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The role of digital transformation in enhancing support and care for families of people with disabilities in Saudi Arabia and Egypt: Current realities, challenges, and strategies for improvement

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ABSTRACT

This study investigates the role of digital transformation in enhancing support and care for families of individuals with disabilities in Saudi Arabia and Egypt, focusing on realities, challenges, and strategies for improvement. Adopting a descriptive-analytical comparative approach, data were collected through an online questionnaire involving 605 families—296 from Egypt and 309 from Saudi Arabia. The findings indicate that families in Saudi Arabia generally exhibit more positive attitudes towards digital transformation than those in Egypt, with younger individuals (under 34), males, and those with educational qualifications below secondary school and bachelor's degrees demonstrating higher positivity. Additionally, families of individuals with physical and hearing disabilities reported more favorable attitudes compared to families of individuals with visual and intellectual disabilities, who were largely neutral. The results also reveal significant differences between the two countries in digital transformation utilization, with Saudi Arabia showing a higher overall mean score (3.395) compared to Egypt (2.824). Moreover, families in Egypt face considerable challenges in adopting digital technologies, and the effectiveness of proposed strategies to overcome these challenges is greater in Saudi Arabia. Notably, significant differences in digital transformation use were attributed to country and age, while gender, educational qualifications, and type of disability showed no substantial impact.

1. Introduction

The world has recently witnessed significant transformations in many areas, most notably the digital transformation, which has become a fundamental pillar in developing services in various sectors. In this context, there is increasing interest in employing digital technologies to improve the care and support provided to people with disabilities and their families (Kumar et al., 2024). The digital transformation in delivering support and care services to families of people with disabilities is one of the most critical initiatives to enhance access to educational, health, and social services more effectively and efficiently. In Egypt and Saudi Arabia, governments and relevant institutions are moving towards integrating modern technologies into care and support strategies to improve the lives of people with disabilities and their families. People with disabilities represent an integral part of any society. With the development of technology and modern technologies in all fields, the family has become a role in teaching their children with disabilities to benefit from technology and modern technologies, so the use of technology and modern technology tools, especially with people with disabilities, has become a reality and imposed on every nation seeking development, growth, and prosperity. Therefore, childhood disability poses many long-term pressures on the individual himself and his family members, as family members of people with disabilities face challenges in adapting to the needs and care of their children. Families of people with disabilities need to provide and meet the needs of their children, as this may affect the well-being of the child and his family.

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Therefore, it was essential to adopt strategies to meet the daily needs of their children. Recently, parents have used digital transformation to increase their support and assistance in caring for their children with disabilities (Gruebner et al., 2022).

The study by Yang et al. (2021) indicated that technology can provide innovative solutions to several challenges faced by people with disabilities and their families, such as access to health and educational services, facilitating communication with specialists, and providing training and rehabilitation programs. However, the success of these initiatives requires the availability of an appropriate infrastructure, continuous training for specialists, and community awareness about the importance of digital transformation in improving the quality of life of people with disabilities. Moreover, Al-Azawei et al. (2016) explored the application of Universal Design for Learning (UDL), an approach that uses technology to accommodate diverse learners, including those with disabilities. It highlights the importance of inclusive educational environments and the integration of assistive technologies to remove learning barriers—matching the intent of your original source but with peer-reviewed academic backing.

Therefore, most countries have sought to apply digital transformation technologies in all institutions and fields, given their utmost importance, especially with the technological development in information and communications. Accordingly, the National Council for Disability indicated that the more society becomes dependent on technology to perform essential aspects of daily life, such as communication, learning, shopping, and interaction, the more necessary it becomes for people with disabilities to have the ability to access technology efficiently. Digital transformation has revolutionized support for families of children with disabilities by enhancing access to information and social support through digital platforms, such as social media and health-related applications, addressing gaps in traditional healthcare systems, and improving caregiver experiences. Gruebner et al. (2022) indicated that technology has significantly improved communication between caregivers and families, enhancing psychosocial support for families and providing better care for children with disabilities. The digital transformation in education could provide adequate educational support for families raising children with disabilities by enhancing communication and organizing educational resources in an improved manner. The digital transformation significantly impacts children with disabilities and their families because it focuses on adding a modern and exciting character to the programs used by parents or children with disabilities. As Donohue and Schomburg (2017) suggested, the goals of digital transformation in childhood education have evolved beyond simply imparting technical skills or knowledge. They now include empowering parents to intentionally select and use assistive technologies that support their child's development, problem-solving abilities, skill mastery, and future readiness for the labor market.

1.1. Study problem

Modern digital transformation techniques and technology are still far from the reality for people with special needs, as reliance on traditional methods, whether at home or school, is still the basis for raising and educating children with disabilities. Accordingly, the countries Egypt and Saudi Arabia, in long-term visions such as Vision 2030, have been interested in caring for people with disabilities and providing the capabilities and capacities to help guide and educate them and benefit from them in the development of society.

Apps et al. (2024) believed that parents and family members of people with disabilities benefit from many services, technologies, and devices available in caring for their disabled relatives and that there are many benefits of using technology for these families, such as providing support and care for them, understanding modern and effective technologies with their children, and increasing their children's participation in society. Accordingly, many challenges and obstacles prevent the optimal use of this technology, such as the fact that many families of people with disabilities live in isolation from development and technology, the weak economic level, and the high price and cost of purchasing and repairing these devices (Osam et al., 2021). The research problem is evident in the scarcity of studies that addressed the role of digital transformation in enhancing support and care provided to families of people with disabilities, although some studies, such as the study (Jankowska, 2020), addressed digital transformation among people with disabilities, they were limited to the role of digital transformation with children with disabilities themselves, or the effectiveness of digital transformation with children with disabilities from the point of view of the school and teachers. The researchers' choice to study the role of digital transformation in enhancing support and care for families of people with disabilities in Saudi Arabia and Egypt is due to an attempt to reveal the reality of families' use of digital transformation, the challenges facing the use of digital transformation, and knowing the proposed coping strategies to overcome these challenges; Hence, the problem of the study lies in the following five questions:

1. Do demographic factors such as country, gender, age group, educational level, and type of disability affect the attitudes of families with disabilities toward digital transformation in providing support and care for families with disabilities in Egypt and Saudi Arabia?
2. What is the actual reality of families with disabilities in Egypt and Saudi Arabia using digital transformation in caring for and supporting people with disabilities?

3. What are digital transformation's most prominent challenges in supporting and caring for families with disabilities in Egypt and Saudi Arabia?
4. What are the proposed strategies to overcome the challenges of digital transformation in supporting and caring for families with disabilities in Egypt and Saudi Arabia?
5. Are there differences in the level of digital transformation used by families with disabilities in caring for and supporting people with disabilities attributed to the variables (country, gender, age group, educational level, and type of disability)?

1.2. Study objectives

The current study seeks to achieve the following objectives:

1. Knowing the impact of demographic factors such as country, gender, age group, educational level, and type of disability on the attitudes of families of people with disabilities towards digital transformation in providing support and care for families of people with disabilities in Egypt and Saudi Arabia
2. Interpreting the actual reality of using digital transformation in caring for and supporting people with disabilities in Egypt and Saudi Arabia.
3. Knowing the challenges facing families of people with disabilities in Egypt and Saudi Arabia when using digital transformation in providing support and care for their families.
4. Understanding the proposed strategies to overcome digital transformation challenges in supporting and caring for families of people with disabilities in Egypt and Saudi Arabia.
5. Knowing the differences in the level of use of digital transformation by families of people with disabilities in caring for and supporting people with disabilities attributed to variables (country, gender, age group, educational level, and type of disability).

1.3. Importance of the study

The importance of the current research lies in two aspects:

A. Theoretical importance:

- The importance of the role played by digital transformation in strengthening and supporting families of children with disabilities and facing the challenges they face.
- The importance stems from the sample covered by the study, which is families of children with disabilities, the strong role of these families in society, and the obligatory duty to help them with the obstacles they face.

B. Applied importance:

- Clarifying the role of digital transformation and technology in helping families of children with disabilities.
- Coming up with results that help address the challenges faced by families of children with disabilities when using digital transformation technologies.

1.4. Study scope

The current study scope was limited to the spatial, temporal, and human limitations. Regarding the spatial limitations, the study was implemented in the Kingdom of Saudi Arabia and the Arab Republic of Egypt, where samples representing different social and age groups were selected from both countries. The temporal limitations: The study was implemented in 2024 AD. Moreover, the human limitations refer to the study sample, which consisted of 605 families, 296 families from Egypt, and 309 families from Saudi Arabia.

1.5. The contribution of this research

This study uniquely contributes to the body of knowledge by comprehensively examining the role of digital transformation in enhancing support and care for families of people with disabilities in Saudi Arabia and Egypt. Unlike prior studies, which have primarily focused on specific aspects such as digital tools' impact on children with disabilities or the perspective of educators, this research:

1. Provide comparative analysis across two nations: By offering a comparative perspective by analyzing the differing realities, challenges, and opportunities of digital transformation in two culturally and economically distinct nations, providing insights into regional variations.
2. Focus on families: Centers on families as the primary caregivers, addressing their digital literacy, access to technology, and the socioeconomic barriers they face.
3. Provide comprehensive framework: By developing a multi-dimensional framework encompassing digital usage, awareness, challenges, and coping strategies specific to families of people with disabilities.
4. Provide insights into demographic variations: By highlighting the impact of demographic variables (e.g., age, gender, educational level, and type of disability) on attitudes toward and usage of digital technologies, enriching the understanding of how digital transformation interacts with societal factors.
5. Focus on Vision 2030 of both countries, bridging the gap between policy aspirations and on-the-ground realities.

Now, the literature review will be presented in the following section.

2. Theoretical framework and previous studies

There are many aspects related to disability and its impact on the family. Children with disabilities are children who suffer from some long-term disabilities that may be physical, mental, medical, intellectual, sensory, or developmental disability or impairments. These needs usually include difficulty in movement or knowledge in perceiving and expressing feelings and emotions and maybe difficulty speaking (Al-Khateeb et al., 2020). Accordingly, Abyss et al. (2022) said that disability is generally defined as a physical, mental, or psychological injury that causes harm to the child's physical or mental development or both. It may affect his psychological state and the development of his education and training. Thus, the individual or the child becomes a person with special needs and is less than his peers of the same age in physical functions perception, or both. Disabled children are usually classified into the following groups: Physically handicapped children disability physical, mentally retarded intellectual disability, socially handicapped children, disability Social. Disability occurs for several reasons or factors, the most important of which are congenital factors, communicable diseases, non-communicable physical diseases, functional psychological and mental disorders, accidents, malnutrition, and addiction to alcohol and drugs. Families are the primary caregivers for children with disabilities. The caregiver's quality of life is poor; caregiver burden scores were high and depended on the type of disability (Arasu and Shanbhag, 2021). Six aspects of the literature will now be discussed, including digital transformation disabilities families, its role in their lives, challenges, tools, Saudi Arabia's and Egypt's interests, and benefits.

2.1. Digital transformation for families of people with disabilities

Digital transformation means moving from a traditional system to a digital system based on information and communications technology in light of a set of requirements represented in developing a strategy for digital transformation, spreading the culture of digital transformation, designing digital educational programs, managing and financing digital transformation, in addition to human, technical, legislative, and security requirements. Accordingly, digital transformation is linked to creating change, achieved through digital technology and business models to improve performance (Seres et al., 2018). As noted by Vial (2019), digital transformation involves a profound shift from traditional processes to technology-driven systems, necessitating the integration of information and communication technologies across all operational areas. This transformation requires organizational readiness, cultural adaptation, technological infrastructure, and robust governance mechanisms. According to Slavković et al. (2024), digital transformation encompasses the integration of modern information and communication technologies to facilitate knowledge dissemination and skill development. This process aims to enhance learning and management practices, thereby improving overall quality and fostering innovation and problem-solving capabilities within organizations. Accordingly, the digital transformation of families of people with disabilities contributes to supporting the family and facilitating its work in caring for their child with disabilities. Digital technologies have been developed to meet the needs of people with disabilities and their families, such as applications that help improve interaction and communication, in addition to providing distance education and rehabilitation services programs, which reduce the challenges of moving people with disabilities and enhance their independence (Al-Jarf, 2020).

2.2. The role of digital transformation in enhancing support and care for families of people with disabilities

The world is currently witnessing a rapid digital transformation that affects all areas, including the areas of care and social support, especially in supporting families of people with disabilities. Digital transformation is essential for facilitating access to the services and information needed by children with disabilities and their families. In this context, digital transformation plays a vital role in enhancing support and care for families of people with disabilities by providing diverse digital services that contribute to improving their lives comprehensively. This role includes enhancing communication, improving access to health and educational care, and providing psychosocial support (Tsatsou, 2021; Peláez et al., 2022). The roles of digital transformation for families of people with disabilities include the following:

1. Facilitating access to information and services: Digital platforms allow families of people with disabilities to easily access information that matters to them, such as directing them to specialized medical services, educational consultations, and educational tools that help children with disabilities learn. Families can access this information anywhere and anytime, reducing the need for exhausting travel to health and educational facilities. Examples include:

- Smartphone applications that provide advice and guidance on how to deal with children with disabilities.
- Online platforms that provide medical advice and recommendations for daily care (Jamwal et al., 2022).

2. Improving remote healthcare: The digital transformation in healthcare has contributed significantly to improving access to specialized

medical consultations online, which facilitates monitoring the health of children with disabilities. Families can benefit from remote medical consultations, where doctors and specialists advise on managing the child's health conditions at home, which helps reduce pressure on the traditional health system. Examples include:

- Digital platforms that provide medical consultations via video.
- Medical applications that help families monitor medications and prescribed doses for children with disabilities (Gruebner et al., 2022).

3. Developing specialized digital education: Digital transformation helps provide educational platforms tailored to the needs of children with disabilities, as educational content can be customized to suit each child's special abilities and needs. Distance learning can also be facilitated through integrated educational platforms that allow students with disabilities to interact with teachers and study materials flexibly, such as:

- E-learning platforms that provide lessons specifically for students with disabilities, such as children with hearing or visual impairments.
- Educational applications that help develop children's skills through interactive games and digital activities (Skourlas et al., 2016; Sanchez-Gordon et al., 2021).

4. Enhancing psychosocial support: Digital transformation provides families a means to connect with online support communities, strengthen social ties, and reduce feelings of isolation. Families can connect with other families facing similar challenges, allowing for the exchange of experiences and advice. This communication is crucial in providing psychosocial support, as it helps families deal with psychological pressures. Examples include:

- Support groups on social media platforms that provide spaces for family interaction.
- Applications that provide remote psychological counseling to support families of people with disabilities (Gruebner et al., 2022).

5. Improving coordination between institutions: Digital transformation improves coordination between various governmental and non-governmental institutions that provide services to families of people with disabilities. Through unified digital systems, cases can be registered, and families can be directed to the best available medical, educational, and psychological solutions. It also contributes to reducing duplication and ensuring that families receive comprehensive services without the need to move between multiple institutions, such as providing unified platforms that give information on all services available to families of people with disabilities in the Kingdom or Egypt and applications that allow coordination of treatment and education between schools and specialized health centers.
6. Addressing cultural and social challenges: Despite the social and cultural challenges that some families may face in adapting to digital technologies, digital transformation enhances community awareness about the importance of caring for people with disabilities and their rights. Through digital awareness campaigns, negative perceptions can be changed, and community support for these families can be strengthened. For example, online awareness campaigns on the rights of children with disabilities and awareness programs on social media platforms can raise awareness about the importance of digital transformation in caring for people with disabilities.

2.3. Challenges facing families of people with disabilities in light of digital transformation

Evidence in recent decades indicates that people with disabilities and their families often have limited access to digital transformation services due to several reasons, including the poor skill of family members of people with disabilities in using the Internet and modern technology devices, the high cost of devices at times, the poor economic level of families, the weak guidance and counseling programs for families of people with disabilities, the lack of specialists in preparing effective digital transformation programs for people with disabilities, the poor level of technical support services and updating of devices, systems and networks, the weak digital culture among families of learners, and the tendency of parents to adhere to traditional methods. Many researchers (Boot et al., 2018; van der Weegen et al., 2024) believe that despite digital and technological development, families of people with disabilities face several challenges that hinder full benefit from the digital transformation services provided, including the following:

1. Lack of technological infrastructure**:** Many areas suffer from weak infrastructure that enables families of people with disabilities to access digital transformation services, such as poor internet connection or lack of appropriate devices.
2. Awareness and use of technology: Some families lack knowledge and awareness of using modern technology to support their children's needs. Some families prefer traditional solutions to digital transformation and technology programs and lack the training to use appropriate technological tools for their children.
3. Social and cultural challenges: Some developing societies lack community support for the role of digital transformation in serving people with disabilities and their families.
4. Organization and management: Administrative and organizational challenges significantly affect

the implementation of digital transformation due to weak coordination between government agencies and private institutions concerned with caring for people with disabilities and the weakness or absence of laws and legislation that guarantee comprehensive access for people with disabilities, which limits the benefit of these families from the digital transformation services provided by the state to them.

5. Weak economic and material level: Some families of people with disabilities suffer from a weak economic level and thus the inability to purchase modern technological devices or to connect to the Internet continuously.

2.4. Digital transformation tools that families of people with disabilities rely on

The digital transformation tools and techniques for families of people with disabilities are many and varied and are represented in various modern technological means that help families of people with disabilities, and help develop the ability of children with disabilities, and help them perform daily life tasks and improve their ability to communicate and learn. It is a new stage of the stages that the tools and devices that humans have invented and used to overcome their disability and adapt them to compensate for what they lack according to the type and severity of their disability. Accordingly, since these tools and techniques depend on technology, they have many superior capabilities in reaching all segments of society, including many supportive, rehabilitative, and adaptive programs and devices for individuals with disabilities and their families, and contain everything that can be used to compensate for deficiencies in some abilities. Digital transformation devices help parents of children with disabilities support and care for their children as they work to diversify the methods and approaches of dealing with each child according to their abilities, teach desired behavioral patterns and provide them with complex concepts, increase children's motivation and excitement, overcome low thinking abilities, repeat experiences, and make the interaction between the child with disabilities and what he learns direct, and form positive attitudes, reduce dependence on others.

2.5. Saudi Arabia and Egypt's interest in digital transformation

The reality of development imposed by the digital knowledge revolution, which has affected all areas of society, has created new skills for individuals. This is in light of the dimensions of the digital transformation that have occurred to keep pace with the labor market's requirements, improve its outputs, and meet the needs of individuals and institutions. Accordingly, Vision 2030 has developed various technologies that help reach and benefit all individuals in line with continuous developments and technology.

The Kingdom of Saudi Arabia occupies an advanced global position, as its economy is among the twenty most significant in the world. The pillars of its Vision 2030 include achieving a prosperous economy by transforming from traditional economic activities and operations to a digital economy. The aim is to attain diversified and sustainable economic growth that achieves competitive advantages among the world's countries and enhances an attractive investment environment that aligns with the vision's goals and sustainable development.

Based on Vision 2030, the Egyptian state also prioritized digital transformation and digitizing all services, intentionally focusing on people with disabilities and their families. The state's role in helping these people includes, but is not limited to, providing rehabilitation services programs and increasing economic support for these children and their families.

2.6. Benefits of using digital transformation by families of people with disabilities

The current era is based on the widespread use of information and communications technology, and this is reflected in children with disabilities and their families in terms of providing methods and means of evaluating the programs used (Mahmoud, 2018). Accordingly, Mahmoud (2018) mentioned a set of advantages of digital transformation that benefit the child with disabilities and his family. These include encouraging the child with disabilities to develop his skills and experiences, facilitating the family's work in caring for their child with disabilities, encouraging self-learning for the child, helping parents to provide content in digital multimedia environments that are safe and reliable, and encouraging collaborative work, digital transformation offers nutrition that parents benefit from in evaluating their children immediately, the possibility of updating digital content, and choosing appropriate programs for each child according to his disability, providing many non-routine solutions and suggestions for parents, and providing environments for exchanging information and interests between parents with disabilities.

Some previous studies that have addressed the role of digital transformation in improving the lives of people with disabilities and their families will be presented. The survey by Osam et al. (2021) aimed to explore parents' experiences and perceptions regarding using assistive technologies by their children with disabilities. The study sample consisted of 35 parents who have children with disabilities. A questionnaire consisting of open and closed questions was used to explore the views of parents. The study results showed that participants acknowledged the benefits of assistive technology in their children's development and participation in society. It was also noted that barriers prevented their children from using this technology. Among many obstacles, parents reported that they lacked the funds to purchase assistive devices. Some

parents also mentioned the high cost of assistive technology and rehabilitation services.

Ramirez-Montoya et al. (2021) conducted a study to analyze the effectiveness of technical systems in supporting people with special educational needs and improving their quality of life. The study relied on the multiple case study approach, which included six analytical categories: Data, objectives, processes, outcomes, technologies, and impact. The results showed that technical systems provide the necessary support to improve health and user experiences and enhance teacher training, curriculum development, and family engagement to improve their care and knowledge. The study also emphasized the role of technology in enhancing effective communication within these systems and achieving educational inclusiveness. It recommended the necessity of sustainability of operations and linking them to ethical standards to ensure sustainable benefits for all stakeholders.

The study of Motawa and Mohamed (2022) aimed to prepare a proposed vision based on the effectiveness and role of digital transformation in providing rehabilitation services to families of people with special needs, according to the stages and steps of the rehabilitation process. The study found that the rehabilitation process in light of digital transformation takes place through several stages, including the case identification stage, the diagnosis and evaluation stage, the registration and referral stage, the rehabilitation plan development stage, the follow-up stage, and the completion stage, within the Egyptian state's direction for digital transformation to facilitate the provision of various services to the targeted people. The study concluded that digital transformation is essential in providing rehabilitation services to families of people with special needs. According to Ihsaniyati et al. (2023), social media platforms play a pivotal role in development communication and social change by facilitating knowledge sharing and empowering marginalized communities. Their systematic review highlights how social media serves as a tool for digital empowerment, enabling individuals, including those with special needs, to access information, develop skills, and participate actively in societal development. This underscores the importance of integrating social media strategies to foster digital transformation and technical empowerment across diverse populations. The concept of technical empowerment came from the point of view of young people with special needs as providing people with special needs with various knowledge and skills that qualify them to participate positively and effectively across multiple digitization activities to the maximum extent that their capabilities and abilities qualify them for, in addition to changing the culture of society towards the disabled and disability from a culture of marginalization to a culture of empowerment. Gruebner et al. (2022) conducted an exploratory study aimed at identifying the most used digital platforms by parents of children with disabilities the reasons for their use and the associated experiences while identifying the ethical issues related to their use. The study was based on an exploratory review of 17 articles published over the past decade and focused on platforms including social media, search engines, and health applications. The results showed that parents use these platforms primarily to obtain information and social support, but barriers included privacy issues, language barriers, and access disparities based on education and ethnicity. Apps et al. (2024) examined the views of parents and caregivers on the use of digital technology to support their children and support its greater use in caring for children with disabilities. The study sample consisted of 43 parents and caregivers who frequently use digital technology to support their children. The results showed that parents and caregivers expressed positive views on digital technology as a tool to support their children and enhance rehabilitation services provided to children with disabilities. The researchers believe that these studies constituted a primary source of important information that helped to identify the problem and choose its methodology and appropriate procedures to achieve its goals. Previous studies showed the role of digital and technical transformation in caring for children with disabilities and that digital transformation benefits the child with disabilities, his family, and the community in which he lives. For example, the study by Motawa and Mohamed (2022) and the study by Osam et al. (2021) showed many advantages of using assistive technology in developing their children and their participation in society. Previous studies such as the study of Osam et al. (2021) and Gruebner et al. (2022) also showed the existence of obstacles that prevent them from using digital transformation and technology, such as the weak economic level or the lack of awareness of parents about using the Internet and available devices.

3. Study methodology and procedures

The data for this research was collected by conducting an online questionnaire to gain primary data. The study relied on the descriptive analytical comparative method, which suits its nature and objectives. This method is based on studying reality as it is without interfering with, changing, or influencing it. In this study, the role of digital transformation in enhancing support and care for families of people with disabilities in Egypt and Saudi Arabia was evaluated by comparing the realities in both countries. The current study community included families of people with disabilities in Egypt and Saudi Arabia, where a simple random sample of 605 families was selected: 296 from Egypt and 309 from Saudi Arabia. Data were collected using an electronic questionnaire to investigate their experiences using digital technology to support and care for people with disabilities. The characteristics of the sample are shown in Table 1.

Table 1: Statistical description of study participants according to study variables

Variable	Categories	Saudi Arabia		Egypt	
		Percentage	Frequency	Percentage	Frequency
Gender	Male	%25.90	80	%61.10	181
	Female	%74.10	229	%38.90	115
Age	Less than 25 years	%10.70	33	%13.50	40
	25-34 years	%53.70	166	%9.80	29
	35-44 years	%20.40	63	%31.80	94
	45-54 years	%9.10	28	%22.00	65
	55 years and above	%6.10	19	%23.00	68
Qualification	Less than high school	%13.90	43	%13.50	40
	Intermediate	%23.60	73	%23.60	70
	Bachelor's degree	%47.20	146	%47.30	140
	Postgraduate studies	%15.20	47	%15.50	46
Type of disability	Physical disability	%22.30	69	%22.60	67
	Hearing disability	%29.40	91	%26.70	79
	Visual disability	%17.20	53	%17.20	51
	Mental disability and autism	%20.40	63	%20.60	61
	Multiple disabilities	%10.70	33	%12.80	38

Table 1 shows that the study sample includes 605 families, of which 309 are from Saudi Arabia and 296 are from Egypt. Females are prominent in Saudi Arabia at a rate of 74.1% compared to 38.9% in Egypt, while males constitute the most significant percentage in Egypt at 61.1%. As for ages, the 25-34 age group tops in Saudi Arabia at 53.7%, and the 35-44 age group in Egypt at 31.8%. Families with a bachelor's degree represent the most significant percentage in both countries, at 47.3% in Egypt and 47.2% in Saudi Arabia. As for hearing impairment, it is the most common in both countries, followed by physical and mental disabilities and autism.

The study tool (data collection) was an online questionnaire. The questionnaire aims to measure the use of digital transformation in supporting families of people with disabilities, identify their challenges, and propose solutions. Its design was based on previous studies, such as the study of Motawa and Mohamed (2022) on a digital model to support families with special needs in Egypt and the study of Alrubaian et al. (2024) that reviewed the opinions of Saudi parents on institutional and home care for children with disabilities. The questionnaire consists of three main aspects:

- The first aspect focuses on families' use of digital technology in caring for people with disabilities. It includes four dimensions: Use of technology (8 statements), digital awareness (7 statements), digital technologies and tools (8 statements), and access to digital services (7 statements).
- The second aspect addresses families' challenges in using digital technology (15 statements).
- The third aspect reviews ways to overcome these challenges (16 statements), such as developing digital skills, providing training courses and technical support, and enhancing institutional cooperation to improve services.

The questionnaire also included participants' attitudes toward digital transformation, which were classified as positive, neutral, or negative. It is based on a five-point Likert scale (always, often, sometimes, rarely, never) with scores of 5-1.

The average score for each dimension is calculated using the formula: Category range=(5-1)/5=0.8. The scores are classified into less than 1.8, which is very low; 1.8 to less than 2.6, which is low; 2.6 to less than 3.4, which is medium; 3.4 to less than 4.2, which is high; and more significant than 4.2, which is very high. To ensure the validity of the questionnaire, it was presented to ten judges from special education and educational technology professors to evaluate the statements and provide comments. Statements with an agreement rate of less than 80% were deleted, and the initial version was designed based on that.

3.1. Validity and reliability

- First: Internal consistency (item with total score of axis): To measure the correlation coefficients between the score of each item and the total score of the axis it follows, the researchers used Pearson's correlation coefficient. Table 2 shows this.

Table 2 shows that the values of the correlation coefficients are high and significant at the level of 0.01, which indicates the validity of the paragraphs of the digital transformation questionnaire in enhancing support and care for families of people with disabilities:

- Second: Questionnaire stability: The stability was verified using Cronbach's alpha coefficient and the split-half method for the digital transformation questionnaire in enhancing support and care for families of people with disabilities, as shown in Table 3.

Table 3 shows that all values of the stability coefficients exceed 0.7, which indicates the stability of the digital transformation questionnaire in enhancing support and care for families of people with disabilities.

3.2. Analysis

After coding, the SPSS program was used to analyze the data to achieve the study's objectives. Arithmetic means and standard deviations were used to study the level of families' use of digital

transformation, and multiple regression analysis was used to study the impact of variables (country, gender, age, educational level, type of disability). Chi-square and Gamma tests were also applied to determine the effects of demographic factors on families' attitudes toward digital transformation.

Table 2: Pearson's correlation coefficients between the paragraphs of the study tool and the total score of the axis (n=35)

The reality of families using digital technology to care for people with disabilities		Challenges of using digital technology in caring for people with disabilities		Ways to overcome the challenges facing families in digital transformation			
CC	Correlation coefficient	CC	Correlation coefficient	CC	Correlation coefficient	CC	Correlation coefficient
1	0.784	17	0.740	1	0.762	1	0.820
2	0.704	18	0.711	2	0.739	2	0.767
3	0.756	19	0.782	3	0.688	3	0.797
4	0.746	20	0.760	4	0.714	4	0.732
5	0.754	21	0.768	5	0.775	5	0.764
6	0.689	22	0.701	6	0.702	6	0.820
7	0.735	23	0.773	7	0.741	7	0.750
8	0.794	24	0.724	8	0.723	8	0.710
9	0.767	25	0.777	9	0.799	9	0.735
10	0.731	26	0.710	10	0.754	10	0.700
11	0.712	27	0.735	11	0.786	11	0.742
12	0.757	28	0.760	12	0.705	12	0.761
13	0.702	29	0.750	13	0.753	13	0.765
14	0.748	30	0.720	14	0.740	14	0.798
15	0.759	31	0.736	15	0.717	15	0.719
16	0.793	32	0.809	--	--	16	0.735

All correlation coefficients are significant at the 0.01 level

Table 3: Values of stability coefficients using the Cronbach's alpha coefficient and the split-half method (n=35)

Axes	Cronbach's alpha	Split-half
The reality of families using digital technology to care for people with disabilities	0.801	0.824
Challenges of using digital technology in caring for people with disabilities	0.824	0.827
Ways to overcome the challenges facing families in digital transformation	0.845	0.862

4. Results and discussion

As shown above, this study answers five questions.

A. The first question states: "Do demographic factors such as country, gender, age group, educational level, and type of disability affect the attitudes of families with disabilities towards digital transformation in providing support and care for families with disabilities in Egypt and Saudi Arabia?"

To achieve this goal, the researchers used chi-square tests and calculated the gamma value to determine how these factors affect families' attitudes toward digital transformation. Table 4 shows this.

Table 4: The effect of demographic factors (country, gender, age group, educational level, and type of disability) on the attitudes of families with disabilities towards digital transformation in providing support and care for families with disabilities in Egypt and Saudi Arabia

Variable	Group	Positive	Neutral	Negative	Total	Chi-square	Gamma
Country	Egypt	(%51.7) 153	(%40.9) 121	(%7.4) 22	(%48.9) 296	101.589	0.757-
	Saudi Arabia	(%88.3) 273	(%11.7) 36	(%0.0) 0	(%51.1) 309	p = 0.000	p = 0.000
Gender	Male	(%89.3) 233	(%10.7) 28	(%0.0) 0	(%43.1) 261	80.866	0.738*p* =
	Female	(%56.1) 193	(%37.5) 129	(%6.4) 22	(%56.9) 344	p = 0.000	0.000
Age	Less than 25 years	(%100) 73	(%0.0) 0	(%0.0) 0	(%12.1) 73	616.033 p = 0.000	0.970 p = 0.000
	25-34 years	(%100) 195	(%0.0) 0	(%0.0) 0	(%32.2) 195		
	35-44 years	(%93.6) 147	(%6.4) 10	(%0.0) 0	(%26.0) 157		
	45-54 years	(%0.0) 0	(%100) 93	(%0.0) 0	(%15.4) 93		
	55 years and above	(%12.6) 11	(%62.1) 54	(%25.3) 22	(%14.4) 87		
Qualifications	Less than high school	(%100) 83	(%0.0) 0	(%0.0) 0	(%13.7) 83	314.251 p = 0.000	0.964 p = 0.000
	Intermediate	(%100) 143	(%0.0) 0	(%0.0) 0	(%23.6) 143		
	Bachelor's degree	(%66.1) 189	(%33.9) 97	(%0.0) 0	(%47.3) 286		
	Postgraduate studies	(%11.8) 11	(%64.5) 60	(%23.7) 22	(%15.4) 93		
Type of disability	Physical disability	(%100) 136	(%0.0) 0	(%0.0) 0	(%22.5) 136	421.035 p = 0.000	0.904 p = 0.000
	Hearing disability	(%100) 170	(%0.0) 0	(%0.0) 0	(%28.1) 170		
	Visual disability	(%57.7) 60	(%42.3) 44	(%0.0) 0	(%17.2) 104		
	Mental disability and autism	(%39.5) 49	(%60.5) 75	(%0.0) 0	(%20.5) 124		
	Multiple disabilities	(%15.5) 11	(%53.5) 38	(%31.0) 22	(%11.7) 71		

Table 4 shows that demographic factors such as country, gender, age group, educational level, and type of disability significantly affect the attitudes of families with disabilities toward digital transformation in providing support and care, reflecting the role of these factors in shaping attitudes towards digital transformation in Egypt and Saudi Arabia, as shown below:

- Country: As shown in Table 4, the data indicate that families with disabilities in Saudi Arabia are more positive towards digital transformation, with

88.3% expressing positive attitudes compared to 51.7% in Egypt. In contrast, the percentage of neutral families in Egypt was higher (40.9%) compared to Saudi Arabia (11.7%). The rate of opposing families in Egypt was also higher (7.4%) compared to Saudi Arabia, which did not record any objections. The chi-square test (X^2=101.589, p=0.000) indicates a statistically significant association between the country and families' attitudes towards digital transformation, as the country affects attitudes towards digital transformation. The gamma value (g=-0.757, p=0.000) supports this conclusion, indicating a strong relationship between the state and household attitudes toward digital transformation. The researchers explain this result by saying that cultural and social differences between Egypt and Saudi Arabia may play a role in the disparity in attitudes, as Saudi Arabia may have come further in adopting digital technologies than Egypt.

- Gender: The data showed that males were more positive towards digital transformation, with 89.3% expressing positive attitudes compared to 56.1% of females. Females also expressed neutral attitudes at a higher rate (37.5%) than males (10.7%). The chi-square test (X^2=80.866, p=0.000) indicates a statistically significant relationship between gender and household attitudes towards digital transformation. The gamma value (g=0.738, p=0.000) confirmed a strong positive effect between gender and household attitudes towards digital transformation. The researchers explain this result by saying that men may be more open to new technologies and digital technologies. At the same time, women may have more significant hesitation or reservations, perhaps due to social or cultural conditions that affect their use of technology.
- Age: As for the age group, people under 25 years old (100%) and 25-34 years old (100%) had positive attitudes towards digital transformation, reflecting full support. Older age groups, such as 45-54 years old and 55 years old and above, showed neutral and negative attitudes, where the neutral percentage was 100% for the 45-54 age group, while the 55 years old and above group showed neutral (62.1%) and negative (25.3%) attitudes. The chi-square test (X^2=616.033, p=0.000) indicates a statistically significant association between age group and household attitudes towards digital transformation, as age group significantly affects attitudes towards digital transformation. The gamma value (g=0.970, p=0.000) also showed a strong positive relationship between age group and household attitudes towards digital transformation. The researchers explain this result by saying that young people and younger age groups are usually more familiar with technology and tend to adapt to it faster than older people, who may have more difficulty adjusting to digital changes.
- Educational level: The data showed that people with qualifications below secondary and intermediate level showed positive attitudes by 100%. In comparison, those with a bachelor's degree showed positive attitudes by 66.1%, while the attitudes of people with postgraduate studies were mainly neutral (64.5%) with a negative percentage (23.7%). The chi-square test (X^2=314.251, p=0.000) indicates that the educational level significantly affects families' attitudes towards digital transformation, reflecting that the education level significantly impacts shaping attitudes. The gamma value (g=0.964, p=0.000) also supports this result, indicating a strong positive effect. The researchers explain this result by saying that people with qualifications below secondary or intermediate level tend to adopt positive attitudes towards the subject due to their lack of knowledge of the complexities and challenges of disability issues, which may be due to their limited experience or lack of complete awareness of the necessary professional and educational requirements.
- Type of disability: The data showed that people with physical and hearing disabilities expressed 100% positive attitudes, while families with visual and mental disabilities expressed mostly neutral attitudes. Families with individuals with multiple disabilities expressed neutral and negative attitudes. The chi-square test (X^2=421.035, p=0.000) indicates that the type of disability significantly affects families' attitudes toward digital transformation. The gamma value (g=0.904, p=0.000) confirmed a strong positive relationship between the type of disability and families' attitudes towards digital transformation. The researchers explain this result by saying that families with physical and hearing disabilities may be able to adapt to digital transformation due to easy access to assistive technology tools. In contrast, people with visual and mental disabilities may face more significant challenges in benefiting from digital transformation. While the results of Piekema et al. (2025) research confirmed that younger individuals, especially women, show positive attitudes toward technology.

B. The results of the second question state: "What is the actual reality of using digital transformation for families with disabilities in Egypt and Saudi Arabia in caring for and supporting people with disabilities?"

To answer the question, the researchers calculated the arithmetic means, standard deviations, and percentages of the responses of families with disabilities on the dimensions of the axis of the actual reality of using digital transformation in caring for and supporting people with disabilities in both Egypt and Saudi Arabia, as shown in Table 5.

Table 5: Results of the arithmetic mean and standard deviation for the dimensions of the first axis, the actual reality of using digital transformation in caring for and supporting people with disabilities from the point of view of families with disabilities in Egypt and Saudi Arabia

Dimensions	Country	Mean	Standard deviation	Relative weight	Level
Households' use of digital technology	Egypt	2.676	0.284	%53.5	Medium
	Saudi Arabia	3.368	0.226	%67.4	Medium
Digital awareness of households	Egypt	2.919	0.282	%58.4	Medium
	Saudi Arabia	3.352	0.223	%67.0	Medium
Digital technologies used	Egypt	2.766	0.252	%55.3	Medium
	Saudi Arabia	3.493	0.223	%69.9	High
Access to digital services	Egypt	2.934	0.319	%58.7	Medium
	Saudi Arabia	3.366	0.226	%67.3	Medium
Overall arithmetic mean	Egypt	2.824	0.140	%56.5	Medium
	Saudi Arabia	3.395	0.110	%67.9	Medium

Table 5 shows that the level of use of digital transformation among families of people with disabilities in Egypt was average, with an arithmetic mean of 2.824 and a relative weight of 56.5%. This indicates that families have started using digital technology to support the care of people with disabilities, but in a limited way, with challenges in accessing digital services due to a lack of training and infrastructure. In Saudi Arabia, the arithmetic mean was 3.395, with a relative weight of 67.9%, reflecting a more effective use of technology. The level of digital awareness of families and the use of digital technologies was high, indicating a supportive environment for improving the quality of care provided to people with disabilities. The study by Alsuraihi and Bashraheel (2013) also showed that Saudi families have excellent access to information technology, as they widely use mobile devices and the Internet. Abed and Shackelford (2024) indicated that parents in Saudi Arabia see tablets as enhancing learning outcomes for children with disabilities, reflecting a proactive approach to technology use:

- First aspect: Families' use of digital technology in caring for people with disabilities.

Table 6 reveals that families in Saudi Arabia recorded the highest averages in the use of digital technology, with an average of 3.368, standard deviation=0.226 and a relative weight of 67.4%, followed by families in Egypt with an average=2.676, standard deviation=0.284 and a relative weight of 53.5%. The researchers explain this disparity by the more significant interaction of Saudi families with technology compared to Egyptian families, which reflects the differences in infrastructure and digital awareness between the two countries. The highest averages were in the paragraph related to monitoring the development of life skills, where they recorded a "very high" score in both countries. The lowest averages were in the paragraphs related to the use of social support platforms and digital applications to track daily activities, where they recorded a "very low" score in Egypt and a "very high" score in Saudi Arabia, indicating the challenges in accessing these tools, especially in Egypt.

- Second aspect: Digital awareness of families in caring for people with disabilities.

Table 7 reveals that families in Saudi Arabia recorded the highest averages in digital awareness (average=3.352, standard deviation=0.223, with a relative weight of 67.0%), followed by families in Egypt (average=2.919, standard deviation=0.282, with a relative weight of 58.4%), which reflects the availability of a more advanced digital environment in Saudi Arabia. The highest averages were in the paragraphs related to benefiting from the experiences of other families in using digital resources, where they recorded a "very high" score in both countries.

Table 6: Results of the arithmetic mean and standard deviation of paragraphs of the dimension of families' use of digital technology in caring for people with disabilities

#	Statements	Country	Mean	Standard deviation	Relative weight	Level
1	I use digital applications to track daily activities	Egypt	1.520	0.500	%30.4	Very low
		Saudi Arabia	4.505	0.501	%90.1	Very high
2	Technology helps me provide care efficiently	Egypt	2.514	0.501	%50.3	Low
		Saudi Arabia	3.456	0.499	%69.1	High
3	I rely on smart devices to facilitate communication	Egypt	1.983	0.813	%39.7	Low
		Saudi Arabia	2.450	1.106	%49.0	Low
4	I use digital resources to obtain necessary information	Egypt	4.514	0.501	%90.3	Very high
		Saudi Arabia	2.521	0.500	%50.4	Low
5	Technology helps me organize medical appointments	Egypt	2.892	1.378	%57.8	Medium
		Saudi Arabia	4.498	0.501	%90.0	Very high
6	I benefit from social support platforms to connect with other families	Egypt	1.520	0.500	%30.4	Very low
		Saudi Arabia	1.521	0.500	%30.4	Very low
7	I use applications to monitor life skills development	Egypt	4.503	0.501	%90.1	Very high
		Saudi Arabia	4.518	0.500	%90.4	Very high
8	Technology is an effective means of entertainment	Egypt	1.959	0.835	%39.2	Low
		Saudi Arabia	3.472	0.500	%69.4	High
Overall Mean		Egypt	2.676	0.284	%53.5	Medium
		Saudi Arabia	3.368	0.226	%67.4	Medium

The lowest averages were in the paragraphs related to following technical blogs and families' belief in Egypt that digital awareness improves the quality of care. This indicates the limited use of these resources in Egypt compared to Saudi Arabia. The researchers explain that these differences may be due to the disparity in the level of governmental and technical support available in both countries. Saudi Arabia has developed a more advanced digital infrastructure and awareness initiatives to promote digital use. In Egypt, families may face challenges related to poor access to digital information and modern technologies, leading to less use of tech blogs and poor digital awareness compared to Saudi Arabia.

- Third aspect: Digital technologies and tools used in caring for people with disabilities.

Table 8 reveals that families in Saudi Arabia recorded the highest averages in the use of digital care technologies (average=3.493, standard deviation=0.223, with a relative weight of 69.9%), followed by families in Egypt (average=2.766, standard deviation=0.252, with a relative weight of 55.3%), reflecting the disparity in the availability of digital technology and training programs between the two countries. The highest averages were in the paragraphs related to using assistive devices to improve interaction, where they recorded a "very high" score in both countries. The lowest averages were in the paragraphs related to virtual reality technologies and progress data analysis tools, indicating the low use of these tools in Egypt and Saudi Arabia. The researchers explain these results by saying that families in Saudi Arabia have benefited more from modern technologies thanks to technical support and advanced infrastructure, while virtual reality technologies and progress data analysis tools are still at an incomplete stage for families with disabilities in both countries due to limited access to these tools and lack of awareness of how to use them.

Table 7: Results of the arithmetic mean and standard deviation of the paragraphs of the axis of digital awareness of families in caring for people with disabilities

#	Statements	Country	Mean	Standard deviation	Relative weight	Level
9	I feel the need for more knowledge about using technology	Egypt	4.486	0.501	%89.7	Very high
		Saudi Arabia	4.476	0.500	%89.5	Very high
10	I search for new information about available applications	Egypt	2.449	0.498	%49.0	Low
		Saudi Arabia	3.460	0.499	%69.2	High
11	I participate in workshops/courses to enhance my digital awareness	Egypt	2.068	0.812	%41.4	Low
		Saudi Arabia	2.518	1.089	%50.4	Low
12	I benefit from other families' experiences in using digital resources	Egypt	4.524	0.500	%90.5	Very high
		Saudi Arabia	2.508	0.501	%50.2	Low
13	I consider digital awareness an essential part of caregiving	Egypt	2.905	1.377	%58.1	Medium
		Saudi Arabia	4.540	0.499	%90.8	Very high
14	I follow blogs that provide tech tips	Egypt	1.503	0.501	%30.1	Very low
		Saudi Arabia	1.482	0.500	%29.6	Very low
15	I believe digital awareness improves the quality of care	Egypt	2.500	0.501	%50.0	Low
		Saudi Arabia	4.479	0.500	%89.6	Very high
	Overall mean	Egypt	2.919	0.282	%58.4	Medium
		Saudi Arabia	3.352	0.223	%67.0	Medium

Table 8: Results of the arithmetic mean and standard deviation for the paragraphs of the axis of digital technologies and tools used in caring for people with disabilities

#	Phrases	Country	Mean	Standard deviation	Relative weight	Level
16	I use educational applications to improve my academic skills	Egypt	1.463	0.499	%29.3	Very low
		Saudi Arabia	4.482	0.500	%89.6	Very high
17	We rely on assistive devices to improve interaction	Egypt	4.534	0.500	%90.7	Very high
		Saudi Arabia	3.466	0.500	%69.3	High
18	Digital entertainment programs enhance the quality of life	Egypt	2.041	0.806	%40.8	Low
		Saudi Arabia	2.495	1.133	%49.9	Low
19	I have an Internet connection at home	Egypt	4.503	0.501	%90.1	Very high
		Saudi Arabia	2.482	0.500	%49.6	Low
20	I benefit from applications that support self-learning	Egypt	3.003	1.479	%60.1	Medium
		Saudi Arabia	4.524	0.500	%90.5	Very high
21	We use virtual reality technologies to provide educational experiences	Egypt	1.537	0.499	%30.7	Very low
		Saudi Arabia	1.495	0.501	%29.9	Very low
22	Some technologies provide new ways to develop social skills	Egypt	2.537	0.499	%50.7	Low
		Saudi Arabia	4.505	0.501	%90.1	Very high
23	I rely on tools to analyze progress data	Egypt	2.507	0.501	%50.1	Low
		Saudi Arabia	4.495	0.501	%89.9	Very high
	Overall average	Egypt	2.766	0.252	%55.3	Medium
		Saudi Arabia	3.493	0.223	%69.9	High

- Fourth aspect: Access to digital services used in caring for people with disabilities.

Table 9 reveals that families in Saudi Arabia recorded the highest averages in access to digital services used in caring for people with disabilities (average=3.366, standard deviation=0.226, with a relative weight of 67.3%), followed by families in Egypt (average=2.934, standard deviation=0.319, with a relative weight of 58.7%), reflecting more significant interaction of Saudi families with digital services. The highest averages were in the

paragraphs related to ease of access to the Internet, where they recorded a "very high" score in both countries. The lowest averages were in the paragraphs related to using forums to obtain accurate information and complex application interfaces. The researchers explain these results by saying that reasonable access to the Internet contributes to improving families' benefit from digital resources and that the challenges associated with using forums and complex application interfaces indicate the need to improve the user experience and simplify the digital tools available to families in both countries.

C. The results of the third question, "What are the most prominent challenges facing digital transformation in providing support and care for families of people with disabilities in Egypt and Saudi Arabia?"

The researchers calculated the arithmetic means, standard deviations, and percentages of families' responses on the challenge's axis, as shown in Table 10. Table 10 shows that families with disabilities in Egypt face more significant challenges compared to Saudi Arabia, as the general average in Egypt was 3.371 with a relative weight of 67.4%, indicating "medium" challenges. In comparison, the average in Saudi Arabia was lower (2.274) with a relative weight of 45.5%, reflecting "low" challenges. Egyptian families also recorded the highest averages in the paragraphs related to technical difficulties, such as "understanding how to use applications" and "lack of technical support." as the average in Egypt was 4.544 with a relative weight of 90.9%. At the same time, the challenges in Saudi Arabia were much lower. As for problems accessing the Internet, Egyptian and Saudi families recorded low scores, indicating that this problem is not a significant challenge in both countries. The researchers explain these results by saying digital difficulties vary according to technical awareness and infrastructure in Egypt and Saudi Arabia. Egypt has more significant problems related to technical support and infrastructure problems, while Saudi Arabia faces fewer challenges. These results are consistent with previous studies such as (Hersh and Mouroutsou, 2019; El-Saadani et al., 2024), which indicated the difficulty of understanding technical applications and the difficulty of accessing technical support, which hinders families' ability to benefit from technologies designed to support people with disabilities.

D. The results of the fourth question, "What are the proposed strategies to overcome the challenges facing digital transformation in supporting and caring for families of people with disabilities in Egypt and Saudi Arabia?"

The researchers calculated the arithmetic means, standard deviations, and percentages of the responses of families of people with disabilities, as shown in Table 11.

Table 9: Results of the arithmetic mean and standard deviation for the paragraphs of the axis of access to digital services used in caring for people with disabilities

#	Phrases	Country	Mean	Standard deviation	Relative weight	Level
24	I benefit from the digital services available to provide care	Egypt	1.493	0.501	%29.9	Very low
		Saudi Arabia	4.521	0.500	%90.4	Very high
25	Good internet connectivity facilitates access to digital resources	Egypt	4.524	0.500	%90.5	Very high
		Saudi Arabia	3.472	0.500	%69.4	High
26	I find that the user interfaces of applications contribute to improving the experience	Egypt	2.061	0.825	%41.2	Low
		Saudi Arabia	2.479	1.065	%49.6	Low
27	I consider technical support important to facilitate the use of digital services	Egypt	2.426	1.114	%48.5	Low
		Saudi Arabia	2.466	0.500	%49.3	Low
28	Awareness about digital services facilitates access to the necessary information	Egypt	3.017	1.376	%60.3	Medium
		Saudi Arabia	4.528	0.500	%90.6	Very high
29	I benefit from forums to obtain accurate information about services	Egypt	4.507	0.501	%90.1	Very high
		Saudi Arabia	1.557	0.498	%31.1	Very low
30	Cooperation with stakeholders contributes to enhancing access to digital services	Egypt	2.514	0.501	%50.3	Low
		Saudi Arabia	4.537	0.499	%90.7	Very high
	Overall average	Egypt	2.934	0.319	%58.7	Medium
		Saudi Arabia	3.366	0.226	%67.3	Medium

Table 11 reveals that the highest general averages for the proposed strategies to overcome the challenges of digital transformation were in Saudi Arabia (average=3.564) with a relative weight of 71.3%, followed by Egypt (average=3.244) with a relative weight of 64.9%, reflecting a more significant interaction of Saudi families with digital transformation strategies compared to Egypt. The paragraph related to organizing workshops to enhance families' digital skills also recorded the highest averages in both countries (Egypt and Saudi Arabia), with an average of 4.503 and a relative weight of 90.1%, indicating a high awareness of the importance of these workshops. The lowest averages were in the paragraph related to establishing technical support channels around the clock, as Egypt recorded a low average (1.449) with a relative weight of 29.0%, while Saudi Arabia (2.964) with a relative weight of 59.3%, indicating the need to develop this strategy in Egypt. These results are consistent with the study (Aldousari and Yuan, 2024), which showed more significant interaction in Saudi Arabia, as well as with the survey (Alrubaian et al., 2024), which confirmed the positive response of Saudi families towards the digital transformation in caring for people with disabilities.

E. The results of the fifth question, "Are there differences in the level of digital transformation use in caring for and supporting people with disabilities by families with disabilities attributed to the variables (country, gender, age group, educational level, and type of disability)"?

The researchers used multiple analyses of variance, and the statistical significance tests are shown in Table 12. The differences within the groups were shown according to the different variables (country, gender, age group, educational level, and type of disability), as shown in Table 13.

Table 10: Results of the arithmetic mean and standard deviation of the dimensions of the challenges axis facing digital transformation in caring for and supporting people with disabilities from the point of view of families of people with disabilities in Egypt and Saudi Arabia

#	Phrases	Country	Mean	Standard deviation	Relative weight	Level
1	I have difficulty understanding how to use apps designed for people with disabilities	Egypt	4.480	0.500	%89.6	Very high
		Saudi Arabia	1.505	0.501	%30.1	Very low
2	We lack the necessary digital skills	Egypt	3.493	0.501	%69.9	High
		Saudi Arabia	2.489	0.501	%49.8	Low
3	We face challenges in accessing the internet on a consistent basis	Egypt	2.527	0.500	%50.5	Low
		Saudi Arabia	1.977	0.831	%39.5	Low
4	Some apps lack adequate guidance for users	Egypt	1.486	0.501	%29.7	Very low
		Saudi Arabia	2.398	1.131	%48.0	Low
5	I find the costs of devices and apps to be a financial burden	Egypt	3.490	0.501	%69.8	High
		Saudi Arabia	2.997	1.463	%59.9	Medium
6	There is a lack of technical support available to families	Egypt	4.544	0.499	%90.9	Very high
		Saudi Arabia	1.472	0.500	%29.4	Very low
7	It is difficult to find reliable information about digital tools	Egypt	3.578	0.495	%71.6	High
		Saudi Arabia	2.537	0.499	%50.7	Low
8	The language of apps is a barrier for family members	Egypt	2.483	0.501	%49.7	Low
		Saudi Arabia	1.997	0.824	%39.9	Low
9	I find it difficult to evaluate the effectiveness of the digital tools used	Egypt	4.486	0.501	%89.7	Very high
		Saudi Arabia	2.447	1.108	%48.9	Low
10	Family members face challenges in adapting to changes in technology	Egypt	1.463	0.499	%29.3	Very low
		Saudi Arabia	3.023	1.493	%60.5	Medium
11	There is concern about using technology safely and effectively	Egypt	4.493	0.501	%89.9	Very high
		Saudi Arabia	1.479	0.500	%29.6	Very low
12	Some lack awareness about the benefits of digital technology	Egypt	3.500	0.501	%70.0	High
		Saudi Arabia	2.476	0.500	%49.5	Low
13	I find it difficult to keep up with updates and changes in apps	Egypt	4.537	0.499	%90.7	Very high
		Saudi Arabia	2.042	0.807	%40.8	Low
14	We have problems accessing digital support services	Egypt	4.554	0.498	%91.1	Very high
		Saudi Arabia	2.408	1.106	%48.2	Low
15	Daily responsibilities interfere with time spent using technology	Egypt	1.453	0.499	%29.1	Very low
		Saudi Arabia	2.861	1.376	%57.2	Medium
	Overall average	Egypt	3.371	0.129	%67.4	Medium
		Saudi Arabia	2.274	0.242	%45.5	Low

Table 11: Results of the arithmetic mean and standard deviation of the dimensions of the proposed strategies to overcome the challenges related to the digital transformation in caring for and supporting people with disabilities from the perspective of families of people with disabilities in Egypt and Saudi Arabia

#	Statement	Country	Mean	Standard deviation	Relative weight	Level
1	I have difficulty understanding how to use apps designed for people with disabilities	Egypt	4.480	0.500	%89.6	Very high
		Saudi Arabia	1.505	0.501	%30.1	Very low
2	We lack the necessary digital skills	Egypt	3.493	0.501	%69.9	High
		Saudi Arabia	2.489	0.501	%49.8	Low
3	We face challenges in accessing the internet on a consistent basis	Egypt	2.527	0.500	%50.5	Low
		Saudi Arabia	1.977	0.831	%39.5	Low
4	Some apps lack adequate guidance for users	Egypt	1.486	0.501	%29.7	Very low
		Saudi Arabia	2.398	1.131	%48.0	Low
5	I find the costs of devices and apps to be a financial burden	Egypt	3.490	0.501	%69.8	High
		Saudi Arabia	2.997	1.463	%59.9	Medium
6	There is a lack of technical support available to families	Egypt	4.544	0.499	%90.9	Very high
		Saudi Arabia	1.472	0.500	%29.4	Very low
7	It is difficult to find reliable information about digital tools	Egypt	3.578	0.495	%71.6	High
		Saudi Arabia	2.537	0.499	%50.7	Low
8	The language of apps is a barrier for family members	Egypt	2.483	0.501	%49.7	Low
		Saudi Arabia	1.997	0.824	%39.9	Very high
9	I find it difficult to evaluate the effectiveness of the digital tools used	Egypt	4.486	0.501	%89.7	Low
		Saudi Arabia	2.447	1.108	%48.9	Very low
10	Family members face challenges in adapting to changes in technology	Egypt	1.463	0.499	%29.3	Medium
		Saudi Arabia	3.023	1.493	%60.5	Very high
11	There is concern about using technology safely and effectively	Egypt	4.493	0.501	%89.9	Very low
		Saudi Arabia	1.479	0.500	%29.6	High
12	Some lack awareness about the benefits of digital technology	Egypt	3.500	0.501	%70.0	Low
		Saudi Arabia	2.476	0.500	%49.5	Very high
13	I find it difficult to keep up with updates and changes in apps	Egypt	4.537	0.499	%90.7	Low
		Saudi Arabia	2.042	0.807	%40.8	Very low
14	We have problems accessing digital support services	Egypt	4.554	0.498	%91.1	Medium
		Saudi Arabia	2.408	1.106	%48.2	Medium
15	Daily responsibilities interfere with time spent using technology	Egypt	1.453	0.499	%29.1	Low
		Saudi Arabia	2.861	1.376	%57.2	Medium
	Overall average	Egypt	3.371	0.129	%67.4	Medium
		Saudi Arabia	2.274	0.242	%45.5	Low

Table 12: Statistical significance tests for multiple analysis of variance between groups

Variable	Statistical test	Value	F	Default degrees of freedom	Error degrees of freedom	Significance level	P-square
Constant	Pillai's Trace	0.996	32835.367b	5	587.000	0.000	0.996
	Wilks' Lambda	0.004	32835.367b	5	587.000	0.000	0.996
	Hotelling's Trace	279.688	32835.367b	5	587.000	0.000	0.996
	Roy's Largest Root	279.688	32835.367b	5	587.000	0.000	0.996
Country	Pillai's Trace	0.688	259.069b	5	587.000	0.000	0.688
	Wilks' Lambda	0.312	259.069b	5	587.000	0.000	0.688
	Hotelling's Trace	2.207	259.069b	5	587.000	0.000	0.688
	Roy's Largest Root	2.207	259.069b	5	587.000	0.000	0.688
Gender	Pillai's Trace	0.012	1.381b	5	587.000	0.230	0.012
	Wilks' Lambda	0.988	1.381b	5	587.000	0.230	0.012
	Hotelling's Trace	0.012	1.381b	5	587.000	0.230	0.012
	Roy's Largest Root	0.012	1.381b	5	587.000	0.230	0.012
Age	Pillai's Trace	0.057	1.699	20	2360.000	0.027	0.014
	Wilks' Lambda	0.944	1.700	20	1947.809	0.027	0.014
	Hotelling's Trace	0.058	1.698	20	2342.000	0.027	0.014
	Roy's Largest Root	0.026	3.081c	5	590.000	0.009	0.025
Eligibility	Pillai's Trace	0.010	0.413	15	1767.000	0.976	0.003
	Wilks' Lambda	0.990	0.412	15	1620.850	0.976	0.003
	Hotelling's Trace	0.011	0.411	15	1757.000	0.977	0.003
	Roy's Largest Root	0.007	.797c	5	589.000	0.552	0.007
Disability	Pillai's Trace	0.032	0.945	20	2360.000	0.529	0.008
	Wilks' Lambda	0.968	0.945	20	1947.809	0.528	0.008
	Hotelling's Trace	0.032	0.946	20	2342.000	0.527	0.008
	Roy's Largest Root	0.022	2.606c	5	590.000	0.024	0.022

a: Variable: constant + country + gender + age + qualification + disability; b: Exact statistic; c: The statistic is an upper bound on F that yields a lower bound on the significance level

Table 12 shows significant differences in the use of digital transformation by families of people with disabilities attributed to the variables of country and age, as Pillai's Trace test for the country variable (0.688) showed a significant effect at the level 0.000. While other variables such as gender, qualification, and type of disability did not show substantial differences, as Pillai's Trace values were not statistically significant (such as gender variable=0.012, significance level=0.230; qualification=0.010, significance level=0.976).

Table 13: The multiple analysis of group variance based on the different variables

Source of variance	Dependent variable	Sum of squares	Degrees of freedom	Mean squares	Value (f)	Significance	Eta square
Country	Household use of digital technology	27.372	1	27.372	412.977	0.000	0.411
	Household digital awareness	12.874	1	12.874	203.131	0.000	0.256
	Digital technologies used	30.064	1	30.064	532.722	0.000	0.474
	Access to digital services	9.245	1	9.245	121.663	0.000	0.171
	Total score	18.802	1	18.802	1177.346	0.000	0.666
Gender	Household use of digital technology	0.001	1	0.001	0.021	0.885	0.000
	Household digital awareness	0.158	1	0.158	2.486	0.115	0.004
	Digital technologies used	0.012	1	0.012	0.221	0.639	0.000
	Access to digital services	0.001	1	0.001	0.008	0.930	0.000
	Total score	0.005	1	0.005	0.295	0.587	0.000
Age	Household use of digital technology	0.057	4	0.014	0.214	0.931	0.001
	Household digital awareness	0.819	4	0.205	3.232	0.012	0.021
	Digital technologies used	0.486	4	0.122	2.153	0.073	0.014
	Access to digital services	0.476	4	0.119	1.565	0.182	0.010
	Total score	0.037	4	0.009	0.578	0.679	0.004
Qualification	Household use of digital technology	0.112	3	0.037	0.564	0.639	0.003
	Household digital awareness	0.052	3	0.017	0.273	0.845	0.001
	Digital technologies used	0.095	3	0.032	0.561	0.641	0.003
	Access to digital services	0.107	3	0.036	0.468	0.705	0.002
	Total score	0.011	3	0.004	0.221	0.882	0.001
Disability	Household use of digital technology.	0.177	4	0.044	0.666	0.616	0.004
	Household digital awareness	0.391	4	0.098	1.543	0.188	0.010
	Digital technologies used	0.132	4	0.033	0.584	0.674	0.004
	Access to digital services	0.162	4	0.041	0.534	0.711	0.004
	Total score	0.006	4	0.002	0.099	0.983	0.001
Fault	Household use of digital technology	39.171	591	0.066	---	---	---
	Household digital awareness	37.456	591	0.063	---	---	---
	Digital technologies used	33.353	591	0.056	---	---	---
	Access to digital services	44.907	591	0.076	---	---	---
	Total score	9.438	591	0.016	---	---	---
Total	Household use of digital technology	5663.172	605	---	---	---	---
	Household digital awareness	6033.082	605	---	---	---	---
	Digital technologies used	6068.500	605	---	---	---	---
	Access to digital services	6094.735	605	---	---	---	---
	Total score	5930.480	605	---	---	---	---

Table 13 shows that there are statistically significant differences between Egypt and Saudi Arabia in the use of digital transformation by families with disabilities, as the value of F ranged between 412.977 and 532.722 and is statistically significant at the level of 0.01, indicating a difference in families' use of digital technology in all dimensions, in favor of Saudi Arabia. The researchers explain that Saudi Arabia has benefited from government support and available digital resources, such as training programs that enhance families' ability to use technology to support people with disabilities. This result is consistent with the study by Aldousari and Yuan (2024) that confirmed the role of training programs and the development of the Internet in improving digital access and technical awareness in Saudi Arabia. Table 13 also shows that there are no statistically significant differences between males and females in the use of digital transformation, as the value of F ranged between 0.001 and 0.930 and is not statistically significant at the level of 0.01. The researchers explain that both genders receive the same training and awareness opportunities, which limits the effect of gender on the use of digital technology. This result is consistent with the study (Holotă and Drăgoi, 2023), which indicated a digital gender gap despite the progress made. This result is consistent with the survey (Whear et al., 2022), which showed that younger people are more aware of health technologies, and the study (Lee and Kim, 2022), which confirmed their greater use of digital tools, while older people focus on safety (Heek et al., 2019), which reinforces the digital gap between generations (Longoria et al., 2022). It is also clear that there are no statistically significant differences between levels of educational qualification in all dimensions related to the use of digital transformation in caring for and supporting people with disabilities, as the value of F ranged between F=0.564, 0.705 and is not significant at the level 0.01. The researchers explain this result by saying that the efficiency in using technology is not significantly affected by educational qualification but rather depends more on the availability of training opportunities and cognitive programs related to digital technology, regardless of the academic level. There are no statistically significant differences between the types of disability (motor, mental, hearing, visual) in the use of digital transformation in caring for and supporting people with disabilities, as the value of F ranged between F=0.534, and 0.983, which is not statistically significant. This indicates that the type of disability does not significantly affect families' use of digital technology or access to digital services. The researchers explain this result by saying that all families, regardless of disability, may face similar challenges in using digital technologies. This result is consistent with multiple studies (Baidarova and Lavrentieva, 2018; Kibakin and Malakhova, 2020; Boztaş et al., 2023) that confirmed that the use of technology in supporting families with disabilities is not significantly affected by the type of disability or educational background.

4.1. Expanded discussion of findings and implications

The study highlights significant variations in attitudes toward digital transformation between Saudi Arabian and Egyptian families. Saudi Arabian families exhibited overwhelmingly positive attitudes, while Egyptian families displayed mixed attitudes, with a considerable portion remaining neutral or negative. This disparity may reflect differences in digital infrastructure, governmental policies, and cultural attitudes toward technology adoption. Ultimately, the study proposed strategies for overcoming challenges, such as improving digital infrastructure, offering family training programs, and fostering institutional cooperation. These strategies align with global best practices and could be customized further to address each country's unique challenges.

This research suggested the following implications:

- Saudi Arabia's high acceptance of digital transformation can be leveraged to accelerate the integration of advanced digital tools, such as AI-driven assistive technologies, and expand training programs for families of people with disabilities. Policymakers should focus on maintaining momentum by addressing emerging challenges, such as the cost and complexity of advanced tools.
- For Egypt, neutral or negative attitudes signal a need for awareness campaigns, increased governmental support, and targeted interventions to improve digital literacy. Efforts should aim to bridge infrastructure gaps, particularly in rural areas, and subsidies digital tools to increase accessibility.
- Regarding differences in digital transformation usage, the study found that families in Saudi Arabia were more engaged with digital technologies for caregiving than families in Egypt. While families in both countries used certain technologies (e.g., assistive devices for life skills), Saudi families benefited more from advanced applications like digital platforms for healthcare and education.
- Service expansion: The Saudi government's success in digital transformation highlights the effectiveness of national programs like Vision 2030. Expanding these programs to include tailored services for people with disabilities can further enhance outcomes.
- Need for localized solutions in Egypt: Families struggle with limited access to high-quality digital resources and reliable infrastructure. Collaborative efforts between the government, private sector, and NGOs could focus on developing low-cost, accessible technologies tailored to the local context.
- Regarding digital transformation challenges, both countries faced a lack of technical support, difficulty evaluating digital tools, and limited awareness of available digital services. These

challenges were more pronounced in Egypt, where families faced additional barriers such as financial constraints and poor technological infrastructure.

- Addressing technical support: Both countries need to strengthen technical support networks, including 24/7 helplines and community-based support centers for families of people with disabilities.
- Economic support: Providing subsidies, financial assistance, or partnerships with tech companies to reduce the cost of devices and applications could address financial barriers, particularly in Egypt.
- Enhancing digital literacy: Training programs tailored to families' educational levels could empower caregivers to navigate and adopt digital technologies effectively.
- The study revealed that younger families, those with less formal education, and families of individuals with physical and hearing disabilities were more likely to embrace digital transformation. Families with older members or those dealing with multiple disabilities were less likely to adopt technology.
- Demographic-specific interventions: Younger families could serve as early adopters and ambassadors of digital transformation, promoting its benefits within communities. Simultaneously, interventions targeting older or less technologically inclined groups should emphasize simplified interfaces and personalized guidance.
- Inclusivity for all disabilities: Families facing mental and multiple disabilities require tailored tools and technologies to meet their unique challenges. Investing in assistive technologies that accommodate a broader spectrum of disabilities could enhance inclusivity.
- Collaborative policy development: Involving families, educators, healthcare professionals, and technologists in policy development ensures solutions are practical and effective.
- Role of international organizations: Collaborating with international organizations specializing in disability rights and technology can provide funding, technical expertise, and frameworks for scaling successful models.
- Long-term sustainability: Establishing monitoring and evaluation systems to assess the effectiveness of digital transformation initiatives will guarantee ongoing improvement and adaptability to evolving needs.
- The findings provide a roadmap for policymakers to leverage digital transformation to achieve national goals such as Vision 2030, which focuses on inclusivity for families of people with disabilities.
- For researchers: This study underscores the need for further research on culturally specific barriers to digital adoption and the influence of demographic variables on shaping attitudes.
- For technology developers, this study's insights highlight the significance of creating user-friendly, cost-effective technologies that cater to the unique needs of families with disabilities.

5. Conclusions

The study concluded that digital transformation plays a crucial role in enhancing support and care for families of persons with disabilities in both Saudi Arabia and Egypt. However, the adoption and effectiveness of digital transformation differs between the two countries, with Saudi Arabia showing higher engagement and readiness for infrastructure than Egypt. Key findings include:

1. Positive attitudes towards digital transformation: Households in Saudi Arabia generally show more positive attitudes towards digital transformation than Egyptian households, influenced by factors such as gender, age, and education level.
2. Challenges identified: Households, especially in Egypt, face barriers such as limited access to infrastructure, lack of awareness, and insufficient training programs. Economic factors and cultural barriers also hinder the widespread adoption of digital tools.

Based on the findings of this research, several improvement strategies are recommended to support the digital transformation process for people with disabilities. Firstly, it is important to promote digital literacy at the household level. This can be achieved by implementing targeted training programs and workshops that equip individuals with the skills needed to effectively use digital technologies. Enhancing access to affordable and reliable digital tools is also essential. In addition, strengthening institutional collaboration is necessary to ensure ongoing technical support and guidance.

In Egypt, comprehensive awareness campaigns should be organized to inform the public—particularly families—about the significance of digital transformation in improving the lives of people with disabilities. These campaigns should highlight the practical benefits of digital technologies and how they can contribute to better care and support. It is also vital to ensure continuous technical assistance so that digital tools are used appropriately and effectively in caregiving.

Furthermore, Egypt should prioritize the development of its digital infrastructure, especially in rural and remote areas. Improvements in internet speed and the expansion of digital network coverage are necessary to create an inclusive digital environment that can adequately support services for people with disabilities.

Special attention should be given to training programs for women, particularly mothers, to enable them to support their children with disabilities through digital means. Similarly, training initiatives should target young people under the age of 25. Their positive attitudes toward technology should be utilized by involving them in the use and development of digital and assistive technologies.

Encouraging scientific research in assistive technologies is also essential. Both Egypt and Saudi

Arabia should support projects that aim to improve digital applications in the fields of education and healthcare for individuals with disabilities. It is recommended that digital technologies be developed to accommodate all types of disabilities, including visual and intellectual disabilities. Ensuring that all categories of individuals with disabilities benefit from digital innovations in education and healthcare is crucial.

Moreover, collaboration between governmental bodies and private institutions should be enhanced. Such cooperation can provide additional resources and innovative tools that broaden the scope of digital transformation in disability care. Finally, Egypt should improve the quality and accessibility of digital distance education. Drawing on the successful experience of Saudi Arabia, Egypt can develop educational programs and training courses for both professionals and families. These should focus on creating accessible and innovative learning content tailored to the needs of people with disabilities.

While the study provides valuable insights, certain limitations should be acknowledged:

- Sample representation: The study sample included 605 families from Saudi Arabia and Egypt. Although substantial, the findings may not be generalized to all families of people with disabilities in these countries due to socioeconomic and regional variations.
- Limited focus on specific disabilities: While the study analyzed various types of disabilities, the findings may not comprehensively capture the experiences of families dealing with rare or complex disabilities.
- Cross-Sectional design: The study employed a cross-sectional approach, simultaneously providing a snapshot of attitudes and experiences. Longitudinal studies could provide deeper insights into the evolving impact of digital transformation.
- Infrastructure and policy disparities: The comparative nature of the study between Saudi Arabia and Egypt means that findings are influenced by country-specific factors, such as infrastructure development and government policies, which may not apply universally.
- Accent and cultural nuances: While culturally sensitive, the study's tools and methodologies might not fully address the diverse accents and cultural nuances of the populations studied. To address these limitations and build upon the study's findings, future research could:

- Conduct longitudinal studies to track the long-term effects of digital transformation on families of people with disabilities.
- Include a diverse sample from various socioeconomic and geographical backgrounds to improve representativeness.
- Explore specific challenges faced by families dealing with rare or complex disabilities.
- Investigate the role of government policies and programs in shaping attitudes and access to digital transformation technologies.

Compliance with ethical standards

Ethical considerations

The study adhered to ethical research standards involving human participants. Participation was voluntary, and informed consent was obtained from all respondents. The data collection was conducted anonymously to ensure confidentiality and privacy.

Conflict of interest

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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