Chapter 7

AR and AI Applications Supporting Listening Skills in Early Childhood: Innovative Solutions in Language Teaching

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Abstract

This study examines the impact of augmented reality (AR) and artificial intelligence (AI)-based applications on enhancing listening skills in early childhood. Listening is a foundational skill in language development and is crucial for acquiring social and cognitive abilities. Integrating digital technologies into educational processes offers an innovative approach to support children's attention spans and listening habits. In this context, the study investigates how AR and AI-supported applications can engage children, increase their focus duration, and develop their listening skills. The AR applications used in the study facilitated children's interaction with auditory and visual stimuli, thereby providing a multisensory learning experience. AI-based storytelling, on the other hand, helped children extract meaning from stories and focus on details while listening. The findings reveal that AR and AI technologies effectively strengthen children's listening skills and improve their attention spans. These technologies not only contribute to language development but also foster active participation and motivation in the learning process. In conclusion, integrating AR and AI applications into early childhood education has the potential to enhance children's linguistic and cognitive skills. The study's findings suggest that technology-supported learning environments offer a valuable complement to traditional methods and provide innovative solutions in children's education.

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1. Introduction

Listening skill, which is accepted as the first step of the mother tongue acquisition process, is considered as one of the foundations of cognitive development and language development in early childhood. The listening process is not only limited to the physical perception of the sounds heard, but also includes making sense of these sounds, interpreting them and using them in a social context (Jalongo, 2010). Therefore, although listening seems to be a learning process that occurs spontaneously in the natural environment, it also takes place depending on innate genetic characteristics and personal development.

Listening is one of the most effective ways of acquiring information and communicating in children's learning process. The verbal inputs that children gain through listening skills form the basis of language development. According to research, children learn by making sense of the sounds they hear from birth. Especially the 0-3 age period is a critical period in terms of brain development and auditory experiences in this period affect long-term learning and language skills (Vouloumanos & Werker, 2007). Listening, as the first language skill acquired, is also important for the development of other skills.

Listening skills begin to develop at an early age and this process is a part of language acquisition. Akhtar (2004) states that children begin to understand certain words as early as 9 months of age and that listening experiences in this early period positively affect language development. Listening habits acquired during this period also form a foundation for children's literacy and language skills. In addition, children's vocabulary increases and enriches as their listening skills improve (Hurtado, Marchman & Fernald, 2007). Listening skills also have an important place in children's socio-emotional development. Through listening, children develop empathy skills by understanding the feelings and thoughts of others. In this context, Jalongo (2010) emphasizes the importance of listening skills in social relationships and states that listening habits enable children to respect others, express themselves and be more successful in their relationships. In addition, studies by McDevitt (1990) and Imhof (2002) show that children can recognize the characteristics of effective listeners at an early age.

Listening is a skill that supports children's language development and can be developed both in the family and in the school environment. In particular, parents can contribute to this process through interactive readings and daily conversations to strengthen children's listening skills (Dougherty & Paul, 2007; Robinshaw, 2007). In addition, these skills can be strengthened and

developed through regular listening activities in schools and activities that will ensure children's active participation.

On the other hand, the digital age, which has become the center of our lives in recent years due to the development of technology, artificial intelligence and changes and transformations in distance learning practices, deeply affects children's interaction styles, information acquisition processes and language development. Children's interaction with their environment and listening experiences are being reshaped through digital tools and technologies. Research shows that the impact of digital media and technologies on language development is multidimensional; some technologies can be supportive while others can negatively affect children's language skills (Vulchanova et al., 2017). In the digital age, children develop their language skills through digital tools such as tablets, computers and smart devices in addition to traditional book reading and face-to-face communication. Especially tablets and interactive books are thought to support children's symbolic comprehension and vocabulary learning skills (Allen et al., 2015). However, overuse of digital tools can negatively affect children's attention and motivation to learn (Anderson & Pempek, 2005).

In digital technology, robot-assisted language teaching is another innovative application that has attracted attention in the digital age. Social robots are designed as companions to support children's language learning and contribute to the learning process by providing interactive games and language activities (Westlund et al., 2016). The fact that robots can give emotional feedback to children and adapt to their language level is an important factor that strengthens interaction (Kennedy et al., 2015).

The most important question regarding the use of digital technologies in educational research is whether these tools facilitate children's learning to read and write. In particular, methods such as educational games and interactive storytelling can attract children's attention and help them develop their language skills in a fun way (Kucirkova et al., 2014). However, it is emphasized that educational practices should be designed in accordance with children's cognitive levels (Bavelier et al., 2010). In this context, in this study, the effects of artificial intelligence and augmented reality applications on listening skills, which are considered one of the most important steps of language teaching in early childhood and form the basis of language teaching, will be discussed.

2. Listening Skills in Early Childhood

Listening skill forms the basis of language development and is of great importance especially in the preschool period in terms of providing the child with all thoughts, feelings and knowledge. In this period, children learn to listen and try to make sense of it, but it is possible to make this process effective with the guidance of families and teachers (Çetinel, 2016; Sever, 2000). The child's listening skill is first acquired in the family and this skill is important as a basic communication skill that the individual will use throughout his/her life (Melanlıoğlu, 2012).

Listening is a process in which speaking and communication skills come to the fore in preschool education. Since children do not have reading and writing skills, they turn to speaking and listening in their communication (Cin Şeker, 2020). In the process of listening education, it is important for children to be able to direct their attention, focus and make sense of what they listen to. For example, activities such as listening to sounds in nature, recognizing sounds or matching them with visuals aim to focus children's attention on sound and strengthen their listening skills (Çetinel, 2016). It is also possible for teachers to make children's listening skills effective by using strategies such as planning, evaluation and metacognitive awareness (Jones, 2007).

Listening education, when carried out through a well-planned process, has positive effects on children's language and cognitive development. The teacher has a great influence in this process. The teacher needs to prepare the environment and equip himself/herself in order to help children acquire listening skills (Özbay, 2005; Jalongo, 2010).

Since listening is the first skill acquired by an individual, it will be important throughout his/her life. Language teaching develops by the individual imitating his/her environment. Therefore, preschool period is one of the critical periods for shaping listening and speaking skills. Listening activities carried out in this period form the basis of other language skills as it is the only comprehension skill until the school period in terms of developing sensory memory (Doğan, 2011; Damar, 2024). The development of listening skills in early childhood will be effective in the future of the individual.

3. Innovative Technologies in Language Teaching

In the 21st century, rapid developments in computer and information technologies require societies and individuals to keep pace with this change. Integrating technology into educational environments enables individuals to have basic skills such as accessing, organizing, evaluating and presenting

information effectively. These skills are critical for both the personal development of individuals and their contribution to social life. The use of multiple learning tools such as computers, videos, augmented reality and virtual reality in education makes teaching-learning processes more effective and efficient (İşman, 2013; Yılmaz, 2005). This situation offers us very important opportunities in areas such as teaching Turkish as a foreign language, teaching Turkish to Turkish children abroad, teaching Turkish descendants, teaching to disadvantaged groups, especially mother tongue teaching. Especially with the developments in the global pandemic period, the emergence and commissioning of distance learning applications suddenly increased the need for technologies and innovative technologies in language teaching. On the other hand, the use of technological tools provides the opportunity to visualize information in education, allowing information to become more permanent in the mind. This visual support can make what is learned more meaningful, especially in areas that are difficult to concretize, such as language teaching. By going beyond traditional methods in language teaching, activities such as gamification, interaction and creating a perception of reality are used with the opportunities offered by technology, thus making the learning process more fun and motivating (Kılıç Avan, 2024).

Since language education also encompasses the culture of the language, the use of technology is of great importance. Presenting the language not only auditorily but also visually facilitates the comprehension of the language in terms of meaning. For example, making various situations and concepts concrete helps learners to form a meaningful whole in their minds. In this context, students, who have the opportunity to learn by doing and experiencing, move away from ordinary lesson environments and engage in a process that is more interesting and in which the learner is active. Because the motivation and participation of individuals who are supported by the unique educational materials offered by technology increases; this makes learning more efficient and effective. In addition, the ability of individuals to progress according to their own learning pace, to repeat subjects when necessary and to receive feedback improves the quality of the educational process (Li, 2016). Technology also saves time, allows learners to focus their attention more effectively, and improves their ability to multitask. In this framework, technology stands out not only as a tool in language teaching but also as an element that supports and facilitates language acquisition.

When innovative technologies in language teaching are examined, some of the technologies that come to the fore are as follows:

1. **Augmented Reality (AR)**: Augmented reality makes language learning more immersive by adding digital content to the physical world. For example, by associating words with 3D models or everyday objects, learners can visually recall words and concepts more easily.
2. **Virtual Reality (VR)**: Virtual reality transports users into virtual environments where the target language is spoken, allowing them to experience the natural use of the language. Students gain a stronger understanding of language use through practice, such as ordering in a café or visiting a museum.
3. **Artificial Intelligence (AI) Based Language Assistants**: AI-powered applications provide instant feedback to students while improving their speaking, listening and writing skills. For example, AI-powered speech recognition systems can identify student pronunciation errors and make suggestions for correct pronunciation.
4. **Chatbots** In language teaching, chatbots provide students with the opportunity to practice by chatting in the target language. Chatbots can help students improve their written and spoken language skills and allow them to practice language through natural dialogues.
5. **Gamified Language Learning Apps**: Language learning apps like Duolingo make learning more fun by adding game elements. Gamification techniques such as earning points, rewards, levels and competitions increase students' motivation and keep them engaged in the language learning process.
6. **Mobile Apps and Microlearning**: Mobile apps support language learning with short and focused content. This method, called microlearning, provides learners with short lessons, breaking down knowledge into chunks and allowing it to be reinforced over time.
7. **Voice Recognition and Natural Language Processing (NLP**): Voice recognition technologies analyze students' speech to ensure correct pronunciation. Natural language processing can analyze students' speech and give meaningful feedback. Thus, students can better analyze their own mistakes.
8. **Writing and Speech Analysis Tools**: Written language development tools such as Grammarly improve writing skills by providing grammar, spelling and style suggestions. In addition, AI-based speech analysis tools analyze students' speaking errors and provide feedback.

9. **Online Language Exchange Platforms**: Applications such as HelloTalk and Tandem offer the opportunity to practice with native speakers of the target language. Students participate in a natural language acquisition process through cultural exchange and language practice.
10. **Language Learning Podcasts and Videos**: Podcasts and video series allow students to familiarize themselves with the natural conversational flow of the target language while improving their listening skills. These resources address a variety of topics and provide content of interest to language learners.
11. **Adaptive Learning Technologies**: These systems provide a personalized learning experience by delivering content based on students' learning speed and difficulty level. Adaptive learning, which is shaped according to the strengths and weaknesses of the student, offers a more effective learning process.

When these technologies are examined, it is seen that they contribute to different dimensions of language teaching. Within the scope of the study, especially AR applications and Artificial Intelligence applications will be discussed in the context of in-class activities.

4. Supporting Listening Skills with AR Applications

An example of the use of AR applications in preschool course activities is presented below.

Listening Skills - "Discover Animal Sounds"

Class Level: Preschool (4-6 Years) **Duration:** 30-40 minutes

Tools and Equipment:

- Tablet or smartphone (can be used for each student or in small groups)
- Augmented reality (AR) app (e.g. an AR app with animal sounds or AR cards)
- Animal figures (toy animals, pictures or cards)

Course Objectives:

1. Developing children's listening skills.
2. Listening to animal sounds and guessing which animal the sounds belong to.
3. Using augmented reality applications to provide students with audio stimuli to practice focusing and listening.

4. Engaging children to actively participate and increase their focus on listening.

Entrance (5 minutes):

1. The teacher talks to the class about animal sounds and explains that some animals identify themselves by making different sounds.
2. Introduces the purpose of the activity by saying "Today we will try to recognize animal sounds and learn which sound belongs to which animal."
3. Animal figures that will be involved in the practice are shown (e.g. cat, dog, bird, cow, etc.), so that children are visually prepared.

Development (20 minutes):

1. **Introducing the AR App:** The teacher introduces the augmented reality app to the children and shows how to use it. For example, the app can be an AR experience where sounds are made when the tablet camera is pointed at animal figures.
2. **Listening Activity:**

- Children take turns using the tablet or smartphone to open the image of the selected animal.
- When the sound of the animal is heard, children listen quietly and make guesses: "Which animal does this sound belong to?"
- The teacher listens to the children's answers and gives clues to help them guess correctly.

3. **Matching Game:**

- Ask the children to match the sound they hear with the toy animals or cards in the classroom.
- Children can create a story by sorting the stuffed animals according to the sounds they hear during the listening activity. At this stage, children can come together and work in small groups.

4. **Question and Answer and Hint Game:**

- The teacher asks children questions for each animal sound: "Where does this animal live?" or "Where else do we hear this sound?"
- Children reinforce their listening skills and knowledge by talking about the animals' environment, where they live and how they live.

Conclusion and Evaluation (5-10 minutes):

1. **Feedback:** At the end of the activity, the teacher evaluates each child's participation in the activity and provides feedback on the children's answers.
2. **Rewarding:** Each child is given positive reinforcement such as small rewards or applause for his/her effort in the activity.
3. **Sharing:** Children are given a short opportunity to share their feelings and learning about the activity.

Evaluation Criteria:

- Observing children's listening skills and attention span.
- Correct animal recognition rate when using the AR app.
- The level of cooperation in group work and guessing games.

With the lesson plan given as an example, children's attention and listening skills can be improved by using augmented reality technology. Active participation of children can be ensured with topics that can attract their interest, such as animal sounds, and they will be able to use their different senses at the same time while supporting their ability to match and predict the sounds they hear with the AR application. In this context, some AR applications that can be used in the lesson are given below:

QuiverVision

Image 1. Images from the QuiverVision AR app

You can access online content related to the application via the QR code.

Usage: Children can color animals on coloring pages and bring them to life through AR. They can focus their attention with visual and auditory stimuli while watching the sounds and movements of the animals.

Benefits: Develops color and sound matching skills, supports fine motor skills, increases focus and listening skills by observing the movements and sounds of animal figures.

Benefit to the Child:

It develops color and sound matching skills because children see the animals they paint with their voices.

Supports fine motor skills through the coloring process. Watching the movements and sounds of animal figures increases children's listening and focusing skills.

AR Flashcards

Image 2. Images from the Google AR Animals AR app

You can access online content related to the application via the QR code.

Usage: Children learn about different animals and their sounds through the cards.

Benefits: Memory and comprehension skills are developed through animal figures and sounds, and attention spans are extended with audio-visual stimuli. Logical thinking and prediction skills are supported with sounds and visuals.

Benefit to the Child:

Develop memory and comprehension skills by recognizing animal figures and sounds. Audiovisual stimuli increase attention spans and enable active participation.

Listening to animal sounds and guessing which sound belongs to which animal supports logical thinking and inference skills.

Narrator AR

Image 3. Images from the Google AR Animals AR application

You can access online content related to the application via the QR code.

Usage: Children follow the stories visually with AR and watch the animations of the characters of the story.

Benefits: Visually following the characters during storytelling improves focus and listening skills. Children's interaction with the characters supports their imagination and language development.

Benefit to the Child:

By supporting storytelling with three-dimensional visualizations, it strengthens children's listening and comprehension processes.

Visually following the characters in the story helps children focus and improves listening comprehension.

Contributes to their imagination and language development by participating in the story with AR.

Google AR Animals

Image 4. Images from the Google AR Animals AR application

You can access online content related to the application via the QR code.

Usage: Through the devices, children can see life-size 3D models of animals and listen to their sounds.

Benefits: Increases the sense of curiosity through direct observation of animals and offers concrete learning experiences. The combination of visual and auditory information develops children's environmental awareness and observation skills.

Benefit to the Child:

The child's three-dimensional examination of animals in their natural size and listening to their sounds offers a concrete learning experience.

It develops the child's sense of curiosity and helps them learn about new animals.

By combining visual and auditory information, it develops children's environmental awareness and observation skills.

Assemblr EDU

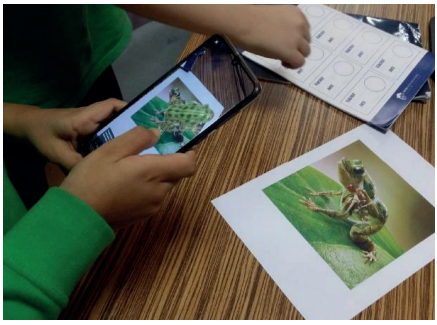

Image 5. Images from Assemblr EDU AR application

You can access online content related to the application via the QR code.

Usage: Allows children to observe and investigate by creating a variety of 3D models.

Benefits: Improves children's listening skills and supports their ability to recognize different voices and characters. The AR experience boosts children's self-confidence and intrinsic motivation to learn.

Benefit to the Child:

With a variety of 3D models and AR content, it enables children to observe and research so that they can actively participate in the learning process.

While developing listening skills, it also supports the ability to distinguish and recognize different sounds.

Studying animals and story characters on their own boosts their self-confidence and intrinsic motivation to learn.

Wonderscope

Image 6. Images from the Wonderscope AR app

You can access online content related to the application via the QR code.

Usage: Presents stories in an interactive way, making children feel part of the story.

Benefits: Interactive storytelling develops empathy and emotional intelligence. Children interact with characters, reinforcing language, listening and attention skills.

Benefit to the Child:

It makes storytelling interactive, making children feel part of the story. This promotes empathy and emotional intelligence.

Reinforces attention and language skills by interacting with characters and listening to commands.

As an active participant in the story, it develops children's listening and questioning skills, while offering a fun experience.

Catchy Words AR

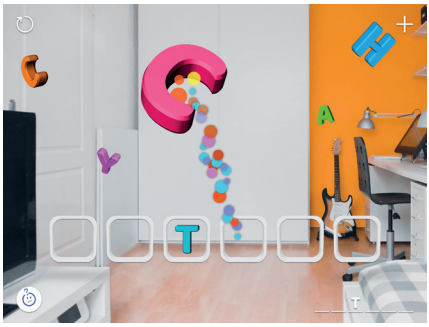

Image 7. Images from the Catchy Words AR app

You can access online content related to the application via the QR code.

Usage: It contributes to children's language development by visualizing letters and words in three dimensions in AR environment.

Benefits: Supports phonological awareness through letter and sound matching and strengthens visual word learning skills. Sorting words improves memory and concentration skills.

Benefit to the Child:

It supports language development through letter and sound matching and contributes to children's phonological awareness. Learning words visually provides a basic preparation before reading and writing skills.

Keeping track of words and placing them in the correct order in a fun game environment improves children's memory and concentration skills.

5. Supporting Listening Skills with Artificial Intelligence Applications

An example of an application for the use of artificial intelligence applications in preschool lesson activities is presented below.

Listen to the Story, Answer the Magic Questions!

Objective

- Developing children's attentive listening skills.
- To reinforce their ability to distinguish important details during listening.
- Increasing children's interest and motivation with artificial intelligence-supported audio storytelling.

Age Group

- 4-6 years (preschool level)

Required Materials

- AI-powered audio storytelling app (e.g. Storytime or a similar digital assistant)
- Tablet or smart device
- Story questions and picture cards related to the activity (main characters, events and objects in the story)

Event Duration

- 20-25 minutes

Event Implementation

1. **Introduction (5 minutes)**: The teacher explains to the children the importance of listening skills. She emphasizes that listening is not just sitting quietly but also trying to understand what is being said. The teacher then explains how to use AI-supported storytelling.
2. **Choosing the Story (2 minutes)**: Choose a simple and fun story that can attract children's attention. For example, a short story that arouses curiosity such as "The Lost Teddy Bear" is preferred.
3. **Listening to a Story with AI (8-10 minutes)**: The story is started with an artificial intelligence application and children are asked to listen carefully to the story. In the meantime, the teacher can give small clues to help children remember some important events and objects in the story.

4. **Listening Comprehension with Questions (5 minutes)**: When the story ends, children are asked questions about the story. For example:
    - "Where did the teddy bear go?"
    - "Who was the main character and what was he trying to do?"
    - "Which part of the story did you like the most?"

As the children respond, the teacher emphasizes that careful listening is important for accurate responses.

5. **Game Reinforcement (5 minutes)**: The teacher places the picture cards of the characters and events in the story on the table and asks the children to make the correct order in the story. Thus, children are given the opportunity to reinforce what they have listened to with visual memory.

During this activity, the teacher observes the children's level of focus while listening to the story, their responses to questions and their participation during the game. Thus, she can make an overall assessment of each child's listening skills. Some artificial intelligence applications that can be used here are:

Listening to Stories with Google Assistant and Alexa

- **How to use it**: Smart assistants, such as Google Assistant or Amazon Alexa, offer a choice of stories tailored to children. Children can listen to stories with simple commands like "Tell me a story".
- **Advantage**: These assistants work with simple commands that are easily accessible to children. They also respond by voice, encouraging interaction.

Storytime

- **How to Use**: Storytime is an app that offers age-appropriate, short and educational stories. The AI-powered storyteller is a great tool for developing children's listening and attention skills.
- **Advantage**: Engages children with interactive and audio storytelling, and some stories include question-and-answer sections.

Kahoot Kids

- **How to Use**: Kahoot's version for children helps children practice their listening skills by asking questions after the story. Teachers or parents can create small quizzes related to the story being listened to.

- **Advantage**: Children both listen to the stories and reinforce what they learn through fun games. The question and answer format encourages careful listening.

YouTube Kids Story Channels

- **How to use it**: The YouTube Kids app features audio story channels for children. These story videos usually engage children with animated visuals and simple narration.
- **Advantage** Children's attention span is supported by presenting visual and auditory content together. It can also be controlled under the guidance of parents or teachers.

Spotify Children's Stories

- **How to Use**: Spotify has audio story playlists created specifically for children. Parents or teachers can choose an age-appropriate playlist and play it.
- **Advantage**: There is also a Spotify Kids app that offers an ad-free experience. Such playlists allow children to develop their listening skills in a relaxed environment.

Lingokids

- **How to Use**: Lingokids is an app that provides educational content and stories for children. It develops children's language and listening skills through stories, games and music.
- **Advantage**: Reinforces listening skills by providing a multi-sensory experience. There are also interactive features, so children actively participate in learning while listening.

These practices can help preschool children develop the habit of listening attentively and increase their ability to think through stories.

6. Conclusion

In recent years, there has been a significant increase in academic studies on listening skills, which is the first step in the language acquisition process. In particular, much attention has been paid to the learning processes of individuals at the preschool and primary school levels in basic education based on the four basic skills. The most important skill that naturally comes to the fore in this process is listening. Because individuals with well-developed listening skills will also develop their comprehension, speaking and writing skills linearly. For this reason, a healthy listening process, environment, digital

technology and artificial intelligence-supported applications developed based on scientific research are of great importance at all levels, especially at basic education levels. In line with these considerations, this study examined the effects of augmented reality (AR) and artificial intelligence (AI)-based applications on supporting listening skills in preschool period. AR and AI applications play an important role in increasing children's attention span and improving their listening skills. In particular, activities supported by AR provide children with a multidimensional learning experience with audio and visual stimuli and provide significant improvements in their listening and focusing skills.

Thanks to the sample applications used in the study, children's interaction with visualized content encourages them to participate more actively in the learning process. AI-based storytelling tools improve children's listening and comprehension skills and increase their interest and motivation in listening activities. Technology-supported learning tools are not only an entertaining tool in children's language development but also an effective educational material.

In conclusion, the integration of AR and AI technologies into the preschool educational environment has the potential to improve children's cognitive and linguistic skills. It is important for educators and parents to carefully manage children's interactions with digital tools in order to gain maximum benefit from these technologies. AR and AI technologies offer a valuable alternative to traditional methods in developing children's listening skills.

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