The Impact of Assistive Technology on Down Syndrome Students in Kingdom of Bahrain

Jaflah ALAMMARY, Fatima AL-HAIKI and Kawther AL-MUQAHWI
College of Information Technology, University of Bahrain, Kingdom of Bahrain
jafuob@gmail.com

ABSTRACT
Assistive Technology is playing an enabler role in the life of Dawn Syndrome. Assistive Technology can allow Down Syndrome to engage in the normal life activities and be more social and independent. The Arab countries are providing vital effort on facilitating the life of Dawn Syndrome and encouraging their engagement in normal social life. However, there is a lack in utilizing Assistive Technology in supporting such segment of people in these countries. The main aim of the current research is to investigate the current situation regarding the adoption of AT in the teaching and learning processes of Down Syndrome students in inclusion schools and rehabilitation centers in Kingdom of Bahrain. In addition, the impacts of AT in enhancing the independence, performance and social interaction of Down Syndrome students were examined. To achieve these objectives, two different questionnaires were administered to a non-random sample of teachers or specialists and families of Down Syndrome at Kingdom of Bahrain. In general the results show that the adoption of AT in teaching and learning of Down Syndrome students can enable them to be more social and independent person. AT can enhance the Down Syndrome communication which in turn can improve their independence, social interaction, and performance. However, to perceived the greatest and sustainable advantage on using AT, there is still a need for enhancing the capabilities and skills of the teachers/specialists and families to be able to adopt the AT for getting the best results. The research outcomes address several recommendations to enhance the educational process for the Down Syndrome students and other disabled people in Kingdom of Bahrain. Moreover, the study has a vital contribution to the theoretical literature and knowledge by building new model for examining the impact of AT on the Down Syndrome which is rarely develop by previous literature. In addition, it has developed new measurements which can be adopted in further studies in the same field.

INTRODUCTION

Information and Communication Technology ICT and Assistive Technology (AT) is considered as an effective learning tools that can help in improving and developing social skills as well as academic achievement and enable Dawn Syndrome (DS) is increasing their abilities to cope with the rapid progression life (Ahmed, 2015;Lahm, 2002). AT offer new opportunities for everyone, but for DS these opportunities are more significant as they can use AT for their daily activities to a higher extent than other normal people (Ahamed, 2015). That's means disabled individuals are able to participate in all aspect of social life on more equal terms than ever before. AT enables DS to communicate with others, involve in the social activities and be effective part in their communities that they would be unable to do without technology (Cowan and Khan, 2005).

Despite the vital concern devoted for the DS and other disabled people in the Arab countries, there is still a lack in utilizing Information Technology (IT) for supporting such segment of people. Few number of researches have been conducted to study the role and the impact of AT on disabled people. Therefore, the current research is aimed to answer a main question of "*To what extent AT enables DS students to be independent and engage in normal life at Kingdome of Bahrain*? The main objective of the current study is set to be investigating the current situation regarding the adaption of AT in the learning process of DS students in inclusion schools and rehabilitation centers. This will be tackled from the following aspects: problems and challenges facing DS student which are caused by their special features or disabilities and to what extent this difficulties are impacting their teaching and learning process, and types of AT that are adopted by inclusion schools and rehabilitation centers for the learning and teaching processes. In addition the study will examine the impacts of AT in enhancing the independence, performance and social interaction of DS students.

The current research is considered as one of the few and significant studies in the field of AT and the learning of special needs. The study is tackled a vital issue concerning the Arab world which is the engagement of DS students in an effective learning environment and normal social life. As a social implication for the study, the findings would help in enhancing the awareness toward the special needs people and especially the DS and how they can be an active factor in the society. More attention will be paid by the decision makers and educators in the Kingdom of

Bahrain toward the effect of AT in supporting the DS students and enhancing their achievement. As such, the study will provide information on the different types of AT that can be adopted in the learning of DS and how each type can support different disabilities and challenges for DS which need to be considered by management and academic staff in the inclusion schools and rehabilitation centers. As a theoretical implication, the current study will enrich the theoretical literature on the field of AT and DS in the context of the Arab countries as well as developing new model on the impact of AT on DS performance, independence and social interaction which rarely undertaken by previous studies. Moreover, the study provides new measurements that can be further used and developed in new studies in the same field.

The current paper is articulated into seven sections including the introduction. AT impact on DS students and AT in the Arabian Gulf Countries and Kingdom of Bahrain were discussed in the next two sections. The research and hypotheses were discussed in the Section 4. Section 5 discusses the research methodology and data collection. Section 6 presents the data analysis and results of the research. The paper then concludes with Section 7.

ASSISTIVE TECHNOLOGY IMPACT ON DOWN SYNDROME STUDENTS

DS is a set of physical and mental tracks which is caused as a result of a chromosomal disorder (Al-Edwan, 2015). Normally a person has 46 chromosomes; while DS determined by 47 chromosomes (Percy and Schormans, 2006). This extra genetic material alters the course of development (Al-Edwan, 2015) and causes diverse impairments such as visual, hearing, cognitive, motor and communication (Feng et al, 2008).Therefore, individuals with DS have varying degrees of abilities, skills, behavior and physical development. However, DS learning deficits result from different learning styles rather than learning impediments (Alfaraj and Kuyini, 201). DS people have a numerous disability appear as physical and cognitive characteristics that need to be identified serious attention and helpfulness when it comes to their education or other aspects of their life (Faragher and Brown, 2005; Alfaraj and Kuyini, 2014). As a general rule, students with DS need activities that are highly structured and sequenced, small amounts of information presented at a time and a good reward system (DASWM, 2015).

AT are a powerful tools for improving the participation and engagements of disabled people in their learning process (Gierrach and Stindt, 2009; McKnight and Davies, 2013). AT is defined as the equipment, devices, services, systems, processes that aim to help the disabled persons with special educational needs to better function in daily life, attain a higher quality of life and secure their full, active and easy participation in society (Lancioni et al., 2013, Hersh and Johnson, 2008). Moreover, the International Classification of Functioning, Disability and Health (ICF) define the assistive products or technologies as any product, instrument, equipment or technology that are specially designed for improving the functionality of a person with a disability (WHO, 2014). In general, AT is used for aiding the DS students in their education, enhancing motivation and independency, and help them to be more active member in the social activities (Reed, 2007). AT might be adopted to support vision, hearing, reading or communication, as described by UNICEF (2013). Voice recognition applications, mobile devices, symbol-based interaction and virtual reality technologies are designed to assist the DS weakness to be more active in the learning process with their tutor and their classmate or peers (Winter and O'Raw, 2010; McKnight and Davies, 2013). Knowing the strength and weakness of the DS will enable the decision makers in setting plan to select the most appropriate AT to be adopted for more effective results. In addition, previous studies deduce that there is a need to identify intelligent ways to determine where, who, why and when to use AT (McKnight and Davies, 2013, Al-Ammary, 2010). However, the adoption of the Educational Technology in the classroom for the disabilities student's needs special and well skilled education teachers or specialists to refine their skills and trains them on how to interact and use the technology in the classroom. They need to work as coordinators and organizers to initiate Individualized Education Plans (IEP), which arrange a separate plan for each student by initiate schedule according to their cases to be able to consume extra time detecting the systems by themselves (Cramer et al., 2012).

Students with disabilities need specific and suitable education corresponding to their education level (Jenkinson, 1997). Teaching disabilities students in isolated classrooms enable the adoption of unifying curriculum for whole similar disabled students to support their self-assurance or confidence, as well as, make sure they will acquire appropriate privacy, safety and adequate enhancement (Jenkinson, 1997). However, such way of teaching could restrict and limit the DS capabilities acquired. Therefore, combining students with disabilities in general school currently become very popular in most countries, where this integration currently called inclusion or mainstream (Kliewer, 1998). Wang (2009), exposed that implementation of integration system may not comfortable for all students with disabilities, as consider that, students with disabilities may not be able to interact and participate with their normal peers. Thus, there is a need to integrate the usage of AT with different types of model for special education such as SETT, Education TechPoints, Human Activity Assistive Technology- HAAT, AT CoPlanner Model and others (Edyburn; 2001). Hersh and Johnson (2008) revealed that the goal of these models is to remove the existing barrier in using the AT which include tools, equipment, hardware, software, applications, etc, and make it easy for DS students to use AT anywhere and anytime. In addition, AT devices and services will allow DS

students to have a better governor over their personal lives, be able to interact with normal people and participate more in social activities either in their homes, schools, work environments, or communities (McKnight and Davies, 2013)

ASSISTIVE TECHNOLOGY IN THE ARAB GULF COUNTRIES AND KINGDOM OF BAHRAIN

Although, the Arabian Gulf countries are aware about the disabled people and their various needs and provide vital efforts in enhancing their independency and performance, they are still beyond other countries in adopting AT is supporting the disabled people either in their education or social life (MADA, 2015). In Qatar for instant, there are a variety of associations for special needs such Qatar Society for Rehabilitation and Special Needs, Al Noor Institute for the Blind-Qatar, International Mosaic Down's Syndrome Association, and Qatar Assistive Technology Center. However, Qatar Assistive Technology Center was established just in 2010 by the Qatari Supreme Council of Information and Communication Technology, with an aim to use AT in the classroom, home and surrounding environments for engaging the disabled people in the revitalization environment and enhance their social interact and performance (MADA, 2015). In UAE there are more than 30 associations to qualify disabilities people such as Al Noor Training Centre for Children with Special Need, Zayed Higher Organization, Super Kids Nursery, Little Hands Kids Club, Sharjah American International School, Abou Hanifa Basic School, Al Baraa Kindergarten etc. (UAE Down Syndrome). However, only two associations include Al Noor Training Centre for Children with Special Need and Zayed Higher Organization – ZHO are using AT for teaching people with special needs. These associations are offering multi-disciplinary program and variety of consolidating services for nurturing the skills of the disable students by improving their performance and independence and encourage the social interaction with their peers. Among the AT that adopted by ZHO are labs which are equipped with computers that introduce with text-to-speech, screen reader, screen enlargement software as well as Braille printers, sensors, adaptive mouse and keyboards..

In Kuwait there are multiple special education schools for individual with special needs such as Al-Noor School, Al-Amal School, Al-Raja Schools, Al-Wafa Schools, Rehabilitation schools, School of autistic behavior, Schools of educational workshops, etc. However, only three of these schools are using AT in the teaching processes. These centers are highly depending on AT in the learning and teaching for supporting DS and other mental impairments. They are using different devices in teaching Kindergarten, primary, intermediary and secondary stages to assist students to become more independent, enhancing their abilities and improving student's self-care skills and social interaction. In Saudi Arabia there are various associations to support DS such Saut Society, The Help Center, Down Syndrome Charitable Association “DSCA”, Al-Nahda Schools for Down Syndrome, etc. According to Ranaet al. (2011), there are 1237 institutes and programmers which have integrated the use of ICT in offering special education for people with learning disabilities. However, there is no clear information on the technologies being used by the various institutions for individuals with learning disabilities and the types of learning disabilities being dealt with (Rana et al., 2011).

Kingdom of Bahrain is providing more concern and focuses on disabled people by providing financial, psychological, and educational support. There are 1700 cases of DS and are recording 30 injured annually. Around 54 students with DS from different levels of study are registered in inclusions schools, while the others students are engaged in different rehabilitation and special needs centers supported by the Ministry of Labor and Social Developments - MLSD. There are 35 rehabilitation centers in Kingdom of Bahrain, include but not limited to Bahrain Hope Special Education Institute, Al Matrook Conductive Rehabilitation Centre and Bahrain, Hope Center for Early Care, Bahrain Down Syndrome society, Special educational services center for children "Tafaol” includes and Kayan Center for Special Education (Al-Watan, 2015). Al Matrook Conductive Rehabilitation Centre is providing AT for their students to support and expand the characteristic and physical abilities and skills. The AT provided include smart tablets, touch control panels, motor support tools, communication tablets, and others (MLSD, 2015). Recently there is an agreement between Bahrain Down Syndrome society and Special Educational Services Centre for Children (TAFA’OL), to initiate AT room in each center to use it for disabled students to promote, enhance and augment their capabilities, performance, independence and social interaction. However, criteria, policies and standards of the agreement are under study. Moreover, and as an appreciation for the importance of the DS and other disables individual in Kingdom of Bahrain, AlShaikh Nasser bin Hamad Al Khalifa – a Bahrain military office, member of Bahrain Royal Grand and president of the Bahrain Olympic Committee, announced “The Award of Nasser Bin Hamad for Disabled Persons Creativity” for promoting the capabilities and qualification of the disabled people and DS, improving their intellectual, artistic and scientific skills and expanding their innovation and creativity (MLSD, 2015). Furthermore, in 2007, the MLSD was established the disabled services centre. The centre was established particularly for employing the disabled people in the private and non-governmental sectors. It is responsible for processing the requests and applications of the disabled and their guardians and finding solutions for them in coordination with governmental and non-governmental organizations and private bodies.

RESEARCH MODEL AND HYPOTHESES

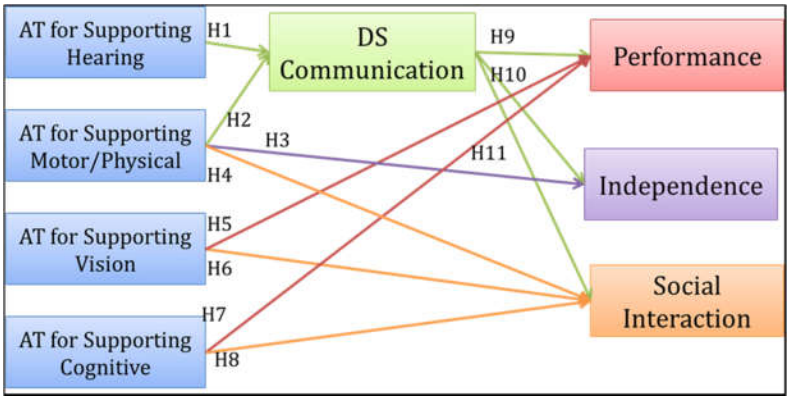

Figure 1. Research Model

The indirect impact of the AT for supporting hearing and motor/physical on performance via enhancing the DS communication:

Hearing impairments considered as main problems with DS as conductive and sensor-neural hearing loss are more common with DS than in the general population (Diefendorf, et al 1995). Such hearing loss can reinforces specific speech and language delay and difficulties in auditory processes which impact the DS communication (DSAWM, 2010). With the continuous advancement in technology, a wide range of AT devices were provided to support DS with different hearing problems, such as Personal Frequency Modulation (PFM) systems, Infrared systems, Induction loop systems, one-to-one communicators and others (Wiazowski, 2009). AT for supporting hearing impairments reduce the noise sounding and improve the speech recognition of DS which can help in improving their performance and enhancing the hearing effectiveness (Wiazowski, 2009). Such AT moreover, can enable the DS to communicate with, participate and contribute more effectively the the community, and be more independence which can maximize the DS overall quality of life (Cowan et al., 2012)). For example, voice output encourages DS with hearing impairments to start discussion and communication with other people easily from extended distances without any obstacles and complications (Doyle and Phillips, 2001). In general it can be revealed that AT for supporting hearing is the most important assistive tools to enable DS to define their strength and weakness and prompt communication, cooperating with surrounding environments and maximize their independence (Kumin, 2003; Lloyd et al., 2006, Olaosun and Ogundiran, 2013). This will decrease the needs of DS for outsider caregivers and minimize their deficiencies level. As such, DS can use such AT anywhere and anytime to communicate and interact with others through sound amplification or any other alternative ways so they can be able to participate and communicate without control with the community (Olaosun and Ogundiran, 2013, Lartz, et al. 2008, McCoy, 2013). Therefore, the following hypothesis was developed:

H1: AT for supporting Hearing has a positive impact on enhancing DS communication in the Kingdome of Bahrain.

As it was motioned above the communication skills of DS need to be enhanced and improved to be more independent. DS that lack the communication skills, scored significantly lower for expressive language, reading and writing (Buckley et al, 2006). For many DS, the inability to communicate with others can have a devastating effect on social personal skills (Deutschsmith, 2006). DS student's need more time, practice, consistency and reinforcement to be able to communicate and enhance their social interaction (Erdem, 2017) as effective communication skills and socially appropriate behavior are interrelated (Erdem, 2017). Improving DS communication skills provides a gateway to their independence, dignity and self-esteem, and allows them to move around their environment, communicate with others and take part in developing appropriate activities (Cowan and Khan, 2005). Communication has a tremendous impact on the development of students with DS as it affects their ability to become contributing members in classroom and community. Enhancing communication of DS students will enhance their speech and language expression and provide plenty of opportunities for social activities (Jon et al, 1999). It has been revealed that AT that support people with hearing impairment can enable DS to communicate with others and exploring more different environments which has high potential in increasing and improving independence and confidence (Azenkot et al, 2011). Moreover, it may allow disabled people to be able to perform activities of daily living easily (Baker, 2003). Therefore, the following hypotheses were developed:

H9: Enhancing the communication of DS students has a positive impact on improving DS performance in the Kingdome of Bahrain.
H10: Enhancing the communication of DS students has a positive impact on enhancing DS independence in the Kingdome of Bahrain.
H11: Enhancing the communication of DS students has positive impact on enhancing the DS social interaction in the Kingdome of Bahrain.

Many DS have physical mobility, stability, motor coordination and range of motion challenges. Such disabilities need to be supported to enable DS movement and communication and ensure that this segment of people can be more independent and take part in their daily and routine activities (Mulligan, 2003). The delay in physical and motor skills could affect the physical education and sports activities. It may affect the DS's physical abilities in school, and has an impact on classroom activities, for example, drawing and coloring and handwriting development. Hence, the use of the AT that support motor/physical disabilities, such as special keyboard and mouse can help in developing the motor/physical skills of the DS so they can practice at home and school which can enhance their independence (Cook, 2011, Cowan et al., 2012). By adopting AT for support DS motor disabilities, DS will be able to manage the tasks independently, and build learning self-help skills (Cook, 2011; Kling, A., et. al., 2010). AT devices such light pointer, eye gaze direction, or head/mouth stick, can be used to leverage and encourage DS communication skills, and improve their performances and body functions to participate more effectively in their environment (Cook, 2011). Several other AT are available to assist DS in completing their social work including audio books for those who can't physically handle books. Moreover, keyboard adopters such as key guars can help DS to make selection more easily and prevent mistyping from tremors or less of control, while switches make it more possible for DS to access a computer keyboard using mouth, head or foot, and voice recognition software for students who can't type. This could reduce the need for informal caregivers where it takes the pressure off and can prevent burnout. Moreover, AT for supporting mobility such as wheelchair, scooters, walkers, canes and orthotic devices, prosthetic limbs, functional electrical stimulation, and wearable exoskeletons can expand DS performance and enhance their mobility and movement (Cowan, et al., 2012). Adopting AT to help DS with physical or motor disabilities may not be simple as it is very important to select the suitable AT devices that suit the DS level of disability, surrounding environment and other health problems (Mulligan, 2003). Previous studies have shown that AT for supporting motor/physical, when are appropriate to the user and the user's environment, have a significant impact on increasing the level of communication, independence and social interaction (Cowan and Khan, 2005). Therefore, the above mentioned discussion reveal strongly on the positive effect of the AT support for motor on enhancing the communication, independence and social interaction of the DS and simplifying their movement and overall life. Therefore, the following hypotheses were developed:

H2: AT for supporting motor/physical has positive impact on enhancing DS communication in the Kingdome of Bahrain.
H3: AT for supporting motor/physical has positive impact on enhancing DS independence in the Kingdome of Bahrain.
H4: AT for supporting motor/physical has positive impact on enhancing DS social interaction in the Kingdome of Bahrain.

The direct impact of AT for supporting vision on performance and social interaction of students with DS:
AT is designed to support people with diverse disabilities such vision or memory (Cognitive), by assisting them to do what they normally cannot do with an expected level. AT that support vision increase and sustain the capabilities of a student's performance, independence, and social interaction (Parette et al., 2007). Previous studies revealed that people with vision disabilities or blind are taking advantage from using AT it enhances their performance in learning and overall life (Bouck et al. 2011; Bowers et al. 2001; Ferrell 2006; Lovie-Kitchin et al. 2001; Spindler 2006). Developments in AT support vision result in a better achievement and high quality life for students with visual impairments, especially in educational processes as it enrich their performance and academic achievement (Koweru, 2015). For example, Talking Tactile Tablet devices which are supporting multi-sensory impairment can result in a positive impact on the performance of students suffering from visual impairment as these tools enable them to become more contributors and effective in the classroom (Cooper, 2015). According to the American Foundation for the Blind (2014), students with visual impairments faced obstacles in completing learning requirements, but AT can facilitate their ways to complete their assignments, coursework, task, etc. Hence it will support the performance of the students by enhancing their efficiency accomplish their tasks easily and within minimum time (Kareri et al., 2014). Furthermore, AT that support vision is supporting not only the students with visual impairments, but also enhance teacher skills for teaching students carefully, expand awareness, and enhance the performance of disabilities students to get superior consequences (Kareri et al., 2014).

On the other hand, the AT inspire disabilities, and enable people with vision impairment to express and interact easily with others without any obstacles by promoting their social skills, encouraging interaction with other peers and enriches the quality of the life of such people (Bird, 2000, Ee and Cohen, 2010). Additionally, Berry and Nees (2013) stat that AT such as Text-to-speech and auditory are contributing and assisting people with different disabilities, especially visual impairments. The advantages of such AT are removing the barriers and obstacles during interaction with others (Berry and Nees, 2013). Beside, people with visual disabilities are using AT for aligning their personal management skills to support the modification and adjustments in their capabilities to facilitate their interaction and reaction with others (Wiazowski, 2009). For example, Auditory Scanning devices facilitating understanding and interaction for people with vision impairment's. Currently, instructors used Neoteric AT and technical supports throughout teaching students with visual impairments, for providing professional and qualified support; to make them able to define their achievement and points of improvements in learning processes, where successfully provide modifications in their behaviors to promote interaction with other peers (Koweru, 2015). Therefore, the following hypotheses are developed:

H5: AT for supporting vision has a positive impact on enhancing DS performance in the Kingdome of Bahrain.
H6: AT for supporting vision has a positive impact on enhancing DS social interaction in the Kingdome of Bahrain.

The direct impact of AT for supporting cognitive on performance and social interaction of DS students
Evolving with technology, permits individuals with different impairments to ensure encouragements, ease of use, upgrade social image, commitments and satisfaction, and enhance social interaction with their normal peers (Carter et al., 2009; Edrisinha, et al., 2011; Lancioni et al., 2011). Social interaction will result in recognition, accepting and positive influences in managing disabled people lives and reducing reliance on caregivers (Felce and Perry, 1995; McDougall et al,. 2010). According to Scherer et al. (2005), the main purpose of AT for supporting cognitive impairment is nurturing the DS performance on functional accomplishments, which assist them in minimizing needs to caregivers, and drive them to become more interactive in social life. AT can support people with cognitive impairment in expanding their quality of life and improve performance of sequential behavior (Neill et al., 2010). Wilson and Evans (1996) agreed that AT for supporting cognitive impairments such as virtual keyboards reorganizing letter digraph frequency augment remembrance, where it not only expands the performance of cognitive impairments, but also encourages them to be more corroborative through educational courses as it minimizing error occurrence.

On the other hand, the majority of the AT for supporting cognitive impairment has a significant role in enhancing the social interaction for people with cognitive impairment (Dawe, 2006). Teacher/specialists and family suggested that, the main role of AT has a positive impact on DS students with cognitive disabilities, as they enhancing and increasing their social interaction with other (Dawe, 2006). Students with cognitive disabilities are advised to use smart interface that recommends communication options and encourage interaction and conversation with partners and peers. For example, AT such as "persuasive" cellular phone that called the KIT phone (keep-in touch) can be used to reminds the people with cognitive to call other people in their contact list who they haven't been in touch with recently which enhance the relationship development and social engagement (Golder, 2004). Therefore, the following hypotheses are proposed:

H7: AT for supporting cognitive has a positive impact on enhancing DS performance in the Kingdome of Bahrain.
H8: AT for supporting cognitive has a positive impact on enhancing DS social interaction in the Kingdome of Bahrain.

RESEARCH METHODOLOGY AND DATA COLLECTION

A self-administrated questionnaire was adopted in order to elucidate the impact of adopting AT to assist the DS in the class room and enhance their performance, engagement and interaction in the inclusion schools and rehabilitation centers in the Kingdom of Bahrain. The population of the current study was identified to be all those who are working with DS students such as teachers from inclusion schools, expertise and specialist from rehabilitation centers and family members. All the experts or specialists in all rehabilitation centers which shown in the Table (1) were selected. On the hand, all teachers assigned to teach in an inclusion class were selected from the inclusion schools shown in Table (1). Moreover, 400 randomly family were selected from a total of 1700 families that have DS. Therefore, the sample size was calculated to be 700 inclusion teachers, experts, and specialists and parents. Only 550 legible, correct and completed questionnaires were returned with a response rate of 71.4% which considered as high rate especially with the DSs' families. The returned questionnaires consisted of 300 for teachers/specialist and 250 for families of DS students in the Kingdome of Bahrain. Due to the lack of well established scales developed to measure research model constructs such as AT for supporting vision

impairment, AT for supporting hearing impairment, AT for supporting motor, AT for supporting cognitive and mental impairment, the measurement scales were developed by the authors. However, the measurement of communication was developed based on the measurement of Easlin and LaRose (2002) and Kaya and Weber (2003). Social interaction was developed based on the measurement of Mahadavinejad et al. (2014), while independence scales were adopted from Persel (2012).

Table 1: List of schools and rehabilitation centers in the Kingdom of Bahrain

Rehabilitation centers	Inclusion schools
Bahrain Hope Special Education Institute	IbnTufail primary school (Boys)
Bahrain Hope Center for Early Care	AlKhamis primary school (Boys)
Al-Wafa Autism Center	AlYarmook primary school (Boys)
Bahrain Down Syndrome Society	Al-Oruba primary school (Girls)
Special educational service center for children " Tafaol"	Arad primary school (Girls)
Kayan Center for Special Education	Al-Hidd secondary school (Girls)
NBB Rehabilitation Home For Disabled Children	Uthman bin Affan Intermediary school (Boys)
Salwa Club for disabled (Bin Khuldoon)	Alfarabi Intermediary School (Boys)
Salwa Club for disabled (Hamad Town)	UmaimabintAlNuman secondary school (Girls)
Academic and Vocational Rehabilitation Center	Isa town intermediary school (Boys)
	Alwadi primary school (Boy)
	Ghazi AlQusaibi secondary school (Girls)
	Imam al-Tabari Primary School (Boys)
	Al-Esteqlal secondary school (Girls)

DATA ANALYSIS AND RESULTS

Demography

The current section will present information on the demographics of the participants both teachers, experts, specialist and the families of the DS. Such information can provide explanation and indications on the results of the research model analysis. The results in Table (2) show that most of the participants are special and general educational teachers (34.8% and 18.6%, respectively). However, social worker and supervisor from the rehabilitation centers represent just (12.4 %). The inclusion teachers also represent few of the participants (8.1%). Moreover results in Table (2) show that most of the participants are young (40 or less, 73.9%) female (60.9%), and are holding bachelor (65.8%) and that is why they have few years of experiences (five or less, 66.1%). Table (3) presents demographic information on the families of DS students. The results show that most of the member of the families are young females (<=40 years old) (67.9% and 69.1% respectively). However, they are less educated as they are holding diploma or less (60.3%).

Table 2: Teachers demographic information

Gender		Education level	
Female	60.90%	Secondary	11.20%
Male	39.10%	Diploma	11.80%
Age		Bachelor	65.80%
20-30 years	36.60%	Master	9.30%
31-40 years	37.30%		
41-50 years	21.70%	Doctoral or more	1.90%
More than 50 years	4.30%		
Education Role			
Senior Head of education		6.20%	
Social supervisor		5.60%	
General education teacher		18.60%	
Special education teacher		34.80%	
The Social worker		6.80%	
Inclusion teacher		8.10%	

Table 3: Families demographic information

Gender		Education level	
Female	69.10%	Less than secondary	16.00%
Male	30.90%	Secondary	28.40%
Age		Diploma	25.90%
20-30 years	42.00%	Bachelor	23.50%
31-40 years	25.90%	Master	2.50%
41-50 years	28.40%	Doctoral or more	3.70%
More than 50 years	3.70%		
Related to the Down Syndrome			
Mother	57.10%		
Father	48%		
Brother/Sister	55.60%		
Other	31.6		

Current situation regarding the adoption of AT for teaching DS students in Kingdom of Bahrain

The following section presents information on the current situation regarding the adoption of AT in teaching DS in the school or rehabilitation centers in term of the skilled teacher's gains, types of AT adopted, challenges and problem faced by family and teachers. The demographics information show that most of the participants include teachers, experts and supervisor were young that's why results in Table (4) have few years of experience in teaching the DS students (five or less years of experiences) (67.1%) and have adopt AT in teaching few courses (5 courses or less) (82.0%). However, the results show that they have no experience in using AT as they never evolve in any workshop (42.9%) or attended just 5 courses or less (39.8%).

Table 4: Experience of teacher/specialist in using AT in Kingdom of Bahrain

Experience in Teaching DS students		No. of courses in which AT was adopted		No. of Workshops or training on AT	
Less than one year	28.6 %	None	38.5 %	None	42.9 %
1-5 years	38.5 %	1 -5 courses	43.5 %	1 -5 courses	39.8 %
6-10 years	13.0 %	6-10 courses	8.7%	6-10 courses	9.3 %
More than 10 years	19.9 %	More than 10	9.3%	More than 10	8.1 %

The families were asked to specified the best way for teaching their DS students were they revealed that the best way is to include their DS students in special school or centers (23.6%) not inclusion schools. However, they don't mind to adopt the AT either in special class or in inclusion class (32.9%, 31.1%, respectively)

Table 5: Family perception on the best ways for teaching DS students

Teaching DS in inclusion school	Teaching DS in special school	Adopting AT to teaching DS in inclusion class	Adopting AT to teaching DS in special class
12.40%	23.60%	31.10%	32.90%

Table 6: Types of disabilities that DS are suffering from

Types of disabilities that DS are suffering from	
Infantile paralysis	3%
Cognitive disability	58%
Communication impairment	37%
Motor/physical impairment	10%
learning difficulties	52%
Schizophrenia psychotic	10%
Vision impairment	19%

Development delay	36%
Traumatic brain injury	6%
Hearing impairment	12%
Speech/language	80%

Results on the different disabilities that DS students usually suffered from are presented in Table (6). Results show that DS mostly suffered from speech/language (80%), cognitive disabilities (58%) and learning difficulties (52%). Problems faced with DS students either in the home or in class room are demonstrated Figure (2). As shown in the table, teachers are mostly facing problems such as speech and communication (50.9%) and lack of focusing and understanding (58.4%). However, families are facing problems with speech and language (76.5%) and reading and writing (50.6%).

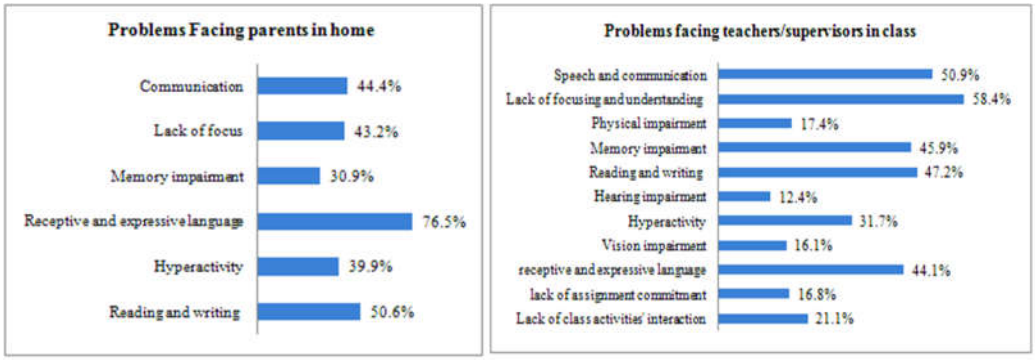

Figure 2: Problems faced by teachers and families with DS students

Although AT has many effects on supporting the learning and teaching of DS students, there are many challenges and barriers that may facing both teachers and family in adopting such technology. Therefore, teacher and families were asked to identify the most barriers they perceived in adopting AT and results are presented in Table (7). The results illustrate that both teachers and families are facing two main barriers: selecting and choosing the suitable AT (41.6% and 59.3% respectively) and the high cost of the AT (46.9%, 43.2%, respectively), as well as the lack of training provided on AT (31.7%) and lack of sufficient skills and experience to adopt AT(32.9%).

Table 7: Barriers for adopting AT for supporting DS students

Barriers are facing while adopting DS students BY:	Teacher, experts and specialists	Family
Difficult to encourage DS to adopt AT	27.7%	4.9%
Adopt the suitable AT	41.6%	59.3%
Complexity of AT (not easy to use)	15.5%	4.9%
Lack of sufficient skills and experience to adopt AT	32.9%	25.9%
Adopt poor and cheep AT	13.0%	7.4%
lack of training provided on AT	31.7%	27.2%
High cost of AT	46.0%	43.2%
Availability of AT	21.1%	6.2%
Perceived benefit of AT	30.3%	24.6%

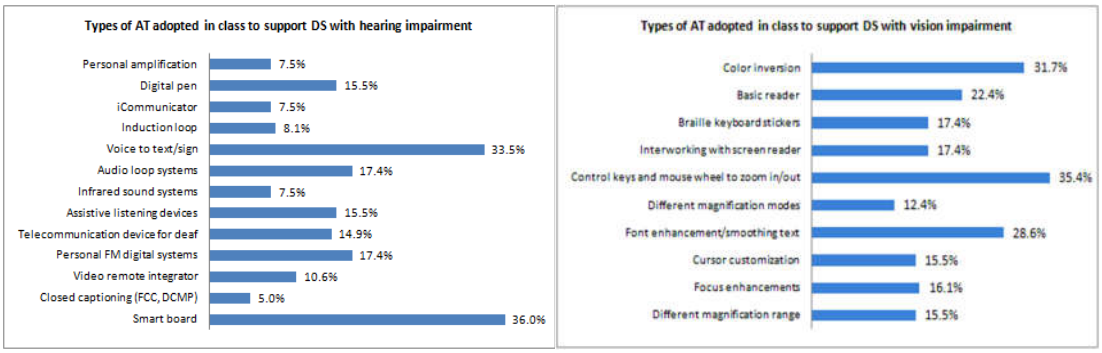

Figure 3: AT adopted for supporting DS with vision and hearing impairments

Finally, the different types that have been adopted in class to support the different impairments include the vision, hearing, motor and cognitive were identified as shown in Figure (3) and Figure (4). Regarding to the types of AT adopted to support the vision and hearing , the results revealed that control keys and mouse wheel to zoom in/out (35.5%) and smart board (36.0%) were identified to by the main adopted AT to support vision and hearing impairment, respectively. On the other hand the results in Figure (4) show that electronic notebook (50.3%) and graphic organizers (34.2%) are the main AT adopted for supporting the cognitive impairment. However, touch screens (56.5%) and trackball for easer mouse manipulation (28.0%) are very important AT that has been adopted to support the motor impairment.

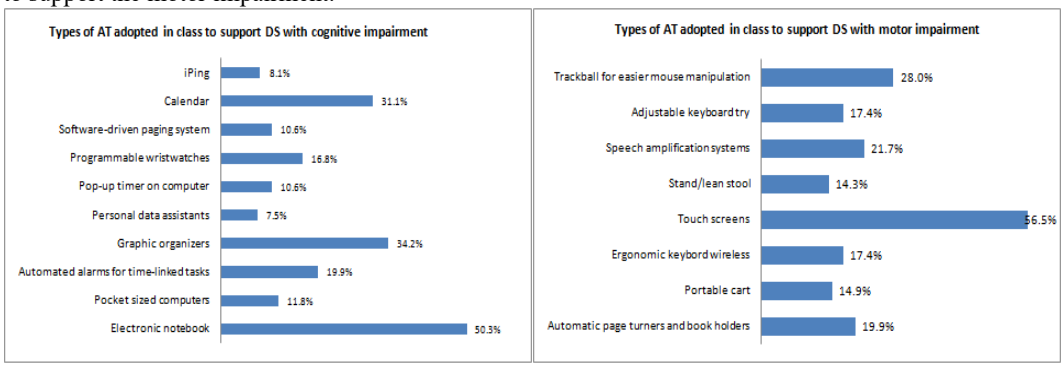

Figure 4: AT adopted for supporting DS with cognitive and motor impairments in class room

Assessing model measurements

PLS path analysis was done using SmartPLS-3 to test the research model. Goodness-of fit indexes of latent variables are shown in Table (8) and Table (9), which indicates that the model has good fitness. All the value of AVE are mostly greater or equal to 0.5 and all values of composite reliability are greater than 0.8, while all value of Cronbach's Alpha are greater than 0.7.

Table 8: AVE, composite reliability and Cronbach's Alpha

Construct	AVE	Composite Reliability	Cronbach's Alpha
AT for Supporting Cognitive	0.658	0.92	0.896
AT for Supporting Hearing	0.69	0.899	0.85
AT for Supporting Motor/Physical	0.685	0.897	0.846
AT for Supporting Vision	0.654	0.883	0.823
DS Communication	0.658	0.906	0.87
Independence	0.79	0.919	0.867
Performance	0.698	0.92	0.891
Social Interaction	0.724	0.929	0.905

Table 9: Factor loading of the items.

Construct	Items	Factor Loading	Construct	Items	Factor Loading
AT for Supporting Cognitive	CS.1 CS.2	0.806 0.804	AT for Supporting	VS.1 VS.2	0.821 0.852

	CS.3 CS.4 CS.5 CS.6	0.788 0.849 0.819 0.8	Vision	VS.3 VS.4	0.761 0.797
AT for Supporting Hearing	HS.1 HS.2 HS.3 HS.4	0.843 0.849 0.861 0.767	DS Communication	CMS.1 CMS.2 CMS.3 CMS.4 CMS.5	0.782 0.821 0.83 0.819 0.801
AT for Supporting Motor/Physical	MS.1 MS.2 MS.3 MS.4	0.809 0.858 0.84 0.803			

Research hypotheses testing

The causal relationships in the proposal research model were tested. Consistent with Chin (1998), bootstrapping was applied to produce standard error and t-statistics. This permits the measurement of the statistical significance of the path coefficients. The statistical objective of PLS is to show high path coefficient - R and significant t-statistics, thus rejecting the null hypothesis of no effect. The t-statistics need to be significant to support the hypothesized paths. R indicates the explanatory power of the latent endogenous variables.

Properties of the causal paths, including standardized path coefficients, t-statistics and explanation of variance for each equation in the hypothesized model are presented in Table (10) and Table (11). As expected, the results reveal that adopting AT to support some impairments of the DS have some impact on enhancing their communication, independency, performance and their social interaction. AT has vital role in enhancing the communication of the DS students as it can be enhance directly or act as intermediate in enhancing the engagement of DS in the learning process as the normal students. As such, the results indicate that by enabling the communication of the DS students, they can be more independent, reach better achievement and performance, and interact more in the social life. Thus, H9, H10, and H11 were accepted ((r=0.694, T= 9.038), (r=0.575, T= 8.301), (r=0.566, T= 5.748), respectively). Moreover, H1 and H2 were accepted ((r=0.343, T= 4.469) and (r=0.571, T= 8.89), respectively), thus enabling the communication of the DS can act as an intermediate factor for the impact of the AT for supporting hearing and motor on the performance. While, AT for supporting motor of the DS has a direct impact on the independence (r=0.287, T= 4.21) it has only indirect impact on enhancing the social interaction of the DS but not direct impact (r=0.116, T= 1.66). Thus, H3 was accepted and H4 was not accepted.

On the other hand, the AT for supporting the DS with vision impairment has shown insignificant effect on enhancing the performance and the social interaction of this segment of students. Hence, H5 and H6 are rejected (r=0.102, T= 1.548 and r=0.074, T= 1.188). Finally while, AT support for the cognitive of the DS shown a weak impact on the social interaction of DS students (r=0.184, T= 2.149), they has shown insignificant impact on enhancing the performance of the DS students (r=0.121, T= 1.873) as shown in Table (10).

Table 10. Path analysis

Path	Coefficients (β)	T-Test	P-Values	Hypothesis statues
H1: AT for Supporting Hearing -> Communication	0.343	4.469	0	Accepted
H2: AT for Supporting Motor/Physical -> Communication	0.571	8.888	0	Accepted
H3: AT for Supporting Motor/Physical -> Independence	0.287	4.21	0	Accepted
H4: AT for Supporting Motor/Physical -> Social Interaction	0.116	1.66	0.098	Rejected
H5: AT for Supporting Vision -> Performance	0.102	1.548	0.063	Rejected
H6: AT for Supporting Vision -> Social Interaction	0.074	1.188	0.235	Rejected
H7: AT for Supporting Cognitive -> Performance	0.121	1.873	0.062	Rejected
H8: AT for Supporting Cognitive -> Social Interaction	0.184	2.149	0.032	Accepted
H9: Communication -> Performance	0.694	9.038	0	Accepted
H10: Communication -> Independence	0.575	8.301	0	Accepted
H11: Communication -> Social Interaction	0.566	5.748	0	Accepted

On the other hand, the results has shown that AT for supporting the motor and hearing impairments of the DS explained 63% of the variance in enabling the communication skills of DS; which in turn, explained 74% of the variance of the performance while AT for support for both cognitive and vision have no impact on that variances. Conversely, AT for supporting motor and enabling DS communication are explaining 66% of the variances on enhancing the independency of the DS, while AT for supporting the cognitive of the DS and the enabling of their communication are explaining 75% of enhancing the social interaction of the DS as shown in Table (11).

Table 11: R Square of the items

	R Square
DS Communication	0.628
Independence	0.661
Performance	0.740
Social Interaction	0.746

DISCUSSION AND CONCLUSIONS

With the increasing number of DS in Kingdom of Bahrain, there is a need to exploit the opportunities provided by the rapid succession in the innovative ICT and AT to make life easier for these segments of people and enables them to communicate and participate in the community and provided them with the best way of learning. Although Kingdom of Bahrain are providing vital efforts for enhancing the development of people with special needs and DS and involve them more as contributable persons in the community, they still not reaching a mature level in adopting AT in the teaching and learning processes of DS in the inclusion schools or rehabilitation/special centers. It have revealed that lack of ICT accessibility, lack of resources and lack of skills are the major challenges that hinder the use of technology in the learning institutions. This implies that even if there are schools make available for supporting the educational needs of children with DS, they may not be adequately equipped with modern technologies for supporting their learning. In the Kingdom of Bahrain the inclusion of DS and other students with minor disabilities and special needs in the standard learning and teaching process started just on 2001 as an ad hoc process but reached more structured and more manageable process on 2011. The results of the current study reflect the current situation of the adoption of AT in inclusion schools or rehabilitation/special centers. The findings demonstrated that there are a reasonable numbers of specialists and teachers for teaching DS either in the inclusion schools or in the rehabilitation centers with specialists, supervisors or special education teachers in rehabilitation centers represents (34.8%) while specialist teachers in the inclusion schools represents just (8.1%). Thus, there is still a shortage in the specialist teachers in the inclusion schools that can help in teaching DS students. Moreover, the majority of the teacher/specialists who are taking care about DS students are females. Actually, female with their natural skills and characteristics as they are full of tenderness and passion can be more suitable for dealing with DS students and thus, can contribute, collaborate and embraced the DS students either in the classroom or home.

Regarding the capabilities of the teachers and specialists, the findings reveal that there is a need for building and enhancing the capacity in this field. The finding revealed that most of the teachers/specialists are young with high level of education as they hold at least bachelor or higher degree but with few years of experience; no more than 5 years. However, it is not essential for those who want to teach DS students to be graduated with psychology or special education. They can be graduated with any specialization such as science, art or any other field of study. Graduated with special education, psychology will obtain importance skills and knowledge needed for such occupation to be able to understand DS capabilities and needs. Moreover, the majority of teachers/specialist have applied the AT in maximum five courses without attending workshops interrelated to the adoption of AT. Thus they has a little knowledge about AT and are not prepared well for adopting AT in classrooms as most of the teachers/specialists confirmed that they are "somehow prepared". Few workshops were provided for the teacher/specials to prepare them to deal with this segment of students and how it can be adopted in teaching DS students. Increasing knowledge and experience of the professionals in using AT will lead to an increase in education opportunities for DS (Erdem, 2017). Government should pay more attention in building the capacity and skills of specialists and teachers in using new technology.

Parent of DS students think that the best ways to improve the learning quality of their DS students is through adapting AT in inclusion schools but not in rehabilitation or special centers. DS can be improved and do well if they involve in school with normal students. Keep DS students in special environment with special students will restrict their ability for improvement. In a press conference conducted on 2010, decision makers from Ministry of Education-MOE in Kingdom of Bahrain have discussed the possibilities of the inclusion of the DS in kindergartener level in the normal kindergartens and the need for enhancing the learning of these people (Alwasat, 2010). Moreover, parents of the DS have confirmed in many events conducted by the Bahrain Down Syndrome Society in Kingdom of Bahrain that they want their DS to be taught and qualified in inclusion school not in special

center or an isolation environment (Alwast, 2003). They demonstrate that teaching DS in inclusion school will offer the opportunity for the DS individual to share and participate in the general life and community (Alwast, 2003). When the inclusion class implemented effectively it will offer academic and social benefits for DS students. Many parents of children with DS revealed that the inclusion experience have many benefits, including higher self-esteem, improved speech and communication, friendship development, independence in daily life activities, high educational accomplishment, and social interactions (DSAWM, 2010).

Teaching DS is not easy as it necessitate the understanding of these people and identify their weakness, strength and problems to be able to deal with them in a proper way and adopt the most suitable AT that may support their impairments. In addition, there are many problems are facing DS students either because of their nature and special characteristics or in adopting the AT in their teaching and learning processes. There are many problems that may be faced by DS in classroom or family at home. However, these problems may not be the same as DS may be impacted by the environment surrounding them. As such, the finding of the study show that the main problems faced by teachers/specialists in classroom are the “lack of focusing and understanding”, “difficulties in speech and language”, and “communication with others”, while at home, family are facing problems such "receptive and expressive language", “reading and writing” and “lack of focus” . Concerning the problems that are facing teachers/specialists and family in adopting AT in teaching DS, the findings disclosed that the main challenges and barriers that are faced by teacher/specialists in adopting AT are “high cost of AT devices” and “adopt the suitable AT” in the suitable situation. Both teacher/specialists reveal that they are striving to acquire AT to improve and expand the capabilities of DS students but due to the high cost of the AT sometime it become impossible. Hence, the both government and private sectors need to support the family, schools and rehabilitation centers with an adequate financial support. Actually, digital empowerment in Kingdom of Bahrain is the main concern of the MOE as a high budget was set to enhance the digitization. As the AT is a way for DS students’ empowerment and will enhance the student digital empowerment it needs to be the focus of the MOE in the Kingdom of Bahrain. Moreover, they need to help in determining the specific types of AT needed by each DS students according to their case either in the inclusion school or rehabilitation center by enhancing the research and academic studies in this field. There is a need to develop an appropriate assessment tools to help decision makers in evaluating and selecting the most suitable AT for improving the academic and social life of the DS students (Erdem, 2017).

By identifying the problems and the characteristics and needs of the DS students, it will be easy to identify the most appropriate AT in improving their learning. However, with the problems faced in adoption AT in Kingdom of Bahrain, mostly inappropriate AT was adopted. The findings show that a low level technologies, cheap and very simple that does not need experience or skills AT was adopted. As such "control keys and mouse wheel to zoom in/out” are adopted to support DS with vision impairment because of its ease/effortless and low cost. However, “different magnification modes” is not adopted because of its complexity and the teacher/specialists do not have the enough experience to adopt such tools. For supporting DS with hearing impairments , “smart-board and voice to text/sign” are the most adopted AT in inclusion schools and rehabilitation as they are flexible and easy to use for both teachers/specialists and students. Whereas, "closed captioning (FCC, DCMP) which may have better effect was not adopted because it need special skills and experiences. On the other hand, “electronic notebook” adopted for supporting DS students with cognitive impairments, while PDA and iPing are not adopted. Finally, findings elucidate that “touch screen” which is commonly used for DS students with motor impairments was adopted because it is easy to use and not required a lot of training.

Although several studies have confirmed that AT has a positive effect on supporting DS, there are few studies that attempted to examine that effect empirically. Therefore, the impact of AT on the DS students was examined and assessed by developing a theoretical model based on the available literature in the related field. The model has a main hypothesis indicate that adopting AT in teaching DS students can enhance their performance, social interaction and independence. AT can support different disabilities and characteristics of the DS and hence, the research model has identified the effect of each type of AT on the aforementioned effects. In general it can be concluded that the adoption AT in teaching and learning of DS students can enable them to be more social and independent person. AT for supporting hearing and motor have an effective impact in enhancing the communication of DS students which in turns effect their independence, social interaction and social interaction directly. While AT for supporting motor has indirect effect on independence, social interaction and social interaction via enhancing the communication of the DS students, they have direct effect on enhancing their independence but not their social interaction. AT for supporting cognitive of DS has shown to have a strong impact on enhancing the social interaction of DS but not their performance. However, the finding indicated that AT for supporting vision has no impact on enhancing the performance or the social interaction. These results are against what have been revealed and approved by previous literatures. Therefore, more investigation needs to be conducted to examine the indirect effect of the AT for supporting vision impairments of DS or adopting larger sample of size to get more reflective results. Overall, the importance of enhancing the communication of the DS

was the main findings of the model analysis. In many respects, the improvement of the communication of DS can motivate DS people especially those with speech and language disabilities, to involve in competition with others by attending workshops encourage participation with others (McCoy, 2013). In addition, it provides a gateway to the independence, dignity and self-esteem, and allows children to move around their environment, communicate with others and take part in appropriate activities that they would be unable to do without technology (Cowan and Khan, 2005).

The main aim of the current research was to investigate the current situation regarding the adoption of AT in teaching and learning DS students in inclusion schools and rehabilitation centers. In addition, the impacts of AT in enhancing the independence, performance and social interaction of DS students were examined. The study demonstrate that AT are playing a vital role in supporting the learning of DS and enabling them to be an active member by enhancing their communication, performance, social interaction and independence. Kingdom of Bahrain provides more effort and focus on the DS and established a long term strategic plan for having such segment of people as a normal person that can live like others and act normally in the general life.. They provide different inclusion programs for the disables and special needs. They started by providing these programs in eight primary schools in 2001-2002 and recently they have such program in 54 schools in different level. They also provide a special curriculum for the DS and special assessments. The MOE started with an academic inclusion (mainstreaming) and shifted to the social inclusion (normalization) (Alwasat, 2003). Moreover, there are many AT were provided for supporting motor, vision and hearing imperilments of DS such as buss with elevator to simplify the movement of the DS and support the motor and assign their classes in the ground floor with special and well equipped bathroom. Moreover, they provide Dell touch computer, pronto, CCTVE, CCTV, Digital amplifiers and others. On the other hand, some professional certificate such as the agriculture program are providing for DS to enhance some of their skills and improve their social interaction. They are also assigning specific scholarships for DS that have finished the secondary school (Alayam, 2015).

However, to exploit the opportunities provided by AT, consideration should be pay to many aspects such as the capacity building of the teachers/specialist, types of AT to be adopted, the environment where to adopt the AT and the DS themselves. Government' strategic plan should consider building capacity on AT and emergent technology to have sufficient specialists to satisfy the needs of the disabled segments in the country. More attention should be paid for building capacity and skills for using AT by teachers/specialist at inclusion school and rehabilitation centers via involving them in more workshop and courses. They can be involved in direct and indirect training as a way for building capacity and skills. A direct training can be conducted through the involvement of specials, developers, special educators, teachers and volunteers in different workshops and courses. While indirect training can be achieved through the communications with house holders and disabled parents. Moreover, indirect way of enhancing knowledge and experiences of AT for supporting DS can be done through implementation of special e-learning networks for teachers in inclusion schools to exchanges lessons courses and information among themselves or network let say "Bahrain DS", include all societies that are concern about the DS in Bahrain, experts. Such online networks will support DS students and their parents and family so that they can inquire about certain services, suitable support and guidance for DS. Moreover, school that are successful is integrating students with DS must have an effective leadership to deal with student's individual needs and commitment to provide a broad and balanced range of curriculums for all students (Krahn et al., 2015). Therefore, MOE should pay more attention in building well established academic leadership. On the other hand, decision makers need also to enhance the financial support for the special needs centers and inclusion schools that can help them in establishing a well qualified environment for providing more effective services for this segment of people. Social community and business sectors should support inclusion schools and rehabilitation centers financially to be able to provide and improve the current AT.As such Tamkeen and Economic Development Bank - EDB can offer free workshop through a memorandum of understanding with MOE, while banking sectors and other financial institution in the country can help in supporting schools and rehabilitation centers with the appropriate AT.

REFERENCES

Ahmed, F.K. (2015), Use of Assistive Technology in inclusion education: making room for diverse learning needs, Transcience, Vol. 6, No. 2, pp. 62-77

Al-Ammary, J. (2010), "Educational Technology: A Way To Enhance Student Achievement At The University Of Bahrain", *Procedia-Social and Behavioral Sciences,* Vol (55), pp. 248-257

Alayam (2015), No. 9624, Available online: www.Alayamnews.com

Al-Edwan, S. (2013), "Developing the mathematical skills among sample of Down Syndrome by education", *Journal of Education and Practice*, Vol. 4, No. 16, pp. 145-156

Alwasat (2003), No. 424, Available online: www.alwastnews.com

Alwasat (2010), No. 2791, available online: www.alwastnews.com

Azenkot, S., Prasain, S., Borning, A., Fortuna, E., Ladner, R., Wobbrock , J. (2011), "Enhancing independence and safety for blind and deaf blind public transit riders", *in proceeding of SIGCHI conference on Human Factors in Computing Systems*, Vancouver, BC, Canada, May 07-12, pp. 3247-3256

Baker, B.L., McIntyre, L.L., Blacher, J., Crnic, K., Edelbrock, C., Low, C. (2003), "Pre-school children with and without developmental delay: Behavior problems and parenting stress over time", *Journal of Intellectual Disability Research*. Vol. 47, pp. 217–230.

Berry, L., Phillips, C., and Nees, M.A. (2013), "Readers as an audio accommodation in high stakes standardized testing: Difficulties with experimental approaches", Presented *at the 28th Annual LVAIC Undergraduate Psychology Conference*. Vol. 20

Bird G, Alton S, Mackinnon C. (2000), "Accessing the curriculum - Strategies for differentiation for pupils with Down Syndrome", *Down Syndrome Issues and Information*

Bouck, E. C., Flanagan, S., Joshi, G. S., Sheick, W., and Schleppenbach, D. (2011), "Speaking math-A voice input, speech output calculator for students with visual impairments", *Journal of Special Education Technology*, Vol.26, No. 4, PP.1–14.

Bowers, A. R., Meek, C., and Stewart, N. (2001), "Illumination and reading performance in age related macular degeneration", *Clinical and Experimental Optometry*, Vol.84, No. 3, PP.139–147

Bucklet, S., Brid, G., Sacks, B. and Archer, T. (2006), "A comparison of mainstream and special education for teenagers with Down Syndrom: Implication for parent and teacher", *Down Syndrome Research and Practices*, Vol. 9, pp. 54-67

Carter, E. W., Owens, L., Trainor, A. A., Sun, Y., and Swedeen, B. (2009), "Self-determination skills and opportunities of adolescents with severe intellectual and developmental disabilities" , *American Journal on Intellectual and Developmental Disabilities*, Vol.114, PP.179–192.

Cook, A. M. (2011). "It's Not About The Technology, or is it? Realizing AAC Through Hard and Soft Technologies*". Perspectives on Augmentative and Alternative Communication*, Vol.20,No. 2, PP.1-64.

Cooper, H. (2015), "Identifying infants and young children with visual impairments", *Texas Child Care Quarterly*, Vol. 38, No.4

Cowan,D and Khan,Y (2005), "Assistive technology for children with complex disabilities", Current Paediatrics, vol. 15, pp 207–212.

Cowan,R. Fregly, B. Boninger,M., Chan,L., Rodgers,M. And Reinkensmeyer, D. (2012), "Recent Trends in Assistive Technology for Mobility", *Journal of Neuroengineering and Rehabilitation*, Vol. 9, No. 20, P.1-8

Cramer N, Galdzicki, Z. (2012), From abnormal hippocampal synaptic plasticity in Down Syndrome mouse models to cognitive disability in Down Syndrome. Neural Plast 2012:101542

Dawe, M. (2006), "Desperately Seeking Simplicity: How Young Adults with Cognitive Disabilities and Their Families Adopt Assistive Technologies", *in proceeding of CHI conference*, Montreal, Queen, Canada, PP.1-10.

DeutschSmith, Deborah. Introduction to Special Education: Teaching in an Age of Opportunity. 5th ed. (Boston: Pearson Education Inc., 2006), 149183

Diefendorf A., Bull, M, Casey-Harvey, D., Miyamoto, R. , Pope, M., Renshaw, J., Richard L. Schreiner, R., and Wagner-Escobar, M (1995), "Down Syndrome: A Multidisciplinary Perspective", *Journal of the American Academy of Audiology*, Vol. 6, No. 1, PP.39-46

Doyle, M. and Phillips, B. (2001). "Trends in Augmentative and Alternative Communication Use by Individuals With Amyotrophic Lateral Sclerosis". *Augmentative and Alternative Communication,* Vol. 17, No. 3, PP.167–178

DSAWM (2010), Supporting the Student with Down Syndrome in Your Classroom, Educator Manual, Down Syndrome Association of west Michigan: Possibility, Promise and Potential

Eastin M. S. and LaRose, R. (2000), "Internet self-efficacy and the psychology of the digital divide", *Journal of Computer-Mediated Communication*, Vol. 6, No. 1

Edrisinha, C., O'Reilly, M. F., Choi, H. Y., Sigafoos, J., and Lancioni, G. E. (2011). ''Say cheese: Teaching photography skills to adults with developmental disabilities*". Research in Developmental Disabilities*, Vol. 32, No. 6, PP.36–642.

Edyburn, D. L. (2001). Models, theories, and frameworks: Contributions to understanding special education technology, *Special Education Technology Practices*, Vol.4, No. 2, pp. 16-24

Erdem, R. (2017), "Student with speachel needs and AT, a literature review", *The Turkish Online Journal of Education Technology-TOJET*, Vol. 16, No. 1, pp. 128-146

Faragher, R., and Brown, R. I. (2005), "Numeracy for adults with Down Syndrome: It's a matter of quality of life", *Journal of Intellectual Disability Research*, Vol. 49, No. 10, pp. 761–765.

Felce, D., and Perry, J. (1995), "Quality of life: Its definition and measurement*", Research in Developmental Disabilities,* Vol. 16, pp. 51–74.

Feng, J. and Lazar, J. and Kumin, L. and Ozok, A. (2008), "computer usage by young individuals with Down Syndrome: an exploratory study" , *in proceedings of the 10th International ACM Sigaccess Conference on Computers and Accessibility*, PP. 35-42 Halifax, Nova Scotia, Canada

Ferrell, K. (2006), "Evidence-based practices for students with visual disabilities*", Communication Disorders Quarterly*, Vol. 28, pp. 42–48.

Gierrach, J., and Stindt, K. (2009), "Assistive technology for activities of daily living", Assessing Students' Needs for Assistive Technology (ASNAT) 5th Edition – complete version. J. Gierach (Ed.). (p.1-16) .

Golder, S.A. (2004), "The keep-in-touch phone: A persuasive telephone for maintaining relationships. In proceeding of the CHI EA '04' Extended abstracts on human factors in computing systems, Vienna, Austria, April 24-29, pp. 1551-1551

Hersh, M. A., and Johnson, M. A. (2008), "On modelling assistive technology systems part 1: modeling framework", Technology and disability, Vol. 20, pp. 193-215

Jenkinson, J.C. (1997), Mainstream or Special? Educating Students with Disabilities. London: Routledge.

Jon, M. and Paul, H. (1999), Improving the communication of people with Down Syndrome, Brooker, Pub.

Kareri,F. W. M. (n.d.). Perkins.org. (W. M. Francis Kareri, Editor, W. M. Francis Kareri, Producer, & Kenya Union for the Blind) Retrieved September 2014, from Perkins.org: www.perkins.org/..../kareri..w..Mutua...J...

Kaya, N. and Weber, M. J. (2003), "Privacy regulation and college adjustment: A comparison of American and Turkish freshmen living in residence halls", *College Student Journal* , Vol. 37, No. 1, pp. 79-92.

Kliewer, C. (1998). "The meaning of inclusion", *Mental Retardation*, Vol. 36, pp. 317-322

Kling, A., Campbell, P., and Wilcox, J. (2010), "Young Children With Physical Disabilities", *Infants & Young Children*, Vol. 23, No. 3, pp.169-183.

Koweru, R., Omoke, C. and Orodho, J. (2015)., "The Role of Assistive Technologies on Quality Educational Outcomes of Student with Visual Impairment in Kisumu County, Kenya.

Koweru, R.A., Omoke, C.M, and Orodho, A.J. (2015), "The role of assistive technology on quality educational outcomes of students with visual impairments in Kisumu County, Kenya", *Journal of Humanities and Social Sciences of the Organization of Social Science Research (IOSR-JHSS)*, Vol. 20, No. 3.

Krahn, G. and Fox, M., (2015), "Public health respective on intellectual and developmental disabilities", in Ed Rubin, L., Merrick, J., Donald, G. and Patel, D., Health care for people with intellectual and developmental disabilities across the lifespan, Springer

Kumin, L. (2003). Early Comunication Skills in Children with Down Syndrome: A Guide for Parents and Professionals. Third edition, Bethesda, MD: Woodbine House.

Lahm, E. (2002), "Factors that influence assistive technology decision making", *Journal of Special Education Technology*, Vol. 17, No. 1, pp. 15-26

Lancioni, G. E. , Sigafoos, J., O'Reilly, M. F., and Singh. N. B. (2013), "Defining assistive technology and the target populations", in ed. Assistive technology. Interventions for Individuals with Severe/Profound and Multiple, Autism and psychopathology Series, Springer

Lancioni, G. E., Singh, N. N., O'Reilly, M. F., Sigafoos, J., Green, V., Oliva, D., et al. (2011), "Microswitch and keyboard-emulator technology to facilitate the writing performance of persons with extensive motor disabilities", *Research in Developmental Disabilities*, Vol. 32, pp. 576–582.

Lartz, M., Stoner, J. and Stout, J.L. (2008), "Perspectives of Assistive Technology from Deaf Students at a Hearing University", *Assistive Technology Outcomes & Benefits (ATOB)*, Fall2008, Vol. 5, No.1, pp. 72-91.

Lloyd, J., Moni, K., and Jobling, A. (2006), "Breaking the hype cycle: using the computer effectively with learners with intellectual disabilities", *Down Syndrome Research and Practice*, Vol.9, No. 3, pp. 68-74.

Lovie-Kitchin, J. E., Bevanm, J. D., and Hein, B. (2001), "Reading performance in children with low vision", *Clinical and Experimental Optometry*, Vol. 84, No. 3, pp. 148–154

MADA (2015), Marhaba.qa, Mada and Al Noor Institute Sign Agreement to Support Technological Needs of the Blind in Qatar. [online] Available at: http://marhaba.qa/mada-and-al-noor-institute-sign-agreement-to-support-technological-needs-of-the-blind-in-qatar/ [Accessed 24 March 2015].

McCoy,K., Arnott,J., Ferres,L., Oken,M., and Roark,B. (2013), "Speech and Language processing as assistive technologies", *Computer Speech and Language*, Vol. 27, pp. 1143–1146.

McDougall, J., Evans, J., and Baldwin, P. (2010), "The importance of self-determination to perceived quality of life for youth and young adults with chronic conditions and disabilities", *Remedial and Special Education*, Vol. 31, pp. 252–260

McKnight, L., and Davies, C. (2013). Current Perspectives on Assistive Learning Technologies: 2012 review of research and challenges within the field. Oxford.

MLSM (2015), Ministry of Labor and Social Development , Kingdom of Bahrain, available online: www.social.gov.bh, access on Dec 22, 2015

Mulligan, S. (2003), "Assistive Technology: Supporting the Participation of Children with Disabilities", *Young Children*, Vol. 58, No. 6, pp. 50-51.

Neill,B., Moran, K. and Gillespie,A (2010), "Scaffolding rehabilitation behavior using a voice-mediated assistive technology for cognition, Neuropsychologyical rehabilitation, Vol. 20, No. 4, pp 509–527.

Olaosun,A and Ogundiran,O. (2010), "Assistive Technology For Hearing and Speech Disorders", *Journal of Biology, Agriculture and Healthcare*, Vol.3, No.17.

Parette, H., and Peterson-Karlan, G. (2007), "Facilitating student achievement with assistive technology", *Education and Training in Developmental Disabilities*, Vol. 42, No (4), pp. 387-397

Percy, M. and Schormans, A. (2006). "Down Syndrome", *Journal on Developmental Disabilities*, Vol. 12. No. 1, pp. 1-6.

Persel, C. (2012). The Independent Living Scale. *The Center for Outcome Measurement in Brain injury.* http://www.tbims.org/combi/ils - accessed June 29, 2017 .

Reed, P. (2007). A resource guide for teachers and administrators about assistive technology Wisconsin Assistive Technology Initiative. (pP.1-22). Oshkosh, Retrieved from http://www.wati.org/content/supports/free/pdf/AT Resource Guide Dec08.pdf

Scherer M., Hart T., Kirsch N., Schulthesis M. (2005), "Assistive technologies for cognitive disabilities, *Crit Rev Phys Rehabil Med*, Vol. 17, No. 3, pp.195–215.

Spindler, R. (2006), "Teaching mathematics to a student who is blind", *Teaching Mathematics & its Applications*, Vol. 25, No. 3, pp. 120–126

UNESCO. (1994). The Salamanca Statement and Framework for Action on Special Needs Education. World Conference on Special Needs Education: Access and Quality, Salamanca, Spain, 7-10 June 1994. Oliver, M. (1996). Understanding Disability: from Theory to Practice. Basingstoke: Macmillan. Paris: UNESCO.

UNICEF (2013), The state of the world's children 2013. Children with disabilities. New York: United Nations Children's Fund

Wang, H.L (2009),"Should All Students with Special Educational Needs (SEN) Be Included in Mainstream Education Provision? - A Critical Analysis", International Education Studies, Vol. 2, No. 4, pp. 1-8.

WHO. ICF Browser. Chapter 1 Products and technology: World Health Organization; [June 9, 2014]. Available from: http://apps.who.int/classifications/icfbrowser/.

Wiazowski, J. (2009), "Assistive technology for students who are blind or have low vision". In Jill Gierach (Ed.), Assessing students' needs for assistive technology: a resource manual for school district teams. Milton, WI: Wisconsin Assistive Technology Initiative.

Wilson, B.A., Evans, J.J. (1996), "Error-free learning in the rehabilitation of people with memory impairments". *Journal of Head Trauma rehabilitation*, Vo1. 1, pp. 54–64.

Winter, E., and O'Raw, P. (2010). Literature review of the principles and practices relating to inclusive education for children with special educational needs. National Council for Special Education. Trim, Northern Ireland. Retrieved from http://ncse.ie/wp-content/uploads/2014/10/NCSE_Inclusion.pdf