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ANALYSIS OF THE EXAMINATION METHODS OF GARDNER'S INTELLIGENCES IN THE DIGITAL ENVIRONMENT

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Abstract

The subject of this research was the examination of the dynamically changing and widely applied theory of Multiple Intelligences (Gardner, 1983; 1999; Gardner, 2009), and its possible manifestations (Dezső, 2012; 2015; 2020), in relation to kindergarten education (Gyarmathy & Herskovits, 1999; Sándor-Schmidt, 2019; Ábrahám, 2022). The aim of the research was to implement the "Everyone is Intelligent in Different Ways" (EIDW) method (Sándor-Schmidt, 2016; 2019; 2022) into the digital environment. The EIDW is used for the investigation and development of Multiple Intelligences and is a methodology based on an independent adaptation of the Project Spectrum concept (Gardner, Feldman, & Krechevsky, 1998), but differs from it in many points.

With the spread of mobile devices and the Internet, as well as the digital work schedule outside the classroom, digital devices and the online space play a key role in children's lives. In the 21st century, everything is given to realize the examination of Multiple Intelligences in the digital space. The affordable, accessible, and easy-to-use mobile devices are essential to the digital world of digital natives (Prensky, 2001). Based on these thoughts, the following questions arose: Can the examination of Gardner's Multiple Intelligences be realized in the digital space? Is the EIDW method (Sándor-Schmidt, 2016) applicable in the digital environment? To what extent is the method transferable, and what difficulties arise when implementing it in the digital space?

The goal of the research was, on the one hand, to analyse how the activities related to the seven knowledge areas based on Gardner's eight intelligences of the EIDW method can be transferred into a software solution, and on the other hand, to define the appropriate software and audio-visual elements. As a result, an application was created that runs on a tablet or mobile phone, and it was established that the activities of the EIDW method can be transferred to the digital environment, if not entirely, but to a significant extent. In addition to the implemented application, the research aims to provide a comprehensive concept of the possibilities of examining Multiple Intelligences with software tools.

Keywords: *Multiple Intelligences concept, examination method, digital environment*.

1. Introduction

Thanks to the opportunities provided by technology, the quantity and quality of available knowledge about the complex phenomenon of learning has changed. This change enabled a more thorough understanding of the learning processes, the development of previous theories and practical methods, and the creation of new theories and methods. Digital education already goes beyond the digitalisation of educational methods. It mostly means supplementing, enriching and rethinking the process by involving digital devices. A current task that needs to be solved is how technology can be used to increase the efficiency of learning, support differentiated teaching, increase student persistence, increase attention, and maintain motivation (Molnár, Turcsányi-Szabó, & Kárpáti, 2020).

The environment where children play and study have also been transformed. The accessibility of digital devices gives them the opportunity to interact with new, diverse learning environments and other children in a global community (Arnott, 2017). Children are connected to technology from birth, thereby acquiring skills that allow them to easily transition and move between the real and virtual worlds (Marsh, Plowman, Yamada-Rice, Bishop, & Scott, 2016).

2. Objectives

The aim of the research presented here is to implement the existing, validated "Everyone is Intelligent in Different Ways" kindergarten education method (Sándor-Schmidt, 2019; 2022) into the digital environment. This method is used for the examination and development of Gardner's intelligences in a kindergarten environment. Our goal is to present a new perspective in the investigation of Gardner's intelligences in early childhood in relation to the digital space.

3. Theoretical framework

Gardner's (1983) theory of Multiple Intelligences breaks with the singularist notion that there is a general intelligence, and that the g-factor, which is at the top of the hierarchy of partial abilities, may define all our intellectual abilities (Dezső, 2012; 2015; 2020). Gardner uses the concept of intelligence in the plural, as he distinguishes between linguistic, logical-mathematical, spatial, musical, bodily-kinesthetic, interpersonal, intrapersonal, and naturalistic intelligences as eight independent units. In his perception of the intelligences he describes, each person reaches a certain level, the differences may be traced exclusively in the extent and pattern of the levels (Gardner, 2009; Dezső, 2015; Dezső, 2021).

4. Method

The "Everyone is Intelligent in Different Ways" (EIDW) method created by Barbara Sándor-Schmidt (Sándor-Schmidt, 2016), is an independent adaptation of the Project Spektrum kindergarten education methodology based on Multiple Intelligences (Gardner, 1983) and Nonuniversal Development (Feldman, 1980) theory. According to the Project Spectrum approach, every child has a unique and individually identifiable intelligence profile. By using these profiles, we can develop individualized educational programs for the children (Gardner, Feldman, & Krechevsky, 1998).

The EIDW method is associated with seven domains of knowledge. These are language, math, music, art, social understanding, science, and movement. The domains of knowledge are closely related to the eight intelligences formulated by Gardner. The domains of knowledge and intelligences are connected to each other as follows: the movement domain of knowledge is connected to bodily-kinesthetic intelligence, language is for linguistic intelligence, math is for logical-mathematical intelligence, science is for naturalistic intelligence, social understanding is for intrapersonal and interpersonal intelligence, art is for spatial intelligence, and music is for musical intelligence (Gardner, Feldman, & Krechevsky, 1998; Sándor-Schmidt, 2019).

Different activities belong to these domains of knowledge. The activities focus on the development of children's personalities, taking into account differentiation and diversity. The activities of the EIDW method include predefined game accessories, methodological procedures, game descriptions, and measurement and evaluation strategies, based on which the activities are performed (Sándor-Schmidt, 2022). The making of the game equipment is a complex and time-consuming task, as the accessories are not commercially available, and in many cases, they must be modified to the given test group. During the examination transporting and taking care of the equipment is also challenging.

5. Digitalisation

The idea of the digitalisation of the EIDW method occurred because we wanted to keep up with the trends of the time and create a solution that is simple, easy to use, durable, affordable, compact and available for everyone. The process of the digitalisation started with the analysis of the EIDW's activities, game descriptions and methodological procedures, in order to determine which methods and techniques can be transferred to the digital environment, and what is necessary to implement a software solution. We also conducted research on which mobile devices are the most suitable for the investigation in the early childhood.

Children are attracted to using tablets because the screen size, which is smaller than a PC and larger than a smartphone, the portability, ease of use, and multifunctionality (Chaudron S. , 2015). Aziz's (2013) study reveals that at the age of 2, children still struggle to perform multi-touch gestures (flick, slide, drag and drop, rotate, pinch and spread). Similar problems also occur during multi-touch rotations, pinches and spreads in case of 3-year-old children. The background of all this is the development of their fine motor skills, which is still in the early stages of learning at this age. However, children between the ages of 4 and 12 successfully perform all 7 major finger gestures such as tap, drag/slide, free rotate, drag and drop, pinch, flick and spread (Aziz, 2013). Currently, we would like to examine the pre-kindergarten (4-5 years old) and kindergarten (5-6 years old) groups. Considering the above, we concluded that the tablet is the most suitable mobile device for using the application and examining this age groups.

After the analysis of the feasibility, the functions of the software were determined. Transferring the activities to the digital space consisted of describing how the application works, creating the application's media elements, and designing the look of the user interface.

Among the activities of the EIDW method, we considered the activities that examine logical-mathematical, naturalistic, musical, linguistic and spatial intelligences to be easier to adapt to the digital space, so we focused on these and transferred eleven games into the application. The activity examining inter- and intrapersonal intelligences was transferred to the digital environment during a previous research, therefore this will not be detailed here (Sándor-Schmidt & Ábrahám, 2021). The activities that are examining the bodily-kinesthetic intelligence will be implemented later, because they are more complex and require further research due to their physical nature.

Logical-mathematical intelligence is examined with the *Dinosaur* and *Bus* games. These activities are used to test numerical conceptual understanding, counting skills, as well as rule-conscious and task-oriented behaviour, and to explore strategic thinking. The *Reporter* and *Storyboard* games are used to investigate linguistic intelligence. Language functions, the ability to narrate, and the ability to manage information play an important role in these games. Activities belonging to naturalistic intelligence are the *Treasure Hunt* and *Swim or Sink* games. These activities are designed to explore the ability to make logical conclusions. When examining musical intelligence, the focus is mainly on vocal-musical activity. Examining this intelligence includes the *Melody Recognition*, *Listen and Match*, *Error Recognition* and *Play and Match* activities. In order to examine spatial intelligence, a portfolio of artworks created by children has to be assessed during the original activity. During the evaluation, the quality of the spatial integration, the quality of the work, the level of recognition and the artistic value must be taken into account. Also, the placement of objects and people in the pictures plays an important role. (Sándor-Schmidt, 2022) In the digital implementation of this activity, we created the *Colour and Place* game, which is a digital colouring book. Children have to colour the included figures and then place them in a picture.

5.1. Operation of the application

Like the original EIDW method activities, one game lasts 10-15 minutes. The games can be played in two difficulty levels (pre-kindergarten and kindergarten mode). The examiner who has to be present throughout the whole examination, explains the tasks and how to use the application at the beginning of the activity and follows the child's activities. The application contains animated, movable and sound-emitting graphic elements, videos, images, and the simulated physics of certain objects. Consequently, the examined child engages in various interactions (tap, flick, drag and drop, rotate) with the application.

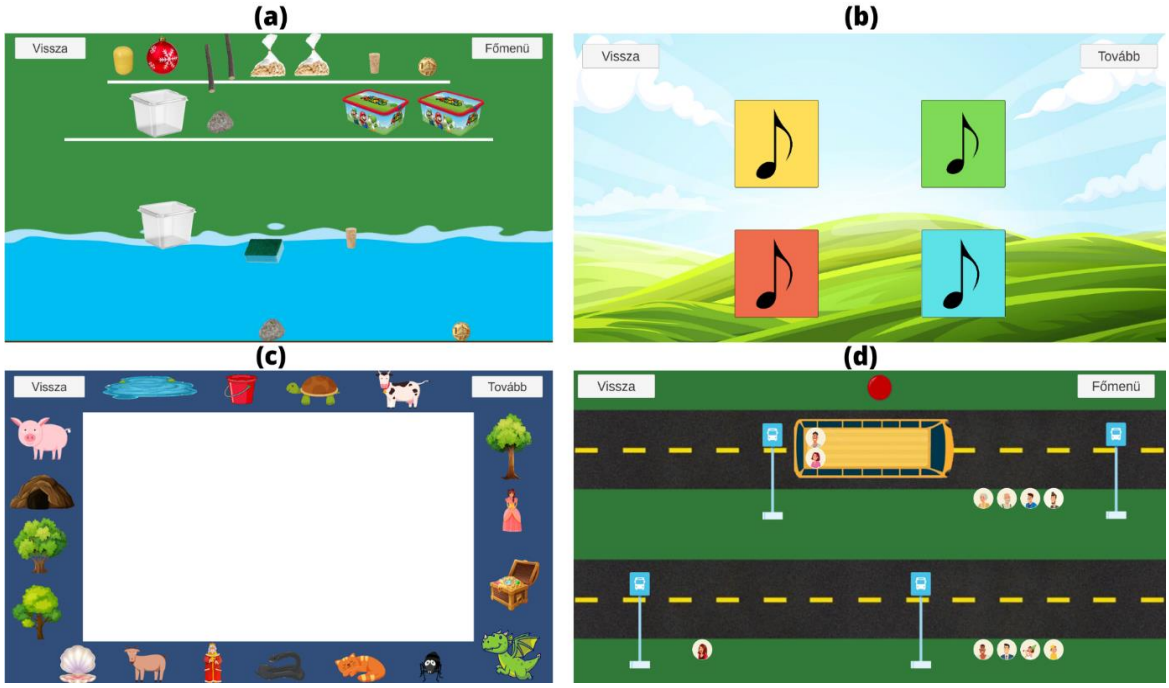
Some examples of the techniques used in the application and their interactions: During the *Swim or Sink* game (see Figure 1a), which examines natural intelligence, kindergartens can drop various objects into water, predicting beforehand whether the given item will float or sink. In the application, objects sink or float on water in the same way as in real life. In this game, the technique of drag and drop and the simulated physics of objects gave the possibility to adapt the original activity. There are four game activities to explore musical intelligence (see Figure 1b). In these activities, tapping on elements, moving them, dragging them on top of each other, and playing sounds are the dominant techniques. In these games, children have to recognize and match individual sounds and familiar melodies. We also used the drag and drop technique in the *Storyboard* activity (see Figure 1c) that examines linguistic intelligence. In this activity, different figures have to be placed on the storyboard, from which the kindergartners have to create a fictional story. In the *Bus* game (see Figure 1d), that examines logical-mathematical intelligence, the bus transports passengers from one stop to another, which is realized using pre-animated technology.

We are aware that it is not possible to fully transfer the games to the digital space, however, we have kept the originality of the game descriptions and game equipment in the application. Based on experience, the EIDW method is applicable in the digital environment, and the majority of the game activities can be transferred to the digital space. As a next step, we would like to investigate the differences between the examinations carried out in physical and the digital space.

6. Conclusions

Examining Multiple Intelligences in the digital space provides a safe and neutral environment. The application doesn't judge, doesn't get tired and doesn't lose patience. The application performs the repetitive exercises in the same way and as many times as necessary, thus allowing the child to progress at his own pace. In addition to all this, taking advantage of the possibilities of the digital space can also help to minimize the subjective nature of the examination. Further advantages of the application are that it is compact, simple, easy to use, portable and accessible for everyone. Instead of the time-consuming development of complex game equipment, only one application needs to be downloaded to the tablet. As a further development, we would also like to digitalise the process of the evaluation.

Figure 1. The graphical user interface of the application. (a) Swim or Sink game, (b) Error Recognition game, (c) Storyboard game, (d) Bus game.



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