DEVELOPING ICT SKILLS OF VISUALLY IMPAIRED LEARNERS: A PERSPECTIVE FROM INDIAN PEOPLE

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Abstract: Education for visually impaired people is very important and they face several problems while studying with normal sighted people. The education environment for Visually Impaired Learners (VIL) requires some specific considerations in the development to guarantee the naturalness and intelligibility. E-learning is one the important way to educate disabled people efficiently. In this paper, we made an attempt to identify the problems faced by VIL during the development of Information and Communication Technologies (ICT) skills and suggestions are provided. A qualitative descriptive case study is done by 30 VIL in the view of ICT skills in Puducherry, India. The performance of VIL's computer usage recorded by screen capture software and they are analyzed based in their skills. In addition, the perception of VIL and their trainers are also investigated in the study. The outcome of the study implies that there is a need of rules for VIL to enhance their ICT skills.

Keywords: Visually Impaired Learners; ICT skills; OS; word processing; internet usage

1. Introduction

The recent advancement in wireless networks and advanced development in the field of Information Technology (IT) has drastically changes the universe in the last decade and fundamental need of learning in the future is also drastically changed. Knowledge is the very importance source for socio-economic development [1]. Efficient usage of computer and internet with higher education is the primary way to get a job. Communication skills are also essential for human life quality. Therefore, web and computer accessibility is highly required for education, employment and also in day to day activities. Though these advancements imposed the society in several aspects, it is a huge barrier for VIL who may suffers from accessing these visual cues in modern graphical user interfaces [2]. Additionally, VIL suffers from accessing web, accessing materials and computer trainings [3]. World Health Organization (WHO) announced that around 314 million people are suffered from visual impairedness; 45 million people are completely lost their vision. Turkey Disability Survey conducted a survey in 2002 and pointed out there are 412,313 visually impaired people in Turkey [4].

The world's largest number of blind people lives in India and the count is increasing 30,000 every year. Cataract is the primary cause for blindness in India. Every year approximately three million people develop cataract in India but the worst part is that almost half of these cases are curable, which when left unattended translates to complete or partial blindness [5]. Visual impairment refers to a person with sight loss which cannot be completely cured by glasses or contact lenses. Blindness indicates a person has the following conditions: VA <3/60-1/60, <1/60-PL and NPL. In India, people with VA < 6/60 is legally blind and the person with lower eye sight indicates a person with impairment of vision of less than 6/18 to 6/60 with better correction and the people with 20/20 is considered normal vision [6]. The number of VIL using computers is increasing [7]; still they have some barriers while using ICT tools due to no knowledge of fundamental ICT skills, training and training materials [8].

Because of the absence of ICT for socially vulnerable groups, it is needed to learn the ICT skills of VIL to give them same chance as normal sighted people [9, 10]. It is useful to enhance the professional career and also too mingled to the social environment.

Information & Communication Technology (ICT) is the way of learning, designing, developing, implementing, supporting or managing computer-based information system, especially software applications and computer hardware. ICT comprises of digital components and software to translate, secure, archive, process, communicate and access information in a secured manner. In 1970, ICT is introduced for education and then government realized the significance of ICT. Next,
they gave special attention to the use of ICT for disabled persons [11]. The main aim of this paper is to discuss the problems faced by VIL during the learning process of ICT skills and solutions are also suggested.

1.1 Organization of this paper

The remainder of the paper is formulated as follows. The existing techniques are reviewed in Section 2. The methodology to perform the case study is explained in Section 3. The results and discussion are given in Section 4. The paper is ended in Section 5.

2. Related Work

Several studies were made on VIL and ICT to design web pages and web accessibility. But, still the requirements of VIL are not completely satisfied. In this paper, a study on computer and Internet usage of VIL is conducted. The responsibility of VIL trainers is to teach ICT has two major challenges while improving ICT skills of VIL. A study is conducted among 10 VIL to perform a copy typing task, the elder VIL fails to have good working habits like bad touch-typing, shortcut keys are not frequently used, deficient in use adjustment of equipment, furniture and copy material. It suggested VIL for proactive and creative ideas to enhance skills and work techniques. [12] expressed technical accessibility issues as one of the additional limitations that VIL needs to handle. In [13] performed an experiment to identify the usability of access for web site accessibility, 6 VIL uses computers were investigated. This study revealed that the elder VIL finds highly useful with the modified web pages.

On the other side, the responsibility of VIL trainers is very important in developing their ICT skills. Though, numerous teacher preparation programs for VIL are available which fails to produce good performance. [14] indicated that teachers of VIL and deaf-blindness have lack of knowledge in particular fields of assistive technology, and [15] recommends the teacher education programs to educate trainers to get essential knowledge, skill and confidence to acts as a link between VIL and technologies to provide computer knowledge [16]. [17] explained the technologies and multimedia presentations by trainers of VIL. [18] designed a new distance education portal which enables VIL to use educational sources and materials. It allows to easily access various education packages with various contents. The proposed method is programmed using PHP; MySQL is used for the database. JAWS are employed as a tool for screen reading. HTML web pages are designed with HTML5 and CSS3 and it should be well-suited with JAWS. An education portal for VIL is developed with new tools, and the results are produced by use of JAWS. The software requirement analysis comprises of two levels: Determination and development of requirements, second is the requirement management process. To test the performance of the system, 3 scenarios were created and are validated by 32 visually impaired and normal students. Each scenario is tested independently with respect to time. The proposed method provides completely dynamic and interactive educational platform for blind people.

[19] discussed the issues faced by VIL and the solutions can be used to overcome the challenges. The available tools and techniques are also explained. E-learning concepts is suggested which provides the digital information to all people using computers and Internet. With the help of e-learning tools, all educational content are available to the students and they can easily communicate with the teachers. Learning management systems (LMS), Web-based trainings (WBT) and other e-learning applications and educational technologies are simple and user friendly technologies. These technologies are utilized by VIL to gain knowledge and life-long learning. By determining the level of disability, text document, audio/video or multimedia type of tools can be used. In the upcoming days, these technologies can fill the gap between normal and disabled people.

[20] discussed about an e-learning application for visually impaired people and also an e-learning application for the teaching English language to deaf and hearing-impaired people. This paper also provides a study which discusses the relationship between deaf and hearing impaired with technological advancements in Greece. The goal of this work is to support the distance and lifelong education, to ensure their equivalent access to information, knowledge, education and employment and also to reduce the gap in the usage of assistive technologies and e-learning platforms.

[21] proposed an e-learning environment designed for visually impaired people and teachers. This platform integrates various technologies which covers the communicative requirements and challenges of the VIL. In addition, it presents a chance to people for using alternate sensory routes like hearing and touch for simpler navigation. It also gives access web content
which intimates them initially and in long term it assures their equal access to information, knowledge, education and employment. The lifelong training-education of the trainer is treated as the important part of the project which improves the educational quality of the visually impaired in indirect form. These platforms basically depend on the knowledge and understanding of the blind people in a psychological perspective. It is necessary not only to support these blind people and also to improve other skills. It fulfills both specific personal and communicative requirements of the visually impaired people [22].

[23] The main goal of this work is to analyze the difficulties of VIL while accessing ICT skills and to recommend clarifications for these problems. [24] analyzed the experiences of visually impaired students in India in the view of e-learning. The goal of this work is to discover the learning experiences of 10 visually impaired online students to analyze their views on e-learning concept. The basic idea is "not to conclude a study but to develop ideas for further study" [25]. A cognitive and user-centered approach is employed to design understanding about this relationship. The cognitive way enables the visually impaired students to easily identify thought processes in the event of a difficulty. The user-centered view depicts the problem in the view of visually impaired students capabilities and requirements in online environment. In overall, this study reveals that visually impaired students believe the e-learning is a substitute for their traditional education environment. They also have some barriers which blocks them from participating in e-learning systems.

The Voice Activated E learning System [26] eliminates the problem of partial sighted and blind people. It helps to assist visually impaired students to learn in an easier way using voice commands. It has 2 key components; Speaker Verification and Speech Recognition subsystem. In the first subsystem, Mel-Frequency Cepstral Coefficients (MFCC) which can be employed for Feature extraction and Vector Quantization (VQ) algorithm is employed for codebook generation. In the speech recognition subsystem, MFCC and dynamic programming (DP) are employed. The experimentation proves that the accuracy of 96% in speaker verification subsystem and 89% in speech recognition subsystem. [27] performed a study to observe the attitude of 10 visually impaired people while performing copy typing task. The visually impaired adults suffer from ineffective working skills like poor touch-typing, lack of frequent shortcut keys usage, absence of adjusting equipment, furniture and copy material. [28] identifies extra barriers as technical accessibility problems for visually impaired people which need to be resolved. [29 also performed a study about the usage of web accessibility by the consideration of 6 visually impaired persons (2 male and 4 female). They performed 6 think-aloud assessments for comparison with default web display. The main intention of this study is to enhance the design by the detection of usability issues. The validated result proves that the tested persons are highly satisfied with the modified web site. [30] also performed a study to provide web accessibility of VIL advised web-site developers to be conscious in the requirements of visually impaired persons in the preparation of their information sites.

[31] is designed to eliminate the three challenges present in the integration of Text to Speech (TTS) technology [32] into screen readers. The system architecture of a TTS system is given in Fig. 1. The three challenges are natural language processing (NLP), speed and quality optimization. A new architecture with advanced features is designed to integrate TTS system to screen reading software as a supporting tool for VIL. Transliteration problems like greeklish are solved effectively using statistically driven transliteration technology for converting greeklish to Greek. This method is validated by subjective assessment tests in which the experts give feedback about performance, quality and overall experience.

3. Methodology

Qualitative descriptive case study research design and interview techniques are employed and the results are observed in the study. Interviews were conducted with same set of questions in same way to all participants. The questions are well organized to ask exactly the same questions [33]. In addition, the barriers faced by trainers in computer usage and web. The study is conducted in both computer lab and using screen capture software. For every observation “behavior check-lists” were employed as standard tools. We conducted a course for 3 months for VIL in computer usage and web. The VIL took 3 examinations in the course duration. The Actions of VIL students were taken by screen capture software (14.9 hrs) during examination and the skills of using OS, word processing and Internet usage are investigated in 3 various ways.
3.1 Participants

This training was organized in “Computer Operating for VIL” managed by a non-governmental institute in Puducherry, India. This training includes the fundamentals of Windows 7 OS, Word Processing and the fundamentals of Internet. 30 VIL are selected and attended the course. Among 30 VIL, 17 were male and 13 were female.

3.2 Data collection

The tools used to gather data for this study is listed below 1) Questionnaire for VIL (including 20 questions), (2) Questionnaire for trainers (including 16 questions), (3) Observation form of basic OSs skills, (4) Observation form of basic Word processing skills, (5) Observation form of basic Internet use skills.

4. Performance Evaluation

The actions of VIL to develop ICT skills like basic OS skills, basic word processing skills and basic Internet usage skills of VIL are explained here. The main difficulty VIL faced to develop ICT skills are tabulated in a table based completing a guideline, number of tries and time duration. The problems faced by VIL during the development of ICT skills are tabulated in Table 1. The views of VIL and trainers of VIL are shown in Figure 1 and Figure 2. In addition, the perception of VIL and their course trainers about the courses are explained as followed:

Basic OS Skills: 32 VIL finished 13 rules including basic OS skills in less than an hour on average. During the process, VIL can easily boot and shut down the computer, open a particular folder. But, they are struggling to add or remove software, finding a file or folder, printing particular copies of documents. Additionally, higher level of VIL suffers more while typing and tab key than low level VIL.

Basic Word Processing Skills: 32 VIL has undergone 13 rules including basic OS skills in less than an hour on average. During the process, VIL can easily change the font size and font color. But, they are struggling to underline words, save document and format font style. It is also observed that VIL facing difficulty to select a particular word and navigating menus.

Basic Internet Usage Skills: 20 VIL followed 10 procedures including basic Internet skills on an average of 38 minutes. During the process, VIL can easily use messenger by the use of shortcut key, shifting the home page in a browser. But, they are facing challenge in copy paste or website registration. Additionally, they took longer time to search content.

Views of VIL: VIL represented the reason of join training in computer course to get a job (4), learn using computer (4) and socialize (1). Less number of VIL felt that the courses are not sufficient. (4) and conveyed that government should provide numerous computer and Internet related courses (2). Since, they indicated that the period of the course is less and they can be extended.

One of the VIL questioned “how did computer and Internet affect your life?” as getting enormous amount of information faster (6), facilitating life (1) and leisure (1). They implied “logical mistakes (3), security image problem in website registration (2), software installation (1)” as barriers while using computer. Using excel sheets are also difficult to use for VIL. So, they require additional computer related courses based on the levels of visual impairment.

Views of VIL trainers: Increased number of trainers (5) indicated that they attended the training program since the program is not detailed enough for teaching assistive technology to VIL. They revealed that applied and repeated instructions are the highly useful techniques while training VIL in computer operating courses (5). A trainer felt the variation in perception and educational level among VIL played a negative role in the courses (1). Based on the observations of the trainers, VIL suffers highly while using spreadsheets (6), in the process of shortcuts and navigation of web pages (2) and menus (2). The problems that VIL meet in the development of ICT skills in this study are specifically the screen reader, which produces the audio output. Absence of screen readers is a major drawback in the addition and deletion of software. It is also noted that the keyboards used by normal sighted people is not useful for VIL. It is important to design the keyboard for VIL with unique size and latter labels. The commands like underline text, printing pages for 3 copies and search files and folders are not easily attained by VIL and they got confused between menus. They tried many attempts and took longer time to identify the suitable commands.
Next challenge is the Web accessibility of the VIL. In this study, the commands based on Internet are website registration, instant messaging and searching Internet. It is observed that VIL has no problems in instant messaging but finds difficult in website registration. In addition, they face barriers in copy paste task from a web page to a text document. Furthermore, higher level VIL fails to perform the task successfully and tried more number of times than lower level VIL. Since, these outcomes are mandatory while developing ICT related training courses.

Based on the view of VIL’s trainers of the VIL, the challenges that VIL faced in the computer operating course are due to lack of teacher training programs and course materials, no standard syllabus for ICT training, software issues and learner thinking variations. Using these outcomes, it is shown clearly that there is a need to design syllabus for VIL with new environment for ICT teacher preparation programs of VIL.

5. Conclusion

E-learning is one the important way to educate disabled people efficiently. In this paper, we made an attempt to identify the problems faced by VIL during the development of ICT skills and suggestions are provided. A qualitative descriptive case study is done by 30 VIL in the view of ICT skills in Puducherry, India. The performance of VIL’s computer usage recorded by screen capture software and they are analyzed based in their skills.

Table 1 Issues of VLI during the development of ICT skills

<table>
<thead>
<tr>
<th>Skill types</th>
<th>Actions</th>
<th>Score</th>
<th>No. of attempts</th>
<th>Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic OS Skills</td>
<td>Uninstall a software</td>
<td>16</td>
<td>12 4 4 4 4 1 1 2</td>
<td></td>
</tr>
<tr>
<td>Basic OS Skills</td>
<td>search file and folder</td>
<td>20</td>
<td>12 4 4 4 4 2 2 2</td>
<td></td>
</tr>
<tr>
<td>Basic OS Skills</td>
<td>Print 3 copies of document</td>
<td>24</td>
<td>8 4 4 4 4 4 4 2 1</td>
<td></td>
</tr>
<tr>
<td>Basic OS Skills</td>
<td>Installing a software</td>
<td>24</td>
<td>8 4 4 4 4 4 2 2 3</td>
<td></td>
</tr>
<tr>
<td>Basic Word Processing Skills</td>
<td>Underline word</td>
<td>4</td>
<td>28 12 8 4 4 4 2 0 3</td>
<td></td>
</tr>
<tr>
<td>Basic Word Processing Skills</td>
<td>Save document to disk</td>
<td>16</td>
<td>16 8 0 8 0 8 5 1 0</td>
<td></td>
</tr>
<tr>
<td>Basic Word Processing Skills</td>
<td>Format font style</td>
<td>20</td>
<td>12 4 28 0 0 5 2 0</td>
<td></td>
</tr>
<tr>
<td>Basic Internet Skills</td>
<td>Copy text from web page</td>
<td>12</td>
<td>8 4 0 8 8 0 0 3 1</td>
<td></td>
</tr>
<tr>
<td>Basic Internet Skills</td>
<td>Website registration</td>
<td>12</td>
<td>8 0 0 16 0 0 0 4 1</td>
<td></td>
</tr>
</tbody>
</table>

In addition, the perception of VIL and their trainers are also investigated in the study. The outcome of the study implies that there is a need of rules for VIL to enhance their ICT skills. While adapting to IT, there is a need to regulate the procedure in the design process of ICT skills. The absence of standard syllabus for VIP is the major problem. They also face barriers in the access of visual information. So, the web designers and developers should consider the requirement of VIL to motivate them to mingle with the socio-economic development with normal people.

References


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