ICT accessibility Research Capacity building in the State of Qatar

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Abstract –

The potential of information and communication technology (ICT) to promote economic growth, eradicate poverty, and assist the integration of emerging countries into the global economy has garnered widespread agreement. Accessible ICTs has become an obligation that <u>as</u> is governed by policies and procedures all around the world. Therefore, training the next generation of experts has now strategic aim of governments and institutes working toward inclusion and sustainable future. there also is a growing consensus that strengthening research capacity requires a concerted effort across multiple institutes. This paper discusses an overview of the ICT accessibility Research Capacity Building in the State of Qatar, including a Case Study on Our Experience at HBKU University and Working Together with the Mada Centre.

Keywords: Capacity building, inclusive education, research, Qatar

Introduction

In many countries around the world, accessibility has shifted from being merely an option to satisfy the design of Information Communication Technology (ICT) to a moral obligation and policy enforced by law. There are various means and methods to enhance accessibility in an ecosystem, however, the core and most fundamental aspect are to train the people designing and employing these technologies. Article 9 of the Convention on the Rights of Persons with Disabilities (CRPD) [1], in fact, has stressed the importance of providing training for stakeholders on accessibility issues facing persons with disabilities and promoting access to ICT through designing and developing ICTs.

ICT accessibility has started to gain interest in research and academic spheres since the mid-90s when the use of the internet started to take place on the global stage. During that time, the initial developments of guidelines related to web accessibility were the result of efforts by the civil rights of Americans with disabilities, ongoing work on telecommunications accessibility, and growing interest in using the web as the main source of modern-day information [2]. By the end of the 90s, the web accessibility initiative (WAI) of the world wide web consortium (W3C) released the first version of its infamous web content accessibility guidelines (WCAG) 1.0 [3]. This was followed by a number of Governments in the United Kingdom, United States, and Australia to consider accessibility to ICT in their legislation systems by either specifically implementing their own guidelines or by adapting the W3C guidelines. The interest continued to raise as technologies increasingly integrates into our daily lives. In 2008, the CRPD came to light and become the driving force behind many of the accessibility- initiatives including the

teaching and research initiatives in academia, that we have today. Today many renewed research and academic institutes around the world established courses, research groups, and centres that focus on accessibility and assistive technology paving the way to more inclusive societies. In this article, I discuss ICT accessibility Research Capacity building in the State of Qatar, detailing our journey at HBKU university and collaboration with Mada center as a case study. This article is structured as follows; section 2 discusses the background of accessibility practice and research in the state of Qatar; section 3 details how ICT accessibility is integrated into the courses at HBKU; and ICT research training experiences are then discussed in section 4.

Background

The state of Qatar was among the first nations that ratified United Nations CRPD in May 2008, and in April 2015 the state adopted a law on persons with disabilities which covered all the rights contained in the Convention. In its effort to adopt the convention, in 2011 Qatar released the National e-Accessibility Policy [4], which aims to raise the level of accessibility across all digital platforms. Prior to that, in 2009, the Supreme Council for Information and Communication Technology established Mada (Qatar Assistive Technology Centre), a non-profit organization dedicated to connecting people with disabilities to information and communication technology.

Today, Mada Center is the world's Center of Excellence in digital access in Arabic. Mada's center work is influenced by its core belief that persons with disabilities form an integral part of society and that if they are equipped rightly, they will play a vital role in the growth of Qatar's economy. To pursue this belief, Mada center has built a number of strategic partnerships with entities in Qatar and the world. Through these partnerships, the center works to enable the education, culture, and community sectors through ICT to achieve an inclusive community. Mada center supports technology initiatives in research, training, and innovation through its various program. our research group closely works with the Mada center on a number of initiatives.

Over the past two decades, Qatar has established solid foundations in education and has played a leading role in scientific research across the region, developing a number of world-class facilities and institutions, including QNRF, the first national institution to finance research on a competitive basis in the Middle East; Qatar, and several research hospitals, including Hamad Medical Corporation, Sidra Medical Center, as well as Qatar Biobank Medical Research and Qatar Genome Program. Qatar also has branches of a selection of major international universities, while Qatar University is ranked among the top five universities in the Arab world. At the same time, Qatar has increased the number of local opportunities available for postgraduate degrees through the launch of masters and PDD programs at Hamad Bin Khalifa University (HBKU)

In 2018, the Qatar Research, Development, and Innovation (QRDI) Council was established. This was a big step forward for Qatar's research, development, and innovation (RDI) agenda [5]. The first thing the Council had to do was come up with a national strategy that would make the best use of RDI activities and help the country reach its overall goals and aspirations. At the end of 2019, the Council launched the Qatar Research, Development, and Innovation

Strategy 2030. Capacity building is the heart of the QRDI strategy thriving a knowledge-based society.

Our research group is based at HBKU, a member of the Qatar Foundation. HBKU was founded in 2010 as a research-intensive university that acts as a catalyst for transformative change in Qatar and the region while having a global impact. In our research group, which was founded in 2016 at HBKU, we believe each of us must play an active role in supporting access and use of technology. Designing technologies that suit different abilities and ages is critical in allowing individuals to achieve a smooth and undiminished ICT interaction. The aim is for this interaction to reach optimal levels of performance. Our research group is interested in addressing the issue of designing a comprehensive user experience and accessibility to create a more inclusive community in Qatar and the world. The group, therefore, experiments and design human-centered technologies that are sensitive to use in various contexts including education and health. To achieve this, we collaborate with world-renowned centres and experts in the field, engage with users with disabilities to understand their needs, design human-centered technologies by taking advantage of modern technological developments and artificial intelligence, and train the next generation of highly skilled researchers.

Research capacity building is referred to as "a process of developing sustainable abilities and skills enabling individuals and organizations to perform high-quality research" [6] In many research intuitions focus on capacity building as one of their most important pillars and tools of development and continuity. In the HBKU 2016-2026 strategic plan [7] capacity building is in its core four pillars. Mada's mission implies that is aiming Unlock the potential of persons with functional limitations (PFLs), persons with disabilities (PWDs), and the elderly – through enabling ICT accessible capabilities and platforms [8].

Training

The aim of research capacity building is to strengthen the existing workforce with skills that will widen their understanding [6]. Through this, they are able to contribute to the development of high-quality research that improves their field's understanding, persuades funding authorities, and makes evidence-based practice possible. That is in addition, to enhancing practices currently taking place.

Training includes offerings a course on ICT accessibility in the Bachelor of Computer Programming and Engineering Course, embedding ICT accessibility, Universal Design, and Inclusive design fundamental in a Human-computer Interaction elective course offered for the master's and Ph.D. students at the College of Sciences and Engineering at HBKU, and engaging research student in active research grants related to accessibility, digital inclusion, and assistive technology. In the ICT accessibility, the Mada Accessibility and Inclusive Design Competency framework [9] was used to design and prepare the course outline. The course focuses on enhancing the student's capabilities in the domain of ICT accessibility. It provides a comprehensive review by covering diverse topics that advance the skills needed to develop, review and evaluate accessible digital platforms according to the international best practices and ICT accessibility standards. When completing the course the students will be able to understand the definition and the importance of ICT accessibility, develop accessible websites and Mobile applications including the creation of accessible digital content such as multimedia, and evaluate the level of accessibility of digital platforms, such as website, Mobile application

and electronic kiosks, identify the uses of assistive technology, and demonstrate the application of universal and inclusive design principles in the development of user-center technology. During the course, the student gets the opportunity to visit Mada Center and its innovation lab, interact with the team, and know more about the work taking place in Mada. The course also involved students working on innovative projects addressing pressing accessibility problems. The students were engaged and should a real interest in the subject. In fact, a number of them express their interest in engaging in ongoing accessibility research in HBKU and Mada.

To build capacity on the research level, I offer a class on accessibility and inclusive design in collaboration with Mada Center As part of its Interactive Design for Healthcare course. In this class students who register in the course attend a workshop on digital accessibility at Mada – Qatar Assistive Technology Center. The workshop at Mada enhanced participants' learning experience, providing them with opportunities to engage with real-world applications and technologies. The workshop, entitled Introduction to Digital Accessibility, stressed the importance of inclusiveness and accessibility in technology-related innovations.

Research experience

Providing research experience is a crucial part of capacity building in a university setting. HBKU is a research-intensive university in which most of its programs are at the graduate level. Thus, research training is given the highest priority. In our research group at HBKU, we work on a number of projects related to accessibility and inclusive design in collaboration with the Mada Center. We also have a number of partnerships with local centers in Qatar such as Shafallah Center for Persons with Disabilities, Center of Empowerment and Care of the Elderly (Ehsan), Step by Step Center for Special Educational Needs, and iSpeak Rehabilitation Center. We have a number of international collaborations with research institutes and non-governmental organizations around the work such as Texas A and M University, University of Bristol, University of Ottawa, Autism Speaks, the National Autism Society in the United Kingdom, and Age–Well in Canada. Most of the research projects we currently work on are funded by the Qatar National Research Fund, Mada center, HBKU College of Science and Engineering, and HBKU innovation fund. Master's, Ph.D., research assistants, and postdoctoral fellows are hired in the projects to work alongside the Principal Investigators from both Mada and HBKU. They would be engaged in the different phases of research from ideations to data gathering, analysis, and dissemination. Two Ph.D. and three master's students working in areas related to inclusive design and accessibility have so far graduated from the team. We currently have 12 research team members in our group working on a number of active research grants that focus on technology design for the elderly, children with autism, and inclusion. The team actively publishes in reputable research venues and top-tier journals in the field of accessibility and human-computer interaction. The team also received a number of patents and is looking into the opportunity of technology transfer to feed into the innovation ecosystem in Qatar and the world.

When looking at my research work, it becomes evident that I have had a focus on supporting the design of inclusive technologies for people with autism spectrum disorder (ASD). There are a number of reasons for pursuing this research direction. Firstly, the incidence of ASD has increased significantly in the United States of America, as reported by the Center for Disease Control and Prevention (CDC). The increase in the number of children diagnosed with ASD is not limited to the USA, but is a global trend, including in Qatar. A recent study by the Qatar

Biomedical Research Institute (QBRI) has found that one in 56 boys and one in 230 girls have been diagnosed with ASD in Qatar. The experience of families who have children with ASD shows that the children require a great deal of support from the parents and siblings, relatives, and friends. Sometimes, the support needed by children with ASD spans from childhood to adulthood, which is usually overwhelming and psychologically challenging. Thus, one of Qatar's 2030 visions is to meet the needs of individuals with special needs regarding development rights. This vision emphasizes Article 24 of the UN Convention on the Rights of Persons with Disabilities, which recognizes the right of persons with disabilities to education and opportunities without discrimination. Intellectual disabilities, such as ASD, have remained the most significant proportion of disabilities over the past decade in Qatar. Within this pillar, I have four active projects. The research in this pillar received several grants for projects in which I am a Lead PI. These grants are: (1) idea development from Hamad bin Khalifa Innovation Centre, (2) QNRF NPRP13S-0108-200027, (3) QNRF PDRA6-0611-20012, (4) QNRF RRC-3-010, and (5) NPRP10-0208-170408. I also received in-cash funds from Mada Assistive Technology Center and Shafallah Center.

Children with ASD are characterized by attention deficit and exhibit a range of attentional behaviours due to heterogeneity in the spectrum. The current state-of-the-art states that engagement assessment in ASD happens through subjective methods, requiring a long year of experience [10]. Our previous review [11] shows that researchers often focus on how technology innovations can improve the engagement level of children with ASD. However, the application of this technology for engagement assessment is still in its infancy. The commonly applied method is based on subjective evaluation, which requires high expertise and is time-consuming. However, few studies have explored objective assessment of engagement levels during learning by utilizing existing sensing technologies for typically developing individuals. Those few engagement assessments conducted to date are based on evaluating generalized attention, which is not suitable for children with ASD due to their heterogeneity. Our group applied a personalized engagement assessment that captures visual, auditory, and social attention for children with ASD during learning. Our study explored the effect of social and non-social visual stimuli on the attention of children with ASD and typically developing (TD) children in a simulated virtual classroom [12][13]. Using a webcam and eye-tracking, forty-six participants (ASD = 20, TD = 26) took part in a series of attention tests, in which social and non-social visual stimuli were used as target stimuli [14][15]. We proposed a face-based attention recognition model using two methods [16]. We showed that the geometric feature transformation [17] using an SVM classifier outperforms the CNN approach, emphasizing that the attention features are more generalizable in the TD group.

Our recent AR [18] review shows that researchers have targeted several skills related to ASD in the studies. However, the teaching of vocabulary or language is still underexplored despite its importance in academics. Working closely with local stakeholders (parents and their children, teachers, and centers), we conducted a detailed qualitative study to ascertain and understand their needs [19]. As a result, an AR app was developed using collected requirements in the classroom and at home. The app was then evaluated using a participatory approach [20]. Through feedback received from our sessions with teachers, we incorporated the concept of mixed reality into the app. Children with ASD can benefit from the app by regularly connecting with their teachers and performing a set of tasks within the app environment. However, in the absence of a teacher, a 3D humanoid talkative avatar would support a child and parents in a virtual environment. To the best of our knowledge, there is no educational platform that caters

to the needs of children with ASD. The platform allows parents and teachers to view a child's performance, and teachers can create lesson plans according to the child's needs. The AR app would benefit children with ASD as it would allow them to become independent individuals and live better lives. The application will be available on the Apple app store, by the name of MARVoc, and it is now being used at Shafallah Center, which is a center that provides educational support for children Intellectual disabilities and mental disabilities associated with motor disability, ASD, and its spectrum.

In the realm of web accessibility for the blind, we investigated ways of generating overview web search results [21][22]. We amended these different approaches in a search engine which we called InteractSE. This search engine uses Formal Concept Analysis (FCA) to generate an overview of search results. InteractSE was evaluated with 16 users [23] and five HCI experts [24], showing a significant improvement in search efficiency and individual user experience for VI web users. The team continues to work on research projects related to accessibility and looking for aspiring scientists to join this journey. Our future research plan aims to strengthen and develop a local research team in the area of ICT accessibility.

Conclusion

Building research capacity can be targeted on three different levels, including foundational training on the topic of accessibility and the initial introduction of research in this field (such as understanding how to search, evaluate, and consciously apply research evidence to inform practice), active participation and gaining the research experience (such as assisting designing the research, and participating in the data collection and analysis), and finally leading research grants in this area. Building research capacity can be targeted on all three levels simultaneously. The collaboration between Mada and HBKU has gone a long way with a number of ongoing projects, and courses taught on both undergraduate and graduate levels. We hope that this fruitful is shared with institutes around the region to work towards building a strong foundation for ICT accessibility both in research and practice.

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