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Experiences of Teachers and Children with Autism Regarding Integration of Information and Communication Technology (ICT) in the Teaching and Learning in Tanzania

Bilhuda S.Chamshama[1*] Cosmas B.F. Mnyanyi[2]

1. Faculty of Education, The Open University of Tanzania, P.O. Box 23409, Dar es Salaam, Tanzania
2. Faculty of Education, The Open University of Tanzania, P.O. Box 23409, Dar es Salaam, Tanzania

* E-mail of the corresponding author: baraka_ally@yahoo.com

Abstract

This study aimed to investigate the experiences of teachers and children with autism regarding the use of ICT in the teaching and learning process. The study was guided by the Technology Acceptance Model. In this study the researcher employed mixed methods research approach with the concurrent triangulation designs. This study included a total of sixty (60) participants, comprising thirty-six (36) teachers who work with children with autism and twenty-four (24) parents of children with autism. Quantitative data were collected using questionnaires, whereas qualitative data were obtained through interviews and observations. The study found out that teachers got experiences in ICT through teaching where several tasks require them to work with computers and internet and others have integrated with ICT in teachers' colleges and Universities. Unfortunately, children with autism in the surveyed primary schools were less acquainted with ICT. This study brings into attention to the government and private school owners that without improvisation of the ICT related facilities and teaching-learning environment integration of ICT in teaching and learning could not be fully realized. Therefore, the following recommendations are made: first, school administrators (both government and private) should launch initiatives to ensure an adequate supply of ICT resources in schools. Second, there should be the establishment of professional development programs focusing on the application of ICT in teaching and learning for children with autism.

Keywords: Autism, ICT, Teaching and learning, Technological Acceptance Model

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1. Introduction

The word autism is a generic term that is used to describe a group of complex developmental brain disorders known as Pervasive Developmental Disorders (PDD) or Autism Spectrum Disorders (ASD). The PDDs include autistic disorder, Asperger Syndrome, Pervasive Developmental Disorder –Not Otherwise Specified (PDD-NOS), Rett Syndrome and Childhood Disintegrative Disorder (Carpenter, 2013). According to the American Psychiatric Association (2000) children with autism must display at least a total of six characteristics in three main categories. That is social interaction impairment, communication impairment and stereotyped patterns of behavior. Children with this condition, lack the ability to use language or communicate. This impairment could take several forms. The child may have limited non-verbal communication, including flat facial expressions and absence of gesture use. In some children autism spectrum disorder appears after a particularly traumatic case of childhood malaria or rheumatic fever and has been one of the major causes of autism (Prizant, 1996).

Promoting ICT infrastructure for special needs education (SNE) is necessary in order to provide for the appropriate conditions of teaching and learning in the Special Needs Education context. The conditions in every type of inclusive educational area cannot be successfully created without the appropriate ICT tools applied. Teacher professional development policies need to be in place to support ICT-related teaching models, in particular professional development strategies that encourage both students and teachers to play an active role in teaching activities (Kafyulilo, 2010; Mwalongo, 2011). Autism is said to be a lifelong developmental disability that affects the way a person communicates and relates to people around them. People with autism can often have accompanying learning disabilities. Worldwide research indicate that ICT contributes in the length of people with autism.

According to Jordan (1995) children with autism may find it difficult to cope with various changing demands of the environment around them. The computer can offer the opportunity, through the internet and through multimedia applications and programs to experience the world around them within clear boundaries. The computer can therefore be a useful tool in encouraging co-operative working and dialogue through a common interest that can extend beyond games. Boucennaet al (2014) talks about advances in the research on innovative information communication technology (ICT) for the education of people with autism. Their review focused on an overview of the ICT applications used in the treatment of autism and the early development of imitation and joint attention in the context of children with autism as well as robotics. They highlighted the fact that there is a profusion of ICT applications developed for autism as well. Interactive environments, virtual environments, avatars and serious games as well as telerehabilitation have been used in numerous studies in order to develop emotional skills in children with Autism Spectrum Disorder. Mitchel et al (2007) attempted to demonstrate the efficacy of using Virtual Environments in teaching social skills to children with Autism Spectrum Disorder. They used a sample of six teenagers. They used a Virtual Environment of real cafés and buses so as to learn where they would sit and why.

Evidence indicates that Information and Communication Technology (ICT) can accomplish many tasks autonomously quickly and efficiently. Meanwhile, it is a common practice to use ICT in health care delivery and management. Moreover, more and more Brain – Computer Interface (BCI) devices are developed to assist people with disabilities (Wolpaw, McFarland &Vanghan, 2000). For instance, technologies exist to enable people with severe cerebral palsy to make verbal communication with mental thoughts via Electroencephalograph (EEG) Neuper, Muller, Kubler, Birnanner&Pfurtscheller (2003). Along with the benefits of ICT people with disabilities can now enjoy a more suitable and independent life.

Different from other children with disabilities, children with autism have some developmental malfunctions such as mental disability and language disorders that affect the process of cognition to behaviors. Despite of several other factors that hinders them in access to education, as enrollment of the eight consecutive years demonstrated in (Table 1). Evidence from elsewhere indicates that ICT such as Computer, Technology has the potential in facilitating language learning and communication among children with autism (UNESCO, 2006; Mikre, 2011; Søby, 2013). So, through ICT, the technology can enhance their participation and improve their performances in the education system.

Table 1. Enrolment of Children with Autism in Primary Schools in Tanzania from 2012-2021

Year	Male	Female	Total
2012	63	49	112
2013	432	314	746
2016	590	391	981
2017	869	578	1447
2018	1091	755	1846
2019	1315	1008	2323
2020	1108	748	1856
2021	1339	898	2237

Source: URT, 2012; 2013; 2016;2017;2018; 2019;2020;2021.

Enrolment of children with special needs and disabilities, including those with autism in Tanzania is increasing (Mnyanyi, 2014). As ICT has been viewed to be an important agent in teaching and learning (Mikre, 2011; UNESCO, 2006; Soby, 2013; Mnyanyi, Bakari &Mbwette, 2012; Mnyanyi, Bakari &Mbwette, 2010; Rhema&Miliszewska,2009; Seale, 2013). There is a need to investigate on how ICT can be integrated into the teaching and learning for autistic children in Tanzania.

Few if any have been talked about ICT for persons with autism in Tanzania. Unlike ordinary children, children with autism have different habit of living due to their deficits in social skills and cognitive abilities. This research intends to investigate the effectiveness of using/ integrating ICT in enhancing learning for children with autism in Tanzania. ICT is said to be a tool for supporting social and academic development (Javiet, Moore & Anderson, 2012). As such ICT can help children to overcome many of their communication difficulties, so they can be

included in the lessons, and access a wider curriculum. For example, access devices can help learners with physical difficulties to use computer and enable them to access the same curriculum as their peer.

Integrating ICT in teaching and learning is a topical agenda and more so for children with autism. The challenge in addressing ICT for a person with autism is basically on, how can we teach and how can the children with Autism learn ICT. This gives opportunity to investigate on how the integration of ICT in enhancing teaching and learning for children with autism can be achieved. It is important to note that teachers teaching children with autism not many had the opportunity to learn ICT during their teacher education. Thus, this study investigated teachers and children with autism experiences regarding the use of ICT in teaching and learning process. The study was guided by the following questions:

(i) What are the experiences of teachers of children with autism regarding the use of ICT in enhancing the teaching and learning process?

(ii) What are children with autism experiences about the use of ICT in enhancing the teaching and learning process?

2. Literature Review

This study was guided by Technology Acceptance Model (TAM). The model was used to describe integration of ICT in teaching and learning for children with autism. This model addresses the requirements of technology users and how their observations influence their acknowledgment or dismissal of a particular ICT technology. The model was chosen because it gives clarification of the determinants of ICT acknowledgment that is general, fit for clarifying user's conduct over a wide of end–user computing technologies and user populations (Jaeger, 2006). The model also provides an opportunity for tracing the impact of external factors on internal beliefs, attitudes and intentions, so as to identify acceptability of technology and then follow the appropriate steps.

The underlined theory in TAM asserts that the intention to use ICT is determined by two generalized beliefs; perceived usefulness and perceived ease of use. For children with autism, it is thus important to determine how the expected ICT users believe that using a particular technology is advantageous for improving teaching and learning process. Perceived ease of use in this study refers to the extent to which teachers, children with autism and other inclusive education stakeholders will support the provision of education to children with autism with less difficulty. This can be asserted to the easier the technology the likely is accepted by the users. In this study this theory fits well as will discover the teaching and learning environment through which children with autism are educated in Tanzania and the underlying challenges and opportunities for integrating ICT in education for children with autism.

Autism is relatively new health condition and developmental disabilities in Africa. The prevalence of autism in Africa is estimated to be similar to that of other part of the world. In Tanzania, Autistic children are often considered cursed, leading to social exclusion and leading to social violence. However, in Tanzania, we are noticing a large gap in information on knowledge, prevalence and care of children with Autism Spectrum Disorder. There is very little information on children with Autism in Tanzania. There have been scattered information and no concerted effort for these children (Ndunguru&Kisanga, 2023). In Kenya, for instance, there is an influx of both accurate and inaccurate information available to parents, teachers and medical professionals about the condition. Government schools in Kenya have begun to deploy inclusive education to replace what was previously referred to as special needs education in the effort to increase and guarantee educational opportunities for children with disabilities like autism (Riccio, 2011). Contrary to that, in Ghana, the general education curriculum does not include direct teaching of core skills (such as imitation or language) which are usually inherently lacking in individuals with autism and stand out as prerequisites to the acquisition of other forms of knowledge (Dawson &Osterling, 1997). The inclusion of curriculum content which specifically addresses culturally relevant social and communicative behaviours could mitigate attitudinal barriers to inclusive education.

Scholars have documented that the use of computer and other digital technologies assist the classroom learning of children with ASD (Attwood, 2000; Hedges et al, 2018). The integration of ICT supports learning of children with ASD. For any new innovation for children with special needs, the degree to which interventions are easy to use, and can be used by typical teachers in natural applied settings, is paramount (Massaro &Bosseler, 2006).

Higginson and Chatfield (2012) conducted a project on teaching and learning strategies for children with autism in New-Zealand. Teachers described the use strategies such as comic strips, computers, literacy techniques, numeracy techniques, and pen profiles in teaching. Teachers demonstrated abilities in using computers and other different inclusive strategies including individualised education programmes and educating the class about ASD. It was also found that severity of ASD, impact on other children and lack of support of the teacher and/or the child with ASD were reasons given for withdrawing the children from the classroom. Many teachers reported knowing people with ASD: either having taught them, been aware of them in the schools, or through personal contact. It was concluded that by incorporating a team approach with the individual mentoring, alongside one-off workshop/seminars by experts in the ASD field, teachers were given multiple opportunities to gain the knowledge they needed to successfully include children with ASD in their classrooms.

In Egypt, Al-Gawhary and Kambouri (2012) conducted a study to measure the impact of using ICT in Individual Learning Programmes of students with learning disabilities. Twenty-five students and thirteen teachers took part in the research which was based on classroom observations. A high correlation between keyboard, power point, and literacy skills (writing, reading, and maths) was revealed suggesting the significance and impact of keyboard training as an essential component towards achieving educational objectives. Findings further confirmed the positive impact of computer skills training on the students' learning experience which also revealed a strong belief in the right of every child to all learning opportunities, particularly ICT regardless of his/her abilities.

Drigas (2013) presented an overview of the most representative studies of the last decade (2001-2010) which deal with the two important issues in the field of special education. Today as a result of research the use of ICTs has gathered accumulative evidence around it. The diagnosis of autism or the rest of the ASD is in most of the times a result of the several traditional assessment tests that are available to professionals. However, the latest years, important attempts have been made in the field of ICT assessment. In addition, a large number of studies have employed ICT to facilitate and train youngsters and adults with Autistic Spectrum Disorders. For example, Ozonoff et al (2004) conducted a computer-administered set of neuropsychological tests designed to examine specific components of cognition. These tests examine the integrity of frontal functions since several studies support involvement of frontal cortex in autism. This method was tested to 79 participants with autism and 70 typical controls and the results indicated that the autism group had difficulties in planning efficiency and extra-dimensional shifting relative to controls comparing to the control group. Based on the results of this study, they argued that there is frontal lobe involvement in autism.

Another research by Tseng and Yi-Luen Do (2010) presented a novel design prototype ICT application for children with ASD. The Facial Expression Wonderland (FEW) application is designed to improve the ability of ASD learners in facial expression recognition. FEW is a daily training tool which consists of different levels. Moreover, requires learners with ASD to play in everyday basis in order to improve their skills in facial expression recognition and 'Theory of Mind' (the ability to understand mental status of other people). The real impact of FEW application is not yet evaluated and is to be estimated in the future. Although these literatures have revealed several issues on the relationship between teaching and learning for children with autism spectrum disorder and ICT in educating them, very little has been said on the use of ICT in teaching and learning for children with autism spectrum disorder in Tanzanian education system.

3. Research Methodology

The study used mixed methods research approach. This approach offers a number of benefits to approaching complex research issues as it integrates philosophical frameworks of both post-positivism and interpretivism (Fetters, 2016). In this research the focus was on ICT integration in teaching and learning for children with autism through capturing teaching and learning experiences, thus a concurrent triangulation design was adopted. This approach allowed for the simultaneous collection and analysis of both quantitative and qualitative data, providing a deeper understanding of how ICT is utilized in educational settings for children with autism. Through this method, the study aimed to uncover the various ways in which ICT is integrated into teaching practices and its impact on the learning outcomes of children with autism. In the same course the research managed to cross-validate findings from either method (Creswell et al, 2003). This design generally uses separate quantitative and qualitative methods as a means to offset the weaknesses inherent within one method

with the strengths of the other method (Creswell, & Plano Clark, 2011).

The study involved 36 teachers, 24 parents and the children with autism whose learning was observed from seven (7) primary schools located in three regions (Arusha, Dar es Salaam and Morogoro). The surveyed schools were selected with intention of having possible representation of the essential parties in the provision of the education for children with autism in Tanzania. Questionnaires were used to collect quantitative data, while qualitative data were gathered through in-depth interviews and observations. Data collected through questionnaire were analysed by Mean and Standard Deviation to indicate variation of teachers' experiences and their opinion were rated into four levels; strongly agree, agree, disagree and strongly disagree. Analysis of data obtained through interview followed four steps; transcribing interviews, re-read the data to obtain a sense of the overall data, creation of themes, and lastly, putting themes into categories responding to the research questions.

4. Findings and Discussions.

4.1 Experiences of Teachers Regarding the Use of ICT in the Teaching and Learning Process for Children with Autism

The study intended to determine how teachers' experiences facilitate the integration of ICT in the education of children with autism in primary schools. The experiences are presented in Table 2. Findings reveal that teachers had varied experiences in integrating ICT in the teaching and learning of children with autism. Almost all teachers (92%) responded that ICT was essential assistance in teaching and learning for the children with autism. Teachers were using ICT in adopting varieties of learning experiences for children with autism, ICT provided ways for children with autism to accomplish learning tasks easily, the teaching and learning contents through internet were helpful in preparation of lessons and most importantly ICT was useful in entertainment and recreation of the children at leisure time. One head teacher, who also has expertise in working with children with autism, highlighted a common use of ICT for teachers, as indicated in the following quotes:

> *"Actually, ICT is very useful in preparation of lessons and instructions that are relevant to children with autism since most of the materials in literature we have were not meant for our children. Since college, I developed ability of materials via internet and other sources in the library. Some of the available resources are for the grown-up learners. Similarly, in other places children with ASD use of digital cameras it is really surprising because from personal observations only teachers in our schools are the one using smart-phones with digital cameras".*

Table 2. Experiences of teachers in integrating ICT in the teaching and learning of children with autism

	Teachers' perception	**Mean**	**SD**
i.	Integrating ICT in teaching and learning for children with autism	1.22	0.42
ii.	Integrating ICT in teaching and learning for children with autism to accomplish learning tasks easily.	1.58	0.5
iii.	Searching teaching contents/knowledge through internet are helpful in preparation of lessons (resources and contents)	1.39	0.49
iv.	ICT is highly essential in designing varieties of teaching-learning materials	1.53	0.5
v.	ICT is useful for entertainment and recreation purposes at leisure time	1.42	0.5

Key: 1= Strongly agree; 2= Agree; 3= Disagree; 4= Strongly Disagree
(p = 0.05)

The researcher also wanted to establish the frequency of integration of ICT in teaching children with autism. Teachers were required to respond to the question which needed them to tell how often they integrated with ICT in teaching the selected contents as indicate din Table 3.

Table 3. Frequency of using ICT in Teaching for children with autism

	Learning content(s)	Very rare		Sometimes		Often		Very often		Mean	SD
		F	%	F	%	F	%	F	%		
i)	Arithmetic/Number skills	17	47.2	18	50	1	2.8	0	0	1.56	0.55
ii)	Social related contents	12	33.3	18	50	6	16.7	0	0	1.83	0.69
iii)	Health related contents	12	33.3	24	66.7	0	0	0	0	1.67	0.47
iv)	Communication skills	4	11.1	28	77.8	4	11.1	0	0	2	0.47
v)	Vocational skills	5	13.9	24	66.7	7	19.4	0	0	2.06	0.58

Note: 1= Very rare; 2= Sometimes; 3= Often; 4= Very often
(p = 0.05)

Findings indicate that teachers were less integrating with ICT in teaching children with autism. In all contents indicated in the table teachers' responses stood between very rare and sometimes (Mean range from 1.56 to 2.06). Such findings imply that ICT were more supporting teachers rather than the children with autism. This was evident from comment of a male teacher, as indicated in the following quote:

"*With no doubts teaching and learning with the integration of ICT enhances professional development among teachers. This also influences the effectiveness*

of children with autism through collaboration with peers. With improved knowledge and skills of teaching with ICT simplifies tasks of teachers"

Some teachers were generally in supporting the use of ICT in teaching and learning of children with autism. Another teacher claimed that:

"From what I know, computers and other items of information and communication technologies enrich the teaching and learning of subjects considerably. There are ways in which they may integrate and can benefit greatly in learning outcome including children' active involvement in their own learning, development of child's thinking skills, authentic environments, children interest and engagement in learning and collaborative learning"

From the data gathered on experiences of teachers it is revealed that, most teachers agree that the technology they currently use in their classrooms has a positive influence on their teaching and learning for children with autism. Therefore, successful integration of ICT in the teaching-learning process, among other things, is dependent on the lesson preparation by teachers and actual involvement of children with autism in all learning tasks. These findings align with those by Roblyer and Doering (2010) who found that teachers have preference for the implementation of ICT in their classrooms. In the views of the teachers, the use of ICT has several benefits to the students. This includes an improvement in the learning and teaching process, ability to save time, and the ability to improve the communication and social skills of the students with ASD. Chatfield (2012) also found that teachers had strategies such as comic strips, computers, literacy techniques, numeracy techniques, and pen profiles in teaching. They demonstrated abilities in using computers and other different inclusive strategies including individualised education programmes and educating the class about ASD.

A study by Al-Gawhary and Kambouri (2012) found a high correlation between keyboard, power point, and literacy skills (writing, reading, and mathematics) was revealed suggesting the significance and impact of keyboard training as an essential component towards achieving educational objectives. It was also confirmed the positive impact of computer skills training on the students' learning experience which also revealed a strong belief in the right of every child to all learning opportunities, particularly ICT regardless of his/her abilities.

4.2 Children with Autism Experiences in integration of ICT in their Learning Processes

The researcher wanted to establish to what extent children with autism are engaged in learning through ICT. Findings are presented in Table 4. The study shows that in all means of interaction with ICT only computer games children with autism are mostly engaged with. Teachers agreed that children with autism didn't interact directly with ICT in subject taught in schools but in other related tasks. Such integration was demonstrated by this teacher, that:

Table 4. Frequency of pupils' interaction with the ICT

S/N	Means of integration	Mean	SD
i.	Computer games	2.17	0.91
ii.	Photoshop	2.33	0.828
iii.	Searching/browsing internet	2.42	0.649
iv.	Digital library	2.83	0.697
v.	Forums and blogs	2.97	0.56
vi.	Social networking	2.92	0.692

Note: 1= Very often; 2= Often; 3= Rare; 4= Not at all
(p= 0.05)

The study shows that in all means of interaction with ICT only computer games children with autism are mostly engaged with. Teachers agreed that children with autism didn't interact directly with ICT in subject taught in schools but in other related tasks. Such integration was demonstrated by this teacher, that

" *Aaah! In this school we don't use computers directly in teaching of children with autism, but in developing motor skill computer assist teachers in enabling movements of children. Teachers design learning tasks mostly related with tactile orientations. Usually, children with autism isolate themselves from others, so they need more of social skills rather than sitting in front of computers".*

Another teacher said that children with autism used ICT facilities such as television mostly for recreation purposes. She put it this way:

"*At our school, children with autism really enjoy watching television (TV) programs. Most of them are watching documentaries on success of fellow children with ASD. Otherwise, they watch cartoon and other TV programmes of which are very entertaining and educating as well"*

Other teachers had similar experiences and commented that:

"*I have witnessed that ICT helps children with ASD engage in time demanding learning activities. It is so, only if the teacher engages the children with play and some academic tasks, then they can concentrate for more time. The good of ICT integration, children with autism are able to accomplish tasks working at their own pace"*

"*The television programmes such as 'akili' which are in Kiswahili are very essential to our children.They give thought and purpose of living as other children in a community. In some occasion children ask teachers and supportive staff to connect television for them to watch 'akili' cartoon"* as it was quoted by a female teacher

Interaction of ICT in teaching children with autism from the perceptions elicits positive feelings, whereas communication with children with ASD. The more they interact with ICT facilities children with autism become familiar with the behaviour of some computer related programs. Then, with little training children with autism master the intended learning tasks. Findings concur with those by Konstantinidis, et al, (2009) who found that

computer-based learning methods are increasingly being considered as a key tool for educating people with autism. They demonstrated that persons with autism, especially children, enjoy interacting with computers particularly as they are free from the expectations and judgments that make social interaction problematic. Use of ICT or product system that can be used to maintain, increase or improve functional capabilities for any person with a special need (Lorenzo et al, 2016). Research by Lorenzo and colleagues involved 40 children from the age of seven to twelve who are on the autism spectrum and have difficulties in the social and emotional field. By providing different social scenarios to the children, the researchers recorded their facial expressions, which were then visualized in virtual environments to record whether or not they responded to the social situation.

5. Conclusion and Recommendation

In the light of the findings from the study, it was evident that most teachers had experiences on the use of ICT in teaching as well as securing learning resources for their children. But they fail to effectively integrate children in learning though ICT due to the limited learners' capacities and teaching and learning environment. Teachers faced difficulties in assisting learners to acquire desired competences in learning with ICT due to lack of ICT related facilities available in schools. Thus, the study recommends for primary schools' teachers to engage ICT in teaching they need be given technical support that will be attached to with means to access and develop online information. Secondly, the child-ICT facility ratio should be reduced to minimal number possible for them to learn effectively. Lastly, the government and other school owners should guarantee reliable and cheap internet access. With internet access children with autism and special needs education teachers will be able to interact within the school premises and at home.

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