Digital games for acquiring everyday life skills for students with intellectual disabilities

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Abstract: The process of upbringing and educating students with intellectual disabilities (ID) should be based on an individualized approach to learning. This can be achieved through the use of game-based learning, which allows presentation of certain educational content in an appropriate way. In this sense, digital games can be a good mediator in the development of everyday life skills, as they can be used to simulate everyday situations (e.g. shopping, dressing, eating, personal hygiene), which allows students with ID to become more independent in life.

The aim of this work in progress is to provide an overview of digital games that enable the acquisition of everyday life skills for students with ID. The presented research highlights the importance of digital games in the upbringing and education of students with ID as well as the importance of finding games that are suitable for the individual needs of students with ID. Throughout the work, a number of digital games are presented and their features that make these games suitable for use by students with ID are described. This overview will play an important role in subsequent research steps – in developing an ontology that more formally describes the individual needs of students with ID and the requirements that a game must have in order to be compatible for playing by students with ID.

Keywords: Digital Games, Intellectual Disabilities, Everyday Skills, Domain Ontology

1. Introduction

Intellectual disabilities (ID) represent a complex concept, which includes biological, psychological, and social factors (Bouillet, 2010). It is a state of insufficient development of the central nervous system during the early development of an individual and is characterized by a deficit in an individual's intellectual and adaptive functioning (APA, 2013).

Deficits in adaptive functioning are more difficult to detect and measure by standard tests than the intellectual ones, and they result in the inability to meet socio-cultural standards (e.g. lack of judgment) and are related to intellectual impairments (APA, 2013). Adaptive functioning skills include a set of conceptual (language, money, time concepts), social (inter and intrapersonal skills, judgment, social problem solving), and practical skills (self-care, activities of daily living, occupation) that a person has adopted to function in everyday life (Vuijk, et al., 2010; Maulik, et al., 2011; Anon., 2019).

This work in progress aims to provide an overview of digital games which help students with ID to acquire everyday life skills for students with ID. In this sense, the work highlights the importance of digital games in the upbringing and education of students with ID as well as the importance of finding games that are suitable for the individual needs of students with ID.

2. Digital games for acquiring everyday life skills

Digital games and Game-based Learning as a process of learning with the use of digital games (Prensky, 2003; Whitton, 2009; Rugelj, 2016) in order to accomplish certain learning outcomes (Shaffer, et al., 2005), can be a good mediator in adopting everyday life skills for students with ID. The purpose of digital games in education is mainly to enable players to learn basic and advanced skills that contribute to meeting educational goals by relying on trial and error and repeating used steps. Digital games can offer solutions for the players' daily-life problems by playing games dealing with various daily activities (e.g. shopping, dressing, feeding, personal hygiene) (Saleh & Battisha, 2020). In this way, students with ID can move closer to real-life situations and become more independent in life.

Educational games specifically designed for students with ID are difficult to find, and existing ones are not always available to the public. For this reason, teachers who want to improve the teaching process and facilitate acquiring everyday life skills are often in a situation where they have to find games that are not explicitly categorized as games for students with ID, but such students can play them. In order to find such games, one must first find available game databases (such as iTunes, Google play, or Scratch), search them, and test each

game for special requirements due to the specific difficulties of the students. As there is no unified list of all requirements, the process of finding adequate games is very time-consuming.

While searching and selecting appropriate games for this paper, special education teachers were consulted who, based on their own experience of working with students with ID, could better notice the shortcomings of certain games such as too high abstraction level or too much information on the screen.

To instill healthy eating habits in children and adolescents with ID, the authors (Isasi, et al., 2013) created a tablet game that is based on a set of mini-games with different functionalities and aims. The purpose of the first mini-game is to put healthy food into a bowl in order to make a salad (figure 1). In the second mini-game, the aim is to drag the right food on the table in order to make a healthy breakfast (figure 1). The preliminary results of the case study have shown that the users had fun playing the game and would play it again. When creating the game, the creators made sure that students receive feedback immediately after the end of a task and that the game uses familiar symbols.
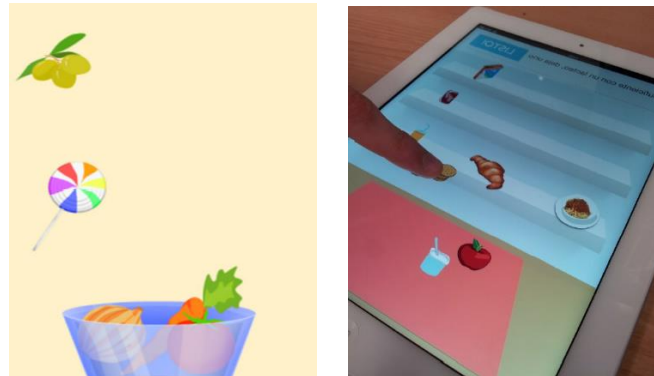

Figure 1: Game for instilling healthy eating habits (Isasi, et al., 2013)

The authors (Oliveira Malaquias, et al., 2013) created an educational virtual environment (VirtualMat) for learning mathematical and logical concepts important to everyday functioning for students with ID. Virtual Mat is a virtual city with several houses, buildings, cars, and a supermarket (figure 2). The idea is that the student prepares a shopping list, goes shopping, pays for the groceries, takes them home to organize them. In the process of developing the game, special requirements were taken into account like imitating real world situations, using intuition interface, and familiar objects. For example, by hovering the mouse over a buying item, the name is heard, to add the item to the list, the student has to click on the item, and when organizing the items at home, the game has been programmed that the student receives immediate feedback when storing an item in the correct place (e.g. hygiene products in the bathroom), or in the wrong place (e.g. food in the laundry cabinet). The system has been tested on a group of 15 students and qualitative and quantitative results have shown that virtual reality significantly contributes to the process of learning for students with ID.

Figure 2: VirtualMat game (Oliveira Malaquias, et al., 2013)

Even though Scratch is regarded as the world's largest coding platform for kids (MIT Media Lab, 2019), it also can encourage the development of students' everyday life skills. With the option to share projects, Scratch is now a large database of stories, digital games, and animations available in different languages. It offers many playable games related to everyday life skills such as a healthy food-collecting game or seasons game (figure 3). The games are using analogies, practical examples and objects related to the students' usual social situation, which makes the games easily to operate with. A study conducted on students with ID has shown that Scratch enabled a higher level of participation and students' autonomy when carrying tasks related to the importance of water for living beings and recycling (Pinto, et al., 2016).
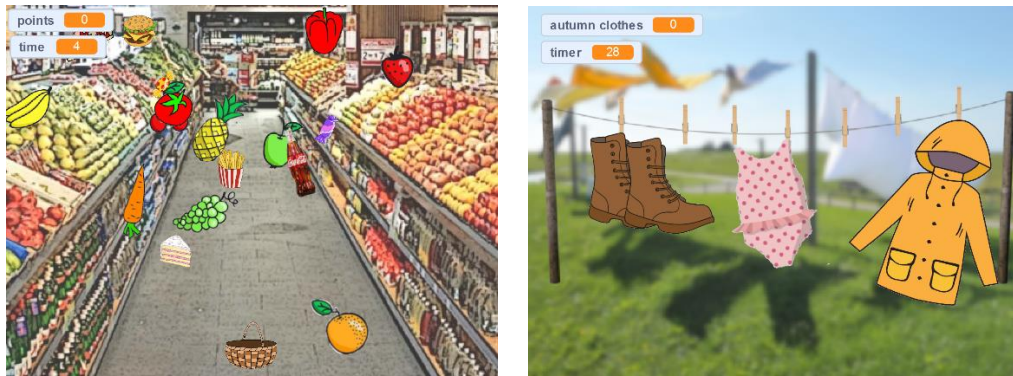
Figure 3: Scratch games (Hoić-Božić, et al., 2019)

Shopping with us is a serious game that promotes independent living for people with ID. It includes real-life situations divided into three parts – cooking recipes, shopping offers, and healthy style (Lopez-Basterretxea, et al., 2014). By designing the game, special attention was given to the interface in order to adapt it for people with ID (figure 4). The authors used realistic elements to simulate real-life, short conclusions after each game, and clear and easy interface, and did not use time limits because of different user profiles (severity of ID) and no animation or sound effects in order to keep the user focused.
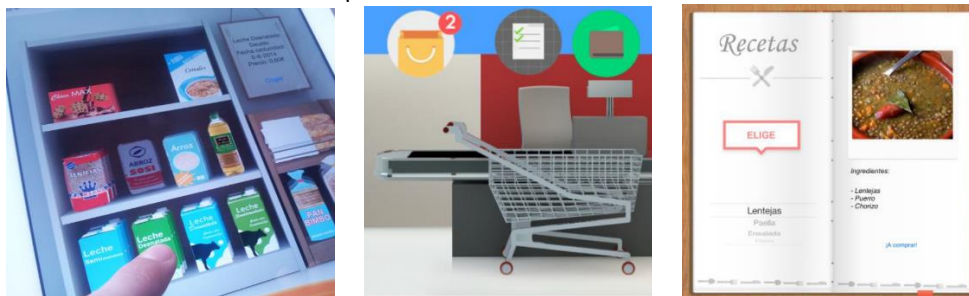

Figure 4: Shopping with us game (Lopez-Basterretxea, et al., 2014)

Bimi Boo games (Bimi Boo Kids, 2021) are educational game apps that are designed and developed by designers, graphic artists, programmers, animators, and educational experts. Most of the apps are intended for preschool kids, but due to the significant limitations in the intellectual functioning of children with ID (APA, 2013), the apps can be played by students in primary school depending on the severity of ID. The apps cover mastering a wide range of not only academic skills, but also everyday life skills like the Birthday game (figure 5) where players can make a cake, buy gifts and decorate the yard, and the Play and Learn game (figure 5) which trains the player the difference in sizes and colors and develops attention and fine motor skills. The games are designed with many levels so that challenges can be easily overcome by students and also allow students to cooperate together by playing the games on a tablet.

Figure 5: Bimi Boo games

Juhuhu (HRT, 2021) is a tablet app for children from three to eleven years old. The content is divided into three groups – look, listen and play, so it contains video and radio shows, popular cartoons and documentaries, and games. It stimulates the intellectual and adaptive development of children and the games are providing extra fun with learning. For example, there is a game that teaches children to prepare a meal (figure 6). The game is suitable for students with ID because it deals with daily life practices like cooking. Also, the game enables skill

progression from simpler to more complex, which is achieved by leveling the game. On the first level the player is learning about seasonal food (name of the food, category like fruit or vegetable), and later what dishes can you make with the food.

Figure 6: Juhuhu cooking game

3. Conclusion and future plans

The analysis of game examples established that digital games for students with ID need to meet special requirements in order to enable those students to stay motivated and accomplish learning outcomes by playing digital games. Those requirements can be divided into educational requirements, instructional design requirements, and practical application requirements (Saleh & Battisha, 2020). The educational requirements refer to requirements like designing real-world situations related to daily life practices, providing immediate feedback, enabling skill progression from simpler to more complex, using analogies and practical examples. Instructional design requirements imply that the user interface is designed with high levels of intuition, that the used symbols are familiar to the students with ID. The last, practical application requirements, include that the digital game is easy to operate by children, that it allows them to cooperate together while playing, and that the game challenges can be overcome (that the game is neither too simple or too complex) (Saleh & Battisha, 2020). The process of selecting digital educational games suitable for students with ID is very time-consuming because some special requirements must be taken into account in order to be playable for students with ID. Some of the special requirements were stated in the highlighted games in the previous chapter (familiar symbols, objects, and situations, using levels to enable skill progression, intuitive interface), but it takes time to recognize these requirements in each game, so special education teachers often avoid using digital games to improve the teaching process.

In order to shorten the process of testing and analyzing each educational game playable for students with ID, an expert system would be of great use. The expert system will provide special education teachers with recommendations that will help them to implement digital games in the teaching process which will address the student's individual needs with the goal of developing intellectual and adaptive skills.

The expert system will be developed based on an ontology which will describe all game characteristics, requirements, relations, and users in a formal and machine-readable way. In this way, by defining semantic data models and combining them with the associated domain knowledge, the individual needs of students can also be more formally described. The ontology (and later the expert system) will be designed in cooperation with special education teachers for better determining adequate game characteristics for students with ID.

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