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An Education Portal for Visually Impaired

Nilufer Yurtay^a, Yuksel Yurtay^a, M. Fatih Adak^{a*}^a *Sakarya University, Faculty of Computer and Information Sciences 54187, Sakarya, Turkey*

Abstract

It is a major problem for visually impaired people to access to information readily. Although, there are a plenty of written sources, the number of recorded sources are limited. So how can we make visually impaired to use online educational material? In this study, it is aimed to develop a distance education portal that makes educational materials and sources easily accessible to visually impaired. It enables an easy access to a variety of education packages with different contents and durations. The distance education portal developed in this study is coded in PHP, and MySQL is used for the database. JAWS is used as the screen reading software. HTML pages are coded using HTML5 and CSS3 technologies, and are designed to be compatible with JAWS. Distance education portal for visual impaired is designed using new tools, and successful results are obtained with help of JAWS screen reading software. The portal will provide the visually impaired with many dynamic and interactive educational opportunities. Therefore, it would be reasonable to use the portal to offer all or part of any special or vocational education in varying content.

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* Corresponding author. Tel.: +902642957049

E-mail address: fatihadak@sakarya.edu.tr

1. Introduction

The visually impaired individuals must learn the techniques related to meeting their daily personal needs. The essential subjects of such training start from the simple subjects such as eating techniques and making up the bed and extend toward peeling off the fruit, ironing, buttonholing, shining the shoes, cleaning, central, shaving, determining the time and finally, cooking techniques. In addition to them, training about modeling, Braille writing and abacus is also important for the visually impaired individuals.

Many studies are also carried out related to the vocational education for the visually impaired individuals. It has carried out the works developing the hand skills, providing the brain and finger coordination in the proper business lines during shop classes. The training related to acquiring the professions such as computer education, switchboard operation, massaging and DJ is provided commonly and face-to-face. It may be possible to allow the visually impaired individuals to access to some of these educations through the distance learning support.

It is found that as the orthopedically handicapped, hearing impaired, speech handicapped and mentally handicapped population is examined throughout Turkey, and the ratio of literate and illiterate individuals is 63.67 and 36.33, respectively. It is found that when all education levels of the orthopedically handicapped, hearing impaired, speech handicapped and mentally handicapped individuals are considered, the ratio in the urban area is higher than in the rural area and ratio in the men higher than in the women. (TUİK,2002). When the evaluation is made regarding the alma maters, the ratio regarding primary, secondary, high-vocational high schools and higher education is 40.97%, 5.64%, 6.90%, 2.42%, respectively.

In many studies in the literature, the face to face training is compared with the distance learning. As a result of this comparison, it is concluded that development in the information and communication technologies, then in the education field, called e-learning, accordingly increases the life quality of many individuals (Jones, 2005), (Kelly, 2007), (Latchman, 1999). (Holmgren, 2012) suggests that the distance learning students are more successful regarding the subjects such as research, exam, reflecting the course contents than the students, educated in the campus. It has been told about the distance learning and its advantages in many studies since 1990. Consequently, many universities or education institutions have the e-learning web sites established for distance learning. However, almost none of those sites are designed for the visually impaired users. Hence, those individuals may not get benefit from the advantages provided by e-learning. Many studies have been carried out related to the education of visually impaired students. (Salleha, 2010), examined the social behaviors of visually impaired students and pointed out the issues which they need or find missing during their education. (Freire, 2009) discussed the problems which the visually impaired students faced with while using the e-learning technologies and stated that many of those platforms were impractical for the visually impaired individuals. The e-learning platform, compatible with the interactive board and narrators, has been developed in order to solve this problem and has been operated in harmony with the visually impaired students and it has been stated that such approaches were very useful regarding learning.

In the study of (Cox, 2005), it has been determined what would be considered while providing education via web and the web site was established conforming to the technologies such as Jaws, Supernova that were required by the visually impaired individuals and was made consistent for them. (Chiang, 2005) assumed that the one's visual acuity would not be known exactly, and designed a system considering all visual acuity levels. The JAWS software, magnifier and Braille keyboard were used together in order to navigate in the web. (Yurtay, 2011) suggested a system which would allow the visually impaired students to get benefit from the advantages of library in the university using the speech synthesizing technology. (Junying, 2012) designed a system which the sighted and visually impaired individuals had the opportunity to take the exam on the same platform. (Ozgur, 2007) stated that they prepared the audio books of many books in the university library and helped to the education of visually impaired students.

Nowadays, e-learning platforms are not only the courses provided via web sites, but are the environments that the courses may be provided as if they are in the actual classroom and bear all activities. As a result of this, the learning and teaching may already be provided more effectively. This may also be possible for the visually impaired individuals and must be realized.

In this work, a distance learning portal was designed and prepared considering the needs of visually impaired individuals. The base structure of the portal, database relations was explained and the studies that might be executed in the future were discussed.

2. Education Portal and Accessibility Criteria

Many developments occurred in the internet and computer technology fields addressing to the disabled individuals recently. Especially, the letters on the screen may be read through the adapted technologies such as speech synthesizing or Braille visions (Subaşıoğlu,2010). However, when the today's web sites are considered, it is difficult that the visually impaired individuals may perform the procedure which he/she wishes among the dense video, picture and letter. In order to overcome these difficulties, either the designers should consider the accessibility standards while designing the sites or the visually impaired individuals should navigate through the certain tools while navigating among the sites. One of those tools is, for example, Kurzweil Education System addressing to a large mass. Kurzweil is a system using 300 software. This software may vocalize the printed text and the technologies that it uses are a synthesizer and an electronic scanner (Presley et al., 2009). The tools such as ZoomText and Lunar, which are developed for the partially-sighted individuals, allow for partially or fully selection and zooming of the visions on the screen (Chiang et al., 2005). Jaws program is a screen-reading program. It reads aloud the part which the user selects on the screen. As the visually impaired individuals may communicate through the software, they may also communicate through the hardware products. The example for this is the Braille input-output hardware. Braille is a special system which allows the visually impaired individuals to access to the texts. As this can be made through a keyboard, it may also be used with an embossed monitor (Jimenes et al, 2009). Various tools using Braille were developed (Hughes et al, 2011; Jianga et al, 2002; Debowska et al, 2013). However, as those tools analyze the sites, they follow the certain rules. In addition, it requires the more detailed operations other than navigating in the sites such as education portal. Hence, the tools, used by the visually impaired individuals, may experience the problems as navigating in such sites. For this reason, if there are visually impaired or partially-sighted individuals among the site users, then some criteria should be met in designing the site. In this work, it has been tried to establish those criteria and they have been tested in an Education portal by a pilot study. The purpose of those criteria is to allow the visually impaired individuals to access to the contents faster and more accurately and that the tools, which they use, don't encounter with a problem in the site.

In this work, the software requirements were determined at the stage of software requirement analysis, and the system requirement document and interface requirements document were prepared. Software requirement analysis consisted of two stages. First is the process of determining and developing the requirements, second the requirement management process which those requirements would be managed during the entire software lifecycle. All requirement analysis methodology is determined under the consultancy of visually impaired computer operator as a result of joint work with the distance learning portal software developers and includes the following headings:

- The fixed clicking (access) point should be determined through the picture and other animated objects' grammatology. The detailed information should be inserted to the characteristics such as sub-characteristics of the pictures and similar objects used in the site. For example, "".
- Customized combo boxes (selection boxes) should be accessible.
- The work of reader programs should be made easy. The easy readability may be provided through the arrangements to be made on the shortcut keys of screen reader programs instead of special shortcut keys in the site. (e.g.: using the headers in the fundamental structure of Html.)
- The accessibility and usability should be increased through the structures such as Anchor in the site. The reader programs should be used in order to allow for controlled passage of structures such as anchor from one point to another in the same page.
- Easy availability in the pages should be provided. The unnecessary information in the pages should be removed and redundancy should be eliminated.
- The structures like flash should not be used excessively. Even if such additions don't create problem for presentation in the site, then the screen reader programs may cause the problem at this point.
- The structures like toolbar should not be used. Such structures may lead to the confusion as the unnecessary fields in the reader programs.
- There should be letter size adjustment for the partially-sighted individuals. It should be possible to zoom the letters on the screen for the partially-sighted individuals. This method may also be provided through the script languages such as JavaScript for the main texts.

- The headers should be in place and detailed. Since the screen reader programs runs especially through the headers, they provide easily accessing to the other points as well as to the position.
- The designs should be made compatible with the scanner to be used. Those, which are supported by some scanners, may not be supported by others. At this point, the standard terms, which usually run in the encoded sites and the screen reader program would not face with consistency problem, should be used.
- The page continuity should be provided. The page should have the special links which allow for returning from current page to the main page or changing it to the other page. (such as paging and index links)

In this work, the criteria, determined through the researches on the visually impaired individuals and through the studies in the literature, were blended and given attitudinally in the Table 1. The principles in the Table 1 cover not only the visually impaired individuals, but are directly in relation with the visually impaired individuals.

Table 1. Web contents’ accessibility standards (Centeno et al., 2010; Leuthold et al., 2008).

	Principle	Target
1	The menu structure should be in the numbering basis.	Fast showing it
2	All objects in the interface should have the names.	Modeling
3	The buttons should come after the inputs and information in all kind of forms.	Quality
4	One should avoid using the unnecessary words.	Quality and Quickness
5	The frame should be established in the page using the similar elements	Consistency
6	All pages should have the navigation menus and they should be consistent.	Consistency
7	There should be a general navigation menu and the links at the end of page in order to provide the continuity.	Consistency
8	The scanning field to be placed on the page should be able to access to all pages.	Quality and Quickness
9	All visuals, inserted for page arrangement, should be removed and they should be prepared through CSS without using visuals.	Quality and Quickness

Education portal was designed using PHP and HTML5. In this work, mostly HTML is emphasized based on the criteria. The system design consists of 4 base components. All subjects related to the system architecture as well as to the hardware structure, communication infrastructure, security structure, application structure were designed as the system’s general structure and all structural features of that education portal were showed up. The database, prepared in MySQL database for the Database Design, has 13 tables as seen in the Figure 1 table diagram. In this diagram, the Foreign Key relations between them were also indicated.

The prepared portal interface draft was tested and evaluated by the visually impaired consultant. The functional process related to each step was cyclically planned. The students access and listen to the course documents online and whenever they wish, download them to their computers and repeatedly access to those documents. The web site interface and all interfaces were tagged and prioritized consistent with the screen reading program which they will be correlated with in the Web Site Interface Design. The attention was paid to all above criteria in all pages. HTML sample summarizing it was taken from the Education Portal and listed in the Figure 2. As seen in the Figure 2, the attention was paid to the menu structure hierarchically and the simplicity was provided (Figure 2. (1)). It was avoided using excessive pictures and the bottom and title tags in the pictures were certainly completed (Figure 2. (2)).

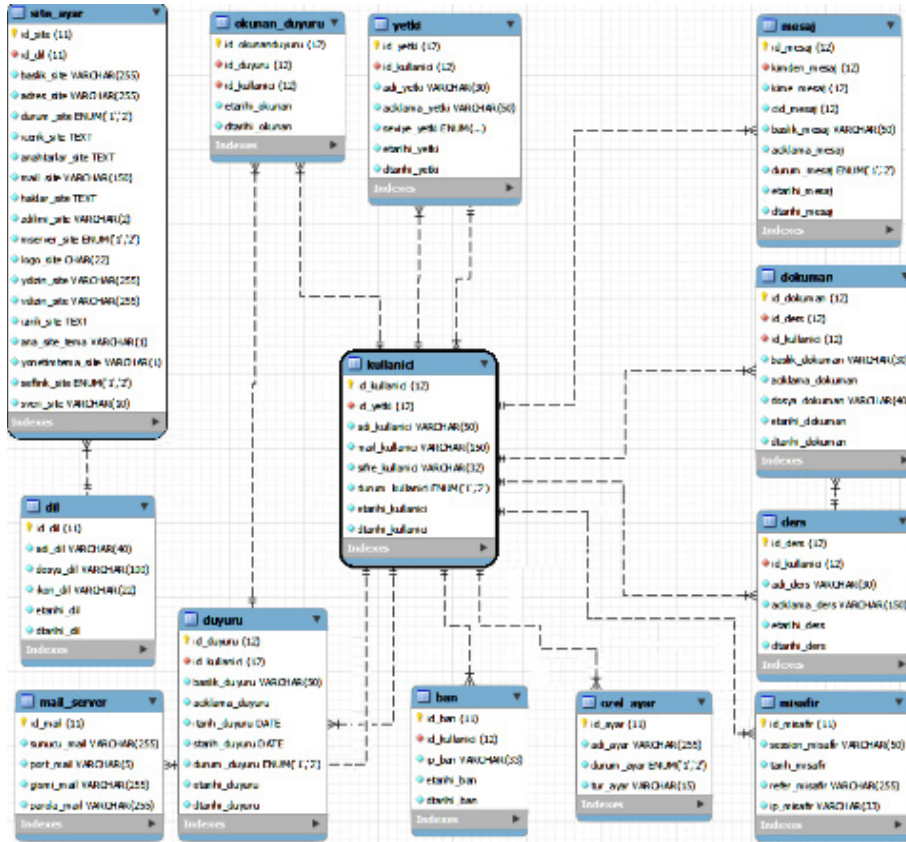


Fig. 1. Database diagram.

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<span>Dişisel Ayarlar</span>
</a>
</li>
<li>
<a href="anassayfa.php?Bolum=Ders@oranla" class="icon-menu corners">

<span>Dersler</span>
</a>
</li>
<li>
<a href="anassayfa.php?Bolum=Sinav@oranla" class="icon-menu corners">

<span>Sinavlar</span>
</a>
</li>
<li>
<a href="anassayfa.php?Bolum=Somu@oranla" class="icon-menu corners">

<span>Somuqlar</span>
</a>
</li>
<li>
<a href="anassayfa.php?Bolum=Dokuman@oranla" class="icon-menu corners">

<span>Dokumanlar</span>
</a>
</li>
</li>

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Fig. 2. HTML design.

3. Performance Evaluation

3.1. Content of Education Portal

The education portal, which is developed for the visually impaired individuals, includes the following main steps:

- Registration to the education portal without charge
- Displaying the available education headings, course registration and if one desires, sending request for a new education program
- Listening and downloading the course document which s/he is registered.
- Attending the pilot tests of the course which s/he is registered
- Establishing communication between the administrator, teacher and students registered in the portal through the forum.
- Attending the virtual live lessons related to the course which s/he is registered.
- Following the announcements.

3.2. Education Portal Tests

3 scenarios were created in order to determine the usability of education portal by the visually impaired individuals and the tests were carried out through each of 32 visually impaired and unimpaired individuals. The scenarios were evaluated separately and regarding the time using in the test procedures. Table 2 lists the scenarios. The steps in the scenarios were described in the simple and comprehensible manner and were introduced to the volunteered subjects previously. The computer using degrees of volunteered subjects are at least at the medium level.

Table 2. Education Portal Test procedure scenarios

<p>Scenario 1: Registering to the Website</p> <ul style="list-style-type: none"> • User logs in to the website. • Clicks the Register button. • Completes the user name, mail address and password sections in the opened page. • Clicks the Save button. <p>Scenario 2: Downloading the Course</p> <ul style="list-style-type: none"> • User logs in to the site. • If not registered, performs the registration scenario. • If registered, completes mail and password sections and enters the site. • Lists the courses in the Courses tab. • Clicks the tab “go to course document” beside the relevant course. • Downloads the relevant document clicking download button next to it. <p>Scenario 3: Test</p> <ul style="list-style-type: none"> • User enters the site. (Assumed that s/he is registered and downloaded and read the course documents) • Completes the mail and password sections and enters the site. • Displays the tests from the Tests tab. • Finds the relevant test and clicks the start the test button. • Answers the questions in an order and goes to the next question. At the same time, s/he may pass between the questions. • When s/he completes the test, clicks the save button and finishes the test.

Table 3 shows the observed average times for the scenarios. The correlation between the visually impaired and unimpaired subjects is very close to “+1” value. This means that there is not any negative progression in the scenario processes for the visual impairment. Figures 3, 4 and 5 show the times used by the visually impaired and unimpaired subjects for each scenario in second. It is observed generally from the test results that the visually unimpaired individuals realize the scenarios shorter than the visually impaired individuals.

Table 3. Average realization times for the scenarios.

Scenario	Scenario processing times according to the Impairment Situation		Correlation
	impaired	unimpaired	
1 Registering to the Site	90,22	75,22	0,9800
2 Course Downloading	143,59	130,59	0,9947
3 Test	3050,31	2665,31	0,9891

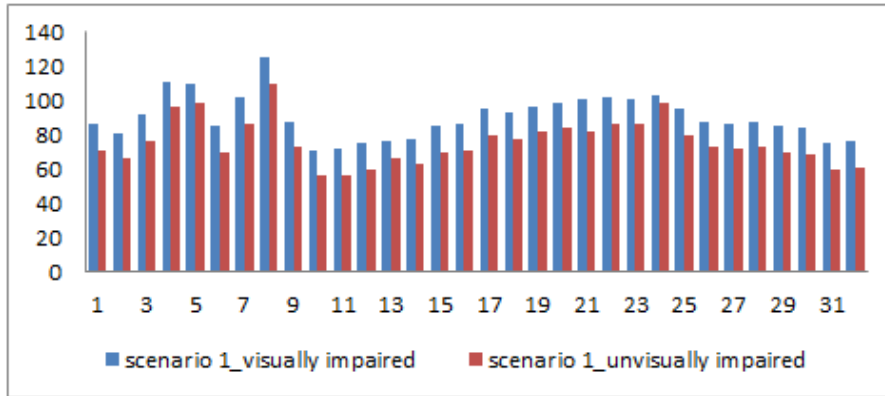


Fig.3. Test results according to the scenario 1.

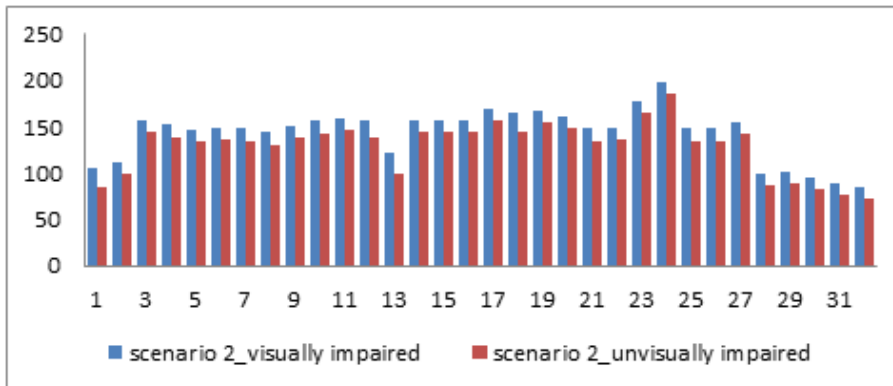


Fig.4. Test results according to the scenario 2

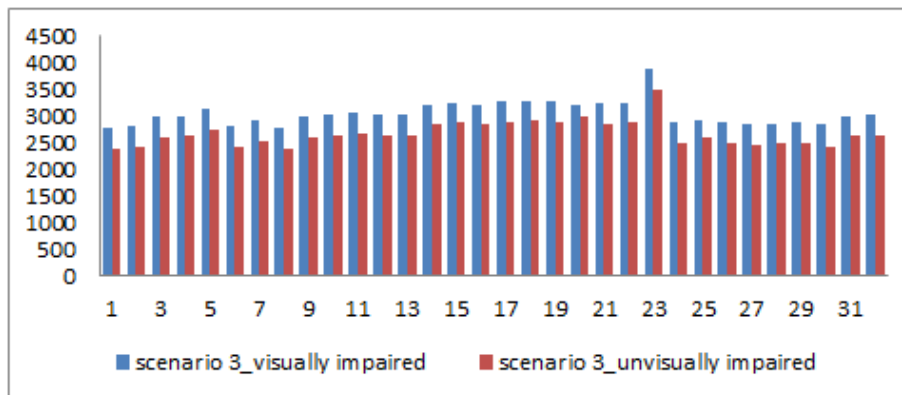


Fig. 5. Test results according to the scenario 3.

Figure 6 summarizes the significant results from the poles performed for the feedbacks from the visually impaired volunteered subjects. The pole consists of open-ended questions and allows for evaluation related to the content of education portal. They stated that they have the expectations related to the sociology, literature, public relations, religion, psychology, international relations and all other verbal courses. The visually impaired users clearly mentioned that they have difficulty in the quantitative subjects, and especially they are not successful in math. In the pole, the participants selected more than one field and did not prioritize any selection.

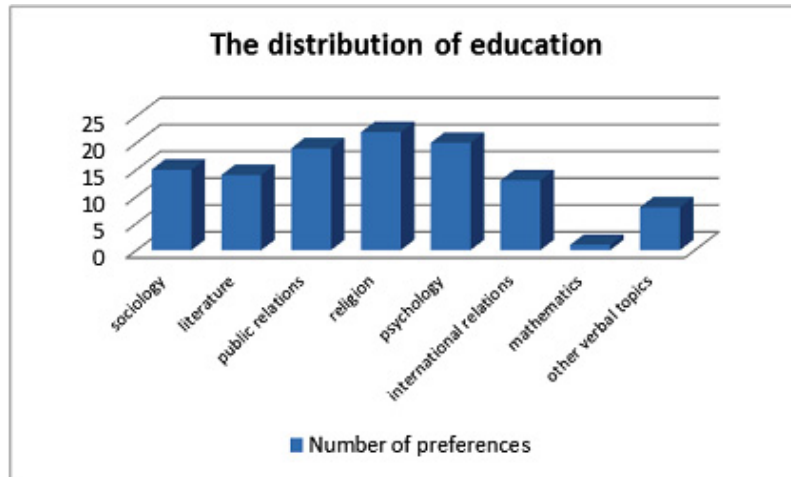


Fig. 6. 3. Subject fields that the visually impaired subjects concentrate on.

4. Conclusions

In this work, when the available technological possibilities and education materials were brought together through the developed distance learning portal for the visually impaired individuals, it was assumed that the education quality of visually impaired individuals would increase and for this, the education portal was prepared. This portal would provide many opportunities to the visually impaired individuals for the dynamic and interactive education. The education and socializing would be common together. Portal has a structure which organizes the educations in the various lengths. A structure, which was interactive with listening the course, test, forum, messaging environments, was established. The comments from the visually impaired individuals related to the portal are satisfactory. For this reason, the educations, which meet fully or partially both the personal and vocational training on the subjects in the various contents and to be determined by the visually impaired individuals, may be provided through this portal. The course contents should be prepared by the experts and should be arranged consistent with the auxiliary tools which the visually impaired individuals use.

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References

- Jones, J. G., Morales, C., Knezek, G. A., (2005). "3-Dimensional Online Learning Environments: Examining Attitudes Toward Information Technology Between Students in Internet-Based 3-Dimensional And Face-to-Face Classroom Instruction", *Educational Media International*, Volume 42, No. 3, (pp. 219–236).

- Kelly, H. F., A., Ponton, M. K., Rovai, A. P., (2007). "A Comparison Of Student Evaluations Of Teaching Between Online And Face-To-Face Courses", *Internet And Higher Education*, (pp. 89-101).
- Latchman, H. A., Salzman, C., Gillet, D., Bouzekri, H., (1999). "Information Technology Enhanced Learning in Distance And Conventional Education", *IEEE Transactions On Education*, Vol. 42, No. 4. (pp. 247-254)
- Holmgren, R., (2012). "Preparations For Practical Exercises in Vocational Education: Can ICT-Based Distance Instruction Be An Alternative To Face-To-Face Instruction? An Empirical Contribution", *Procedia - Social and Behavioral Sciences*, Volume 46, (pp. 1152 – 1161).
- Salleha, N. M., Zainal, K., (2010). "How And Why The Visually Impaired Students Socially Behave The Way They Do", *Procedia Social And Behavioral Sciences*, Volume 9, (pp. 859–863).
- Freire, A. P., Linhalis, F., Bianchini, S. L., Fortes, R. P. M., Pimentel, G. C., (2009). "Revealing the whiteboard to blind students: An inclusive approach to provide mediation in synchronous e-learning activities", *Computers & Education*, Volume 54, (pp. 866–876).
- Cox, R., (2005). "Devising A Blend Model Of Learning Accessible To The Training Of Sighted And Vision Impaired Rehabilitation Workers", *International Congress Series (Ics-Elsevier)*, (pp. 75-79).
- Chiang, M. F., Cole, R., Gupta, S., Kaiser, G. E., (2005). "Computer And World Wide Web Accessibility By Visually Disabled Patients: Problems And Solutions", *Survey Of Ophthalmology* Volume 50, Number 4, (pp. 394-405).
- Yurtay, N., Bici, Y., Celebi, S., Çit, G., Dural, D., (2011). "Library Automation Design For Visually Impaired People", *TOJET: The Turkish Online Journal Of Educational Technology*, Volume 10, Issue 4, (pp. 255-260).
- Junying, A., Baiwen, F., (2012). "The Application And Efficiency Analysis Of Exam Platform For People With Visual Impairments", *IEEE Symposium On Robotics And Applications (ISRA)*.
- Özgür, A. Z., Kıray, H. S., (2007). "Evaluating Audio Books As Supported Course Materials In Distance Education: The Experiences Of The Blind Learners", *The Turkish Online Journal Of Educational Technology – TOJET*, ISSN: 1303-6521, Volume
- TUİK , (2002). <http://kutuphane.tuik.gov.tr/pdf/0014899.pdf>
- Subaşıoğlu F., Engellilerin İnternet'e erişimi üzerine, *Ankara Üniversitesi Dil ve Tarih Coğrafya Fakültesi Dergisi*, 3-4 (2010), pp.203-216.
- Presley I., D'Andrea F. M., *Assistive Technology For Students Who Are Blind or Visually Impaired*, Amer Foundation for the Blind, USA, 2009.
- Chiang M. F., Cole R. G., Gupta S., Kaiser G. E., Starren J. B., Computer and world wide web accessibility by visually disabled patients: problems and solutions, *Survey of Ophthalmology*, 50/4, 2005, pp.394-405.
- Jimenes J., Olea J., Torres J., Alonso I., Harder D., Fischer K., *Biography of louis braille and invention of the braille alphabet*, *Survey of Ophthalmology*, 54/1, 2009, pp.142-149.
- Hughes B., Gemmert A. W. A., Stelmach G. E., Linguistic and perceptual-motor contributions to the kinematic properties of the braille reading finger, *Human Movement Science*, 30/4, 2011, pp.711-730.
- Jianga M., Zhub X., Gielenc G., Drábekb E., Xiab Y., Tanb G., Baob T., *Braille to print translations for Chinese*, *Information and Software Technology*, 44/2, 2002, pp.91-100.
- Debowska W., Wolakb T., Soluch P., Orzechowski M., Kossuta M., Design and evaluation of an innovative MRI-compatible Braille stimulator with high spatial and temporal resolution, *Journal of Neuroscience Methods*, 213/1, 2013, pp.32-38.
- Centeno V. L., Kloos C. D., Fisteus J. A., Alvarez L. A., web accessibility evaluation tools: A survey and some improvements, *Electronic Notes in Theoretical Computer Science*, 157, (2006), pp.87-100.
- Leuthold S., Bargas-Avila J. A., Opwis K., Beyond web content accessibility guidelines: Design of enhanced text user interfaces for blind internet users, *Int. J. Human-Computer Studies*, 66, (2008), pp.257-270.