due to digital game learning. However, they found that low-performing students who participated in digital game-based learning groups achieved better learning outcomes than students who participated in traditional learning.

Game-based learning did not have a significant impact on writing strategies. They also found that playing lessons had a slight advantage in increasing the transferability of learned vocabulary into writing. When it comes to colloquial speech, digital games that include multimodalities can provide an opportunity to speak out on language learning.

Digital games are effective in improving pronunciation, which is perceived as a linguistic component. It is assumed that learning in digital games led to an increase in the portability of the acquired knowledge in everyday communicative speech.

The findings are heavily focused on interviews and observations. Games such as WoW, MMORPG have been effective in promoting the development of a new language by incorporating meaningful learning materials into an authentic and interactive environment that has been created through the learning process.

6. Conclusion

The contemporary time has some specific issues which are based on inconsistency, simulation, abstractness, irrationality, unpredictability. These features are significant for our life because they determine all spheres of activity. It is not the exception of an educational field. It has a lot of changes. In the learning process is very popular to use games, as soon as they help to make the study more interesting and effective. A game is like a simulation of reality. If we speak about computer games, we consider it a different subject. Our mind is always active and is ready to solve different problems. Game-driven learning in the Digital age is useful, interesting phenomenon; it has a lot of possibilities thanks to the development/progress of technique, hardware.

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