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Use of Information and Communication Technology by Visually-impaired Students: A Study in University of Calicut, Kerala

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ABSTRACT

The purpose of this study was to investigate the use of Information and communication technology (ICT) by the visually impaired students in Calicut University, Kerala. Semi-structured interviews were employed to collect data from a representative sample of 100 visually impaired students from the departments and affiliated colleges of the University. The study found that a large majority of the students are computer literates and use mobile phones frequently. A good number of them use screen readers in their mobile phones. However, the foreign accent of screen reading programs is a challenge for the students. The support of friends and family members is very helpful for the students to acquire the skills of ICT. Microsoft Office and Jaws screen reader supported by Windows operating system are the most popular software among the students. Use of internet by the students is very less and most widely used internet service is www followed by e-mail. It is found that a majority of the students need training in word processing and Internet. This study provides useful information about the use of ICT by visually impaired students in India.

Keywords: Information and communication technology, visually-impaired students, internet, ICT literacy, computer literacy, assistive technology, university

1. INTRODUCTION

Information and communication technology (ICT) provides many opportunities for social inclusions[1]. The ICT offers great benefits to people with disabilities and enables them to participate equally in the social, cultural and economic developments. The ICT can enable them to improve their quality of life and to live in much the same way as those who are not disabled[2]. They can accomplish tasks that would be impossible to do without ICT. However, the prospective promised with the ICT often has not the reality for most people with disabilities. They had been kept away from the mainstream society, denominating them as disabled[2]. At present, the term disabled is no more prevalent; instead of it has been using words like differently-abled or visually-impaired. It is important to recognise that visually-impaired may have counterbalancing strengths in other areas.

With the widespread use of the internet and increased reliance on e-resources, the internet has become a prominent channel of online communication and e-resources. However, the internet has created a digital divide between those who have access and those who do not have access to the internet. Although the internet access is increasing across the world, many visually-impaired have no access to the internet. Therefore, the internet could become a barrier for the visually-impaired increasing the information gap by missing out on all the advantages available through the internet[2]. Internet will enable visually-impaired students to access more e-resources and work independently than what they could do via traditional methods[3]. They can access the internet as long as the interfaces, resources and services on the internet are designed appropriately.

The study has reviewed a number of available literatures published in national and foreign publications. Bayir[4], *et al.* conducted a study on computer literacy of visually-impaired in Turkey. The study shows that the cost of hardware and software for visually-impaired is more expensive, therefore the ratio of having computer among visually-impaired is low. Murphy[5], *et al.* conducted a study on the difficulties experienced by visually-impaired internet users. The findings from the survey have informed the development of non-visual interface, which uses the benefits of multimodal technologies to present

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spatial and navigational cues to the visually-impaired users. In another study, Fichten[6], *et al.* found that most visually-impaired students use software that reads text on the screen; many of these can 'read' icons, tabs, and menu bars as well. Puffelen[7], *et al.* found that the support of family was very helpful to acquire ICT skills for visually-impaired. Soderstrom & Ytterhus[8] investigated the symbolic values and use of assistive technologies from the world of ICT in the daily lives of 11 visually-impaired young Norwegians. To fit in as ordinary young people the visually-impaired participants reject ICT assistive technologies whenever possible. The partially sighted participants who were somehow capable of participating in online interactions with their peers without ICT assistive technologies reject them. The blind participants, however, do not have the option of participating online without ICT assistive technologies and, consequently, they accept ICT assistive technologies. Uimuek[9], *et al.* showed that there is a necessity of regulations for visually-impaired learners to develop their ICT skills.

There has been a surprising lack of research in the use of ICT by visually-impaired. This study investigates the use of Information and Communication Technology by visually-impaired students in Calicut University. Calicut University is the second oldest and the largest University of the State of Kerala, that caters to the needs of a large number of rural, semi-urban, and urban students of the state as well as to several national and international students. Established in 1968, the university is imparting higher education to over three hundred thousand students[10]. This study provides useful information about the use of ICT by visually-impaired students in India.

2. OBJECTIVES OF THE STUDY

The main aim of the study was to investigate the use of ICT by the visually-impaired students in Calicut University. To fulfill this aim, the following specific objectives were identified:

(a) Examine the ICT literacy of the visually-impaired students.

(b) Assess the use of ICT by the visually-impaired students.

3. RESEARCH DESIGN

The study was conducted among the visually-impaired students in the departments and affiliated colleges of the Calicut University, Kerala. A representative sample of 100 visually-impaired students was selected for the study. Semi-structured interviews with schedules were employed to collect data from the students. A total of 93 students responded to the questions. Microsoft-Excel was used to analyse the data. The investigators used computation of percentages as the statistical technique for the purpose of analysis.

4. RESULTS AND DISCUSSIONS

4.1 Computer Literacy

Visual impairments change the way the students gather information and limit the opportunities to learn through observation. The ICT literacy is very essential for visually-impaired students to access educational resources and programmes such as those delivered via the internet or multimedia educational portals. The students were asked to indicate their computer literacy and the responses were summarised. The analysis shows that a majority 80 (86.02 %) of the students were computer literates, while a very few 13 (13.98 %) were computer illiterates.

4.2 Methods of Learning Computer

Visually-impaired students need special trainings and classes to learn the skills of ICT. They need assistance from their family members, friends and teachers. Institutions can also provide sophisticated assistive technologies for visually-impaired students. The students were asked to indicate the methods of learning computer and the responses are summarised in the Table 1. It is found that out of the 80 computer literates, a good number 31 (38.75 %) of the students learned the computer skills with the help of their friends and family members. 30 (37.5 %) of the students learned the skills through short term courses. A very few students learned the skill from their peer colleagues (12.5 %) or by themselves (11.25 %). This reveals that the assistance from the friends and family members is very helpful for a visually-impaired to learn the skill of ICT. It further reveals that short term courses and training programs are also effective methods for visually-impaired to acquire the skills of ICT.

Table 1. Methods of learning ICT

S. No.	Methods of learning	Responses (n=80) (%)
1.	Learned themselves	9 (11.25)
2.	Short term courses	30 (37.50)
3.	Friends & family	31 (38.75)
4.	Peer colleagues	10 (12.50)

4.3 Use of ICT-based Tools and Services

The ICT plays an essential role in education, lifelong learning, work and leisure. Rapid developments in ICT especially in portable hand-held devices, improvements in voice and magnification software, and accessible websites present tremendous opportunities for visually-impaired students. The students were asked to indicate the use of ICT-based tools and services and the responses are summarised in the Table 2. The table shows that a large majority 88 (94.62 %) of the students use mobile phones frequently. None of the students use daisy books. 37 (39.78 %) students use desktop computers and

40 (43 %) students use CD-DVD frequently. A very few students use laptop computers (12.9 %) and e-books (11.83 %). It shows that daisy books are not at all popular among the students. Majority of them use screen readers.

Table 2. Use of ICT-based tools and services

S. No.	Items	Not yet used	Rarely	Occasionally	Frequently
1.	Desktop computer	15 (16.1 %)	14 (15.1 %)	27 (29.1 %)	37 (39.8 %)
2.	Laptop computer	68 (73.1 %)	4 (4.3 %)	9 (9.68 %)	12 (12.9 %)
3.	CD/DVD	19 (20.4 %)	12 (12.9 %)	22 (23.7 %)	40 (43 %)
4.	Mobile phones	-	2 (2.2 %)	3 (3.2 %)	88 (94.6 %)
5.	Printer	78 (83.9 %)	6 (6.1 %)	9 (9.7 %)	-
6.	Screen Reader	32 (34.4 %)	11 (11.8 %)	23 (24.7 %)	27 (29.1 %)
7.	Scanner	57 (61.3 %)	10 (10.8 %)	5 (5.38 %)	21 (22.6 %)
8.	E-books	76 (81.7 %)	3 (3.2 %)	3 (3.2 %)	11 (11.8 %)
9.	Daisy books	86 (92.5 %)	3 (3.2 %)	4 (4.3 %)	-

4.4 Confidence in ICT Tasks

The ICT has become a catalyst for economic and social developments. However, the benefits of ICT have spread unequally, especially between disabled and non-disabled. The ICT can effectively used for imparting knowledge to students with additional learning needs and disabilities. It is a fact that many visually-impaired students lack confidence with ICT and often refuse to use it. The students were asked to indicate their confidence in ICT tasks and the responses were tabulated in Table 3. A large majority 70 (87.5 %) students stated that they can do the data entry work by themselves. A very few 11 (11.25 %) do this with the help of someone and one student (1.25 %) didn't know what it means. A good number 36 (45 %) of the students can do disk writing task by themselves. 10 (12.5 %) students only heard about it and don't know how to right a disk. About half (52.5 %) of the students can do the internet surfing by themselves. A few 20 (25 %) students only heard about it and don't know how to surf Internet. A good number 30 (37.5 %) of the students can do scanning and editing by themselves. About half (48 %) of the students indicated that they don't know how to play computer games. A large majority 74 (92.5 %) of the students can play audio/video by themselves.

4.5 Use of Software

Visually-impaired students can use different types of assistive technologies including devices such as talking calculators, computer programs with speech output and electronic writing tablets with speech output. The students can use a variety of software to assist them in their academic assignments including screen reading software and listen to the notes through a computer. Jaws is a very common software for visually-impaired students. It is increasingly compatible with more programs and websites, especially as web designers take a more accessible approach to building their web-based contents. Kurzweil is also widely used by visually-impaired students for its invaluable scanning capabilities. Zoomtext is another useful program for individuals who have low or limited vision. Visually-impaired people mainly use screen readers while people with low-vision may access a much wider variety of software applications[11]. Persons with low-vision can use the applications that magnify the screen display in order to facilitate the performance of visual tasks such as reading texts, selecting menus, responding to system prompts and navigating between different parts of websites. Usually this magnification involves the use of a screen magnifier software application that runs as a background task[12]. The students were asked to indicate the use of software and the responses are given in the Table 4. The analysis shows that a majority 77 (82.8 %) of the students use MS Word. 34 (36.56 %) of the students use MS-Excel. 27 (29.03 %) uses PowerPoint. A very few

Table 3. Confidence in ICT tasks

S. No.	Tasks	I can do this very well by myself	I can do this with the help of someone	I know what it is but I cannot do it	I don't know what it is
1.	Data entry	70 (87.5 %)	9 (11.3 %)	-	1 (1.3 %)
2.	Disk writing	36 (45 %)	33 (41.3 %)	10 (12.5 %)	1 (1.3 %)
3.	Internet surfing	42 (52.5 %)	20 (25 %)	14 (17.5 %)	4 (5 %)
4.	Scanning and editing	30 (37.5 %)	10 (12.5 %)	28 (35 %)	12 (15 %)
5.	Computer Games	17 (21.3 %)	11 (13.8 %)	14 (17.5 %)	38 (47.5 %)
6.	Playing Audio/Video	74 (92.5 %)	4 (5 %)	-	2 (2.5 %)

11 (11.83 %) use Linux supported Open Office. It is found that the most used application software package is MS Office. Only a very few of the students use Linux supported office software.

Table 4 depicts that more than half, i.e., 44 (55 %) of the students use Windows operating system whereas a very few (11.25 %) use Linux. A few 25 (31.25 %) students indicated that they use both Windows and Linux. Two students (2.5 %) have Android in their mobile phones. It is found that a majority 61 (76.25 %) students uses Jaws and a good number of the students use Orca as screen readers. A very few (3.75 %) use Windows Eyes as screen reader. It is very clear from the table that Jaws supported by Windows operating system is the most popular among the screen readers. Orca supported by Linux is also becoming popular.

34 (42.5 %) of the students use Kurzweil as screen reading software. A very few use Real Speak (7.5 %) and Easy OCR (6.25 %). Only two (2.5 %) students responded that they use Zoomtext as magnifying software. It is revealed that the use of scanning and magnifying software is not very common among the students.

Table 4. Use of software

S. No.	Software	Total
Use of Application Software		
1.	MS Word	77 (82. 8%)
2.	MS Excel	34 (36.56 %)
3.	MS Power Point	27 (29.03 %)
4.	Open Office org	11 (11.83 %)
5.	Photoshop	8 (8.6 %)
Use of Operating System		
1.	Windows	44 (55 %)
2.	Linux	9 (11.25 %)
3.	Windows and Linux	25 (31.25 %)
4.	Android	2 (2.5 %)
Use of Computer Screen Reader Software		
1.	Jaws	61 (76.25 %)
2.	Orca	36 (45 %)
3.	NVDA	7 (8.75 %)
4.	Windows Eyes	3 (3.75 %)
Use of Scanning Software		
1.	Easy OCR	5 (6.25 %)
2.	Kurzweil	34 (42.5 %)
3.	Real Speak	6 (7.5 %)
Use of Magnifying Software		
1.	Zoomtext Magnifier	2 (2.5 %)

4.6 Use of Internet Tools and Services

The internet can be of great value to visually-impaired students as it empowers them to independently complete tasks which they would normally not be able to accomplish without help from others. Visually-impaired students can access internet using a traditional browser with text-to-speech software. The students can use screen readers that provides not only output but to some extent an improved interface. Internet browsers designed specifically for visually-impaired should be able to discriminate the structure of webpages and pass the information to the user in a meaningful way. Students with low-vision can use screen magnification software or rely on features built into the operating system or the browser to enhance the visibility of websites. Screen magnification software makes text and graphics on websites bigger. However, visually-impaired students face special barriers in using the internet, aside from those related to material access and computer-related trainings[13]. The students were asked to indicate the use of internet tools and services. Table 5 depicts that most frequently used internet application is search engine (33.3 %), followed by e-mail (28.9 %). Majority (57.8 %) of the students use WWW occasionally. e-mail is the only one application used by all the students. It reveals that internet use is generally not so common among the students. Most widely and frequently used internet services are WWW, and e-mail. It is seen that social networking sites are not so popular among the students. But mailing list (like Access India) is one of the internet applications which are used for knowledge sharing among the students.

Table 5. Use of Internet tools and services

S. No.	Internet service used	Frequently	Occasionally	Rarely	Not yet used
1.	E-mail	13 (28.9 %)	15 (33.3 %)	17 (37.8 %)	-
2.	WWW	9 (20 %)	26 (57.8 %)	8 (17.8 %)	2 (4.4 %)
3.	Search engines	15 (33.3 %)	18 (40 %)	8 (17.8 %)	4 (8.9 %)
4.	Social Networking Sites	6 (13.3 %)	9 (20 %)	10 (22.2 %)	20 (44.4 %)
5.	Blogs	-	2 (4.4 %)	2 (4.4 %)	41 (91.1 %)
6.	Mailing lists	8 (17.8 %)	3 (6.7 %)	2 (4.4 %)	32 (71.1 %)
7.	Newsgroups	6 (13.3 %)	1 (2.2 %)	4 (8.9 %)	34 (75.5 %)
8.	Chat	5 (11.15 %)	7 (15.6 %)	8 (17.8 %)	25 (55.6 %)

4.7 Confidence in Internet Tasks

Visually-impaired students can use the internet with screen readers to complete their assignments. However, it is found that most of the students are not so confident about the use of internet. Website designers and developers should take into account visually-impaired while designing web interfaces. The students were asked to indicate their confidence in internet tasks and the responses are summarised in Table 6. The analysis shows that a large majority (91.1 %) of the computer literate students can get into internet by themselves. A very few (4.4 %) know this but can't do it and another few (4.4 %) can do this with the help of someone. About half 23 (51.1 %) of the students can copy/download files from the Internet by themselves. A few (22.2 %) students know what this means but can't do it. The table shows that a majority (64.4 %) of the students can send e-mail by themselves and a good number (40 %) of the students know how to attach a file with a mail. A very few (17.8 %) students indicated that they can send mail with the help of someone. It is found that attaching file with email is seen as the most difficult task since 22 % of the students not even heard about this. More than half (55 %) of the students can search a word in the Internet by themselves. Another important factor is that only a few students show the confidence to send an online application by themselves.

Table 6. Confidence in internet tasks

S. No.	Internet tasks	I can do this very well by myself	I can do this with the help of someone	I know what this means but I can't do this	I don't know what this means
1.	Get on to internet	41 (91.1 %)	2 (4.4 %)	2 (4.4 %)	-
2.	Copy/download files from internet	23 (51.1 %)	10 (22.2 %)	10 (22.2 %)	2 (4.4 %)
3.	Write and send e-mail	29 (64.4 %)	8 (17.8 %)	8 (17.8 %)	-
4.	Attach a file with an e-mail message	18 (40 %)	9 (20 %)	8 (17.8 %)	10 (22.2 %)
5.	Searching a word	25 (55.5 %)	16 (35.6 %)	4 (8.9 %)	-
6.	Apply online for an examination	7 (15.5 %)	22 (48.9 %)	16 (35.6 %)	-

4.8 Foreign Accent in Screen Reading Software

Visually-impaired can use screen reading software to access language documents and websites. This software produce audio versions of electronic text and speech recognition programs change what is spoken into an electronic document. However, the most important barrier while using screen reading software is the foreign accent of the software. It is hindering the use of this software. The students were asked to indicate the difficulties and problems while they use electronic documents and internet with screen readers. The data in the table 7 shows that nearly half of the students (47.5 %) face difficulties while using electronic documents and internet with screen reading programs. The foreign accent of screen reading programs is a challenge for the students. It may due to the fact that most of the screen reading software is designed abroad. This problem can be easily overcome by designing screen reading software for visually-impaired in India.

Table 7. Foreign accent in screen reading software

S. No.	Foreign Accent	Total
1.	Easy	24 (30%)
2.	Challenging	38 (47.5%)
3.	Satisfactory	18 (22.5%)
4.	Total	80 (100%)

4.9 Screen Reader in Mobile Phones

Various forms of assistive technologies are available to help visually-impaired to live in the electronic environment. Screen reader software speaks aloud what's on a computer screen or mobile phone, including desktop icon labels, document contents, and drop-down and tool bar menu items. An added benefit is that screen readers include shortcut keys that allow visually-impaired to navigate around websites with consistent structures. Visually-impaired students can use mobile phones with screen readers. The students were asked to indicate whether they use screen reader in their mobile phones and the responses are summarised in the Table 8. A majority (55 %) of the students do not use screen readers in their mobile phones. It may be due to the high cost of screen reading software. A good number (43.01 %) of the students

Table 8. Screen reader in mobile phone

S. No.	Response	Total
1.	Easy	40 (43.01 %)
2.	Difficult	2 (2.15 %)
3.	Not using	51 (54.83 %)
4.	Total	93 (100 %)

indicated that screen reader in their mobile phones is very easy to follow.

4.10 ICT Training Needs

Visually-impaired students face difficulties in accessing the most basic forms of education. They can use assistive technologies to access traditionally inaccessible educational contents. These technologies are key driving force to equip visually-impaired students to access the digital environment well in the classroom and workplace. However, sufficient training should be provided to visually-impaired students to use different assistive technologies including development of relevant content, provision of software and hardware resources. The students were asked to indicate the areas in which they need training and the responses are shown in the Table 9. It is found that a majority of the students need training in both word processing (64.52 %) and disk writing (62.36 %). Nearly half (47.32 %) of the students need training in keyboard familiarisation. Most of the students (97.85 %) need training in the use of Internet tools/services/utilities. A very few (15.05 %) students demanded training in mobile usage. Five (5.38 %) students want to get trained in other areas such as music editing, graphics and animation, web designing, programming, etc.

Table 9. Areas of ICT in which training is needs

S. No.	Areas of ICT	Total
1.	Basic word processing	60 (64.52 %)
2.	Keyboard familiarization	44 (47.32 %)
3.	Mobile usage	14 (15.05 %)
4.	Internet tools/services/utilities	91 (97.85 %)
5.	Disc writing	58 (62.36 %)
6.	Others	5 (5.38 %)

5. CONCLUSIONS

It is revealed that a large majority of the visually-impaired students are computer literates. However, they are deprived of getting the benefits of ICT. The benefits of ICT have spread unequally, especially between disabled and non-disabled. ICT can effectively used for imparting knowledge on visually-impaired students. The support of friends and family members is very helpful for the students to acquire the skill of ICT. It is found that a large majority of the students use mobile phones frequently and a good number of them use screen readers in their mobile phones. However, the foreign accent of screen reading programs is a challenge for the students. Rapid developments in hand-held devices especially in mobile phones provide tremendous opportunities for visually-impaired students. The students face difficulties in the use of various software and MS-Office software package is the most used application software. Internet use is generally not so common among the students. Most widely and frequently used internet service is WWW followed by e-mail.

It is found that the students are potential enough to use ICT. They lack confidence in high level ICT tasks and often refuse to use it. The use of ICT depends on the environment within which it is to be used, including the constraints, barriers and the attitudes of the users[14]. The students can use ICT independently if the designs provide enough degree of modification to assist the visually-impaired. The students should give sufficient training to empower them with ICT. They should also get enough assistance from their family members and friends. The society should learn many things to assist visually-impaired to enable them to live independently.

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