

Statistical Analysis of Scientific Research Challenges for Disabled Virtual Reality Users

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Abstract: This study aimed to identify the challenges associated with scientific research and digital quality for Persons with Disabilities using virtual reality libraries. It gathered the opinions of 122 language teachers, as well as 35 Persons with Disabilities (both male and female, with various disabilities) aged between 14 and 18 years in the United Arab Emirates. Utilizing a descriptive-analytical approach with a questionnaire, the results highlighted several materials, administrative, training, and technical challenges that impact scientific research and digital quality for Persons with Disabilities within the framework of virtual reality libraries, as viewed by both language teachers and persons themselves. Among language teachers, the mean scores for scientific research challenges ranged from 2.98 to 4.98, and for digital quality challenges, they ranged from 2.99 to 4.97, with significant differences observed at the 0.05 level. Regarding the second sample of Persons with Disabilities, the average for the challenges of scientific research was 4.3, which is the same as the average for the challenges of digital quality. These averages are significant at the level of 0.05. The results also indicated no significant differences between males and females at the 0.05 level in their opinions regarding these four challenges. The study concluded by recommending the necessity of addressing these challenges, ensuring that virtual reality applications consider the realities and needs of Persons with Disabilities in relation to their scientific research and digital quality through the utilization of virtual libraries.

Keywords: Digital Education - Scientific Research - Digital Quality - Persons with Disabilities - Virtual Libraries.

1 Introduction

Recognizing the crucial role of scientific research in the modern era, human societies accord it significant importance. Scientific research serves as the key differentiator between advancement and regression, and the principal engine propelling development in any society. Furthermore, it is a cornerstone of development and modernization initiatives. Advanced countries worldwide are actively engaged in a race within scientific research, dedicating substantial budgets and attracting skilled Persons and human expertise to leverage research for addressing issues across diverse sectors. The scientific and knowledge advancements seen globally in diverse fields are solely the result of scientific research at multiple levels and in various areas. However, despite the significant importance generally recognized for scientific research and its necessary role in any country, it faces numerous challenges, especially in the current era of digitization and artificial intelligence [20].

The significance of digital life is undeniable today, with its growing demand across all sectors. Recognizing this, concerned parties emphasized the need to establish digital engagement guidelines. This has given rise to the notion of

digital quality of life or digital well-being. Promoting the safe and advantageous utilization of technology and digital life for persons and the community alike. Due to the profound digital revolution, information technology has become the most significant driver of improved quality of life. The definition of illiteracy has evolved beyond the traditional inability to read or write; it now encompasses the inability to navigate and create in the digital realm, as well as the challenges in accessing digital resources. [15].

Digital technology is central to the education and development of persons with Disabilities, empowering their capabilities and facilitating their social inclusion by supporting all aspects of daily life and easing communication between persons and within communities. Consequently, this area became a key focus for scientists and educators, driving research and experimentation to fully leverage modern digital technologies for this population. The fundamental right of Persons with Disabilities to benefit from substantial care in the application of advanced technology, similar to their non-disabled peers, in both their education and the continuation of their academic and research endeavors, is a principle that must be firmly established in all societies [9]. In light of the widespread current focus on Persons with Disabilities (persons of determination), encompassing the evolution of the concept, the advancement of diagnostic techniques, the variety of guidance and treatment programs available, as well as the provision of support and inclusion services, and culminating in the creation of virtual libraries that emulate virtual reality for

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this population [6], this study has been undertaken to discuss the challenges of scientific research and digital quality for Persons with Disabilities, particularly concerning the use of virtual reality libraries from the perspective of language teachers.

2 Study problem

Despite the encouraging focus and considerable efforts by Arab governments to enhance the importance of scientific research and its impact on society, scientific research in Arab nations continues to grapple with numerous obstacles. These challenges include inadequate funding for research endeavors, the emigration of Arab intellectuals, a shortage of up-to-date references and resources, limited computing services, intricate administrative hurdles, corruption, and the theft of scientific proposals. Consequently, the library and information science field are compelled to assume a significant role in supporting scientific research and addressing these challenges. As [1] indicated, the effective implementation of digital libraries requires more intensive work and is hampered by numerous difficulties that need to be overcome.

The increasing prominence of information technology and digital life as a central and vital element for the majority of individuals underscores the neglect experienced by persons with disabilities in this area, a point supported by [16]. This neglect is evident in the inadequate training of staff and service providers, the scarcity of appropriate computing devices, the deficiency of suitable educational strategies, and the inaccessibility of electronic applications. This lack of attention has prevented special needs groups from benefiting from modern technology, resulting in psychological and physical difficulties that worsen their situation and complicate their integration into society, school, and university, despite their need for the development of their scientific abilities and various communication skills. Consequently, this study aims to identify the digital challenges faced by Persons with Disabilities in conducting scientific research and utilizing modern digital technologies, as well as to enhance their digital quality levels through the use of virtual reality libraries. Additionally, it aims to explore methods for enhancing these libraries to better serve this vital segment of the Arab community.

3 Study questions

The study questions may be defined in the central question: "What are the challenges of scientific research and digital quality for Persons with Disabilities in light of virtual reality libraries from the perspective of language teachers? This question branches out into other questions:

- What is the extent of the challenges facing scientific research for Persons with Disabilities in light of virtual libraries from the point of view of language teachers?
- What are the challenges facing scientific research for Persons with Disabilities in light of virtual libraries from the perspective of Persons with Disabilities?
- What are the challenges facing digital quality for Persons with Disabilities in light of virtual reality libraries from the perspective of language teachers?
- What are the challenges facing digital quality for Persons with Disabilities in light of virtual reality libraries from the perspective of Persons with Disabilities?
- Are there statistically significant differences between males and females regarding the challenges facing scientific research for Persons with Disabilities in light of virtual reality libraries?
- Are there statistically significant differences between males and females regarding the challenges facing digital quality for Persons with Disabilities in light of virtual reality libraries?

4 Study objectives

The present study seeks to understand the obstacles hindering scientific research and digital quality for Persons with Disabilities when utilizing virtual reality libraries, as perceived by both language teachers and the individuals themselves. Additionally, it aims to explore the advancement of digital library services designed for Persons with Disabilities.

5 Study significance

The study's significance lies in examining the challenges concerning scientific research and digital quality for Persons with Disabilities within the context of virtual reality libraries, specifically from the viewpoint of language teachers. Many researchers have not concurrently investigated these variables, and this study also seeks to emphasize the crucial need to extend the benefits of modern technology and digital reality services to Persons with Disabilities, similar to other segments of society.

6 Study terms:

The current study included several terms, the most important of which are:

- **Scientific research:** A systematic scholarly endeavor aimed at uncovering facts, understanding their interrelationships, and deriving general principles and explanatory laws for scientific phenomena through defined scientific methodologies, with the ultimate goal of resolving existing problems.
- **Digital Quality:** Positive interaction between humans and computers by integrating the digital world with the physical world through specific skills to direct digital channels and stimuli towards achieving goals and personal benefits from the use of digital life, and guiding it positively. It also entails avoiding excessive engagement with new digital media, considering the prevalence and accessibility of digital communications.
- **Persons with Disabilities:** A significant deviation from typical or average person's performance, referring to persons whose performance differs substantially from the norm in areas such as cognitive, physical, or sensory abilities, or in behavioral, psychological, motor, health, linguistic, or educational characteristics, necessitating the provision of specialized education and support services, as well as psychological, counseling, and therapeutic interventions.
- **Virtual reality libraries:** Digital virtual environments linked to databases, electronic applications, etc., containing all materials of digital interactive visual, auditory, and tactile media, sources, and references, etc., related to various fields and sciences that contribute to human life development, with the availability of necessary digital tools and technologies for that.

7 Literature review

The previous studies were divided into more than one axis as follows:

7.1. Studies that addressed the challenges of scientific research.

A study presented by [4] discussed that the environment of scientific research and publishing is witnessing rapid development driven by the intersection of internal and external forces, including the increasing reliance on metric-based evaluation of scientists; the significant increase in the volume of manuscripts alongside expectations for rapid review and publication; the rise in the number of journals, including for-profit open access publications; and the adoption of preprint servers in an increasing range of disciplines. This contributed to increased anxiety and personal burnout among authors, reviewers, and editors, in addition to placing significant pressure on all steps of scientific research, a fundamental pillar of the scientific system. While emphasizing the values of editing and investing in them, respecting integrity and scientific credibility, and committing to content availability, transparency, and accountability, all of this enhances the pressures and challenges facing scientific research.

A study [17] has clarified that the production of scientific research in Arab countries is considered low relative to their population size and diverse natural resources. The low participation rate in global scientific research has significantly impacted various aspects of life in these countries. The study called for fundamental reform processes in the field of scientific research to begin, viewing it as an investment in the future and a cornerstone of development. The study confirmed that improving educational standards in Arab schools and universities represents a fundamental step in the process of reform and change. It attempted to answer questions such as: Do Arab universities have the opportunity to achieve progress in the future? How can Arab universities maintain their development? The researcher presented some recommendations among the results, the most important of which is that scientific research and its various mechanisms, as well as the financial, human, and technological challenges it requires, must be among the top priorities of those countries within their development plans.

The study [3] aimed to identify the challenges facing scientific research from the perspective of faculty members in Jordanian universities. The sample size was 460 faculty members from public and private universities. The most prominent findings include: the weak financial funding for scientific research, the lack of a connection between scientific

research and the needs of society and its fundamental issues, the emigration of scientific competencies from specialized professors, the lack of an information bank in educational institutions, the lack of seriousness among academic administrations in applying the results of scientific research in practice, and the fear among some of the technological transition in education and the insistence on adhering to traditional methods. One of the most prominent methods for addressing these challenges involves providing financial support for scientific research at universities, offering technical assistance, and electronically connecting them to the databases of educational institutions with advanced global rankings.

7.2. Studies addressing the digital lives of Persons with Disabilities.

The study [10] aimed to analyze the obstacles faced by Arab researchers in scientific research across the region. The study relied on a mixed-methods research methodology to collect data. A questionnaire was distributed to 86 Arab researchers, in-depth

interviews were conducted with three researchers, and scientific literature was reviewed.

The results showed that spending on scientific research is limited, averaging 0.5% of GDP, compared to 2% to 4% in developed countries. There is also a lack of facilities and equipment, brain drains, and limited scientific productivity. Furthermore, academic freedom and support for new ideas were insufficient, and publications in prestigious scientific journals were few.

The study [21] addressed artificial intelligence-based assistive technologies that may help individuals with special educational needs access and interact with educational content. The opportunities and capabilities of artificial intelligence for individuals with special educational needs have been presented and analyzed, particularly in the context of teaching and learning. The types of assistive technologies based on artificial intelligence for Persons with Disabilities were also explained. Considering the importance of curricula and instructional design models in the teaching and learning process for persons with special educational and learning needs, a blended learning approach and model is presented in special education, along with an explanation of its basic components and sub-components, with application to a case study.

The study [13] also aimed to develop digital applications as technological support for lecturers in media to use in the education process for students with disabilities, based on design-based research through needs assessment, design process, and the technology used, in addition to creating initial interactive prototypes. The results indicated that developments in assistive technology and disability research have led to increased interest in using assistive technology to enhance inclusive practices in the pursuit of knowledge.

In addition to focusing on creating diverse and culturally adaptable educational environments that meet various needs and experiences, there is also an increase in awareness of the challenges and societal biases when using assistive technology for Persons with Disabilities. This study is part of an effort to make educational environments more inclusive and accessible for students with disabilities, and to provide a range of resources that meet the diverse needs of students, such as customizable screens and interactive multisensory learning tools.

The study [2] aimed to identify the perspective of 70 female teachers towards the effectiveness of using assistive educational technology in the educational inclusion of Persons with Disabilities in schools. The study concluded that the requirements for using assistive educational technology in educational inclusion in schools were available at a moderate level.

The obstacles to using supportive educational technology in inclusive education were the lack of financial allocations, insufficient training and preparation of teachers to use computers, the scarcity of computer devices in inclusive schools and programs, the limited availability of specialized electronic programs, the few educational programs linked to curricula, the lack of time to obtain training and train students to use technology, the shortage of necessary time to prepare and develop new educational strategies that integrate technology into the curricula, the lack of reliable tools in some schools, and the lack of student independence.

7.3. Studies on Virtual Libraries

A study [8] addressed the urgent need for the digitization of cultural heritage to create effective digital libraries, particularly for under-resourced languages such as Arabic and Persian. This paper outlines the methodologies and challenges involved in developing a metadata-based Arabic digital library, integrating text recognition techniques and preservation strategies to address key issues related to accessibility, academic use, and long-term preservation of texts written in Arabic script. The paper discusses how integrated metadata can enhance not only text recognition but also improve user engagement by offering advanced search functionalities and better resource discovery. Finally, the paper points to future directions for expanding metadata frameworks to ensure compatibility and long-term preservation of cultural heritage, which reinforces the idea of virtual libraries.

The study [14] focused on creating a partial digital replica of the Limassol Municipal University Library, a prominent landmark in Limassol, using photogrammetry and 3D modeling techniques. A 3D platform was developed to enable users to experience a real-life feeling within the library. This was achieved by creating a virtual reality representation of an existing physical library, integrated with its core services, as a proof-of-concept, with a focus on 24/7 accessibility, functionality, and interactivity. To achieve this, a study was conducted to understand the current use of traditional libraries, examine the user experience in virtual reality, and identify requirements and expectations related to the development of a virtual library counterpart. Based on the observations and suggestions from the cognitive study, five main scenarios were implemented that demonstrate the potential use of the virtual library. A detailed user evaluation study was conducted after the final implementation of the virtual reality library, and the study strongly confirmed all the essential features of the virtual library and its potential for future application.

The study [1] aimed to investigate the reality of digital library use among a sample of 206 postgraduate students at the Middle East University. The study employed a descriptive survey approach, and a survey was prepared for this purpose. The study results revealed that the degree of postgraduate students' is high, while no statistically significant differences were found in the level of digital library usage due to gender, while statistically significant differences were found attributable to the variable of

college type in favor of the College of Information Technology followed by the College of Architecture and Design, while the difficulties facing the use of digital libraries were moderate.

7.4. Comment on the literature review

The researchers presented various previous studies in three different axes. The first axis addressed studies that discussed the challenges of scientific research. The reviewed studies agreed that scientific research faces numerous challenges, particularly in the Arab environment, as noted in studies by the AGU Editorial Network (2024), Masri (2024), Saaïda (2021), and Al-Damour (2021). It became clear that the reality of scientific research in Arab universities suffers from many obstacles and challenges, such as the lack of sufficient funding to support research, the migration of Arab intellectuals, the scarcity of modern references and sources, the lack of computer services, complex administrative obstacles, administrative corruption, theft of scientific proposals, and the involvement of academics and researchers without their need in scientific research.

The researchers also presented various previous studies in the second axes related to the digital life of Persons with Disabilities, where the studies of (Zavaraki, 2024; Restianty, Et. al., 2024; Al-Badou, 2020) agreed on the necessity of providing the requirements for using technology and overcoming the challenges of its application for this group, such as the lack of material support and the poor qualification of workers with these groups, providing computers suitable for their conditions, developing appropriate educational strategies, with the necessity of preparing classrooms technically, and supporting the surrounding infrastructure and community.

Regarding studies that addressed virtual libraries, researchers reviewed the studies of (El Ganadi et al., 2025; Serghides et al., 2024; Al-Ayed, 2020). These studies highlighted the benefits of digital libraries, which contributed to the development and facilitation of access to knowledge and information compared to traditional libraries. They also shed light on the reality of using digital libraries, which requires further efforts and faces numerous difficulties that need to be addressed. Meanwhile, librarians need to attend executive programs for digital library projects and are required to receive qualifications and training, with emphasis on establishing a digital database. Material support is essential to facilitate the work of digital libraries.

8 Theoretical Framework of the Study

The theoretical study included several axes: challenges of scientific research, digital quality, Persons with Disabilities, and virtual reality libraries. The theoretical framework of the study was divided into several axes that shall be addressed one by one as follows:

8.1. Challenges of scientific research

Scientific research is a fundamental pillar for the advancement of human societies and a primary driving force behind progress across all sectors of human development, playing a crucial role in addressing societal issues. It enables the utilization of scientific heritage and facilitates the acquisition and application of new knowledge in diverse fields. However, scientific research is often influenced by many determinants and factors that affect it and prevent it from being presented in the expected or required manner, such as the weakness of the connection links between the institutions concerned with scientific research in the community, the difficulty of implementing the results of scientific research, the contradiction of results in scientific studies, the multiplicity of institutions interested in the outcomes of studies and research, and many other challenges [15].

Statistical evidence consistently highlights a critical gap in scientific research within Arab nations compared to developed countries globally. Numerous indicators highlight a clear inadequacy and imbalance in the performance of Arab institutions dedicated to scientific research. A primary challenge and shortcoming are the underfunding of scientific research; progress is impossible without adequate financial support. The Arab Human Development Report indicates that funding for scientific research in the Arab world is among the lowest in the world, with spending on scientific research not exceeding 0.02% of national income in most Arab countries, compared to 22% in Japan, for instance [18].

The average Arab citizen's share of expenditure on scientific research is a mere \$ 3, compared to \$ 409 in Germany, \$601 in Japan, and \$681 in the United States. Compounding this issue is the fact that approximately 90% of Arab research funding originates from governmental sources, whereas in the United States, governmental contributions only account for 20-30%. In Arab countries, only 3% of scientific research funding comes from industry sources. Moreover, scientific research in the Arab world suffers not only from a lack of financial support but also from a lack of researchers, particularly in engineering, medicine, space sciences, and life sciences. UNESCO data indicates that for every million Arabs, there are 363 scientists and engineers engaged in scientific research and development. In contrast, this figure rises to 3,359 in North America, 2,206 in Europe, and a total of 3,600 across developed countries.

The migration of Arab intellectuals and talents also poses a major challenge to scientific research at the Arab level, especially in countries that suffer from emigration and the loss of many scholars. It may be noted that many professors from Egyptian

universities had a significant impact on the development of many physical and engineering studies in American universities and research centers, particularly at Columbia University in New York, Boston University and New Jersey, led by the Egyptian scientist Ahmed Zewail, who won the Nobel Prize in Chemistry in 1999, and who was then working at the California Institute of Technology.

The migration of specialized human resources causes Arabs to lose many of their vital scientific resources and wastes financial resources that are spent inappropriately. Previously, hundreds of thousands of Arab talents migrated to the United States, Canada, and Western Europe.

While Arab countries spend vast amounts of money to attract external talent, the real problem lies in the weakness of formulating successful scientific plans to carry out scientific research, implement them, and benefit from their results. This is in addition to coordinating efforts related to scientific research through international scientific conferences and joint projects between research centers and Arab universities on a regular basis to develop skills, exchange opinions, and ideas among researchers of different nationalities and diverse orientations [9].

Moreover, the absence of synergy and coordination between research entities, planning entities, and implementation entities is considered one of the most significant challenges in scientific research, especially in the Arab environment. This lack of integration and cooperation wastes significant effort, time, and financial resources, rendering research an isolated voice. Consequently, researchers are often driven primarily by pursuing degrees and academic titles, selecting topics based on ease of execution and readily available resources rather than their inherent significance, leading to research that fails to address fundamental problems [20].

[10] emphasized the urgent need for initiatives to boost funding, develop infrastructure, enhance training programs, strengthen connections with the private sector, promote intellectual freedom, and revitalize the research ecosystem in the Arab world. Adequate financial resources and training can empower Arab nations to reclaim their historically rich heritage of scientific excellence.

8.2. Digital Life

Today, information technology and digital life have become the primary drivers of economic growth and are improving the quality of life for individuals and communities. In its annual report, "Digital Prosperity: Understanding the Economic Benefits of the Information Technology Revolution," the Information Technology and Innovation Foundation documented the origins of information technology since the mid-1990s. It is widely considered that information technology is the primary driver of economic growth, not only in the United States but also in many countries worldwide.

The American study found that 75% of American adults use the internet regularly in their professional activities. A comparison with developing nations reveals a significant digital divide, with much lower adoption rates. This disparity stems from various factors, including the affordability of internet access and broadband infrastructure, governmental policies regarding digital quality of life, and a lack of emphasis on digital literacy initiatives in developing countries. Achieving a digital quality of life amidst the overwhelming flow of online information and social interactions requires specific skills to direct digital resources and motivations towards personal goals and benefits derived from positive engagement with digital life. It also necessitates managing digital multitasking, allocating time mindfully for daily routines, and reducing excessive consumption of new digital media. These issues represent another aspect of digital life that shall be considered in light of the abundance and ease of access to digital communications, to mitigate the potential downsides of digital welfare.

Over the past twenty years, the concept of digital life emerged following the development of digital technologies and the expansion of their applications, the proliferation of the global web, increasingly filled with all types of content, and the ability to search, select, and filter information. As a result, this quickly emerged as a new efficiency for the newly born digital world, which was named the digital world. This was followed by the widespread and tremendous spread of mobile devices and social networks, resulting in a significant qualitative leap in the digital world.

This expansion also witnessed a theoretical expansion of concepts and theories focused on studying the quality of persons' digital life and ways to achieve it in light of today's massive expansion in persons' digital lives [7].

For the aforementioned reasons, many countries have taken numerous steps to encourage digital adoption and the use of information technology in their transactions. Regarding digital living, Microsoft takes significant steps to help build digital literacy by providing many internet-connected computers to villages in poor countries. On the other hand, this requires governments to take constructive steps to eliminate digital illiteracy and improve their quality, and to make more efforts in partnership with global companies to provide assistive technologies and the infrastructure for communication networks.

The importance of a digital lifestyle has become increasingly apparent during crises, notably the COVID-19 pandemic, highlighting the critical need to enhance digital engagement for individuals and facilitate remote work and learning. Rising

unemployment rates in many societies have also underscored the potential of the new digital life as a solution to alleviate this global challenge. Consequently, digital life has created a space and opportunities for skilled individuals with innovative ideas to market their expertise online. Simultaneously, it has enabled employers and companies to recruit talent that improves their services and the quality of their offerings, thereby contributing to an enhanced quality of life for both employees and employers, while also saving significant effort, time, and financial resources [6].

8.3. Persons with Disabilities

Persons with Disabilities represent a part of society and the educational system, and they require the utilization of modern strategies and techniques in their upbringing, education, and cultural enrichment. This was emphasized by the recommendations of many conferences and international and local seminars. Furthermore, the use of various technologies and strategies, and their application in teaching, contributes to achieving many special education goals, facilitating their integration and involvement in all activities both inside and outside the school. Additionally, Persons with Disabilities suffer from many psychological, social, and educational problems resulting from their apparent or hidden disabilities, whether they are physical or sensory; thus, they are always in need of support and empowerment. [16].

Persons with Disabilities differ from others in one or more aspects of personality, to the extent that this difference makes the persons and society feel the need for these children or persons to receive special services. Therefore, this difference may be intellectual, physical, sensory, emotional, social, motor, or behavioral. For this reason, there are multiple classifications and categories for them, as well as various teaching strategies and methods. [19].

Attention to Persons with Disabilities has increased globally due to their growing numbers and the expansion of their categories. The United Nations Children's Fund reported that there are more than 500 million disabled persons worldwide of various categories and diversity, including 140 million children. The same statistics mentioned that there are over 40 million people with mental disabilities around the world at different degrees and types, while approximately 42 million suffer from visual disabilities that vary in severity, and 15 million are blind. Additionally, those affected by deafness or hearing impairment constitute 70 million. Some global statistics have revealed that the scale of the problem is increasing worldwide, with developed countries accounting for about 136 million persons, including 81 million with severe disabilities, while these percentages are higher in developing countries compared to developed ones. The statistics also indicated that approximately 10% of the world's population suffers from disabilities, especially with the discovery of many disabilities and the development of classification according to the classification of the American Psychiatric Association, which is responsible for that, according to the latest DSM-5 edition. There is a clear disparity between developed countries and developing countries in the average number of Persons with Disabilities, where the average of Persons with Disabilities in developed countries is 8%, while the average in developing countries is 13.5% of the population. This may increase to 20% of the population in poorer and less developed countries.

The fact remains that accurately quantifying the number of Persons with Disabilities is exceedingly challenging due to circumstances related to the nature and intensity of the disability and the unique environmental and social conditions of each category. Nevertheless, statistics typically provide crucial indicators and insights into the extent and seriousness of the problem, as well as the imperative to advance approaches and legislation that simplify the lives of Persons with Disabilities. This includes everything from the terminology used to the electronic services offered, their dedicated social media platforms, the enhancement of support services and educational resources, and the evolution of laws that ease their daily lives and promote their integration into the broader society, extending beyond just the school environment.

8.4. Virtual Reality Libraries

Rapid technological developments and the widespread availability of the Internet have reduced the role of the traditional library as a primary source of information. With the evolution of the metaverse, a revolutionary shift is anticipated in how social relationships are perceived within the educational context. Therefore, libraries must update their services to keep pace with technological trends and be part of this virtual revolution. It is believed that designing and developing a virtual reality library could serve as a hub for community and knowledge. [14].

Libraries today are moving towards becoming community centers that focus on education and experience as much as they are centered around books. Some visit libraries for free access to internet services and computers, 3D printing labs, virtual reality technologies, and other technologies that are not directly related to hundreds of volumes and printed books. Additionally, many library beneficiaries check the available books virtually. This leads us to question whether virtual reality laboratories, tours, and virtual workshops are the next step for libraries? Most indications confirm this proposition, as this technology is evolving and making its way out of games and movies and into education and daily experiences. [11].

Virtual reality in libraries bridges the gap between diverse communities by allowing them to travel to other times and places, working together to learn, build, and view pieces of history and literature, opening up to the experiences of others. Unlike video games, which frequently confine players to their homes, virtual reality in this context serves as a counter to isolation, offering a

way to attract visitors from various communities to the library to share virtual experiences and cultivate empathy and understanding for individuals they might otherwise never encounter. A virtual library is essentially unbound by physical walls, whose collections are not housed in paper documents, microforms, or any other physical medium accessible at a specific location. Instead, it is accessed through computer networks and delivers its services virtually. Consequently, a virtual library does not contain tangible physical information resources and does not inherently exist in a physical space. Therefore, an electronic library can be considered a component and connection within a broader virtual library framework [5].

Virtual reality libraries are truly considered the libraries of the future in light of the scientific trend towards transitioning to electronic education and digital content. The field of libraries and information constantly strives to catch up and benefit significantly from the applications of modern technologies in computing, information, and communication systems, and their applications in the world of libraries.

Virtual reality libraries embody the value of libraries that rely on modern technologies, communication, and information networks in all their operations [12].

[8] Pointed out that the digital library in virtual reality includes immersion, Realism, User Interaction, and Feedback, in addition to other features such as Animated NPCs, 3D Audio, Ray-Casting technology, and Graphical User Interfaces, which greatly enhance the user experience in the virtual reality library in terms of presence and independence in navigation.

9 The study methodology:

The current study employed a descriptive-analytical methodology. The procedures include the following:

9.1. Study Sample: The study sample consisted of 122 language teachers and 35 Persons with Disabilities of both genders and various disabilities, whose ages ranged between 14 and 18 years in Emirati schools in general. Figure 1 shows the distribution of the study sample of teachers by gender:

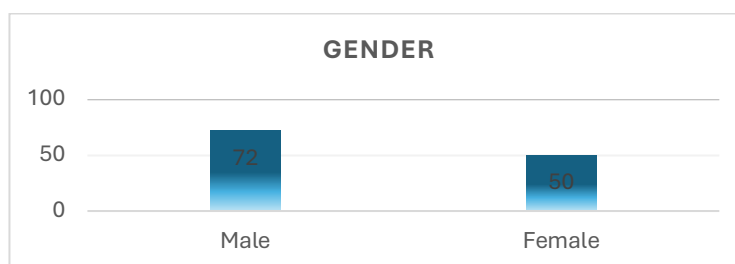


Fig. 1: shows the distribution of the study sample according to gender (teachers)

Figure 1 illustrates the distribution of the study sample of teachers by gender, where males represented 72 teachers. In comparison, the number of females was 50 teachers, and Figure 2 illustrates the distribution of the language teachers' sample according to experience as follows:

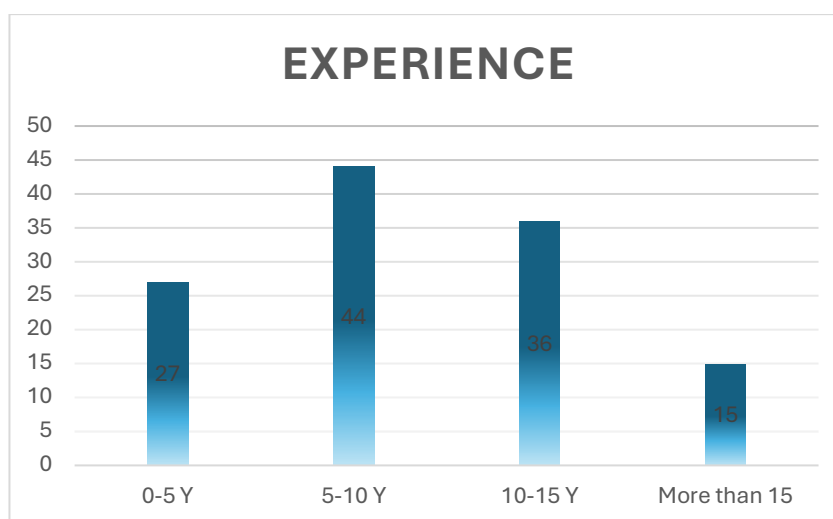


Fig. 2: shows the distribution of the study sample according to experience (teachers)

Figure 2 illustrates the distribution of the study sample according to teachers' experience, where those with (0-5 years) experience represented (27 teachers) of the sample, those with (5-10 years) experience represented (44 teachers), those with experience between (10-15 years) represented (36 teachers), and finally those with experience of more than (15 years) represented (15 teachers) of the total sample, while Figure 3 illustrates the distribution of the sample of Persons with Disabilities according to type as follows:

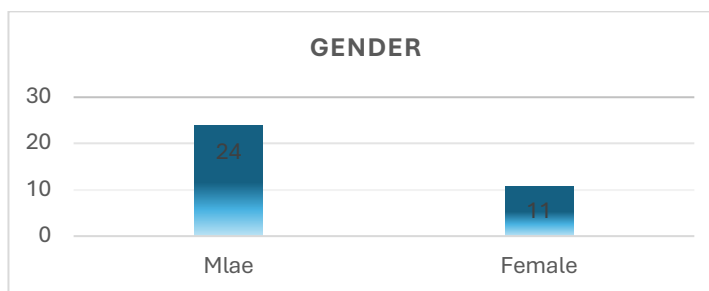


Fig. 3: shows the distribution of the study sample according to gender (Persons with Disabilities)

Figure 3 illustrates the distribution of the study sample of Persons with Disabilities by gender, where the number of males was 24, while the number of females was 11 from within the United Arab Emirates, and Figure 4 illustrates the distribution of the sample of Persons with Disabilities according to the type of disability as follows:

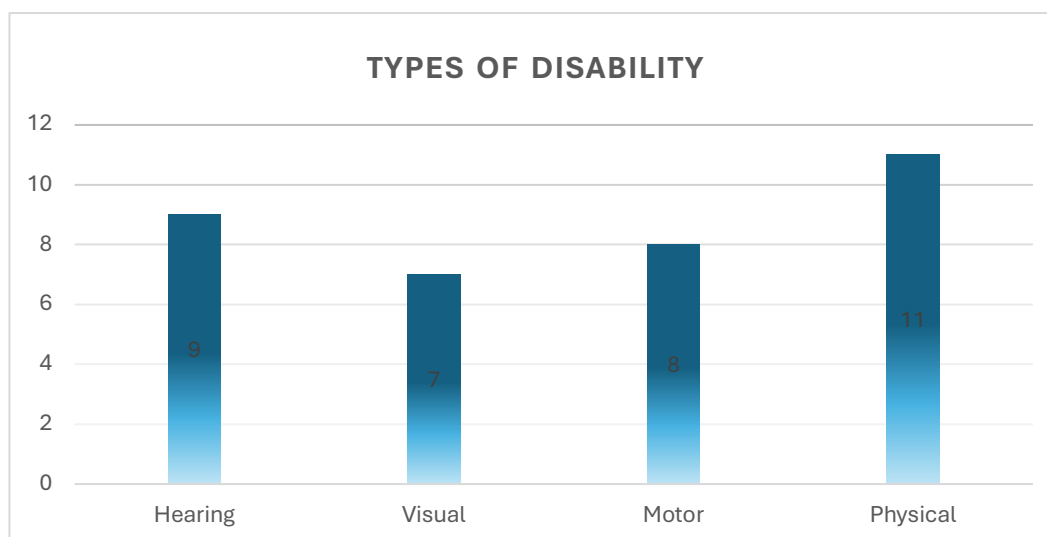


Fig. 4: shows the distribution of the study sample according to the type of disability (Persons with Disabilities)

Figure 4 illustrates the distribution of the study sample of Persons with Disabilities according to the type of disability. There were 9 persons with hearing disabilities, 7 with visual disabilities, 8 with motor disabilities, and 11 with physical disabilities, encompassing various physical disabilities.

9.2. Study Tools: The current study relied on two main tools:

- **A questionnaire examining the challenges of scientific research for Persons with Disabilities in light of virtual libraries:** The researchers prepared a questionnaire that included four axes, including material, administrative, training, and technical challenges. Each axis included six different statements that measured the extent of the challenge faced by Persons with Disabilities in light of virtual libraries.
- **A questionnaire of digital quality challenges for Persons with Disabilities in light of virtual libraries:** The questionnaire was designed to include the same challenges as the previous survey, which were material, administrative, training, and technical challenges. Each axis included five different statements that measured the digital quality challenges faced by persons with Disabilities in considering virtual libraries.

9.3. Validity and Reliability of the Study Tools:

This was done through two methods, namely:

- **Validity of the Arbitrators:** Both surveys were presented to a group of arbitrators to verify their validity and suitability for application. The agreement rate exceeded 90% regarding the soundness and suitability of the questionnaire statements for application in the current study. The phrases that were not agreed upon were removed.

Cronbach's Alpha Coefficient: The reliability of both tests was calculated using Cronbach's Alpha Coefficient, and the coefficients were high for most of the items of the two tests. Weakly related statements were deleted, and the Corrected Item-Total Correlation was less than 0.19, as Cronbach's Alpha Coefficient for the test score was high for all axes, as shown in Table 1.

Table 1: indicates Cronbach's Alpha Coefficients for the questionnaire of scientific research challenges for Persons with disabilities in light of virtual libraries.

Type of Challenges	Cronbach's Alpha Coefficient	Significance
Material	0.84	0.05
Administrative	0.91	0.05
Training	0.82	0.05
Technical	0.88	0.05

The results of Table 1 show high Cronbach's alpha coefficients, indicating the stability of the questionnaire on the challenges of scientific research for Persons with Disabilities in light of virtual libraries.

Table 2 indicates the Cronbach's alpha coefficients for the digital quality challenges survey for Persons with Disabilities considering virtual libraries, as follows:

Table 2: shows the Alpha coefficient for the questionnaire on digital quality challenges for Persons with Disabilities in light of virtual libraries.

Type of Challenges	Cronbach's Alpha Coefficient	Significance
Material	0.79	0.05
Administrative	0.86	0.05
Training	0.90	0.05
Technical	0.94	0.05

The results of Table 2 show that Cronbach's alpha coefficients are high, demonstrating the stability of the digital quality challenges survey for Persons with Disabilities considering virtual libraries.

10 Findings

To answer the study questions, the means and standard deviations of the questionnaire statements were calculated, as shall be apparent from the following:

- **First Question Results:** "What is the extent of the challenges facing scientific research for Persons with Disabilities in light of virtual libraries from the point of view of language teachers?" Table No. 3 shows the results of that question as follows:

Table 3: shows Means, standard deviations, T values, and significance level for the questionnaire on the challenges of scientific research for Persons with Disabilities considering virtual libraries.

Challenges	Statement No.	Average	Deviation	T Value	Importance Level	Challenges	Statement No.	Average	Deviation	T Value	Importance Level
Material	1	3.64	0.77	9.40*	Medium	Administrative	13	4.68	0.62	14.38*	High
" "	2	4.65	0.61	12.33*	High	" "	14	3.13	0.71	16.34*	Medium
" "	3	3.41	0.71	10.35*	Medium	" "	15	3.98	0.58	22.03*	High
" "	4	2.98	0.50	10.30*	Medium	" "	16	3.19	0.56	10.12*	Medium
" "	5	3.87	0.93	12.08*	High	" "	17	4.12	0.74	24.33*	High
" "	6	3.15	0.70	8.77*	Medium	" "	18	3.79	0.53	13.02*	Medium
Training	7	4.11	0.69	10.33*	High	Technical	19	3.58	0.65	10.77*	Medium
" "	8	3.81	0.81	12.31*	Medium	" "	20	3.50	0.68	14.09*	Medium
" "	9	4.47	0.47	13.38*	High	" "	21	4.68	0.81	18.31*	High
" "	10	4.97	0.43	12.25*	High	" "	22	4.89	0.74	14.97*	High
" "	11	3.91	0.67	10.89*	High	" "	23	4.01	0.80	18.48*	High
" "	12	3.07	0.84	8.18*	Medium	" "	24	3.65	0.79	14.55*	Medium

* Tabulated (T) value at the level of ($\alpha \geq 0.05$) (1.669)

The results of the previous table indicate that the averages of the study sample's opinions regarding the challenges of scientific research for Persons with Disabilities, considering virtual libraries, were either high or medium, as the averages ranged between 2.98 and 4.98. This indicates low dispersion among the responses of the sample members regarding the challenges of scientific research for Persons with Disabilities in light of virtual libraries, which reflects the somewhat low convergence of the sample members' viewpoints regarding those challenges. The table also indicates the convergence between the values of the arithmetic means of the statements, as it is noted through the levels of significance that there are no statistically significant differences in the viewpoints about all the statements, as all levels of significance were less than 0.05 for all paragraphs of the survey. Figure (5) refers to the Analysis of means and standard deviations of the challenges faced by the Disabled in virtual libraries as follows:

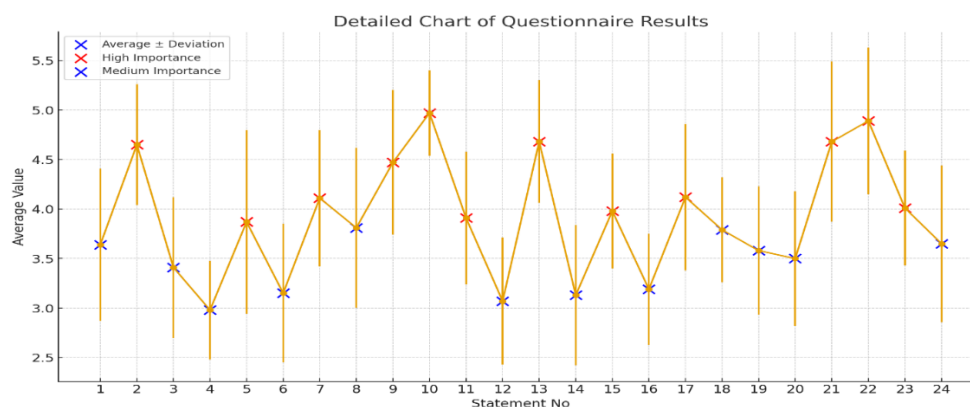


Fig. 5: Means & ST. DV of the challenges faced by the Disabled in virtual libraries

Regarding Figure 5, it can be observed that the sample identified training and technical and technological support as the most significant challenges (especially items 9, 10, 21, and 22).

While some administrative or minor challenges, such as (4, 12, and 14), were considered less important.

The results are statistically consistent, lending strength to the findings and confirming that the challenges mentioned are realistic and serious.

- **Second Question Results:** What are the challenges facing scientific research for Persons with Disabilities in light of virtual libraries from the perspective of Persons with Disabilities? Table No. 4 shows the results of this question as follows:

Table 4: shows Frequencies, percentages, standard deviation, and chi-square for the challenges facing scientific research for the Disabled, considering virtual libraries

Axes	1	2	3	4	5	Standard Deviation	Standard Deviation	chi-square
Material Challenges	20	10	2	2	1	4.6	0.7	30.2 b
	19	9	4	2	1	4.2	0.6	33.2 b
	17	12	2	2	2	3.9	0.5	36.4 b
	18	13	2	1	1	4.6	0.5	33.1 b
	16	12	2	3	2	4.8	0.3	40.0 b
Training Challenges	18	9	4	2	2	4.5	0.4	31.5 b
	17	11	4	2	1	3.8	0.6	36.0 b
	19	12	2	1	1	3.7	0.1	38.5 b
	19	10	3	2	1	4.7	0.4	39.1 b
	17	11	3	3	1	4.0	0.8	33.8b
Administrative Challenges	17	6	6	3	3	4.8	0.7	41.0 b
	15	12	4	2	2	3.9	0.4	30.4 b
	19	10	4	1	1	3.5	0.2	34.1 b
	16	8	5	3	3	4.5	0.2	36.2 b
	13	9	6	4	3	4.6	0.4	35.0 b
Technical Challenges	22	11	1	1	0	4.8	0.3	39.5 b
	19	11	2	2	1	4.2	0.4	32.2 b
	20	11	2	1	1	4.3	0.8	37.5 b

	23	8	2	2	0	3.9	0.5	39.3 b
	18	13	3	1	0	4.7	0.3	29.5 b
Total	362	208	63	40	27	4.3		
%	51.7	29.7	9	5.7	3.9			

The previous table shows the results of the second question, which is about the challenges facing scientific research for Persons with Disabilities in light of virtual libraries, from the perspective of Persons with Disabilities. It became clear that 51.7% of the sample completely agreed with the statements, supporting the existence of material, training, administrative, and technical challenges. The percentage of those who agreed was 29.7%, while those who were neutral were 9%, those who disagreed were 5.7%, and finally those who strongly disagreed were 3.92.4%, which confirms the existence of these challenges at high rates. It is also noted that the arithmetic mean of the total statements was (4.3) with a standard deviation less than one for all survey statements, which indicates the homogeneity of the sample members' responses in their opinions towards the survey statements. All statements' chi-square was less than 0.05, indicating the participants' agreement.

Figure 6 refers to the Distribution of the views of the Disabled on the challenges facing scientific research in the context of virtual libraries as follows:

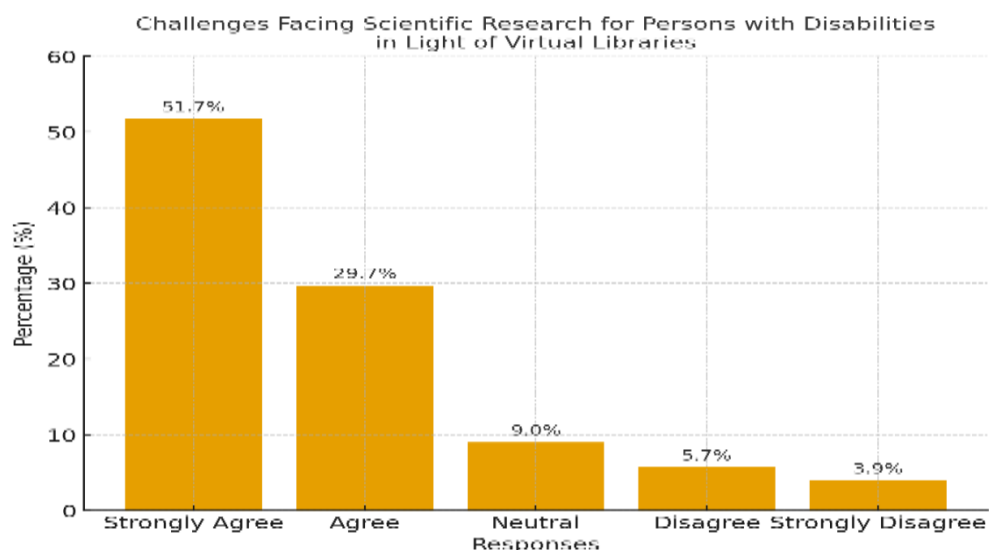


Fig. 6: Challenges facing scientific research in the context of virtual libraries for the Disabled

Figure 6 shows that the majority believe that there are real challenges (financial, training, administrative, technical) facing researchers with disabilities when dealing with virtual libraries, which require practical solutions to reduce these obstacles.

- **Third Question Results:** “What are the challenges facing digital quality for Persons with Disabilities in light of virtual reality libraries from the perspective of language teachers?” Table No. 5 shows the results of that question as follows:

Table No. 5 presents the means, standard deviations, T values, and significance levels of the survey on the challenges of digital quality for people with disabilities, considering virtual reality libraries from the perspective of language teachers.

Table 5: shows the mean ST. DV, T values, on the challenges of digital quality for Disabled, virtual reality libraries

Challenges	Statement No.	Average	Deviation	T Value	Importance Level	Challenges	Statement No.	Average	Deviation	T Value	Importance Level
Material	1	4.35	0.65	9.40*	High	Administrative	11	3.58	0.60	9.35*	Medium
.. ..	2	4.65	0.59	10.58*	High		12	4.68	0.87	12.20*	High
.. ..	3	3.68	0.71	9.08*	Medium		13	4.18	0.58	14.23*	High
.. ..	4	2.98	0.79	10.30*	Medium		14	3.89	0.47	11.02*	High
.. ..	5	3.97	0.65	12.08*	High		15	2.96	0.70	14.05*	High
Training	6	4.77	0.69	10.33*	High	Technical	16	3.55	0.65	12.71*	Medium
.. ..	7	3.81	0.84	11.28*	Medium		17	3.68	0.68	14.11*	Medium
.. ..	8	3.55	0.47	12.30*	Medium		18	4.84	0.71	18.31*	High
.. ..	9	4.97	0.69	10.02*	High		19	4.89	0.58	14.97*	High
.. ..	10	4.05	0.67	11.87*	High		20	4.01	0.67	18.48*	High

* Tabulated (T) value at the level of $(0.05 \geq \alpha)$ (1.669)

The results of the previous table indicate that the averages of the study sample's opinions about the challenges of digital quality for Persons with Disabilities, considering virtual libraries, were either high or medium, as the averages range between 2.99 and 4.97. This suggests low dispersion among the responses of the sample members about the challenges of digital quality for Persons with Disabilities in light of virtual libraries, which reflects the somewhat low convergence of the viewpoints of the sample members about those challenges. The table also indicates the convergence between the values of the arithmetic mean of the statements, as it is noted through the levels of significance that there are no statistically significant differences in the viewpoints about all the statements, as all levels of significance were less than 0.05 for all paragraphs of the survey. Figure (7) refers to means, standard deviations, T values, and significance level of the survey on the challenges of digital quality for the Disabled, considering virtual reality libraries as follows:

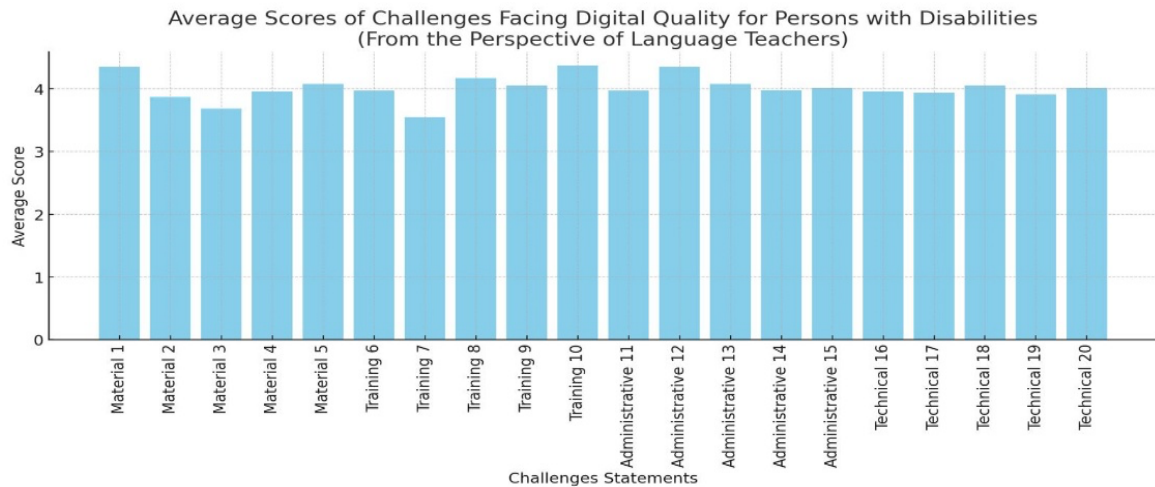


Fig. 7: Means of means, ST. DV, T values, on the challenges of digital quality for the Disabled, considering virtual reality libraries

Reviewing Figure 7, we can find that Training and administrative challenges received the highest averages (approximately over 4.5), indicating that teachers consider them the most challenging. Physical challenges ranged from 3.6 to 4.6, with a medium to high level. Technical challenges also recorded high averages (approximately 4–4.9). All values were approximately above 3, meaning that all dimensions are considered real challenges to varying degrees.

- **Fourth Question Results:** - What are the challenges facing digital quality for Persons with Disabilities in light of virtual reality libraries from the perspective of Persons with Disabilities? Table No. 6 shows the results of this question as follows:

Table (6): Frequencies, percentages, standard deviation, and chi-square for the challenges facing digital quality for Persons with Disabilities in light of virtual libraries from the perspective of Disabled.

Table 6: shows Frequencies, ST. DV and chi-square for the challenges facing digital quality for the Disabled

Axes	1	2	3	4	5	Average	Standard Deviation	chi-square
Material Challenges	18	11	3	2	1	3.6	0.8	33.6 b
	17	12	4	1	1	4.5	0.6	44.3 b
	16	10	3	4	2	4.7	0.6	45.6 b
	14	13	5	2	1	3.9	0.7	55.1 b
	20	9	1	2	3	4.2	0.9	36.1 b
Training Challenges	20	9	2	2	2	3.8	0.5	39.0 b
	16	13	5	1	0	4.6	0.5	37.6 b
	15	13	1	4	2	4.8	0.4	40.2 b
	18	12	2	2	1	4.5	0.6	41.0 b
	21	10	2	2	0	3.9	0.8	33.8 b
Administrative Challenges	22	10	3	0	0	4.5	0.7	37.3 b
	18	11	5	1	0	4.7	0.5	41.2 b
	16	13	1	3	2	4.8	0.3	35.7 b
	19	12	1	2	1	4.3	0.8	29.9 b
	18	14	2	1	0	4.7	0.4	42.0 b

Technical Challenges	23	10	2	0	0	4.0	0.6	41.9 b
	20	11	3	1	0	3.9	0.5	29.3 b
	21	13	0	0	1	4.3	0.8	31.7 b
	24	10	0	1	0	4.5	0.9	30.5 b
	20	12	2	1	0	4.6	0.7	28.6 b
Total	376	228	47	32	17	4.3		
%	53.7	32.6	6.7	4.6	2.4			

The previous table presents the results for the third question, which addresses the challenges facing digital quality for Persons with Disabilities in the context of virtual libraries from their perspective. It became clear that (53.7%) of the sample completely agreed with the statements supporting material, training, administrative, and technical challenges. The percentage of those who agreed was 32.6%, while those who were neutral were 6.7%, those who disagreed were 4.6%, and finally, those who strongly disagreed were 2.4%, which confirms the existence of these challenges at significant rates. It is also noted that the arithmetic means of the total statements reached 4.3, with a standard deviation of less than one for all survey statements, indicating the homogeneity of the sample members' responses in their opinions towards the survey statements. The chi-square was less than 0.05 for all statements, indicating the participants' agreement on all statements. Figure 8 refers to the Distribution of responses from disabled individuals regarding challenges facing digital quality in light of virtual libraries, as follows:

Overall Responses to Digital Quality Challenges in Virtual Libraries

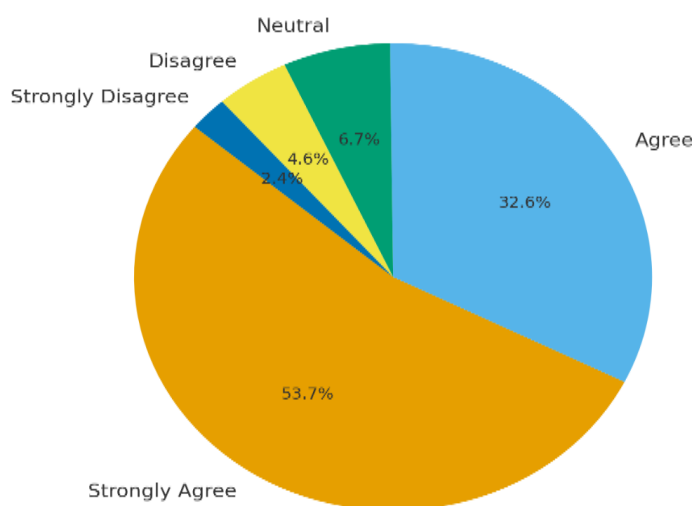


Fig. 8: Challenges facing digital quality in light of virtual libraries for the disabled

Figure 8 shows that Training challenges scored the highest average (4.6), indicating that a lack of training and digital skills is the biggest obstacle. Technical challenges followed (4.5). While physical and administrative challenges were slightly lower (4.3). The figure shows that all dimensions are high (more than 4 out of 5), meaning that all types of challenges are considered significant by people with disabilities.

- **Fifth Question Results:** "Are there statistically significant differences between males and females regarding the challenges facing scientific research for Persons with Disabilities in light of virtual libraries?" Table No. 7 shows the results of that question as follows:

Table 7: shows differences between sample members in their attitudes towards the challenges of scientific research for disabled, regarding to gender.

Challenge Type	Gender	Sample Size	Average	Degree of Freedom	T Value	Significance Level
Materialistic	Males	72	18.32	3.61	-1.02	Not significant
	Females	50	16.41	3.41	0.11	Not significant
Administrative	Males	72	14.32	401	-1.44	Not significant
	Females	50	12.14	3.10	-1.03	Not significant

Training	Males	72	18.65	3.65	0.09	Not significant
	Females	50	16.54	4.08	-2.14	Not significant
Technological	Males	72	14.35	3.80	0.01	Not significant
	Females	50	16.34	2.97	-1.05	Not significant

The results presented in the preceding table indicate that there are no statistically significant differences between existing males and females in their attitudes towards the challenges of scientific research for Persons with Disabilities when considering virtual libraries according to gender, with regard to all material, administrative, training, and technical challenges. This suggests the convergence of views between both males and females regarding their attitudes towards the challenges of scientific research for Persons with Disabilities in light of virtual reality libraries. Figure (9) refers to the Differences between males and females in the challenges facing digital quality for the disabled in light of virtual libraries as follows:

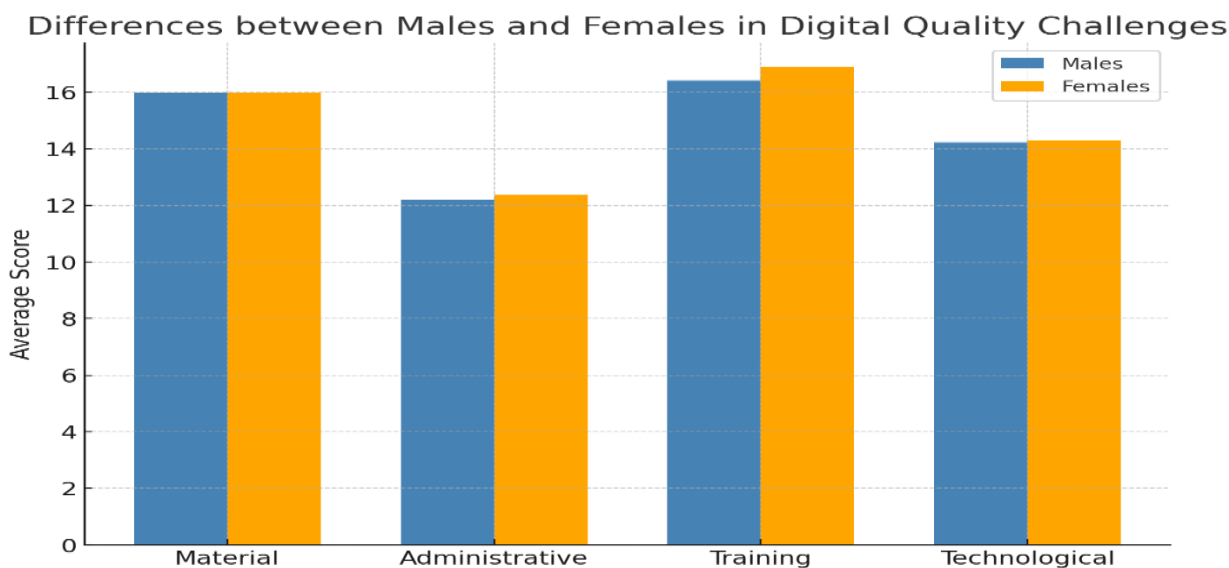


Fig. 9: The Differences between males and females in the challenges facing digital quality for the disabled

Regarding Figure 9, notice that the genders' views on digital challenges are very similar. This suggests that gender is not a significant factor in determining the level of digital challenges in virtual libraries.

- **Sixth Question Results:** “- Are there statistically significant differences between males and females regarding the challenges facing digital quality for Persons with Disabilities in light of virtual reality libraries?” Table No. 8 shows the results of this question as follows:

Table 8: shows differences between sample members in their attitudes towards the challenges of digital quality for the Disabled according to gender

Challenge Type	Gender	Sample Size	Average	Degree of Freedom	T Value	Significance Level
Material	Males	72	16.00	3.03	0.01	Not significant
	Females	50	15.35	3.28	0.03	Not significant
Administrative	Males	72	12.21	4.01	-1.05	Not significant
	Females	50	14.16	3.08	0.04	Not significant
Training	Males	72	16.22	4.11	0.09	Not significant
	Females	50	18.30	4.97	-2.10	Not significant
Technological	Males	72	16.33	3.98	0.01	Not significant
	Females	50	14.28	3.27	-1.08	Not significant

The results of the previous table indicate no statistically significant differences between males and females in their attitudes towards the challenges of digital quality for Persons with Disabilities in light of virtual libraries, according to gender, concerning all material, administrative, training, and technical challenges. This reflects the convergence of views between males and females regarding their attitudes towards the challenges of digital quality for the disabled, considering virtual libraries. Figure (10) refers to the Differences between males and females in the challenges facing scientific research for the disabled in light of virtual libraries as follows:

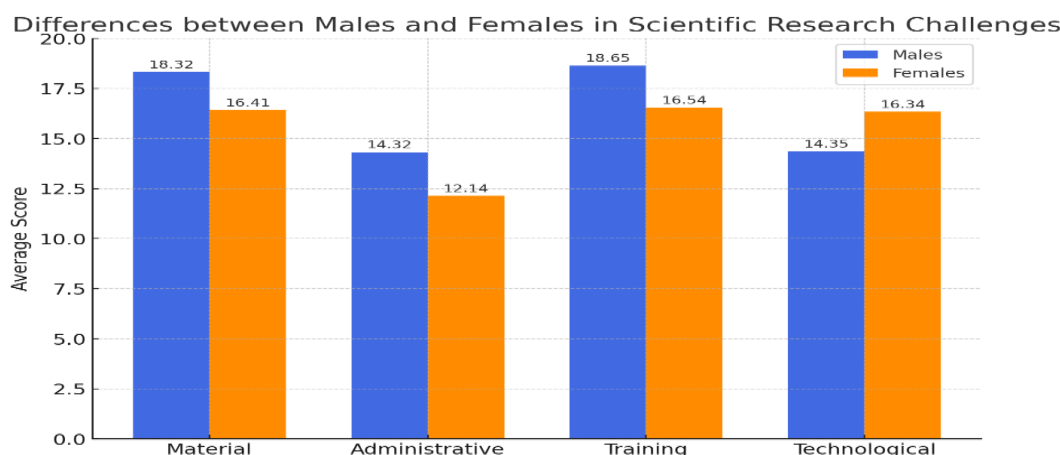


Fig. 10: Differences between males and females in the challenges facing scientific research for the disabled

Figure 10 refers to the fact that both genders share roughly the same perspective on challenges. This reflects the similarity of perspectives and the limited influence of gender on evaluation.

11 Results Discussion

The study results revealed several challenges encountered by Persons with Disabilities in terms of both scientific research and digital quality, particularly in the context of virtual reality libraries, as expressed through the opinions of a sample of language teachers and Persons with Disabilities. The biggest of these challenges were the material, administrative, training, and technical challenges. These studies outcomes align with the observations of (AGU Editorial Network 2024, Masri. 2024, Al-Damour 2021), as the results of the study showed that the reality of scientific research in Arab universities suffers from many obstacles and challenges, such as the lack of sufficient funding to support research, which represents the biggest challenge, and the migration of Arab intellectuals presents another challenge, alongside the limited availability of modern references and sources, insufficient computer services and administrative barriers.

Consistent with the findings of (Zavaraki2024, Restianty et al., 2024; Al-Badou, 2020), persons with Disabilities encounter many challenges in providing digital services, particularly within digital libraries. This highlights the need to provide the requirements for using technology and overcoming the challenges of applying technology to this group, such as the lack of material support and training of workers with these groups, providing computers suitable for their conditions, developing appropriate educational strategies for them, and the necessity of technologically equipping classrooms, and supporting the infrastructure and the community surrounding this group.

The results of the current study also supported what was indicated by (El Ganadi et al 2025, Serghides Et.al2024, Al-Ayed 2020;), regarding the necessity of utilizing the services of the digital library, a matter requiring continued effort, as digital libraries play a crucial role in the development of libraries and facilitating access to knowledge and information, leading the transition towards virtual libraries, which requires developing the expertise of librarians and training them on digital and virtual library services, with the need on focus on creating a digital database, virtual reality applications and its various tools, alongside providing material support to facilitate the delivery of digital and virtual library services.

12 Recommendations

The study suggested several recommendations, including:

- Equipping librarians with training on virtual digital library services and ensuring they are adequately qualified to support Persons with Disabilities.
- Developing digital libraries by incorporating virtual technology and adapting them to meet the needs of people with disabilities.
- Contributing to developing innovative technical methods that align with disabilities of all kinds to enhance library services provided to Persons with Disabilities.
- Providing adequate material support to universities and research institutions, and integrating them to encourage scientific research, especially for Persons with Disabilities.

- Providing Persons with Disabilities with technical services and recreational competitions that help integrate them into the modern digital society, thus enhancing their digital quality.
- Encouraging national non-profit organizations to support talented People with Disabilities in scientific research fields and provide them with all necessary resources to achieve this, so that they can benefit from their ideas and research in various fields.

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Biography:



Ayman Zhran holds a PhD in Psychology and Psychological Counseling, with a specialization in *Psychotherapy for Handicapped Children* (2010). He has served as an Assistant Professor at leading Gulf universities, including King Abdulaziz University, the University of Sharjah, and Ajman University.

His research interests span across Special Needs, Psychology, Criminal Psychology, Education, and Psychotherapy. Dr. Zhran has published numerous research articles in well-regarded international journals in the fields of Humanities and Social Sciences. He also serves as a reviewer and editorial board member for several psychological and educational journals.



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Amal Badr is an Associate Professor at the College of Mass Communication, Ajman University, specializing in radio and television. She has a distinguished academic record, with numerous research papers published in peer-reviewed scientific journals at both the Arab and international levels, covering various fields of media studies. She has served as a reviewer for many media-related research papers and studies, and is a member of the scientific committees of several academic conferences. Dr. Badr has also participated in numerous specialized training courses and workshops, and has received several certificates of appreciation and awards of excellence in recognition of her outstanding contributions to academic work.