Interactive Urdu Braille Learning System for Parents of Visually Impaired Students

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ABSTRACT
Braille literacy is one of the core pillars of education for visually impaired children. Previous studies have highlighted the importance of Braille for Visually impaired children by suggesting that students who read Braille outside of the classroom have higher reading speed and fluency. In resource –constrained countries, such as Pakistan, the visually impaired students may acquire the knowledge of Urdu Braille at special education schools. However, there is a dearth of resources for the parents of such children, when it comes to learning Urdu Braille. Therefore, we designed a web-based Urdu Braille Translator and interactive Braille learning tool to enhance the Urdu Braille learning experience for parents of visually impaired. The usability study of this tool was conducted with 15 parents of the visually impaired students.

KEYWORDS
ICT for Education; Special Education; Braille learning; Self-Learning

ACM CLASSIFICATION KEYWORDS
Human Factors, Performance, Languages, Evaluation

1. INTRODUCTION
Literacy of visually impaired people is a challenge all over the world. It is a mammoth task especially in developing countries. According to the WHO, 285 Million people are estimated to be visually impaired worldwide: 39 million are visually impaired and 246 have low vision [1]. According to a survey of National Federation for visually impaired, "less than 10 percent of the 1.3 million people, who are legally visually impaired in the United States are Braille readers" [2]. Xu, and Cheng developed applications based on TeslaTouch, a system that provides tactile sensation to moving fingers on touch screens [3]. Brailleplay has accessible games for Smartphone that teach Braille character encodings [4].

HoliBraille is a system to enables Braille input and output on mobile devices by using vibrotactile motors [5]. Furthermore, Braille Bug developed for learning English Braille through words games has been presented by *American Foundation for the Blinds* [6]. Besides the above mentioned systems, Araki developed self-learning system using speech technology for visually impaired to learn through audio dialogue [7]. *BrailleTouch* is an eye-free text entry in the Smartphone [8]. V-Braille is Braille touch on the standard phone using the touch screen [9].

The focus of this research is to develop an Urdu Braille Translator and an interactive application, which can assist parents to learn Urdu Braille.

Urdu Braille

Urdu Braille is six dotted (same as English Braille) Braille language used for teaching visually impaired teachers. It followed the UNESCO standard [2]. Urdu is written as Persian style from left to right but Urdu Braille written as Right to left.

2. URDU BRAILLE TRANSLATOR AND LEARNING APPLICATION
First, we developed a web-based Urdu Braille Font and an Urdu Braille Translator as per the standards proposed by the UNESCO [2]. Figure 1 is explaining our web based Urdu Braille translator.

The translated Urdu script can be imported to PDF or directly sent to embosser. Our custom Braille font for Urdu can be downloaded[1] to be used in the MS Word.

Figure 1: Web based Urdu Braille Translator

In the next step, we developed an Urdu Braille learning application for parents of visually impaired students. The Braille learning application has four main modules:

(1) A multiple-choice interface (figure 2) where against each picture learners see multiple Braille words and their task is to pick

[1] http://urdubraille.com/Urdu-Braille.zip

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the right word. If they pick a wrong word, an explanation is given and they are asked to go ahead with the learning exercise.

(2) An Urdu Braille reading module where participants are shown a Braille word and their task is to pick the right Urdu word.

(3) A fill in the blank module where learners are shown a Braille word and they are asked to type in the right Urdu word in the provide space.

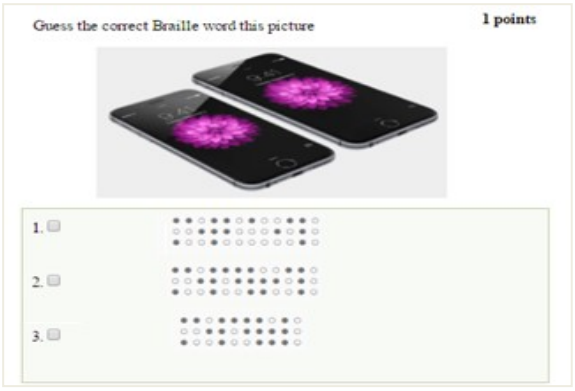


Figure 2: Braille learning application – MCQs interface.

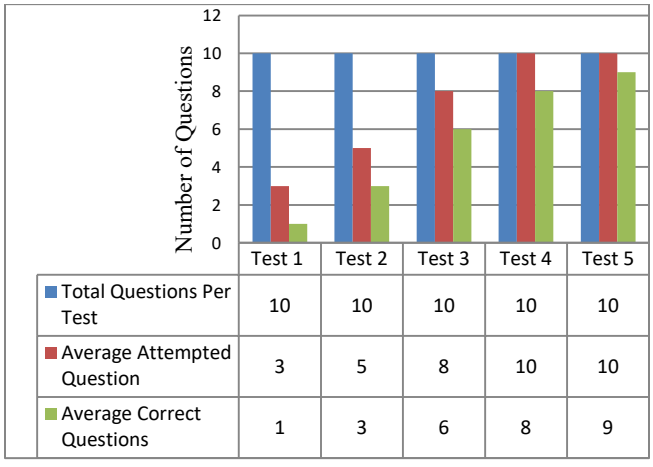
3. USABILITY TESTING

For testing the usability of both the application, we tested the method of learning Braille through self-learning Application with 15 parents (aged 28-45) of visually impaired students who never used Braille before.

We conducted five (5) tests in a period of one month with 15 parents. For these tests, the participants used Urdu script from *BBC Urdu* and translated it by using Urdu Braille translator. On the basis of their learning from translated Urdu script, they used online Braille learning application. In the Figure 3, Results are presented for all five tests. Before using these tests, parents were briefed with the use of application each and every step.

Average Attempted questions: Average questions attempted by all fifteen (15) participants. (Questions attempted /15)

Average correct Questions: Average of correct questions from attempted questions. (Correct Questions /15).



	Test 1	Test 2	Test 3	Test 4	Test 5
Total Questions Per Test	10	10	10	10	10
Average Attempted Question	3	5	8	10	10
Average Correct Questions	1	3	6	8	9

Figure 3: Five (5) Test bases comparison for 15 participants.

During the process of evaluation, the participants had different views to share about educating a special child. One of the Braille instructors suggested that "*Visually impaired students need individual attention from teachers and there is lot more effort required to start their early education". However, according to* one of the parents, *"start of early life education for my child was impossible due to mobility and accessibility issues".*

A female participant shared a view that, *"the idea of using the method of early classes textbooks (using the new system) is great to create interest and ease in learning".*

4. CONCLUSION & FUTURE WORK

A gradual increase in the participant learning by attempting questions correctly proved from the tests helped us to measure the effectiveness of the application. The printed Urdu text to Braille translation system has many interesting applications in schools, libraries and offices, where instructions and notices are to be read. Urdu Braille Translation system can be used for reproducing Urdu textbooks and publications for visually impaired people.

Training the parents in Braille language will enable them to help their children in studying efficiently while sitting in their homes. This study has opened interesting avenues for future. We aim to introduce this application in special educational schools which can guide parents and help them to learn the Braille.

5. REFERENCES

[1]. World Health Organization, "Fact Sheet: Visual impairment and visually impaired", October 2013, Web, July 01, 2014 http://www.who.int/mediacentre/factsheets/fs282/en/

[2]. Mackenzie, C. "World Braille usage." UNESCO,(1954).

[3]. Xu, Cheng, et al. "Tactile display for the visually impaired using TeslaTouch." CHI'11 Extended Abstracts on Human Factors in Computing Systems. ACM, 2011.

[4]. Milne, Lauren R., et al. "BraillePlay: educational smartphone games for blind children." *Proceedings of the 16th international ACM SIGACCESS conference on Computers & accessibility*. ACM, 2014.

[5]. Nicolau, Hugo, et al. "HoliBraille: multipoint vibrotactile feedback on mobile devices." *Proceedings of the 12th Web for All Conference*. ACM, 2015.

[6]. American Foundation for the Blinds *"Braille Bug"* http://braillebug.afb.org/

[7]. Araki, Masahiro, Kana Shibahara, and Yuko Mizukami. "Spoken dialogue system for learning Braille." *2011 IEEE 35th Annual Computer Software and Applications Conference*. IEEE, 2011.

[8]. Frey, Brian, et al. "From texting app to Braille literacy." CHI'12 Extended Abstracts on Human Factors in Computing Systems. ACM, 2012.

[9]. Jayant, Chandrika, et al. "V-braille: haptic Braille perception using a touch-screen and vibration on mobile phones." *Proceedings of the 12th international ACM SIGACCESS conference on Computers and accessibility*. ACM, 2010