

The role of artificial intelligence applications in developing communication and learning skills for students with hearing and vision impairments“Augmented reality” technology as a model

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Abstract:

This study aims to demonstrate the role of artificial intelligence in general and augmented reality in particular in developing the communication and learning skills of students with hearing and vision impairments, which makes them face great difficulties in adapting with education, so we will employ the analytical survey method to comprehensively read these applications and show their contribution to improving the level of communication and learning , our study has reached a number of results: augmented reality can increase the level of interactivity, excitement and entertainment among students during learning and help them stimulate the rest of the sens and employ them to compensate for the deficiency , in Algeria There are efforts being made, but they are not sufficient to generalize the use of artificial intelligence in teaching children with hearing and visual impairments.

Keywords: artificial intelligence; augmented reality; communication skills; learning skills ;hearing vision impairments .

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1. INTRODUCTION

People with special needs in general, and those with hearing and vision disabilities in particular, suffer from difficulty adapting to various activities in the academic, professional and social environment, this is due to a lack of communication skills that do not enable them to keep up with the daily processes and practices that bring them together with ordinary people in the university where they study or the institution in which they work.

In the era of new media, which in recent years have merged with artificial intelligence technologies, which have invaded all fields and areas, including the field of medical and health uses, which attempts to present a set of alternative solutions to the problems and obstacles facing the hearing or visually impaired person and to integrate him to some extent into society and enable him to carry out various activities while raising the level of his communication skills.

Among the spaces that bring together all segments of society, from ordinary people to people with special needs, we find the university institution that requires carrying out a set of activities, duties and tasks that require effort and high communication skills in order to carry them out in the best possible way and crown the academic path with success at the end of each stage of training, accordingly, we will try through this study to highlight the advantage and added services that artificial intelligence with its various technologies especially augmented reality has provided to university students with hearing and vision disabilities , for that , we pose the following essential question: **How do augmented reality technologies**



contribute in developing the communication and learning skills of students with hearing and vision disabilities ?

In order to answer this fundamental question, we will break it down into a set of sub-questions under which the objectives of this study fall as follows:

- ☐ What are the difficulties facing students with hearing and vision disabilities ?
- ☐ What are the artificial intelligence technologies specialized in developing communication and learning skills for students with hearing and vision disabilities?
- ☐ What are the advantages, characteristics and services provided by augmented reality technologies to students with hearing and vision disabilities?
- ☐ What are the opportunities and challenges of implementing augmented reality technologies in inclusive education for students with hearing and vision disabilities in Algeria ?
- ☐ What are the solutions and recommendations that should be worked on to improve the level of university students with hearing and vision disabilities who use artificial intelligence technologies?

This study seeks to achieve the following objectives:

- ☐ Shedding light on the difficulties facing students with hearing and vision disabilities in the university .
- ☐ Identifying artificial intelligence techniques specialized in developing communication and learning skills for people with hearing and vision disabilities
- ☐ Knowing the advantages, characteristics and services provided by artificial intelligence techniques to students with hearing and vision disabilities.

- To identify the opportunities and challenges of implementing augmented reality technologies in inclusive education for students with hearing and vision disabilities in Algeria
- Providing a set of the solutions and recommendations that should be worked on to improve the level of university students with hearing and vision disabilities who use artificial intelligence technologies.

The importance of this study is highlighted in the following:

- The topic of employing artificial intelligence techniques in developing the communication and learning skills of students with hearing and vision disabilities is considered one of the thorny and current topics that require studies that clarify this reality with its advantages, difficulties, challenges, methods and strategies, this study is also considered an additional introduction to monitoring developments in the field of using artificial intelligence techniques especially Augmented Reality by students in education and communication .
- The study is considered as a contribution to discussing a very important topic that has not been sufficiently discussed and analyzed in scientific and communication studies.

The approach followed in this study is to use the methods imposed by the importance of the study and its general objective, as it imposed the treatment, discussion and then analysis of the topic of the role of artificial intelligence in developing the communication and educational skills of students with hearing and vision impairments, which necessitates the need to choose

the appropriate research method and tools raised by the problem, which are:

In our study we have relied on the analytical survey method, which is based on three processes: interpretation, criticism and deduction (Samir , 2010 , p25), with the aim of identifying the role of artificial intelligence techniques in developing the communication and educational skills of students with hearing and visual disabilities, based on communication theories, most notably the theory of uses and gratifications, the theory of individual differences and the spread of innovations, then collecting information and converting it into statistically significant data in order to reach results that can be generalized to the research community as a whole.

The research community for our study is represented by all artificial intelligence technologies used in developing the communication and learning skills of students with hearing and vision disabilities , the research sample is augmented reality technology as a model for these applications that have become employed in major schools and universities specialized in teaching people with special needs.

2. General concepts

2.1 Artificial intelligence

Artificial intelligence refers to intelligent devices or algorithms that are capable of performing intellectual tasks (Philip ,2021 , p 18) , this includes various technological solutions that mimic human logic and range from playing chess to solving complex equations , machine learning is a part of artificial intelligence, and machine learning is done by exposing



its algorithm to a wider database, and thus the machine learns and improves its performance , for example, Google uses machine learning, as its algorithms collect what search engine users put in, and what they liked, in social media applications in order to provide them with more accurate search results(Abdullah,2021 , p 57) , and display recommendations that suit their interests, this search engine can be used by anyone, including people with disabilities.

2.2 Augmented reality

Augmented reality is the enhancement of real-world experiences with computer-generated information, discover new possibilities in gaming, education, art, design, manufacturing, marketing, and more.(Khair , 2019 , p 31) .

Augmented reality is a modern technology that combines the real world with the digital world, where digital information is integrated with the surrounding environment to enhance the user experience, this technology is part of augmented reality and virtual reality technologies, but it is characterized by interaction with the real environment.

virtual reality creates a completely virtual environment, where the user is completely immersed in this environment and loses contact with the real world, but augmented reality incorporates digital elements into the real world, without affecting the user's connection to reality.(Ibrahim , 2024 , p 21)

2.3 Communication skills

Communication skills are the set of skills that individuals use to communicate with others and exchange information and ideas effectively, and this includes both verbal and non-verbal communication (Bilal , 2022 , p 64) , in its basic form, verbal skills include the ability to speak, listen and write effectively, it involves organising and expressing ideas in a clear and productive way, listening carefully to what is being said, and ensuring that information is understood in both directions , non-verbal skills include the ability to use body language and facial expression effectively, and ensuring that facial expressions, gestures and signals express the messages we want to communicate, non-verbal skills also include the ability to understand our surroundings and those around us, and to form friendships and positive interpersonal relationships, communication skills are essential in most areas of life, whether personal or professional, and can be improved with regular practice and training.

2.4 learning skills

It is a set of skills and abilities that help an individual get the most out of the learning process, in fact, learning skills enable you to understand concepts and information and develop the mental skills necessary for critical thinking and analysis, concentration, memory, and organization , in short, learning skills are essential for academic, professional, and personal excellence.

learning skills include a set of basic competencies that an individual needs to learn effectively and better understand information, including: reading and speed reading, in particular,



responsibility, organization, independent work, cooperation, initiative, self-organization, and note-taking.(Badr ,2023 , p 70)

2.5 Hearing impairment

A disabled person is any person who is unable to perform his work or continue in it(Abdul Majeed , 2014 , p 29) , or any person whose abilities to do so are reduced as a result of an organic, mental or psychological deficiency or as a result of a congenital disability since birth.

Hearing impairment is considered one of the most severe disabilities affecting the disabled individual, as the hearing impaired person cannot deal with and communicate with the environment using the sense of hearing, and there is a problem in understanding and dealing with this person, the definition of hearing impairment for any case extends to the diagnostic process, which includes receptive and expressive language, speech levels, and functional behavioral assessment in general, accordingly, hearing impairment can be defined as any type or degree of hearing loss that includes what is simple, moderate, or severe.

Hearing impairment is divided into the following types:(Silva , 2022 , p 13)

A. Communicative hearing impairment: It is the impairment that occurs as a result of any error or abnormality in the sound vibration transmission device that includes the outer ear, eardrum, and middle ear with its three ossicles.

B. Neurological hearing impairment: It occurs as a result of any error, damage, or abnormality in the perception system or

body that includes the hearing organ in the inner ear in the cochlea, auditory nerve, and the hearing center in the brain.

C. Mixed hearing impairment: This impairment occurs in the inner and middle ear and is a combined hearing loss that includes conductive hearing impairment and neurological hearing impairment as a result of a defect in the three parts of the ear.

D. Central hearing impairment: It occurs as a result of any defect between the brainstem and the cerebral cortex, and the reason for this may be due to brain cancer, inflammation of the meninges, or multiple sclerosis.

2.6 Vision impairment

Visual impairment is defined as a condition in which an individual loses the ability to use the sense of sight effectively, which negatively affects his performance and growth(Mason,1997,p 102) “Ashroft” and “Zambone” define visual impairment as a deficit or weakness in the visual system that hinders or changes the patterns of human growth, “Demott” defines visual impairment as a weakness in any of the five visual functions: central vision, peripheral vision, visual accommodation, binocular vision and color vision, as a result of anatomical deformity or disease or injury to the eye, the most common types of visual impairment are the impairments that include central vision, visual accommodation and refraction.

One of the most commonly used definitions currently is that of Barraga, which states: (Visually impaired children are children who need special education due to their visual problems, which requires special modifications to teaching methods and curricula to enable them to succeed educationally),

from a practical point of view, visually impaired children are classified into two categories: (Al-Jawaldeh , 2012 , p 47)

A. The first category: is the category of the blind, who use their fingers to read and are called Braille readers.

B. The second category: is the category of the partially sighted, who use their eyes to read and are also called large_type readers. As for the legal medical definition of visual impairment, it depends on visual acuity.

3. Difficulties and challenges facing students with hearing and vision disabilities

3.1 Educational problems

The main educational problem that hearing or visually impaired students suffer from in the learning process is the speed of forgetting and the difficulty of remembering, because the deaf student relies on sight to a greater extent and this sense exhausts him and does not help him much in remembering and understanding all the lessons, especially since this sense exhausts quickly and the student cannot rely on it throughout the lesson due to eye fatigue and not remembering some information, especially if it is cumulative and abundant(George, 2023 , p 15)

Then comes the problem of distraction and lack of concentration, which completes what we talked about previously, as the deaf child cannot rely on the sense of sight to a large extent, so you find him inattentive because he does not hear the teacher in a modern state except through the vibrations he emits, and we also find that if the deaf student has a dual disability, this greatly affects his concentration , there is also the problem of

slow learning and decoding because the deaf student cannot decode and understand easily except after great effort and continuous repetition, this applies to the slow learning process because in order for the deaf student to learn, the teacher or educator must repeat the process or lesson several times and repeat them at very close intervals in order to be able to absorb and remember the information and decode. In addition to the problem of lack of desire to continue learning and the fact that some students do not like to continue, this is due to the fact that a large percentage of them join university at an old age, so they find themselves wanting to go out to work, and another percentage, due to their feeling of inability to learn, tend to want to stop studying,(Abu Shakra , 2023 , p 102) , all these educational problems that the hearing-impaired student suffers from are due primarily to his disability, its type, and the educational curricula followed in these schools and universities, as they do not adapt to the nature and degree of the disability

.3.2 Psychological problems

Hearing and visually impaired students suffer from many psychological problems, most notably lack of confidence and feelings of inferiority, which is the biggest psychological problem they face in the learning process, in addition to anxiety, stress, depression and obsessions. (George, 2023 , p 20)

The sense of hearing is a great blessing, so its absence makes the deaf disabled person in a constant cycle between his self-esteem and respecting and appreciating others, so we find him always suffering from the problem of lack of confidence and feelings of inferiority, as he always sees himself in the

perspective of being less than others, and this works to destroy his psyche and suppress it and not progress despite their qualifications, and this problem makes the hearing impaired student suffer from anxiety and constant stress and lack of communication with people and interaction with them.

3.3 Social problems

The most common social problem that a hearing and visually impaired person suffers from in personal communication is poor interaction and communication,(Abdullah , 2017 , p 95) this is due to the fact that the world around him does not understand the nature of the deaf or blind person and their inability to understand what he says, which makes the disabled person not interact or communicate with those around him, there is also the problem of difficulty in social adaptation and social immaturity.

It is clear to us from this information that a hearing or visually impaired person suffers from many social problems due to the type of disability he suffers from, as he does not hear or speak, and thus this hinders the communication process. This makes him suffer from social adaptation, which causes him isolation and a tendency towards loneliness due to the outside world not understanding what he wants to say and do and what he suffers from.

3.4 Behavioral problems

One of the most important behavioral problems that hinder personal communication during the learning of hearing or visually impaired students is violence with peers, this is due to the psychological pressure and difficulty in communication that students suffer from due to their lack of understanding of what they are seeking, therefore, they turn to violence and aggression to discharge the negative charges they suffer from (Al-Qarsi, 2015, p79), then we find among the behaviors that appear on them is assaulting the property of other students, this behavior may appear in the form of assaulting the property of his colleagues or friends. Then you find the last behavioral problem that he suffers from is the destruction of tools and equipment, we find that these problems have a deep connection with each other, the pressure that the student suffers from due to the outside world not understanding him, you find him turning to some behaviors to express the extent of his anger or trying to find his place for it.

4. Services and benefits of artificial intelligence technologies for students with hearing and vision disabilities

Artificial intelligence provides many services to enable students with disabilities to perform some tasks more easily through the following: (Jordan , 2024 , p 11)

- Visual identification for students with visual impairments.
- Facial identification for students with vision impairments
- Lip reading identification for students with hearing impairments.
- Text summarization for students with mental disabilities.

- Direct text translation for students with hearing impairments or even students who do not know a certain language.

Artificial intelligence also provides other services that facilitate access for people with various types and degrees of disabilities , we summarize this aspect as follows: (Jones,2020 , p38)

First: Communicating with others:

Depending on the type of disability a person faces, communicating with others can be a major challenge, this applies to staying in touch with others in an increasingly digital world, with the increasing importance of social media and people's reliance on the "Internet" , with technology and artificial intelligence, no one will be left behind, and will be at the service of people, including people with disabilities.

A. Students with vision impairments:

-VoiceOver: The screen reader on Apple phones, although its primary use is to pronounce the content of emails or text messages, it uses artificial intelligence to explain application icons and to tell how much the phone is charged, and can partially explain some images.

-TalkBack: The screen reader reads texts and images, and is an application similar to the previous application but on Android smartphones, and helps its users to fully use their phones.

-Siri: The virtual assistant on Apple phones, where the user can dictate what he wants by voice, from searching on "Google" to dictating texts to send via the phone, this application benefits people with visual impairments, and keeps them in touch with others.

-Cortana: A visual assistant produced by Microsoft and activated on Windows, this program helps people with visual impairments navigate between programs on their computers using voice, it is in some ways similar to Siri.

-Google Assistant: This is a voice-activated application, Through it, the user can set alarms and manage his daily schedule, it is also similar to Siri.

B. Students with hearing impairments:

-Ava is an instant transcription app that transcribes any conversation for a group of people, its algorithm is based on adding punctuation marks, the name of the person speaking, and necessary vocabulary from the user's dictionary, it is an easy way for people with hearing impairments to engage in conversations with other people without having to read lips.

-RogerVoice: A French instant transcription app for group conversations that is available in 90 languages, it works in the same way as Ava.

C . Students with motor impairment:

-A virtual assistant like Siri, Google's voice assistant: People with limited mobility can use their smartphones with voice commands. It was created for people with limited skills.

-IFTTT: It connects to other applications so that a person with limited physical skills can use all the features of their smartphone without any difficulty, it creates a partnership with applications and with nearly 700 services to perform tasks automatically, such as reading an email aloud, or sending a tweet on Twitter, for example, even people with verbal disabilities can benefit from this technology.(Nobula , 2020 , p 128)

Second: Mobility:



Mobility is the biggest challenge facing people with disabilities, how can a student with a motor impairment, for example, move around the city independently and quietly while his movement requires full knowledge of the places that have low sidewalks designated for wheelchairs, and the toilets that serve them, therefore, the person with a disability must draw his path before leaving, for this reason, there are many mobility applications that rely on technology to help these people in their movements , among these applications we find: (Al-Qubaili , 2024 , p114)

-Google Maps: One of the most important navigation applications around the world, using Google Maps, people with visual impairments and wheelchair users can prepare their track before they go out, visualize the road, and get the best means of transportation that suit their disability, there is a “wheelchair accessible” option through which they can find out the locations of ramps and elevators in the city, there is also the “accessible places” feature, which is useful for them in obtaining more information about the plans of many places: their entrances, parking spaces, bathrooms, seating arrangements, and others.

-Moovit: This is a great application for students who use public transportation, it provides the user with real-time traffic information, it has been shown to help people with visual impairments if, for example, the bus is not activated for voice notifications.

-Wheelmap: This application enables you to find restaurants, cafes, bathrooms, shops, cinemas, parking lots, bus stops, and

other places that are easily accessible using a wheelchair all over the world for free.

-Soundscape: This app allows you to evaluate the scene by sound, and it is for people with visual impairments, this app enables them to know the interesting landmarks near them.

-Evellity: It is the first navigation assistant app for people with disabilities, and it helps them to navigate in crowded and somewhat complex places, such as the metro network, universities, colleges, malls, sports stadiums, etc, this app adapts to all types of disabilities, and is useful for everyone in general, this app works like a GPS and gives the user step-by-step instructions.

Third: Independence in life:

Using these types of technology improves the quality of life of people in general and the quality of life of people with disabilities in particular, for example, at home, as we mentioned through several applications such as Siri, Amazon Echo, Alexa, and others , people with disabilities become in complete control within their homes by using only their voices, starting from lighting the rooms to setting the alarm to listening to music and other tasks, any item in the home that can be connected to a smartphone can be controlled, and accordingly, students with visual impairments can, for example, adjust the gas oven by requesting Alexa. (Al-Qubaili , 2024 , p116)

Fourth: Access to the same services used by ordinary people:

Inclusivity means that every person has the right to access services regardless of their identity or disabilities. People with visual impairments can read thanks to Braille, and deaf people



can enjoy movies thanks to the subtitle feature , here are some AI applications that serve this trend: (Danesh , 2023)

-Braille AI Tutor: An innovative solution and a quick, free and fun way to teach how to read Braille, thanks to it, people with visual impairments can learn how to read Braille independently and without the need for a teacher, learning is a right for all people, and students with disabilities have the right to learn, which is the gateway to finding a job and engaging in society.

-Seeing AI: This application allows people with visual impairments and low vision to accomplish daily tasks independently like never before, it helps users read printed text in books, restaurant menus, street signs and handwritten notes, in addition to identifying financial papers and products via its barcode, it can even enable them to recognize images, colors, and faces, thus giving them details about people's feelings.

-Lookout on Android: The app can get details about objects, images, and texts in the user's environment, it uses the camera and sensors in the Android device and tells the user what it has found, it works similarly to Seeing AI.

-Google's Project Guideline: It is the ideal solution to help visually impaired people walk alone without assistance by wrapping a special belt around their waist that is connected to their Android smartphone and putting headphones in the ear, which enables the visually impaired person to follow the instructions drawn on the roads.

5. The role of “augmented reality” technology in developing communication and learning skills

Augmented Reality (AR), commonly abbreviated as AR, refers to technology that adds additional digital content to the real world. Whether it's through smartphone apps, AR glasses, or virtual reality headsets, Virtual Reality (VR) provides a fully immersive experience, where viewers are transported into entirely digital environments, it does not enhance reality or change its details to enhance it and make it richer as in AR, but rather creates a different world from pure imagination, with no basis in reality at all.(Antar , 2023)

Education is one of the environments where technology has had a very significant impact, currently, many technological tools are being used for learning and training with great educational potential, one of which is augmented reality, it has a high motivational power and can increase students' interest and engagement in tasks and provide support for students with special needs.

“Augmented reality” can be a starting point for a more inclusive learning experience for students with disabilities in education if the capabilities of augmented reality are employed in light of the needs and abilities of students with disabilities to bring concepts closer in a form and content that allows them to be recognized and interacted with , this is confirmed by the Horizon Report 2016, which presented AR as an emerging technology with great potential for educational use, allowing the integration of digital and physical information in real time, through the technical support of various devices such as tablets and smartphones; to create a new reality that has an impact on the extension of AR applications.(Ghazi , 2024 , p68)



According to statistics from the World Health Organization, around 15% of the world's population lives with some form of disability or special educational needs, and of that 15% of the world's total population, 2-4% have learning difficulties. However, the global prevalence of disability is believed to be higher than previous WHO estimates, dating back to the 1970s. In contrast, data from last year 2024 suggests that the figure of around 10% is more accurate, with 190 million (3.8%) of those aged 15 years or over experiencing significant learning and achievement difficulties.

Given these facts, and the results of scientific studies, we find that students with disabilities related to conditions such as autism (ASD), attention deficit hyperactivity disorder (ADHD), dyslexia, Down syndrome, and hearing difficulties can often feel out of place in a traditional classroom environment compared to their peers.

Fortunately, education is progressing to become more inclusive of students with different learning styles and educational needs, but there is still much that can be done to make the classroom more inclusive for every student. It is becoming increasingly clear that it is time to rethink not only what we teach our students, but exactly how we teach students with greater long-term impact.

“The results showed that augmented reality applications had a significant impact across 16 scientific studies targeting the areas of impact of augmented reality for people with disabilities. The impact of augmented reality was the greatest in enhancing

learning skills for people with disabilities, followed by social skills, physical skills, and life skills.”(Jain , 2022 ,p 118)

The virtual reality environment has an added value in the education of people with disabilities and its relative value lies in the integration of the senses that is enhanced by the diversity of stimuli in this environment, allowing students to see, hear and touch knowledge in a fun and engaging way. In addition, teachers are able to create personalized learning plans by studying the data of augmented reality users, allowing the teacher to customize lessons according to the student’s specific needs and subsequently allowing him to reach the best ways to motivate students.

Another advantage is that many AR applications are easily accessible, inexpensive, and can be used anywhere, anytime, this enhances students’ ability to retain information better because of the multi-sensory experience, as it is interactive and fun, research also suggests that for students with disabilities such as cochlear implants, hearing impairments, or speech difficulties, who use smartphone technology and headsets that include AR platforms, their outcomes related to auditory comprehension, communication skills, and verbal development were significantly improved.

6.Integrating AI and augmented reality into support programs for students with hearing or vision disabilities in Algeria :

Since this study highlights the potential of artificial intelligence applications-particularly augmented reality technologies-to enhance the learning and communication skills



of students with hearing and visual impairments, it is essential to relate these findings to the Algerian context .

according to available data, Algeria has a number of specialized schools for children with hearing and visual impairments. Reports indicate that there are 42 schools for deaf children and 24 schools for blind children , in addition, efforts are underway to integrate children with sensory disabilities into mainstream schools through special classes. For example, in the 2023/2024 school year, 33,000 students with visual impairments were integrated into mainstream classes, while 2,986 students with hearing impairments were integrated into mainstream classes (APS ,2023) these figures demonstrate Algeria's commitment to providing education for children with sensory impairments through specialized schools and integration programs within the mainstream education system.

In Algeria, there are national initiatives led by the Ministry of National Solidarity and the Ministry of National Education aimed at integrating people with disabilities into the educational system. However, these programs have not yet reached the stage of systematically incorporating artificial intelligence and augmented reality technologies , given the unique challenges faced by students with hearing and visual impairments in Algeria, augmented reality technologies can open up new educational horizons(Dib , 2023 , p780) , For example, these tools can be used to create multi-sensory learning experiences, such as interactive visual guides for the partially blind, or interactive simulations that support lip-reading and speech development for the hearing impaired.

To maximize the benefits of these technologies for the Algerian educational system, it is recommended to encourage collaboration between teachers, researchers, and local developers to develop accessible and culturally adaptive augmented reality applications. These solutions should take into account the linguistic and educational specificities of the Algerian environment and be field-tested within integrated classrooms to evaluate their practical effectiveness.

In Algeria, a range of smart tools and assistive technologies are used to support children with hearing and visual impairments in education and daily communication, these tools include: (Djouiba , 2024 , p 228)

First :Assistive Devices for the Visually Impaired and Blind

1. OrCam MyEye: A portable device mounted on glasses that uses a smart camera to convert printed text to audio, with additional features such as face and object recognition. It is used globally to improve the independence of blind and visually impaired people.

2. AIris Technology: A wearable device equipped with a camera and natural language processing, it provides real-time audio descriptions of the surrounding environment, with features such as face recognition and text reading.

3. Electronic Braille Displays: Devices that display text in Braille, enabling blind people to read digital content.

Second : Assistive Devices for the Hearing Impaired and Deaf

1. FM Systems: Systems that use radio waves to transmit audio directly from the teacher to the student, improving audio clarity in educational settings.



2. Simultaneous translation applications: Applications that convert speech to written text in real time, helping deaf students follow lectures and discussions.

These tools and technologies demonstrate progress in supporting children with sensory disabilities in Algeria, with a focus on improving access to education and daily interactions.

The integration of artificial intelligence technologies-particularly augmented reality-in educational support systems for students with hearing and visual impairments represents a promising path to enhancing inclusive education.

Although the global potential of these technologies is well documented, their application in the Algerian context remains limited, calling for further institutional effort, investment, and local innovation , accordingly, it is recommended that Algerian educational authorities, in collaboration with universities and national technology institutions, launch pilot projects to test the effectiveness of augmented reality tools in special and inclusive education settings , these initiatives should focus on accessibility, cultural relevance, and pedagogical feasibility. Further interdisciplinary research is also needed to evaluate the long-term impact of these technologies on the academic achievement and communication skills of this group of students.

7. CONCLUSION

Despite all the aforementioned results of studies and research in this field, it is still limited on the impact of augmented reality on increasing the level of communication and learning skills for students with disabilities; what is good in

analyzing the results of research is the positive impact of augmented reality applications in education. Some positive aspects have emerged: such as increasing motivation, interaction, and attracting the interest of students with disabilities, which contributes to supporting inclusive education by creating a constructive and realistic learning context to improve learning through an active learning environment. The augmented reality environment also raises a high degree of satisfaction in positive attitudes among students, which improves learning outcomes, augmented reality also improves attention, communication, and long-term memory , in this sense, augmented reality contributes to the search for mechanisms that eliminate or attempt to eliminate barriers that prevent active student participation.

At the end of this study, we present a set of recommendations and suggestions that would develop the communication and learning skills of students and pupils with hearing or vision disabilities, through the proper and positive use of artificial intelligence techniques in this regard:

- Training courses should be organized for students with hearing or visual disabilities to enable them to use artificial intelligence techniques in carrying out various activities carried out by ordinary people.
- Professors and parents should participate in supporting students with disabilities psychologically and morally.
- University programmes should be consistent with the nature of the disability suffered by the student, and it is better to allocate schools and universities specifically for this segment of society.
- A student with hearing or vision disabilities should improve the use of augmented reality and virtual reality technology to

stimulate and activate his communication and learning skills, but without addiction or exaggeration .

- In the Algerian context, schools that educate children with hearing and visual disabilities should be equipped with all the necessary technical and smart equipment to facilitate the learning process, Families should also integrate augmented reality technologies at home so that children with disabilities can perform all daily activities without difficulty.

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