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# THE ROLE OF ROBOTICS TECHNOLOGIES IN PRESCHOOL MOTHER TONGUE DEVELOPMENT OF CHILDREN WITH SPECIAL NEEDS

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**ABSTRACT**

Mother tongue education follows a distinct set of principles, with pivotal considerations including the individual's age and their mental, biological, and linguistic (healthy) development. It is noteworthy that robotics technology plays a crucial role in enhancing the development, creativity, and technical and social problem-solving skills of students with special needs. Despite the revolutionary nature of employing robots, it remains an evolving field. The central inquiry in this study is: What enhancements do the increasingly technologized educational systems, particularly those incorporating robotics, bring to children with special needs in the 21st century? Additionally, what possibilities does robotized mother tongue education present for the advancement of these children? This study contends that, notwithstanding its costliness and associated risks, such as the potential for fostering addiction, robotic materials play a supportive role in the mother tongue acquisition processes of individuals with special needs. This support is facilitated through diverse activities, including oral reading, audio-visual assistance, and mechanisms involving question-answer or action-command. It is noteworthy that this document analysis-based study aims to enrich the literature, particularly in areas where the subject of mother tongue development in children with special needs through robotic applications has been relatively unexplored.

**Keywords:** Native language learning, children with special needs, robotic technologies, education, language, special education.

## 1. INTRODUCTION

In the contemporary landscape, education undergoes transformation through the infusion of Industry 4.0 technologies, leading to enriched methods and contents enhanced by innovative techniques. Among these, robots are emerging prominently as a contemporary teaching technology, finding increased integration into learning environments. Beyond their role in providing engaging learning experiences for students, these tools demonstrate innovative and facilitative potential, particularly benefiting individuals with special needs. Concurrently, scientific research on topics related to the

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mother tongue, including language development, individual language acquisition, biological and psychological factors influencing language learning, and cultural codes of language, is steadily expanding. The acquisition and proficient use of the mother tongue are increasingly acknowledged as integral to achieving success. For individuals with special needs, who exhibit distinct differences from their peers, the development of language skills—enabling them to speak, express themselves, and communicate—is crucial. Addressing the question of how mother tongue acquisition should occur for children with special needs, this prompts an exploration of how teacher robots can be leveraged to optimize mother tongue education for this specific group. Notably, recent literature witnesses a growing number of studies that consider the use of robotics technology, depending on accessibility, as either a teaching tool or a supportive element in special education. However, there remains a recognized need for more in-depth research in this domain (Karal et al., 2023, pp. 170-183; Alemi & Bahramipur, 2019). A detailed examination of robots in education in general and language and mother tongue education in particular would be valuable for educators, parents and other stakeholders involved in special education (Honig & Oron-Gilad, 2018, pp. 1-21; Hemminki & Erkinheimo-Kyllonen, 2017).

In the context of this article, it is essential to clarify a few definitions. Special education refers to an educational approach aimed at preventing the disabilities of children—whether mental, physical, sensory, or social—from evolving into impediments. It employs specific materials and follows distinct rules tailored to different groups within this spectrum. Within this framework, language development assumes paramount importance as language serves as a crucial tool facilitating human connection. Notably, there are eight fundamental groups classified under special needs: individuals with visual impairment, hearing impairment, orthopedic impairment, and chronic illness, autism spectrum disorder, risk of attention deficit and hyperactivity disorder, intellectual disability, risk of speech and language disorder, and giftedness.

The preschool, or early childhood, is a developmental phase spanning from birth to the age of six, marked by rapid advancements in personality, cognition, language, social-emotional skills, and physical capabilities. Language development within this period encompasses the acquisition of words, symbols, and numbers, their storage in memory, and the utilization of language in accordance with established rules. The term "mother tongue" is employed to signify the original or source language.

The study of language is approached from various perspectives, including linguistics, sociology of language, language psychology, anthropology, sociology, medicine, philosophy, and logic. This multidisciplinary exploration reflects the complexity and richness of language as a subject of inquiry (Harley, 2001, pp. 20-22).

## 2. RESEARCH METHOD

The main research method in this study is document analysis. Both written and visual scientific sources were scanned, the internet was actively utilized, YouTube content was watched, and relevant secondary sources were searched in English, German and Turkish. Since there are limitations in some specific scopes in Turkish publications, sometimes the publications of some rehabilitation centers were used.

Within the literature, a noticeable trend has emerged wherein studies exploring the use of robots for individuals without special needs have proliferated, propelled by advancing technology and the evolving landscape of language teaching methods. Notably, however, a gap exists in the body of

research concerning the potential contributions of robots to the mother tongue development of children with special needs. There is a distinct lack of studies examining how robots can assist children with specific types of disabilities in their mother tongue development. An additional observation is the prevalence of studies focusing on the utilization of robots in foreign language education. This gap underscores the need for dedicated exploration into the role of robots in fostering the mother tongue development of children with special needs, a critical area that remains underexplored in the current literature.

It is the mother tongue that will enable individuals with special needs to open up to the outside world. Therefore, the mother tongue-specific conditions expected to be developed in such groups are of critical importance. Since the preschool period is especially important for laying the foundations of mother tongue, this group was chosen as the target group of the study.

The unique aspect of this study compared to other studies is the holistic approach to the issue of robots in special education and the specialization of mother tongue teaching. It is observed that when it comes to the function of robots in language education, the literature mostly focuses on the functions of robots in teaching foreign languages and the functions of robots in teaching English.

In the context of the content structuring of the study; in the theoretical framework, firstly, the developmental characteristics of language and mother tongue in children and the real-possible position of robotic technology in language development in special groups are explained. In the third section, the place of robotic technology in education and special education is analyzed. In the fourth section, robotics technology in the mother tongue development of special groups is analyzed and in the conclusion, the subject is presented holistically and various findings are reached.

In the context of the role of robots in special education and mother tongue Turkish language education in Turkey, it is essential to acknowledge that, despite some incremental strides, the utilization of robotic technology, in general, remains notably insufficient. While certain studies have been conducted aiming to yield cognitive and social benefits to students through the application of robotics technology, there is a marked scarcity of robot-assisted education initiatives tailored specifically for students in need of special education. The current landscape underscores the importance of vigilantly tracking advancements in robotics and fostering collaboration to seamlessly integrate globally utilized educational robotics activities into the Turkish educational framework. This endeavor necessitates support from various sectors, including the business realm, politics, and academia, to contribute to essential research and development initiatives and broaden the scope of this relatively limited field. Ultimately, there exists an industry specifically tailored for children with special needs, emphasizing the significance of enhancing and expanding efforts in this critical domain.

## 3. LITERATURE REVIEW: CHARACTERISTICS OF LANGUAGE- MOTHER TONGUE ACQUISITION PROCESSES IN PRESCHOOL CHILDREN WITH SPECIAL NEEDS AND RELATED FACTORS

The significance of speech and language development in children is underscored by the escalating prevalence of delays in this domain. Interaction emerges as a cornerstone for fostering a healthy language development process. In a typical speaker, the essential competencies encompass biological competence, cognitive-linguistic competence, sensory-motor integration, auditory perceptual integration, and a supportive social environment.

In the process of speaking, mental preparation follows motor preparation, forming a sequence where listening precedes speaking, understanding hinges on listening, and articulation relies on comprehension and conversion into words. The child's communication extends to both family and the broader environment. Through robust interaction, stimuli in the environment are perceived, and novel connections are forged. In instances where the need for stimuli is inadequately met, delays, deficiencies, and hereditary impediments can impede the child's language development.

The critical window for healthy language acquisition spans from ages 3 to 6, during which an individual's phonological and syntactic development reaches its zenith within the initial five years following birth. Consequently, both preschool education and specialized interventions during this formative period assume vital importance, contributing significantly to a child's linguistic and cognitive development.

**Table 1**

*Language Development Stages**

| Pre-speech Period | Speech Period |
|---|---|
| Newborn period (crying) | Sound, word period (9-12 months) |
| Cooing period (2-3 months) | Single word period (12-18 months) |
| Mumbling period (3-6 months) | Period of two-word expressions (18-24 months) |
| Period of repetition of humming (6-9 months) | Period of expressions with three or more words (2-3 years) |
| | Period of speaking with grammatical rules (3-6 years) |

Source: Atay (2009, p. 176)

Language development encompasses the holistic evolution of body, mind, and intellect. "Language, an inherent capability, is universally inherent in children, facilitating the acquisition of any language. The epoch of most rapid language development is recognized as the preschool phase. Moreover, the trajectory of language development intersects with various facets of overall growth. For instance, a child immersed in a social milieu tends to manifest a more expansive vocabulary and adept language usage. Physical development involves refining motor skills, which consequently impacts language proficiency and the accurate articulation of sounds. Furthermore, a serene and emotionally stable environment fosters positive language development. Notably, children grappling with disabilities often exhibit delays or impediments in language acquisition" (Arı, 2015, p. 15). Rectifying errors acquired during the preschool period poses a formidable challenge.

In the context of language development, it is necessary to combine many skills such as understanding the language, using the sounds in the right places, using affixes, and using the language appropriately with the environment. For an effective language development in children, the following skills should be developed:

- To be strong enough to sound out meaningful words,
- Making associations between things, situations and their meanings,
- To know the meaning of the words formed and to use them appropriately,
- To know and use the suffixes added to words,
- To be able to form sentences appropriate to the desired expressions (Yavuz, 1991, pp. 68-69).

There are different views in the literature on language development. According to the first one, the behaviorist view, "when babies make sounds similar to daily spoken language, they are usually rewarded by the adults around them, and this reward is a reinforcer. The more the infant's sounds are reinforced, the more they are repeated by the infant, and the frequency of use of sounds that are not reinforced decreases. [...] The second and most popular view of language development is the one that attributes language development to biological foundations. The pioneers of this view are linguists such as Chomsky and Lennenberg. "[According to this theory], children learn to speak after they reach a certain biological maturity, just as they learn to walk" (Boydak, 2015, pp. 25-26). In sum, the development of the ability to learn in mental and biological contexts is a necessary element.

During the preschool years, children adeptly shape expressions based on the interlocutor's knowledge and interest levels. They discern the appropriate content and quantity for effective communication. By ages 2-3, they engage in explaining, discussing, and sharing jokes.

Language acquisition hinges on varied learning techniques. Individuals utilize strategies like listening, observing, comprehending, interpreting, imitating, memorizing, note-taking, repetitive practices (aloud or in writing), and highlighting key elements for skill development.

Language development serves as a vital mechanism for individuals to engage with their mother tongue. Proficiency in one's mother tongue significantly shapes future experiences and molds identity and character. Through the mother tongue, children gain insights into their environment, society, and the cultural foundations ingrained within it. Disruptions in children's language learning pose challenges in language acquisition, particularly impacting those with special needs, contingent on the nature and severity of their disabilities.

- The following basic objectives can be listed in the teaching of the mother tongue, which is known to develop from the mother's womb:
- To be able to understand what he/she reads completely, without losing the author's message.
- To be able to write down his/her thoughts, feelings, impressions and designs for a specific purpose.
- To be able to listen to speeches on different subjects and perceive them accurately and completely without losing the message and information.
- To be able to transform their thoughts, feelings, ideas and impressions into words in a beautiful, accurate and effective way. (Özdemir, 1983, p. 25).

Approximately 10% to 12% of a country's population consists of individuals with special needs (Baykoç Dönmez, 2010, p. 338). It is anticipated that individuals with special needs would exhibit variations in behavioral characteristics and teaching-learning processes, both compared to others and

within their own experiences. These differences may manifest in physical dimensions, mental aspects, sensory functions like sight and hearing, chronic illnesses, as well as speech and language development challenges. (Erol & İlhan Ildız, 2020, p. 561) Early education endeavors to intervene proactively in the cognitive, socio-emotional, psychomotor, self-care, and language development of children whose development is at risk during the initial stages. Through systematic teaching, these children can acquire skills akin to their peers. (Pera, 2018)

In the literature, key concerns related to identifying and ameliorating language issues in children with special needs, particularly in the context of utilizing robotic technology, are as follows:

Children diagnosed with autism spectrum disorder often face challenges in social interaction, necessitating engagement in activities with close friends. Language development in this group may exhibit characteristics such as complete silence, limited use of one or two words, nonsensical speech with numerous words, repetitive speech, confusion with pronouns, difficulty comprehending spoken language, grammatical disorders, and pronunciation difficulties. To address these challenges, incorporating frequent repetitions in their activities and focusing on acquiring new words based on the sounds they can produce becomes imperative (Turkish Ministy of National Education, 2013, p. 97). Notably, children with autism spectrum disorder represent a demographic where robotics finds extensive application in special education (Robins et al., 2005, pp. 105-120).

Apologies for the oversight. Here's a more concise version:

Children with intellectual disabilities experience delayed language development, similar to their typically developing peers. Tailoring learning to individual pacing, incorporating frequent repetition, using concrete materials, and fostering interaction are vital for these groups, with the potential integration of robotic materials (Panek & Jungers, 2008, pp. 125-132). Grammar proves to be their most challenging aspect (Gökkuşağı Eğitim Merkezi, 2022). Patience in listening to their speech, explaining unfamiliar words and figurative expressions, is essential support. Down syndrome, a leading cause of slow learning and mental retardation, imposes physical and cognitive barriers on these children. Robots effectively engage their interest and enhance social communication skills (Bargagna et al., 2019, pp. 315- 323).

Leveraging technology in the education of visually impaired individuals proves highly beneficial. Audio screen reader programs and applications on smartphones and tablets significantly ease their lives. These tools enable them to read texts in various formats, such as Word and PDF, effectively use the internet, complete assignments, and access information through applications like dictionaries and spelling guides. In academic learning, listening and Braille serve as valuable resources for visually impaired individuals (Boydak, 2015, p. 134).

Robotic technology holds substantial importance for children with hearing impairment, especially those relying on hearing aids in their education. Creating visual materials and fostering natural living environments are crucial for their learning. Establishing eye contact, providing explanations when needed, and incorporating rhythmic repetitions aligned with the child's language level (syllable, word, two, three, or four words) are essential strategies. During activities, encouraging the child to comprehend and express themselves, completing incomplete expressions, and reinforcing correct pronunciation through repetition, such as when a child says "eeuu" for "apple," where the teacher guides the correct word, play pivotal roles (Turkish Ministy of National Education, 2013, pp. 92-93).

Robotics plays a vital role in addressing the specific challenges and developmental needs of four distinct groups. For children with orthopedic disabilities, language and communication issues,

stemming from physical limitations, can be tackled by involving a speech and language therapist. Implementing the therapist's recommendations is crucial, and teaching the child to repeat unclear expressions enhances communication when words are not initially understood (Turkish Ministy of National Education, 2013, p. 94). In aiding the language development of children with hyperactivity disorder and attention deficit risk, employing simple and clear instructions is recommended. Ensuring eye contact verifies the child's comprehension, and asking for the instruction to be repeated reinforces understanding (Turkish Ministy of National Education, 2013, p. 100). For children at risk of speech and language disorders, speaking slightly slower, promoting attentive listening, and providing modeling for imitation are beneficial. Expanding the child's expressions with additional words, such as turning "cat" into "Yes, little cat" or "The cat is cold," contributes to language development (Turkish Ministy of National Education, 2013, p. 106). While gifted children often exhibit advanced skills in speaking, listening, reading, and writing compared to their peers, it's important to note that individual differences exist, and not all gifted children display all characteristics simultaneously (Davis & Rimm, 2004; Silverman, 2002).

## 4. FINDINGS AND DISCUSSION

### 4.1. The Role Of Robotics Technology In Education And Special Education

Robotics technology aims to strengthen education and even develop systems that can replace humans in some applications. Below, first in education, then in special education, the place of robots, goals-opportunities-risks are examined.

#### 4.1.1. Robot Technology in Education

Robots today are mechanical devices that can interact with their environment and have the ability to perceive, learn, plan and act (Ghallab & Ingrand, 2020). Robots use sensors to detect environmental variables, analyze this information, make decisions, and act on these decisions. Robots have recently been playing a particularly prominent role in education (Belpaeme et al., 2018). It is seen that robots, especially those that focus on social skills, attract student interest and facilitate learning. Robot technologies basically make the following contributions to the field of education (Edwards et al., 2018, pp. 473-480):

- Creative thinking: Robotics enables students to use their imagination to bring their own ideas to life.
- Problem solving: Robotics helps students develop problem-solving skills.
- Adaptation to technology: Robotics helps students understand the basics of technology and adapt to new technologies.

Robots contribute to students' learning through interaction thanks to their body language and multiple interaction capabilities. For example, storytelling robots are shown to be a more suitable platform for interacting and entertaining students in the classroom (Chin et al., 2011). Robots can be important as educational tools, but they need to be programmed correctly to achieve the best results.

Some experts predict that robots will replace teachers by 2027. Others argue that robots will never replace teachers because they only inspire us. Others think that "inspirational robots" are possible and can be adapted to each student's learning style. Here are the potential benefits that robots can bring to education (Ingbae, 2021):

Personalized teaching: For example, a robot can identify a student's strengths and weaknesses and deliver a customized curriculum based on the student's needs.

Overcoming language barriers: For example, a robot can help a student learning English by speaking in the student's native language.

Developing a growth mindset: For example, a robot can encourage a learner to find the solution to a problem and teach them not to give up even if they fail.

**Table 2**

*Roles of a humanoid in education*

| Pre-speech Period | Speech Period |
|---|---|
| Newborn period (crying) | Sound, word period (9-12 months) |
| Cooing period (2-3 months) | Single word period (12-18 months) |
| Mumbling period (3-6 months) | Period of two-word expressions (18-24 months) |
| Period of repetition of humming (6-9 months) | Period of expressions with three or more words (2-3 years) |
| | Period of speaking with grammatical rules (3-6 years) |

Source: Tuna & Tuna (2019, p. 99); Alnajjar et al. (2021).

**Table 3**

*Functions and Teaching Outcomes of Robots*

| ROBOT | EDUCATIONAL OBJECTIVES |
|---|---|
| Repeatability | Attracting Attention |
| Humanoid Appearance | Runs the Foreknowledge |
| Physical Movements | Presents Different Types of Content |
| Interaction | Provides Visual Examples |
| No Need for Humans | Student Centered |
| | Provides Feedback |
| | Provides Association and Transfer |

Source: Chang et al. (2010)

On the other hand, there are also the following concerns about the use of robot teachers: Robots can collect students' personal information and this information can be used for malicious purposes. Again,

robots can negatively affect students' social and emotional development. Finally, robotic applications do not yet have the depth of a human.

### 4.1.2. Robot Technology in Special Education

Special education aims to deliver supportive, accessible, and inclusive education to children with special needs, promoting integration into general education environments. Technology, as highlighted by Karna-Lin et al. (2006, pp. 319-321), provides valuable opportunities for enhancing the motor, academic, and social skills of individuals with special needs. Children, including those with special needs, demonstrate a strong inclination to interact with robots for several reasons (Papakostas et al., 2021). These reasons include perceiving robots as cute toys rather than mere machines, the attention-grabbing childlike appearance of robots with interactive features, the patience of robots in repetitive teaching, and the emotional and behavioral stability exhibited during interactions. The predictable nature of interactions with robots has far-reaching benefits. It reduces stress, boosts enthusiasm in education, addresses shyness, motivation, and self-confidence issues in children, and facilitates prolonged engagement in repetitive exercises.

The integration of robotics technology proves highly advantageous in fostering confidence, enriching learning experiences, and promoting socialization for individuals with mental and physical disabilities, as well as those on the autism spectrum. This utilization is driven by the ability to tailor learning experiences, provide inclusive and remarkable educational opportunities, and support special education teachers and students in addressing challenges within the framework of their competencies and deficiencies.

In special education, the choice of robots and their specific contributions play a crucial role. Specially designed robots cater to the needs of individuals with physical disabilities, aiding in their daily routines. These robots, exemplified by the KINOVA JACO robotic arm, are programmable to execute various functions, from fine motor skills like eating and writing to broader assistance in daily activities. KINOVA JACO, a popular robot in this field, serves as an assistive arm that enables users to grasp objects and can be mounted on a wheelchair (Kinova Jaco Assistive Arm, 2023).

Social robots, a distinct category employed in special education, prove to be highly effective tools for nurturing the social and emotional intelligence of students. Specifically designed to engage emotionally and socially with individuals, especially those on the autism spectrum, these robots contribute significantly to creating a safe learning environment. Such an environment simulates social interactions, allowing special education students to identify feelings, learn appropriate reactions, and enhance their socialization skills. Two notable robots in this context are NAO and Milo. NAO, with its humanoid appearance, voice, and gestures, is adept at conducting simple conversations and supporting interactions with a variety of gestures. This capability enables the creation of an educational environment centered around robust interactions (Mwangi et al., 2017, pp. 421-424). On the other hand, Milo is a humanoid robot designed to execute specific gestures, engage in controlled conversations, and assist students in developing their social skills (Yousif, 2021).

Therapeutic robots, also known as companion robots, play a crucial role in enhancing mental health, particularly for students dealing with developmental disorders like autism. These robots, designed to be easily befriended, effectively reduce feelings of loneliness, stress, and anxiety. For instance, Paro is a therapeutic robot specifically crafted to alleviate developmental disorders and establish connections with students (Alhaddad et al., 2019, pp. 249-262).

Educational robots contribute significantly to improving the cognitive development of special education students. Programmed to make various subjects more engaging, these robots facilitate individualized instruction tailored to the learning process. Notable examples include LEGO Mindstorms, a robot building set aimed at teaching critical thinking and problem-solving skills to students with learning disabilities, and Dash and Dot. Dash and Dot, in particular, focus on making interactive training, especially in mathematics and programming, accessible for students with special needs through tablets and phones (Donehower & Anderson, 2023, pp. 1863-1867).

When gamification and robotics unite to engage and motivate students, it creates a more enjoyable, accessible, and innovative educational experience. RoboGarden, featuring a curriculum with a virtual robot named Jett, is a prime example, offering intensive technology interaction for teaching programming terms, inclusive of students with special needs (Lius, 2021).Telepresence robots, such as Double 3, equipped with a camera, microphone, and screen, facilitate remote class participation for students with disabilities. This not only reduces the educational gap but also alleviates feelings of "isolation" (Zhang & Hansen, 2022, pp. 1651-1667).

Popular robots like Kaspar, iRobiQ, Alice, Probo, and Zeno share similar approaches, demonstrating positive results in educational processes (Şen, 2021, pp. 835-839). Despite being in a developmental stage, the use of robots in special education is poised to generate increased interest in the future.

The integration of robotic technology in education brings forth risks and challenges that warrant investigation. Robots may encounter difficulties due to variations in the behavior and skills of children with one or more disabilities (Alimisis, 2013, pp. 63-71). It's worth noting that a significant portion of studies in this field focuses on individuals with autism spectrum disorder (Karal et al., 2023). Another noteworthy concern is the limited number of participants in related studies.

In summary, the primary drawbacks of these technological advancements encompass cost, availability of educational support, safeguarding personal data, challenges in ensuring equal access, and technological limitations (Gezgin & Mıhcı, 2023, pp. 218-219). Access to these robots can pose economic challenges for many families and educational institutions in various countries, emphasizing the need for more affordable solutions. Adequate training for staff, students, and teachers on the integration of robots into institutions is crucial. Employing outdated technology may restrict the scope of interventions, making it challenging for teachers to adapt to innovations. Furthermore, ensuring the protection and security of student data during interactions with these materials is of paramount importance.

### 4.2. The Role Of Robots In Mother Tongue Development Of Children With Special Needs

Children mastering their mother tongue learn other foreign languages more effectively. Language teaching processes are often similar in native and foreign language learning. Robot teachers can undertake three main tasks in language teaching: 1) As a personal-private tutor (including helping to memorize words), it performs various teaching-related functions (Saerbeck et al., 2010, pp. 1613-1622). 2) Robots as peer-friends perform functions related to learning goals (such as correct pronunciation of words) (Han & Kim, 2009, pp. 255-256). 3) Learning agent robots can play games with students (e.g. to help them learn sentences) (Mubin et al., 2013, pp. 1-7). Robot technologies can contribute to teaching mother tongue to children with special needs in the following main areas:

### 4.2.1. Oral Reading

In the preschool period, it's crucial to impart skills that prepare children for reading and writing. For hearing-impaired children, the ability to establish the connection between spoken and written language, as well as the development of phonological awareness, vocabulary, syntax, and meaning skills, relies on diverse literacy preparation activities and their effective implementation. Robots can play a valuable role in this context, guiding students in the repetition of words and sentences through audible reading (Chang et al., 2010, pp. 13-24). Depending on the specific needs and language proficiency of children with special needs, robot applications have the potential to enhance both phonological awareness and vocabulary enrichment.

In the language development of visually impaired individuals, the acquisition of first words may occur later, and language usage differs from sighted individuals (Moore & McConachie, 1994). Visually impaired individuals develop differently in terms of content, mainly due to having less experience in both quality and quantity compared to their sighted counterparts (Bigelow, 1987). Robot teachers can provide valuable support through various activities, especially audio applications like singing or describing objects and events, contributing to the development of the mother tongue. This approach allows the child to reinforce auditory experiences through music, drama, poetry, and stories.

For visually impaired individuals, tactile reading is a slow and cognitively demanding skill, making the reading process time-consuming (Carreiras & Alvares, 1999). It has been found that these students benefit from verbal support in perceiving tactile diagrams, and having a guide can be useful in explaining differences between objects and concepts. In this context, robot teachers can assist visually impaired children as personal tutors, employing strategies like repeated reading, "what do I know, what do I want to learn, what have I learned (K-W-L)," and Wartr ("Watch, ask, read, tell, repeat").

In the language development of gifted children, another group, liking word games, riddles, puzzles and books can often be observed. (Saranlı et al., 2017, p. 4) Designing activities that support the vocabulary and reading skills of gifted children and implementing them by the robot teacher can make contributions to support language development.

### 4.2.2. Providing Audio and Visual Support

The audio and visual support provided by robotic technologies in mother tongue education can be beneficial for most children with disabilities in providing an entertaining teaching method, storytelling, singing, and the use of body language to support mother tongue development.

With body language and multimodal interaction capabilities, robots can entertain children while teaching them. For example, storytelling robots in classrooms are shown as a better platform to interact and entertain. Robots can also provide voice support for developing interactive educational games with robots. Robots can also provide some sound effects or perform funny actions to increase student engagement (Chang et al. 2010, pp. 13-24). At this point, robots are programmed to express emotions through facial expressions, gestures and intonations and respond with appropriate body language in order to develop the targeted behavior in the student, as well as having advanced social skills (Lin et al., 2011).

The combination of robot technology and music can offer valuable contributions to the language development of children with disabilities. In music programs tailored for these children, language gains include the development of language use that supports the mother tongue, acquisition of new words, more natural use of the voice, and appropriate intonation in speech (Bal & Artan, 1995). Therefore, music programs for children with disabilities should encompass elements such as "sound

listening and discrimination," "singing," "rhythm," "creative movement and dance," and "musical stories" (Artan, 2014, p. 51). This method has been observed to support the language development of children with autism spectrum disorder.

Key components of "joint attention," which aids mother tongue development in children with autism, include eye contact, shifting gaze between an object and a person, and pointing. Robots, acting as role models, should engage in shared experiences using audio and visual materials to support children's mother tongue development through joint attention skills. This approach contributes to the development of both social and language skills in children with disabilities.

The combined presentation of audio and visual materials, appealing to multiple senses, plays a crucial role in the native language development of students with mild intellectual disabilities, particularly those facing learning difficulties. In a study, participants noted that students with intellectual disabilities exhibit interest in toys featuring sounds, colors, and unique characteristics, making the use of educational robots particularly suitable in this context (Özdemir et al., 2015, p. 336).

Another group that benefits significantly from auditory and visual input is the hearing impaired. Children with hearing impairment, when deprived of linguistic and visual input, tend to exhibit lower success in language and cognitive skills (Kyle, 2006). Providing audio and visual support through robots becomes essential for the majority of the disabled group, especially those facing challenges in speech.

For children with autism, audio and visual aids emerge as effective teaching tools to infuse emotion and intonation into speech, addressing symptoms such as rapid impaired speech, poor articulation, and monotonous speech. These aids prove beneficial for individuals with speech and language disorders, attention disorders, and hyperactivity.

Gifted children represent another group with distinct needs, requiring support for abstract thinking skills that differ from the language development of their peers. Research by Weinberg and Yu (2008) suggests that robotic applications can be utilized to foster abstract thinking and mental design, particularly in the language development of gifted students.

### 4.2.3. Question and Answer Techniques

The question-answer technique is recognized as an effective language teaching method that supports the development of native speaking skills, particularly crucial for children with special needs who may experience delayed development in asking questions.

Children with disabilities, especially those who repeatedly ask the same question or exhibit reluctance to engage in conversation, may pose challenges for teachers. In such instances, the presence of robots that actively encourage students to ask questions becomes invaluable. For instance, visually impaired children often exhibit a delayed development in asking questions, and robots can play a crucial role in encouraging them to pose questions by providing information about their surroundings, such as objects, people, and events. Robots facilitate communication and comment development through a question-answer system, proving highly beneficial across various categories of children with special needs.

It's essential to tailor the application of the question-answer technique based on the specific disability of the child. Additionally, the feedback component in the interaction is crucial. Feedback not only corrects and manages the learner but also serves to reinforce, motivate, and enhance the overall learning process. In cases where a learner provides an incorrect answer, feedback helps correct

learning deficiencies (Knudson & Morrison, 2002). Robot applications contribute gains for a majority of disabled groups, albeit at varying levels.

An educator working with students with intellectual disabilities highlights the advantage of robots in the question-and-answer process: "In the traditional method, I was attempting to convey whether my student's answer to the question was correct or not. If the robot has humanoid features, my student can consistently receive feedback at the same level, engaging all sensory organs. Teachers may not always provide the same level of feedback, but robots can achieve this" (Özdemir et al., 2015, pp. 337).

For students with attention deficit, autism, or hearing impairment, offering confirmatory or explanatory feedback immediately after their answers can enhance the efficiency of the teaching process, addressing their specific needs. This process, when conducted through a robot, can be more extended, repetitive, patient, and enjoyable. However, it's worth noting that robots have faced criticism for potentially mechanizing learning, as these feedback mechanisms are often designed virtually, using elements such as voices, message boxes, pictures, or icons (Bitchener et al., 2005).

#### 4.2.4. Action-Command Mechanism

Teaching the native language through hands-on, experiential learning involving all sensory organs is strategically crucial. The action-command relationship, facilitated by robots, plays a key role in this approach. Robots prompt students to execute a selected set of tasks, and in turn, students can instruct the robot to perform similar actions, fostering the development of their speaking skills. This interactive role proves highly beneficial in encouraging communication, particularly for children with autism or intellectual disabilities, enhancing their language proficiency. Additionally, the repetitive nature of these activities contributes to knowledge retention.

Repetition is an integral element in the learning and teaching processes. In a study focused on classroom storytelling utilizing the repeatable feature of robots, it was observed that students' listening levels and tolerance limits increased (Han et al., 2009). Another study on user experiences with educational robots highlighted that robots, with their ability to mimic facial expressions and speech, perform functions that teachers might find challenging to repeat, ultimately enhancing the teaching process (Hyun et al., 2010). As robotic applications become more tailored and relevant to the specific needs and language levels of different disability groups, the benefits of this method extend to a broader range of individuals with disabilities.

#### 4.2.5. Cheerleader

Engaging in group games is a crucial practice in mother tongue education, particularly during the preschool period where play significantly contributes to children's development and language proficiency. This holds true for children with special needs as well. Robots assist teachers in facilitating specific games for individual or group play, fostering diverse language exercise dialogues. By organizing language exercise games, such as sticking out the tongue, trying to touch the tongue to the nose, or clicking the tongue, the robot creates a enjoyable and less stressful environment. This approach is expected to yield benefits for all children with special needs, tailored to their specific disabilities and language levels.

For instance, children with visual, hearing, or intellectual disabilities may find group-based language exercise dialogues within games both effective in the learning process and motivating. Beyond game-based applications, activity types can encompass practice-application activities, story activities, and simulations of real-world environments. Video tutor robots support distance learning for certain disabilities. As robotic activities become more diversified and gamified, they are anticipated to offer

increased benefits to the children involved. With the growing effectiveness of artificial intelligence, these robotic applications are likely to evolve, not only assisting teachers but also autonomously selecting games and forming groups based on recorded data about children's disability-ability status, thereby providing a more interactive teaching process with diverse language exercises.

#### 4.2.6. Other Different Elements of Language Teaching

In addition to the abovementioned, a variety of elements provide critical support in mother tongue teaching - such as providing social interaction, making learning fun and not monotonous, the body language of the instructor (facial expressions, gestures and intonations), pronunciation development in students, singing, storytelling, rhythmic repetitions, the use of music and sign language. If recognized, all of these can be further enhanced with robotic applications, which will continue to contribute to the language acquisition of most children with special needs.

## 5. CONCLUSION

Developmental delays in children can stem from various factors, including genetics, prenatal and postnatal issues, and environmental stimuli deficiency. Integrating children with special needs into society is crucial, emphasizing the importance of language development and mother tongue learning for self-expression. Technology, particularly robotic applications, has become a hopeful resource in various stages of special education, easing students' learning processes and lightening teachers' educational burdens. While robots are seen as supportive tools rather than replacements for human teachers, their role in facilitating language development for children with special needs is significant.

This study highlights the contributions of robot technologies to preschool mother tongue development in special education, covering areas such as oral reading, audio-visual support, question-answer applications, action-command mechanisms, and gamified language exercises. The inclusion of interactive screens and humanoid emotional expressions in robots enhances their effectiveness. These applications not only motivate students but also facilitate more accessible and enduring learning. Early intervention using robots to identify obstacles in mother tongue development during the preschool period aligns with national education policies and contributes to the overall development of the child, the teacher, and the institution.

In conclusion, emphasizing the positive outcomes in certain groups through special education with robot technology suggests the need for continued research and development. Increased interaction has the potential to address further disabilities, reflecting the promise of neurotechnology studies for individuals with intellectual disabilities. The current role of robots in education, particularly in special education, offers insights into potential future advancements for diverse groups, fostering healthier mother tongue development in these populations.

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