DIGITAL EQUALITY: ROBOT-ASSISTED THERAPIES IN THE DEVELOPMENT OF CHILDREN WITH SPECIAL EDUCATIONAL NEEDS

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Abstract

The free Robooks site is a breakthrough to help children with special education needs develop basic skills and competences. This programme offers the educational floor robot as a motivating tool to be introduced and used to develop children aged 3-10 years old as effectively as possible. Robot-assisted therapies develop children's creative, critical, algorithmic thinking; and analytical-synthesising skills. In addition to digital skills, flexibility, autonomy and problem-solving competences contribute to the effective development and inclusion of children with special educational needs, and thus to their social integration.

Keywords: special education needs, robot-assisted therapy
Discipline: pedagogy

Absztrakt

DIGITÁLIS EGYENLŐSÉG: ROBOTASSZISZTÁLT TERÁPIÁK A SAJÁTOS NEVELÉSI IGÉNYŰ GYERMEKEK FEJLESZTÉSÉBEN

Az ingyenes Robooks oldal áttörést jelent a sajátos nevelési igényű gyermekek alapvető készségek és kompetenciák fejlesztésének segítésében. A program az oktató padlórobot használatát, mint motiváló eszközt kínálja, a 3-10 éves korú gyermekek minél hatékonyabb fejlesztésére. A robotasszisztált terápiák fejlesztik a gyermekek kreatív, kritikus és algoritmikus gondolkodását; valamint analitikus-szintetizáló készségeit. A digitális készségek mellett a rugalmasság, az autonómia és a problémamegoldó kompetenciák is hozzájárulnak a sajátos nevelési igényű gyermekek hatékony fejlődéséhez és befogadásához, így ezáltal társadalmi integrációjukhoz.

Kulcsszavak: sajátos nevelési igény, robotasszisztált terápia
Diszciplína: pedagógia

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The emergence of the World Wide Web and the spread of ICT tools have brought about fundamental and irreversible chan-ges in the world of teaching and learning (Szűts 2020a). The elements of digital pedagogy support the catching up of students, regardless of age, gender, space, time and social class, even if differentiated (Szűts, 2020b). The Erasmus+ Public Education program (2020-1-HU01-KA-201-078731) – a partnership between the Miracle Castle Foundation (Csodavár Alapítvány), the Caritas Organization of the Diocese of Satu Mare in Romania (Szatmári Egyházmegyei Caritas Szervezet) and the Talentum Foundation (Talentum Alapítvány) in Košice – aims to support the dissemination of robot-assisted therapies and to familiarise as many professionals as possible with and use this tool.

The alpha generation is naturally con-nected to the digital world. The free RoBooks site – downloadable in four languages (Hungarian, Romanian, Slovak, English) – is a breakthrough to help children with special education needs develop basic skills and competences. RoBooks robot assisted therapy can also be used for children with typical development to improve a skill or subskill or even play. This programme offers the educational floor robot as a technical „toy", a motivating tool to be introduced and used to develop children aged 3-10 years old as effectively as possible. This initiative inspires development teachers, speech and language therapists, primary school and kindergarten teachers to innovate their work.

The Robooks site helps them to create a collection of guides and games that can make their development more varied and motivating. It is also important to emphasise that robot programming is not an end but a means to development. The robot is not a substitute for traditional developmental methods, but it is an effective aid to complement their therapeutic effects (Manual for robot-assisted therapies, 2020).

Meaning of special education needs

According to UNESCO's International Standard Classification, special needs education aims to facilitate the learning of individuals who, for a wide variety of reasons, require additional support and adaptive pedagogical methods in order to participate and meet learning objectives in an educational programme. Reasons may include (but are not limited to) disadvantages in physical, behavioural, intellectual, emotional and social capacities. Educational programmes in special needs education may follow a similar curriculum as that offered in the parallel regular education system, however they take in-

dividuals' particular needs into account by providing specific resources (e.g. specially trained personnel, equipment, or space) and, if appropriate, modified educational content or learning objectives. These programmes can be offered for individual students within already existing educational programmes, or be offered as a separate class in the same or separate educational institutions (UNESCO, 2011).

In Hungary, the Act on National Public Education defines the following groups of children and pupils needing special support within the category of children and students requiring special attention (2011. CXC. Law on National Public Education):

- children, pupils with special education needs (in Hungarian SNI: sajátos nevelési igény),
- children, pupils social, learning and behavioural difficulties (in Hungarian BTMN: beilleszkedési, tanulási, magatartási nehézség).

Children/pupils with special educational needs: children/pupils in need of special support who fall into one of the following eight categories based on expert opinion (4 § 25. 2011. CXC. Law on National Public Education):

- children/pupils with a physical disability
- children/pupils with (visual, auditory) sensory impairment
- children/pupils with intellectual disabilities
- children/pupils with speech impairment
- children/pupils with multiple impairments
- children/pupils with autism spectrum disorder
- children/pupils with other psychological developmental disorders
- children/pupils with behavioural regulation disorder

Children/pupils with social, learning and behavioural difficulties are children and pupils needing special support who, based on the expert opinion of the expert committee significantly underperform compared to their age, or have social relationship problems or learning and/or behaviour regulation deficiencies, or their integration into the community or personal development is impeded or shows irregularities but do not qualify as students with special education needs (European Commission, 2023).

The current study does not distinguish between children with special educational needs and children with social, learning and behavioural difficulties, according to UNESCO's International Standard Classification principles thus it interprets both Hungarian classifications as special educational needs.

Floor robots in the education of children with SEN (special education needs)

Playful teaching and activities embedded in action are the primary aspects of the development of children with SEN. In the design of developmental tasks, we can apply the principle of progress in small steps. The cute little robot figure will make children more enthusiastic about learning and can be easily

involved in repetitive tasks. As robots usually have several possible solutions, they allow children to use their imagination and develop creativity. Using robots requires concentration, thus increasing attention. Decision-making in solving tasks also provides a platform for learning independence. Their use creates new pedagogical situations. Using floor robots can develop a range of skills through algorithmic thinking (Mező és Szabóné Burik, 2021). Logical thinking, spatial and temporal orientation, observation skills, working memory, auditory and visual attention can all be integrated in a playful framework. When planning the execution of tasks, the development of the ability to analyse and synthesise also appears as a goal and a tool, since when planning the route, the child tries to see, follow and constantly check the succession of steps. The development of fine motor skills can also be facilitated by pressing the buttons on the floor robot. Last but not least, its use also has an impact on social behaviour, and in the context of small group development, the use of the device encourages cooperation (Manual for robot-assisted therapies, 2020).

Skills development

Skills development is an essential element of an effective learning process. The development of cognitive abilities determines the process of problem solving, the recognition of relationships and the mechanisms of thinking (Mező & Mező, 2020; Mező, 2023). Successful skill development requires a child's motivation, a variety of visual aids, the use of playful tasks and activity-based methods. In our developments, we must strive to respect the principle of complexity – the combined impact of several functions.

What skills can we use floor robots to develop?

Floor robots can also be used in integration and segregation, because the developmental teacher chooses and elaborates the task according to the child's abilities.

Developing spatial orientation: poorly developing motor skills affect the development of spatial orientation (Herendiné, 2007). Its consequences in the process of spatial orientation are in the areas of perception and execution. If the ability to solve spatial tasks is absent or inaccurate, spatial images and concepts become unformed. A lack of spatial memory, imagination, thinking and verbal communication skills in the areas of spatial orientation may result in inadequate functioning in several learning areas. When developing with robots, we reinforce the concepts of infront, behind, right and left. Spatial memory and directional orientation are improved. We influence algorithmic thinking and logical thinking.

Developing attention: attention, memory, imagination and thinking work together, supporting each other. If we want to learn something, we use these skills simultaneously. The effectiveness of teaching/learning is fundamentally determined by the level of attentional functioning. When developing with robots, we reinforce *visual attention*. *Auditory attention* is improved. Increase attention span,

attention duration, ability to focus. We affect memory, algorithmic thinking and logical thinking (Balogh, 1992).

Problem-solving thinking: problem-solving as applied thinking is a complex cognitive process in which critical thinking to apply existing knowledge and creative thinking to acquire new knowledge play a specific role (Mező, 2022, Mező & Mező, 2011). Development with robots gives children direct experience through *creative and critical thinking*. It is an effective way to develop observation skills. Improves the ability to analyse and synthesise. Attention, memory, algorithmic thinking and logical reasoning are influenced.

Developing communication skills: communication skills are a key factor in school achievement (Sugárné, 2001). They play an important role in learning, but they are also present in our everyday lives and activities. Developing with robots expands a child's vocabulary. It improves their acoustic listening skills and speech comprehension. We have an impact on their ability to communicate, to inform and to think.

Developing numeracy skills: elementary numeracy is one of the most fundamental skills of pre-primary and primary school and plays an important role in both general intellectual development and learning mathematics at school (Herendiné, 2007). Numeracy is the result of a complex thinking process. The child needs to pay attention to the number, operation and order. They need to learn to transform the number they hear or see, to remember sequences of numbers. The development of counting skills itself is a long process that takes years. Just as counting itself is a complex process, its development will be effective if it is carried out through as many channels as possible. Development with robots reinforces number concepts and quantity concepts. Spatial orientation, attention and memory are improved. We influence algorithmic thinking and logical thinking.

Whichever area of development you look at, generally speaking, development embedded in a playful situation increases a child's confidence and belief in their own success and achievement. It improves their willingness to perform tasks and their level of motivation. As a result of the work with the robot, children gradually become able to correct their own thought processes during the sessions. For children, through developmental tasks, teachers can provide reinforcement in their skill areas and allow them to experience play as a pleasure/success experience (Manual for robot-assisted therapies, 2020).

What kind of teacher training is required to use floor robots?

The use of floor robots does not require any IT knowledge or IT qualifications.

Expectations for professionals using floor robots:

- having a positive attitude towards ICT tools;
- being receptive to innovative tools;
- having an open-minded pedagogical approach;
- being open to collaborative forms of work based on children's activity/creativity.

Technical requirements

Commercially available floor robots work on a similar principle. They are colourful, easy to use and attractive to children. Programming is done using clearly visible control buttons. The robots can move on any flat surface. They usually move in steps of 15 cm and can turn 90 degrees or 45 degrees.

The robots differ in the number of steps they can be programmed to perform, and in the power supply – most are battery-powered, but some are battery-operated. The two most popular educational robots are Bee Bot and Blue Bot (Manual for robot-assisted therapies, 2020).

Designing the content architecture

A child develops well when he or she gets the developmental influences he or she needs. So design is just as important in the use of educational robots as in other developments. It is essential to take into account the age specificity, the individual's level of knowledge, skills and abilities, as well as the individual's rate of progress when designing tasks. In order to apply therapy, we need to take a complex approach to the area or areas of development we want to address. The complexity of the tasks that can be performed with floor robots can be both an advantage and a disadvantage. It can be an advantage to strengthen and develop several skills with one task. On the other hand, it can be a disadvantage if the task does not focus enough on the area that is primarily to be developed. If you can, it's a good idea to design a series of tasks, from the simple to the more complex. The simplicity of the tasks is represented by the straight track (the robot can move forward and backward in only one line), and the simple placement of images and tasks on the multisquare track, accessible in one or two steps (Manual for robot-assisted thera-pies, 2020).

Types of floor robot toys

- *Matching* – matching pair of images according to a specific criterion.
- *Collector* – collecting pictures belonging to a specific category or concept.
- *Cuckoo's egg* – finding the picture which does not match the given criterion.
- *Seeker* – a more difficult version of the matching game, where pictures on the board are matched with sound strings
- *Sequencing* - using a sequence of pictures of one or more events/stories, they must be collected in the correct chronological order.
- *Matchmaking* – using colour dice or traditional dotted dice, the aim is to move the robot to a specific target square by moving along a route you have created, according to the dice colour or amount.
- *Placer (or pusher)* – placing a pusher on the robot; the task is to sort and place objects in different places according to the aim of the game.
- *Letter finder, word finder, word puzzle* – collecting letters, syllables, words, either by visual matching (see pairing game), by sound (find the letter/word you hear) or

by word analysis (walk the track looking for the letters that make up a word).

- *Puzzle* – collecting pictures according to a given criterion in order to form a whole picture (Manual for robot-assisted therapies, 2020).

General pedagogical and methodological principles

As with any learning or development process, it is essential to consider and adhere to some pedagogical and didactic principles during robot-assisted therapy sessions.

The principle of personalisation: taking account of individual specificities

When designing development sessions, choose tools that capture and hold the child's attention, based on what they like and are interested in (Mező, 2017). De-pending on the child's abilities and inte-rests, we can choose objects or pictures or both, use a slide that can be fitted to the robot or even a pen holder (for example, for a graphomotor task). In the case of children with disabilities, a mini camera can be attached to the robot, which can be coordinated with a computer to display the robot's progress and movements on the monitor, so that children can monitor the progress of the task. What is close to the child and what he or she enjoys doing will definitely increase motivation and maintain attention.

The amount of new knowledge or skills to be developed should not depend on how much time we can allocate to the activity, but on how long the child can pay attention and cooperate. Research has shown that learning with a positive emotional charge is more effective, and that the acquisition of knowledge is faster, more accurate and longer lasting (Estefánné Varga and Dávid, 2013).

The principle of diversity

In the planned robot game, make sure to give the child images and sequences of images that are accompanied by experiences the child has already had, which help to increase the rate and rhythm of acquisition. It is essential to look for such connections, or to provide opportunities for the knowledge and skills to be acquired in the course of the activity to be linked not only to the visual and auditory stimuli received during the robot game, but also to other sensory experiences and, if possible, to manipulative and motor experiences. These can be integrated into other activities of the development session, contributing to a multisensory learning process.

Use a wide variety of toys, creating a series of ever-expanding pictures, paying attention to what the child already knows and what he or she still needs to practise. These known and practised concepts are constantly being added to those not yet known. New things can arouse his curio-sity and interest and keep him motivated to play together.

Principle of gradualness

When we talk about a development or learning process, it is essential to respect the principle of gradualness (Mező & Mező, 2020). It is important to strike a balance between the level of development of the child, the amount of knowledge or skills to be acquired and the specificity of the individual.

According to experts, what interests and engages the child, what he or she likes to play with, is an accurate indicator of the stage of development and what he or she still needs to practise. If a child gets bored with a toy, it is usually because it no longer provides the type or amount of stimulation that he or she needs at the right time for his or her developmental stage. There are also stages of mastery in the use and programming of floor robots. Care should therefore be taken to ensure that, although he may be interested in the tool, he does not lose interest in the activity because of the volume of tasks and the initial programming difficulties. When developing skills and abilities, pay attention to the stages of perception, recognition and diversification.

Active learning or the use of activity-based methods

The idea is that the child should be as active as possible, with as little help or guidance as possible in the robot activity. A motivated child will mobilise all his/her knowledge, skills and abilities to achieve the goal. This increases the rate of acquisition of new skills, the quality of the process and thus also creates another source of motivation for the child through his or her experience of success (Manual for robot-assisted therapies, 2020).

Summary

A major challenge in today's education is how teachers can maintain the attention, interest and motivation of students over the long term, while achieving the objectives of the sessions. Motivation will be a key driver for attracting and retaining students' attention; experiential learning will be a tool for catching up. By working with robots, they will actively learn the different subject content in an action-based way and develop their different skills through developmental tasks with the robots. Robot-assisted therapies develop children's creative, critical and algorithmic thinking; and analytical-synthesising skills. In addition to digital skills, fle-xibility, autonomy and problem-solving competences contribute to the effective development and inclusion of children with special educational needs, and thus to their social integration.

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