Mada ICT Accessibility and Inclusive Design ICT-AID Competency Framework

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Abstract –

The Information and Communication Technologies ICT -evolving into an integral part of everyday life, shapes profound changes in our societies. Consequently, everyone should access ICT in the same way as everyone else, which means that ICT should be accessible to everyone, regardless of his/her abilities, needs, or disabilities. This calls, among other effective measures, for developing skills in ICT accessibility, which includes a shared understanding of ICT accessibility and Inclusive Design ICT-AID, as well as acquiring necessary digital accessibility competencies for everyday life and work. Nevertheless, selecting appropriate accessible training and education materials aligned with specific ICT-AID competencies, especially in the Arabic language, remains a barrier to all, inhibiting aspirations and willingness to build capability and proficiency in ICT accessibility. This paper presents Mada ICT Accessibility and Inclusive Design ICT-AID Competency Framework, encompassing all core competencies required to effectively integrate ICT accessibility principles into training and educational curricula toward closing the training and knowledge gap in this field.

Keywords: ICT Accessibility, Inclusive Design, Competency Frameworks, Persons with disabilities, Open Educational Resources

Introduction

A wide range of challenges and barriers confront people with disabilities and the elderly [1], especially in the field of Information and Communication Technologies (ICT), reducing their access to various online services, educational, and employment opportunities [2]. Under such circumstances, there is a growing global recognition that accessibility is essential for individuals and organizations to help remove barriers hindering access to ICT and create high-quality products and services universally accessible and usable by a broad range of users [3]. Undoubtedly, ICTs play a crucial role in bridging the digital divide and fostering the development of inclusive Knowledge Societies, as was highlighted in the 2030 Agenda for Sustainable Development Goals SDG. On that premise, the United Nations member states have been required to implement the 2030 Agenda [4] and facilitate therefore access to ICT for persons with disabilities. Furthermore, according to the United Nations Convention on the Rights of Persons with Disabilities UNCRPD, access to information and communication technologies, emergency services, and the Internet is recognized as a fundamental human right. As such, signatory states are obliged to take appropriate measures to allow people with disabilities access to these services equitably and invest more in providing ICT products and services meeting their needs and requirements [3]. In particular, leveraging inclusive ICTs in education as well as integrating ICT accessibility within the capacity building, training, and education curricula and programs can enable all persons, including persons with disabilities, to

access equitably to learning opportunities and to gain the necessary ICT accessibility and inclusive design ICT-AID competencies required for life and work.

Nonetheless, ICT-AID topics tend to be underrepresented in training and educational curricula specifically in the Arab region [5]. In addition, the availability of accessible digital educational content appropriate for different learning contexts and proficiency levels remains far short of expectations[6] [7]. This will undoubtedly lead to a lack of knowledge, and awareness, and expertise about developing accessible contents and services, contrary to what was stated in UN conventions. It is therefore extremely important to spread knowledge and awareness, and to develop skills around ICT accessibility, particularly, through fostering the integration of ICT-AID aligned courses in educational institutions and professional development services.

This paper presents Mada ICT accessibility and inclusive design ICT-AID competency framework defining a set of coherent relevant competencies in the ICT accessibility and inclusive design field, intended to serve as a training, and learning guide on the foundation in ICT accessibility and inclusive design [8]. The remainder of this paper is organized as follows: Section II investigates existing educational programs in ICT accessibility and discusses the need for a competency model as an instrument to guide training and learning in this sector. After this, section III describes Mada ICT-AID competency framework. Section IV then presents some results from a 2-round Delphi validation method of the proposed framework. Then, Section VI explores some of the ICT-AID use cases by Mada partners so far in Qatar. Lastly, Section V concludes the paper and suggests ways forward.

Developing ICT accessibility capabilities

As per Article 9 of the Convention on the Rights of Persons with Disabilities, states parties are required to take appropriate measures to enhance accessibility as well as to promote inclusive ICT use and access at a minimum cost [3]. Various surveys have shown that the lack of ICT accessibility skills represents a serious stumbling block to implementing accessibility on digital products, and contents, and services [9] [10]. In response, many organizations and educational and training institutions have rushed to offer capacity building and training programs aligned to their own knowledge and understanding of ICT accessibility [11][12] [13]. Among the most important, the World Wide Web Consortium W3C Web Accessibility Initiative WAI has provided the community with training materials to support individuals understanding and implementing accessibility [14]. The W3C WAI has also developed a curriculum on Web accessibility to be used as a framework for educators to build their own courses. The Curricula modules cover accessibility foundations that apply broadly, and specific skills for developers, designers, content authors, and others [15]. Additionally, the International Association of Accessibility Professionals (IAAP), which operates as a division of the Global Initiative for Inclusive ICTs G3ICT, provides professional resources and certification in digital accessibility in a bid to support accessibility professionals developing and advancing their careers and integrating accessibility into digital products and contents [10]. The W3C's Web Accessibility Initiative (WAI) and the UNESCO Institute for Information Technologies in Education (UNESCO IITE) cooperated to provide a free online course built on the open curricula of the W3C WAI. It is in this context that they launched an Introduction to Web Accessibility Massive Open Online Course MOOC on edX platform [16]. Learners can audit the course for free or choose to receive a paid verified certificate [17]. In the same way, ITU organization offers a self-paced online training on ICT accessibility with the aim to develop a good understanding of ICT accessibility among all relevant stakeholders [18]. Apart from above examples of organizations striving to achieve ICT accessibility through capacity building and training, several universities have also joined these endeavors and have integrated ICT accessibility

courses into their curricula [19] [20]. In Qatar, Hamad bin Khalifa University HBKU [5] and Community College of Qatar CCQ have recently introduced courses dealing with digital accessibility in their curriculum. In the US, the University of Illinois at Urbana-Champaign in Illinois, e.g. has launched an ICT-AID MOOC on Coursera that allows learners to explore the fundamentals of accessibility and inclusive design. Learners can audit the course for free or choose to receive a paid verified certificate (University of Illinois at Urbana-Champaign, 2020) [21].

This is indeed a very important and beneficial effort towards fostering ICT accessibility in the region. It appears, however, that none cannot be effectively used as a holistic and comprehensive framework to cover all the knowledge, skills, and attitudes that learners need to acquire, nor can it be utilized as an instrument for describing and curating existing materials. Therefore, a dedicated competency framework, that specifies globally what stakeholders need in terms of ICT-AID capability development, training, and education towards achieving, is required more than ever before.

In fact, when well-defined ICT-AID competencies are spotted within a dedicated competency framework and adopted as a global standard, individuals and professionals from all over the world will be able to gain the same level of understanding and the same skill sets scaffolded by training professionals and education providers. These latter, by availing such a common competency framework, can better define their curricula and training programmes and materials, and would accordingly drive globally their training offers addressing more accurately ICT accessibility jobs' needs. It is within this context, that Mada has developed the Mada ICT-AID competency framework, as part of its fully-fledged innovative Academy initiative toward fostering ICT accessibility proficiency in the region and beyond [22].

Mada ICT-AID Competency Framework

Mada has developed the ICT-AID Competency Framework [23] in order to guide training of students and workers on the foundation in ICT accessibility and inclusive design, which allows the intended audience to make a sense of the experience of disability related to the use of ICT, and to increase their accessibility awareness when using and creating electronic materials[24], and to apply accessibility standards and techniques [25][26], including W3C Web Content Accessibility Guidelines WCAG[27], so that they will be well prepared to excel in their accessibility professions and contribute in the creation of accessible products, contents and services.

With a view to fostering the integration of ICT Accessibility in education and training programmes addressing diverse audiences, Mada ICT Accessibility and Inclusive Design ICT-AID competency framework can be used as a tool to guide professional education services, universities and individuals on delimiting the required relevant competencies in ICT accessibility [28]. Mada ICT-AID competency framework, as an open framework available in open access under Attribution-ShareAlike 4.0 International (CC BY-SA 4.0), can be adapted for use in different learning contexts and modes, and availed to develop, describe and publish ICT-AID aligned resources in courseware repositories.

Among the audiences for Mada ICT-AID competency framework are decision makers, administrators, and teachers responsible for education and training policy formulation, policies, and programs, as well as business and industry experts. Education, training and certification programs developed according to the Mada ICT-AID competency framework are intended to cover a wide range of occupations and professions, such as digital content writers, Web content managers, web developers, designers, instructional designers, digital education specialists,

teachers, project managers, ICT managers, marketing professionals, communications specialists, etc.

Mada ICT-AID competency framework features six key domains of competencies that follow a logical progression in mastering ICT accessibility (Table I):

- D1. Becoming familiar with Disability and Accessibility
- D2. Describing the legal landscape of Disability and Accessibility
- D3. Making a sense of Universal Design
- D4. Creating Accessible Digital Content
- D5. Creating Accessible Web Content
- D6. Making Digital Environments and Platforms Accessible

Each competency domain contains a set of competencies each of which is sub-divided into capabilities (Table II) that the intended audience should master to be able to develop, evaluate, and remediate accessible digital contents. The first four competency domains (from D1 to D4) represent the ICT-AID core competencies covering key capabilities required to developing a deeper mastering of the fundamental principles of digital accessibility. The fifth competency domain D5 encompasses required capabilities for the evaluation and the development of accessible web content in compliance with international standards and best practices. At last, the sixth competency domain features the broad scope of accessible digital environments and platforms, including mobile apps, gaming, and future digital technologies.

TABLE I. ICT-AID COMPETENCIES

Competency Domains	Competencies
D1. Becoming familiar with Disability and Accessibility	**D1.1** Distinguishing theoretical Models of Disability
	D1.2 Recognizing the major types of Disabilities and their impact on lives of PWDs
	D1.3 Demonstrating Understanding of Accessibility
	D1.4 Describing and following disability etiquette guidelines for interacting with PWDs
D2. Describing the legal landscape of Disability and Accessibility	**D2.1** Identifying and characterizing main Laws, Declarations and Conventions on Human Disability Rights
	D2.2 Recognizing key ICT Accessibility regulations, policies and best practices
	D2.3 Identifying ICT Accessibility standards
	D2.4 Integrating ICT Accessibility across the organization
D3. Making a sense of Universal Design	**D3.1** Describing the Universal Design paradigm
	D3.2 Demonstrating understanding of Universal Design for Learning
D4. Creating Accessible Digital Content	**D4.1** Identifying major Accessibility considerations to common digital formats
	D4.2 Creating Accessible Word-processing documents
	D4.3 Creating Accessible Presentation documents
	D4.4 Creating Accessible PDF documents
	D4.5 Generalizing Accessibility considerations for different multimedia formats
	D5.1 Demonstrating understanding of Web Accessibility

Competency Domains	Competencies
D5. Creating Accessible Web Content	**D5.2** Designing and creating web content in accordance with the W3C Accessibility specifications **D5.3** Testing and evaluating Web Accessibility **D5.4** Remediating inaccessible Web documents
D6. Making Digital Environments and Platforms Accessible	**D6.1** Identifying and applying the basic principles of Mobile Applications Accessibility **D6.2** Evaluating Mobile Applications Accessibility **D6.3** Identifying Accessibility considerations for improved game Accessibility **D6.4** Ensuring the Accessibility of emerging digital technologies

Based on these competencies, ICT-AID specializations in Arabic and English languages are currently being developed. The specialization includes three courses aligned to the ICT-AID competency framework according to three skill levels: beginner, intermediate and advanced. These courses can be offered at universities and training institutions (Table 3), and certificates to be obtained accordingly to attest the acquisition of the necessary competencies for each level. As such, Mada is collaborating with partners in order to offer a joint accredited training programmes in Arabic and English languages including basically the following three key courses:

- An introduction to ICT Accessibility and Universal Design, aligned to the following competencies: D1, D2, D3, D4.1, D4,2, D4.3, D4.4, D4.5.1, D4.5.2, D4.5.3, D4.5.4, D4.5.5, and D5.1.
- Digital Accessibility, aligned to the following competencies: D4.5.6, D4.5.7, D4.5.8, D4.5.9, D4.5.10, D5.2, D5.3, and D5.4.
- Mobile and Environments Accessibility, aligned to the competency domain D6.

TABLE II. CAPABILITIES CORRESPONDING TO THE COMPETENCY DOMAIN D1

Competencies	Capabilities
D1.1 Distinguishing theoretical Models of Disability	**1.** Identifying prominent theoretical models of disability **2.** Describing Models' characteristics and understanding their strengthens and weaknesses **3.** Defining Disability on your own words
D1.2 Recognizing the major types of Disabilities and their impact on lives of PWDs	**1.** Identifying basic categories of Disabilities and related demographics **2.** Naming main characteristics of disabilities and associated barriers **3.** Distinguishing how PWDs are impacted by different technologies
D1.3 Demonstrate Understanding of Accessibility	**1.** Describing the broad scope of Accessibility and technology **2.** Identifying Benefits of Accessibility **3.** Defining ICT Accessibility and related terminology on your own words **4.** Exploring Accessibility barriers and Accessibility solutions

	5. Identifying the use and application of AT and adapted Strategies **6.** Identifying key professional organizations and networks in the area of Accessibility **7.** Discussing your role in promoting digital inclusion through ICT
D1.4 Describing and following disability etiquette guidelines for interacting with PWDs	**1.** Identifying major misconceptions or stereotypes about PWDs **2.** Applying disability etiquette to different life settings **3.** Determining what your contributions could be to the Disability and ICT Accessibility movement

The first course corresponding to the first level can be integrated in education curricula at universities e.g. under the Common Core Program CCP. This course is intended to prepare for the first certificate level attesting the acquisition of core competencies in ICT Accessibility and Inclusive Design. The second and third courses are targeting intermediate and advanced levels and can be accordingly included within specialized computer science programs at universities. These latter levels allow students and trainees taking the certificate for digital accessibility specialists and then the certificate for digital accessibility experts:

- Level I Certificate: Core Competencies in ICT Accessibility and Inclusive Design
- Level II Certificate: Digital Access Specialist
- Level III Certificate: ICT Accessibility Expert

TABLE III. ICT-AID SPECIALIZATION WITHIN MADA ACCREDITED TRAINING PROGRAMME

Course	Title	Level	Certification
Course 1	An introduction to ICT Accessibility and Universal Design	Starter	ICT Accessibility and Universal Design Core Competencies
Course 2	Digital Accessibility	Intermediate	Digital Accessibility Specialist
Course 3	Mobile and Environments Accessibility	Advanced	Digital Accessibility Expert

On the other hand, in order to promote the development of accessible training and educational contents, particularly in ICT accessibility topics, taking advantage from the rise of education technology [29], Mada offers a dedicated accessible open educational resources OER Hub on OER Commons, where ICT-AID aligned accessible resources are aggregated, curated and managed through collections, and groups, and development tools. Mada ICT-AID OER Hub is intended to be a Global knowledge hub featuring freely accessible ICT-AID resources toward expanding capabilities for all in the realm of ICT accessibility [30]. Furthermore, Mada ICT Accessibility and Inclusive Design competency framework is now featured as a standard available to users of the OER Commons digital library and collaboration platform (Fig. 1). As a standard, Mada ICT-AID will be used to index and describe ICT-AID aligned educational resources providing accordingly ease of access and retrieve of these resources. As such, the ICT-AID competency framework will be used for searching, aligning, and evaluating Open Educational Resources serving globally learners and educators.

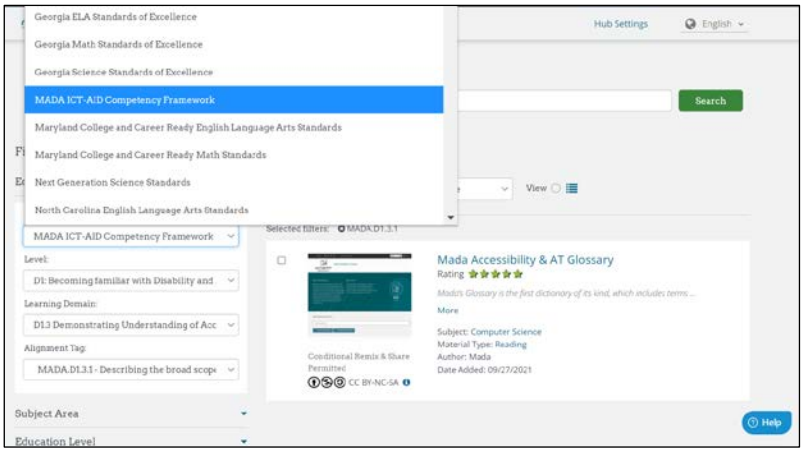

Figure 1 ICT-AID education standard on OER Commons

Expert survey on Mada ICT-AID Competency Framework

Generally, surveys are conducted to acquire expert opinions and recommendations in a particular field [31]. For a better understanding of the required relevant ICT-AID competencies and their inclusion and structure within a framework of competencies, Mada centre prepared and shared questionnaires with a group of experts, requesting their review and then validation on the proposed framework. In fact, two-round Delphi questionnaires were emailed to a selected group of experts in the region. Most of the reviewers came from academia with expertise in accessibility, education technology, and competency frameworks. In the first instance, experts were invited and contacted to gauge their interest in participating in the study. Then 22 experts (from 32 invited experts, about 70 % active responses) took part in the study. As part of the first round of the survey, experts reviewed and validated the structure of the proposed competency framework and checked if it has covered all the relevant competencies, and capability levels and related levels of proficiency. The first questionnaire covers three dimensions, namely: (1) Personal and professional Information; (2) ICT-AID competency domains; and (3) ICT-AID competencies per competency domain. For about half a month, experts were invited to add their detailed responses to the questionnaire sent via email. Following this, the response data were collected and analyzed, and the competency framework was updated and enhanced based on the most common suggestions. Among the 22 experts involved in the study, it is noteworthy that 10 out of 22 affirmed that ICT-AID courses (or similar courses) are not yet integrated into the curricula of universities in their countries, six do not know, and only 6 experts replied that it is or it would be integrated. As for the question on existing similar ICT accessibility and inclusive design competency frameworks, 15 out of 22 answered no and 7 referred mostly to the W3C WAI curricula on Web accessibility and IAAP professional certifications, which both don't cover comprehensively all required knowledge and capabilities on ICT-AID topics, and they are not structured and featured as a competency framework (Fig. 2). The remainder of the first questionnaire is dedicated to investigating the structure of the framework, and to check the spotted competencies and underlying capabilities. At last, 7 experts strongly agreed with the proposed structure of the framework, 12 agreed and 3 somehow agreed. After collecting and analysing inputs and feedbacks from experts, the ICT-AID competency framework was updated and enhanced. Then, the experts were requested in the second-round questionnaire to confirm the suggested updates and validate subsequently the final release of the proposed framework. The average rate of 9.05 on the interval [1, 10] was obtained to expressing the extent to which experts do agree with the current enhanced ICT-AID competency framework version. The promising average rate of 8.09 on the interval [1,

10] was obtained to expressing the potential readiness of experts' universities to be ICT-AID adopters [32].

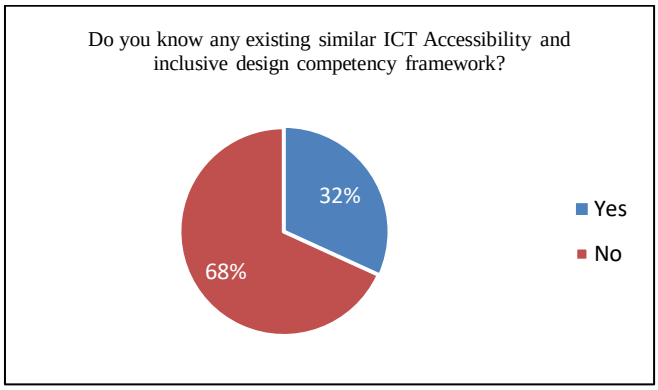

Figure 2 Investigating Similar ICT accessibility and inclusive design competency frameworks

ICT-AID use cases by Mada partners in Qatar

Mada Center is partnering closely with universities and educational institutions to develop accessibility courses aligned with Mada ICT-AID competency framework. In Qatar, Hamad Bin Khalifa University HBKU for example, offers a course on ICT accessibility in the Bachelor of Computer Programming and Engineering. Additionally, master's and doctoral students at HBKU College of Sciences and Engineering have the opportunity to take a Human-computer Interaction elective course covering ICT accessibility and inclusive design topics. Accordingly, research students are engaged actively through active research grants related to accessibility, digital inclusion, and assistive technology. The Mada Accessibility and Inclusive Design ICT-AID Competency Framework was availed to design and prepare these courses with a view to expand the student's capabilities in the ICT accessibility area. By covering a variety of topics of interest, such courses provide a comprehensive review of the skills needed to develop, review and evaluate accessible digital content and platforms in compliance with international standards and best practices. Indeed, a student who has completed ICT-AID courses will have the capacity mainly to: understand the definition and the importance of ICT accessibility, develop accessible content, websites and mobile applications; evaluate the level of accessibility of digital content services, and platforms (e.g. documents, websites, mobile applications, electronic kiosks, etc.); identify the use and application of assistive technology; and apply universal and inclusive design principles to user-centered technology development. As part of the aforementioned ICT-AID courses, HBKU students visited Mada Center and its innovation lab and met Mada team, which has given them the opportunity to learn more about Mada's programs, services, and activities towards enhancing ICT accessibility in Qatar and beyond. It is also noteworthy that students were involved in ongoing innovative projects to address pressing accessibility issues. Throughout the entire process, students showed an intense interest and full engagement. There are many of them who were interested in participating in ongoing accessibility research and projects at HBKU and Mada. In addition, HBKU also offered a class on accessibility and inclusive design as part of its Interactive Design for Healthcare course in collaboration with Mada Center to build research capacity. A workshop on digital accessibility was conducted at Mada Center to all students who took this class. In the workshop, entitled: "Introduction to Digital Accessibility", participants learned about the importance of including people with disabilities and making sure they have access to technology related innovations. Participants were provided with opportunities to engage with real-world applications and technologies, enhancing thus their learning experience (to learn

more about HBKU experience, please see the next paper in this edition entitled: ICT accessibility Research Capacity building in the State of Qatar).

The Community College of Qatar CCQ has also recently introduced an introductory ICT-AID course in Arabic language as part of its core curriculum program supported by Mada. This is indeed a very important and beneficial effort towards fostering ICT accessibility in Arabic in the region. This course, entitled : "An introduction to ICT accessibility and inclusive design" has been started in Fall 2022 with about 22 female students, mostly from the governmental sector in Qatar. The class is covered weekly in part as a theoretical lecture class and also as a lab. The course was designed and prepared by Mada in Arabic language based on Mada ICT-AID competency framework. Accordingly, the following ICT-AID competencies are targeted as per the framework: D1, D2, D3, D4.1, D4,2, D4.3, D4.4, D4.5.1, D4.5.2, D4.5.3, D4.5.4, D4.5.5, D4.5.6, and D5.1. The course is available online in open access under Attribution-ShareAlike 4.0 International (CC BY-SA 4.0) through Mada ICT-AID aligned OER Hub. Therefore, CCQ and any other educational institutions in Qatar and beyond, can adapt the course for use in different learning contexts and modes. It is noteworthy that this introductory course is part of the Mada ICT accessibility and Inclusive Design specialization which is composed of three courses through which students will make a sense of Accessibility and Inclusive Design, and they will acquire the ICT accessibility skills needed to apply, and review, and evaluate the Accessibility of digital platforms in compliance with International ICT Accessibility standards and best practices. By taking the first level of the specialization, CCQ students will understand and learn foundations in ICT Accessibility and Inclusive Design. They will learn the broad scope of Disability, Accessibility and related legal landscape, and they will explore the key principles guiding Universal Design and Accessible content creation. Moreover, they will learn how PWDs use different Assistive Technologies and adaptive strategies. By completing the course, students will be able to develop, evaluate, and remediate Accessible Digital Materials, and they will be prepared for the next Mada specialization courses and further study in ICT Accessibility. The introductory course encompasses the following 7 chapters: the foundation in Disability and Accessibility; Assistive Technologies; the legal landscape of Disability and Accessibility; Universal Design and Universal Design for Learning; ICT Accessibility standards; Accessible Digital Content; and Web Accessibility fundamentals. Furthermore, an onsite visit to Mada center was conducted so that CCQ students get the opportunity to meet Mada team and get hands-on labs in the Mada innovation lab and Mada FabLab. Students were also asked to prepare capstone projects covering all learning outcomes in order to demonstrate their understanding of ICT accessibility and apply related standards and best practices while designing and creating accessible products, contents and services.

Apart from the aforementioned use cases of Mada ICT-AID competency framework by universities in Qatar, the framework was also availed in other specific training programs such as "Tamheen". In fact, this training program aims at qualifying non-pedagogical Qatari graduates to work in the teaching profession in governmental schools in Qatar. The program is a pioneering initiative launched in November 2019 by the Ministry of Education and Higher Education in Qatar, represented by the Training and Educational Development Center (TEDC), in collaboration with national and international partners including Mada Center. A specific ICT accessibility training as part of the whole program has been designed then conducted by Mada. This year, the training of the third batch was designed using the ICT-AID competency framework, targeting accordingly a set of necessary competencies and capabilities related to disability and ICT accessibility, that teachers should acquire and integrate into their teaching practices. The tailored training program was broken down basically into the six following

courses with a total number of 33 training hours: Introduction to disability and Assistive Technology; Universal Design for Learning; Accessible documents, Introduction to mobility impairments and digital accessible solutions; Introduction to sensory, visual and hearing impairments and digital accessible solutions; Usage of accessible technology solutions to serve communication difficulties; And Introduction to assistive technology, accessible solutions, and learning difficulties. A number of 6 female trainees attended the training in 2022 and graduated last June.

Conclusion and future work

It is deemed important and relevant to cover ICT accessibility and inclusive design in training programs, curricula, and courses. This is indeed prompted by the unprecedented technological developments on one hand, and the increasing number of people with disabilities and the elderly having the right to avail such technologies on the other hand, as well as the international and national legislation requiring that technology must be universally accessible to everyone, regardless of ability or age. Despite this urgent need, there is a lack of knowledge, and awareness, and expertise on accessibility, especially in the Arab region, due to, among other factors, the lack of integration of ICT-AID aligned courses in educational institutions and nonexistence, to the best of our knowledge, of a comprehensive global competency framework delimiting all required relevant competencies in the field of ICT accessibility. Within this context, Mada center has developed an open competency framework in order to guide globally training of students and workers on the foundation in ICT accessibility and inclusive design, so that they will be well prepared to excel in their accessibility professions and contribute in the creation of accessible products, contents and services. Future works include the dissemination of Mada ICT-AID competency framework upon possible different adaptations, translations, and contextualization, as well as producing guidelines and toolkits to support adopting the framework worldwide as an ICT-AID education standard.

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