(REVIEW ARTICLE)

The use of educational digital games in the education of students with Down syndrome

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Abstract

In the case of special education and specifically the education of people with mental disabilities and down syndrome, the presence of attractive tools and methodologies in the learning process is a basic request. Educational goals for students with intellectual disabilities and down syndrome may differ from educational goals and methods in formal education settings. At the same time, for each person with intellectual disability and down syndrome, a personalized training method is required according to their needs and capabilities. Despite the differences, the main goal remains the improvement of adaptability and autonomy, through the cultivation of the maximum potential of the individual. Digital gaming is a key and important means of achieving these goals.

1. Introduction

People with intellectual disabilities are a heterogeneous population, whose type of issues they are asked to access in the social and educational environment varies and depends on different factors. It is a fact that the education system for children and young people with mental disabilities has been improved and modernized, but it is often found that the educational needs of students with disabilities are not adequately met. The main reason is that the educational system remains academically oriented, in terms of the pedagogical approach of the students of this category, a category which acquires knowledge primarily through experience and experience (Arbounioti et al., 2007). This approach fails to cover the specific population, both the acquisition of basic academic knowledge, and the need for development and self-improvement of daily life skills. This probably has the effect of increasing their dependence on others and excluding them from the decision-making centers that concern them. Specifically, the field of special education is a special form of education, both for the learner and for the teacher. As the different teaching conditions and the adapted delivery of the educational work" are elements that advocate an education oriented towards other purposes, means and methods (Antoniou et al., 2010; Drakos, 2002), a continuous and additional effort is required on the part of the teacher, with a direct impact often on his emotional burden and physical exhaustion, which often reaches the limits of burnout (Antoniou et al., 2010). The instructor needs tools that are accessible, easy to use and helpful in his work such as the digital game.

2. Digital play and education

Since the 1970s when digital gaming entered the homes and hearts of young people in the form of the first game console, educators and industries have wanted to take advantage of its momentum and combine it with school knowledge. A number of studies indicate that digital games are now a favorite habit, a part of both juvenile and adult life (Greenberg et al., 2008; Olson et al., 2007) exploring their positive or negative effects (Olson et al., 2008; Olson, 2010).

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In recent years, the use of digital games for educational purposes seems to have many supporters at an interdisciplinary and political level. The promise that digital games can transform education has now begun to influence educational policy in several countries, while governments and international organizations provide opportunities to support and fund research into educational games and their development. Scientific journals on the educational use of digital games and conferences dedicated to the subject, support this enthusiasm by highlighting research results that link the digital game to more effective learning, the improvement of cognitive abilities such as problem solving, memory improvement, spatial abilities but also social skills (Markey, 2016).

In digital games, the use of multimedia, interesting plot, tasteful graphics, and creatively balanced twists/difficulties provide the user with the necessary motivation to initially engage with the game, continue playing using different strategies, and by extension are able to maximize theoretically the educational result. All these effects of the game work unifyingly as a holistic mechanism of learning and development since as an activity it integrates cognitive, emotional and social stimuli, it provides the meaning for the intake of new connections and relationships between ideas, experiences, abilities and knowledge (Markey, 2016).

3. Digital gaming and Down syndrome

New technologies can be exploited for the design and development of computing tools that offer both the possibility to express their thoughts, ideas and intuitions but are able to support the knowledge building process by shaping learning environments rich in primary data, as well as in opportunities for reflection and experimentation (Papert, 1998). The use of new technologies contributes to the cultivation of autonomous learning capabilities and the provision of opportunities to access information and communication. Students can engage in learning objectives commensurate with their abilities, show interest, work harder, develop metacognitive skills, self-control and reflection (Vosniadou, 2006).

It is also interesting that as Strogilos (2011) mentions, in general, the materials used in the education of people with intellectual disabilities do not need to differ from those used by typically developing children, unlike other disabilities that require materials that must be constructed from principle, but this material should be able to be used in such a way as to meet their needs within a differentiated approach.

The educational potential of digital games has been quickly accepted within the academic community, following research results supporting the effectiveness and potential of this practice within formal education contexts. Researchers respectively argue that several of the positive features of using digital games that have been reported as interesting and suitable for typically developing students could be particularly beneficial for students with intellectual disabilities (Brown et al., 2008; Brown et al., 2011).

For example, digital games provide a virtual world that can be used as a safe testing environment that students can freely explore, at their own pace, while trying to get immediate feedback. In addition, digital games are able to capture and hold students' attention more effectively than other media, keeping them in the zone of optimal flow for knowledge creation. Research on the use of multimedia applications and especially games by people with autism and intellectual disabilities showed not only increased interest and pleasure, but also positive results in terms of learning concepts, reading and time management (Brown et al., 2009).

In general education, the use of digital games as educational tools seems to have positive results and specifically according to the international literature, the most important part is the development of motivation through the digital game and the high communication and educational strategies that this medium has. However, when reference is made to the possibilities of the digital game, such as adaptation to the individual needs, the learning pace and the abilities of the user, the possibility of supervision through the recording of the user's movements and "smart" guides, the possibility of changing the content according to the personalized planning of the teacher, or the possibility of automatic utilization according to the choices or learning needs of the learner in the context of a differentiated approach, are like describing basic principles and needs in the education of people with intellectual disabilities (Strogilos, 2011). The digital game, in addition to a safe context for action, is an ideal educational space for this population, as the learner can try, take risks and fail without having to suffer the consequences of error or failure as in the "real" world (Gee, 2003).

People with special learning abilities and intellectual disabilities, do not differ in the need for digital entertainment, they use digital games at home and feel pleasure, boosting their self-confidence with each success. According to the literature, in addition to the fun offered by digital games, it has been argued for several decades now that a key value is that students can demonstrate their skills and knowledge. There are indications that the use of digital games can be an essential way of creating an effective and harmonious educational context, adapted to the particular educational needs of each student (Bertolini & Nissim, 2002; Liverton 2000).

Beyond conventional, non-digital play, students with intellectual disabilities can use educational software and digital games to gain experience with situations they encounter on a daily basis, as well as with subjects found in the school curriculum such as math, reading and vocabulary, promote problem-solving skills and potentially prepare themselves for social integration, vocational training and safety (Saridaki & Mourlas, 2013).

Studies that have addressed the potential of digital games to improve the education of people with intellectual disabilities have existed for several decades. For example, computer games used to teach safety issues to children with intellectual disabilities (Coles et al., 2007). Knowledge constructed in the virtual world can be transferred to skills in the real world. Such educational activities may allow the teacher to adopt a new role in the teaching-learning process and practice, that of facilitator and teammate, allowing the child to develop initiatives and skills. In this way the learning process offers not only immediate satisfaction to the student but also a sense of creation and success, a feeling valuable for people with intellectual disabilities and stimulating their psychological state. The same term is mentioned by Piaget, seeing the teacher as a creator of an appropriate environment and a facilitator of development processes" that come from the individual himself (Hodapp, 2005).

In addition, through playful fun activities specifically designed for students with Down syndrome, research has concluded that combining learning with a positive and comfortable experience such as that provided by interesting and fun environments is very important and can be found in edutainment games.) (Vera et al., 2005). An example of high quality in design, aesthetics and educational targeting is the 'Amazing Adventures of Millie Moreorless' specially designed for people with Down syndrome. The game is designed for iOS devices, has a math theme and is the result of a partnership between different companies, namely Enabling Play, Made in Me and Dr. Jill Porter of the University of Reading. The game "First Day at Work" has a similar goal, an adventure game where the player is invited to navigate a virtual workplace, interact with virtual characters and practice his social and professional skills.

The above examples stand out from other efforts as they are based on principles of personalization and user-centered design, taking into account the particular wishes and capabilities of the user both at the avatar selection level and at the content level. In Greece, at the Foundation for the Protection & Rehabilitation of Children & Youth with Mental Retardation "THE THEOTOKOS", the educational digital game is utilized by the trainers in different forms, depending on the needs of the trainees. A complete suite of games concerning everyday skills, through social stories and digital mini-games, was designed and implemented. Many of the above examples are digital games that are oriented beyond academic content, to facilitate collaboration between classmates and improve their social and communication skills (Ohring, 2008) although in most cases, the presence of game elements is limited in a 3D virtual world without strong elements of interaction or substantial connection to the learning process (Gaggioli et al., 2007).

Most attempts to design games for this population, from the research reported on games for cognitive disabilities, focus on rehabilitation and therapy. The most interesting applied examples from this area usually combine multisensory experiences or potential reality techniques. Kinems is a complete suite of games aimed at special educators and leverages Microsoft's Kinect technology, helping students with autism, dyscalculia, attention deficit, motor and developmental disabilities learn through playful educational materials, moving their hands or their body, while at the same time the response is recorded to be used in the therapeutic and/or learning process. Kinems training software is designed to be customized as to the length or difficulty of the game or the games to be used.

Concluding, we emphasize the significance of all digital technologies in the field of education and in DOWN syndrome training, which is highly effective and productive, facilitates and improves assessment, intervention, and educational procedures via mobile devices that bring educational activities everywhere [51-54], various ICTs applications that are the main supporters of education [55-77], and AI, STEM, GAMES, and ROBOTICS that raise educational procedures to new performance levers [78-86]. Additionally, the development and integration of ICTs with theories and models of metacognition, mindfulness, meditation, and the cultivation of emotional intelligence [87-114], accelerates and improves more the educational practices and results, especially in children with DOWN syndrome, treating domain and its practices like assessment and intervention.

4. Conclusion

Today around the world educators, academic researchers and game designers are increasingly interested in the potential use of educational digital games to support the learning experience of students with intellectual disabilities. In recent years, in Greece as well, digital game applications in special education environments have been increasing, as have research programs with similar objectives.

Digital games offer the possibilities of repetition and practice, thus giving the student the possibility to understand at his own personal pace of learning and always according to his own time and mental capabilities. We can therefore conclude that through the electronic game the user with an intellectual disability can achieve at his own learning pace what a user of typical development does, i.e. successfully complete the educational game by understanding its logic, completing the "tests" and having fun. By extension, an appropriate digital application is able to mitigate the cognitive differences between students of different mental abilities.

Compliance with ethical standards

Disclosure of conflict of interest

The Authors proclaim no conflict of interest.

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