

M-Learning for Blind Students Using Touch Screen Mobile Apps Case Study- Special Education in Hail

Abdelrahman H. Hussein¹, Majed M. AlHaisoni¹, Ashraf A. Bany Mohammed², Mohammed Fakrudeen³
¹College of Computer Sciences and Engineering, University of Hail, Hail, Kingdom of Saudi Arabia

²School of Business, The University of Jordan, Amman, Jordan

³Dept. of Computing and Technology, Anglia Ruskin University, Chelmsford, United Kingdom

Abstract- The relative newness of the touch-screen (TS) based device creates a phenomenon unique and unstudied in the academic environment with regard to blind students dependent on Braille. This qualitative research study explores how the use of a multi-modal touch-screen based device affects the academic environment for totally blind students using YouTube videos. The pilot program (android app) included a prototype for the English course offered to fifth grade level pupils attending primary school in Hail, KSA. Data collected from students through a survey and focus group interviews and from the faculty through individual interviews was coded and organized according to the research questions. Findings analysis was organized by way of the study's conceptual framework: (a) substitution of Braille course materials with YouTube video lessons (b) accessibility and usability of the developed prototype. Findings concluded that the majority of students in this study perceived YouTube course materials on an touch-screen based device (using android app) to be as good as, or better, than Braille course materials, the multi-modal functionality of the touch-screen based device augmented personal study and classroom learning, and the personal use positively contributed to academic use of the device.

Keywords- Accessibility; Usability; Touch screen; M-learning; YouTube videos; and Blind students

I. INTRODUCTION

Over the centuries, major shifts in literary technology have circled around usability, durability and ease of reproduction. Blind users of touch-screen technology necessarily depend on other cues to users who are not visually impaired. The successful merging of these factors could enhance the effective reading for blind students and create the next advance in literary technology. According to World Health Organization (WHO) figures in 'Global Data on Visual Impairments 2010' published by WHO, Prevention of Blindness and Deafness (PBD) [12], "285 million people worldwide (4.24% of the general population) are visually impaired. 39 million are blind and 246 million suffer low vision (severe or moderate visual impairment)." KSA is not listed as a country contributing data though its nearest listed geographical region probably includes it in the Eastern

Mediterranean Region (ERM). "The 21 countries in the Eastern Mediterranean Region were sorted into two clusters of PPP (Purchasing Power Parity). The first included 13 countries classified as LI (Low Income) and LMI (Lower Middle Income), the second 8 countries classified as UMI (Upper Middle Income) and HI. Data from three countries in the LI/LMI cluster and from one in the UMI/HI cluster were available for estimates." For this region with a population of 580.2 million, 12.5% are recorded as blind, 7.6% recorded as having low vision and 8.2% recorded as having visual impairment. As can be surmised from the quote above, these figures include countries with low income and where incidence of blindness is more prevalent. These figures suggest that KSA may well have a lesser incidence than 12.5% general population blindness. Furthermore the percentage population of blind students would most probably fall below the age of 50, a group which represents 20% of the general population but which currently displays incidence of blindness at 82%. So, although the sample may be small, data collection for this age group and their socio-economic status is expected to produce meager numbers. The results of 25 students in this age band in a city with a population of 412,758 (2010 census) might not stand scrutiny for significant results analysis in the wider population, but they provide positive encouragement for further investigation in a limited field, specifically academia.

This study sought to gain a better understanding of the accessibility of the YouTube phenomenon in the academic environment, specifically for blind students. Knowledge gained from this research can provide increased understanding and inform future developments to incorporate a visually-impaired appropriate, readily accessible YouTube lecture video device in school education. Participants in this study were blind pupils from a public high school in Hail, KSA.

The paper has been organized according to the following sections: Section-1 is the introduction to the research. Section 2 and 3 consists of problem statements and research questions Section-4 consists of the background information and related technological terms. Section-5 contains the research methodology describing the simulation scenarios and the

required configuration. Section-6 analyses the results which is then followed by the conclusion

II. PROBLEM STATEMENT

YouTube EDU had grown to include more than 300 colleges and universities and over 65,000 videos of lectures, news, and campus life were freely available for public viewing [4]. These videos comprise only a portion of the content on YouTube with potential educational value. While it is important to find academic uses of YouTube technology, very little is understood about the accessibility of YouTube videos using touch-screen devices for blind students. Most modern pilot programs with YouTube videos have provided anecdotal feedback instead of rigorous academic research about what influence this will have on education. The adoption of the touch-screen device for blind students has not been researched at all in an academic environment.

III. STATEMENT OF PURPOSE AND RESEARCH QUESTIONS

The purpose of this paper was to explore what could be learned from participant experience of the pilot program utilizing YouTube lectures presented on an android touch-screen based device. Better understanding of m-learning functionality in an academic environment may enhance future effort in substituting Braille print materials for digital materials. Thus, the following research questions were addressed:

1. How do video lectures on an touch-screen mobile affect blind students?
2. How does the accessibility of YouTube lectures using mobile touch-screen affect blind students?

To investigate this phenomenon, the researchers conducted a qualitative case study with the students of the pilot program. This research informs faculty, institutions, and mobile app developers on how to improve the device for future adaptation in the academic environment.

IV. LITERATURE REVIEW

The overall convergence of e-book availability and e-reader technology has laid the foundation for the societal shift from print text to digital text. Now that e-readers are cost-reasonable and more content is available, schools are investigating the use of these devices in the academic environment. However, there is a lingering question of whether students will accept the substitution of printed course materials with digital course materials.

Video is now a common form of media on the Web. The growth of online video is beneficial for those who teach and learn online, as access to video on a broad spectrum of topics becomes increasingly available. The exact amount of video currently hosted online is not known, but the Blinkx (<http://www.blinkx.com>) video search website reports having indexed 35 million hours of video.

Video is not only widely available, but also popular among Internet users. A report from Pew Internet & American Life states that 69% of U.S. internet users watch or download video online and 14% have posted videos [6]. Studies of worldwide Internet traffic from Cisco (2010) [2] also suggest rising interest in video, which now accounts for 26.15% of global broadband traffic. Cisco further reports that over one third of the 50 most heavily visited websites are video sites. Internet traffic rankings from Alexa (2010) [1] and comScore (2010) [3] reveal that YouTube is the most highly visited video destination of them all. Since its creation in 2005, YouTube (<http://www.youtube.com>) has gained meteoric popularity as an online video-sharing website. At the end of its first five years of service, YouTube was receiving more than 2 billion views per day (YouTube, 2010) [11] and users were uploading more than 35 hours of video per [10].

Although YouTube was created as a video-sharing service for the everyday user, the potential for educational use has not gone unnoticed. Over time, scores of colleges and universities have established a presence on YouTube by creating their own video-sharing WebPages called YouTube channels. In March 2009, YouTube announced the launch of YouTube EDU (<http://www.youtube.com/edu>), which is an organized collection of YouTube channels produced by college and university partners. At the end of its first year, YouTube EDU had grown to include more than 300 colleges and universities and over 65,000 videos of lectures, news, and campus life were freely available for public viewing [4]. These videos comprise only a portion of the content on YouTube with potential educational value.

The growth of educational video on YouTube runs concurrent with broader trends in educational video viewership, which rose from 22% to 38% between 2007 and 2009 [6]. Those who seek educational video have numerous places to look for content, including websites created specifically for the purpose of disseminating educational video. It is beyond the scope of this article to delve into a detailed analysis of all of the websites offering academic video content, which has been written about elsewhere [5]. However, a few examples serve to illustrate the breadth of educational video websites. The adult academic audience may enjoy video websites such as Academic Earth (<http://academicearth.org>), BigThink (<http://bigthink.com>), Fora.tv (<http://fora.tv>), and TED (<http://www.ted.com>). K-12 teachers or children may prefer educational video sites like Teacher Tube (<http://www.teachertube.com>) or Watch Know (<http://www.watchknow.org>). It should be noted that some crossover occurs between educational video websites and YouTube. For example, Big Think, Fora.tv, TED Talks, and Teacher Tube each maintain YouTube channels in addition to independent educational video websites. Watch Know also pulls content from YouTube and other video websites for embedding and ranking on its main website at <http://www.watchknow.org>.

The potential of YouTube for online education has been examined previously [9]. One of the obvious benefits of using YouTube in online education is that it provides online access

to vast quantities of free public video on a broad spectrum of topics. It is a simple matter to link to or embed YouTube videos in online course content or discussion forums. Content management is also a benefit. Online educators can establish YouTube channels to collect, organize, host, and distribute video. YouTube videos may be grouped into one or more "Video Playlist Lessons," which are created by collecting videos into a playlist then typing a lesson plan into the playlist description area. Playlist lessons have been created to meet learning objectives across the cognitive, affective, or psychomotor learning domains in real-world online classrooms [7]. Online educators may also create interactive video games, simulations, or tutorials by linking videos together through the Annotations tool on YouTube [8].

In July 2010, Snelson (2010a)[7] published the results of a study that compared the speed of reading on different devices. This research measured reading speed on a personal computer, printed book, Amazon Kindle, and the Apple iPad. The participants met all comprehension objectives, but read 6.2% slower than print on the iPad and 10.7% slower on the Kindle. Nielsen ultimately determined the results not statistically significant to conclude that reading is actually slower on an e-reader. However, a surprising finding indicated the participants found the reading of print more relaxing than reading electronic text.

In June 2009, the National Federation of the Blind (NFB) and the American Council of the Blind (ACB) filed a lawsuit against Arizona State University regarding their pilot of the Kindle DX in a college course. The device's inability to be fully used by blind students violated both the federal Americans with Disabilities Act and the Rehabilitation Act of 1973 (Case 2:09). The lawsuit was settled out of court in January 2010, and served as a message that all e-readers, if used in an educational setting, must be accessible by all students. On June 29, 2010, the United States Department of Justice and Department of Education jointly published a letter to college and university Presidents reiterating the results of the lawsuit and mandating compliance in the future.

The researchers also examined different navigation modes for presenting text material: page-by-page (paging) or scrolling. Ninety percent of polled users preferred paging in the portrait layout. E-reading for pleasure was exclusively linear. The table of contents was the most important feature of e-text—followed by hyperlinks, illustrations, page numbers, headings, and highlighted words. On the e-reader itself, users highlighted legibility, portability, easy navigation, ample storage and ease of use as important attributes. 78.9% percent preferred reading on a dedicated e-reader compared to a computer screen. "96% disagree with the statement that the e-reader makes them lose the context of what they read, and more than 70% feel they can both deep read and skim with their e-reader".

V. METHODOLOGY

This section outlines the research methodology that was used in this case study with the following sections: 5.1

rationales for qualitative case study method, 5.2 research questions and propositions, 5.3 data collection methods.

5.1 Rationale for Qualitative Case Study Method

This research explored what could be learned about accessibility to YouTube video lectures from participant experience of the pilot program utilizing an android touch-screen based device. This study was explicitly interested in participant reception derived from the experience using video lectures on a touch-screen device, with a specific application within the social context of the pilot program. Therefore, qualitative research was an appropriate match for the intent of this study.

The context of the case included the pilot program faculty and pilot program student experience of using video lectures presented within touch-screen mobile using android. Holistically, the subject of this study was not the participants themselves, but the participants' perceptions of using video lectures using a touch-screen mobile device and the accessibility in dealing with it.

5.2 Research Questions and Propositions

The study propositions, also known as the theoretical framework of a qualitative study, were derived from the literature review (Merriam, 1998)[13]. The research questions with their ancillary propositional questions were as follows:

Q1. How do students perceive video lectures on touch- screen based mobile?

1.1 How does the replacement of Braille course materials with video lectures, regarding frequency of listening, affect students?

1.2 How does the replacement of Braille course materials with video lectures, regarding duration of reading, affect students?

1.3 How does the replacement of Braille course materials with video lectures, regarding speed of reading, affect students?

1.4 How does the replacement of Braille course materials with video lectures, regarding understanding of course materials, affect students?

1.5 How does the replacement of Braille course materials with video lectures, regarding class participation, affect students?

Q2. How does the accessibility of YouTube lectures using touch-screen mobile affect students?

To answer these questions, the following feedback was taken using Likert type scale (1-Strongly, Disagree, 5-Strongly Agree) questionnaire with respect to the original prototype developed by The University of Hail / College of Computer Science and Engineering (Fig. 1).

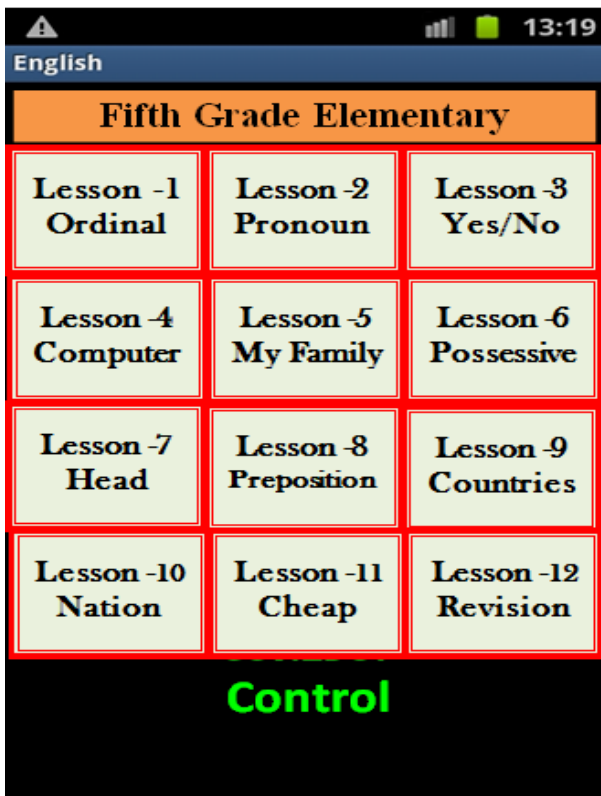


Fig. 1 Prototype Design

5.3 Data Collection Methods

All methods of data collection may be used in case study research (Creswell, 2009; Merriam, 1998; Yin, 2009). In this paper, multiple methods of data collection were utilized in researching the Samsung Galaxy Touch-screen at the Public School, Hail. Data collection for this study occurred between 4th January 2015 and 4th February 2015. The survey and focus group methods were used for blind student participants. Research was divided into three sections. Firstly, a pilot test was conducted using an original prototype developed by University of Hail. Secondly, blind students completed questionnaires to satisfy the first research question. Thirdly, feedback based on the prototype's accessibility, was taken.

The survey method was the best fit to collect data about the blind student feedback at school level. The survey collection tool was selected based on the survey's strength of being unobtrusive, while allowing the researcher to collect information directly from a large group of participants. Typically considered a quantitative tool, in this study a survey was used to build a more complete picture of the processes and perceptions of students' experiences with the digital course materials. The survey used both closed and open-ended questions.

These open-ended questions helped provide insight into the participants' experience and perceptions. The quantitative data collected by the survey is presented and analyzed utilizing descriptive statistics to inform the qualitative study.

The student survey instrument was developed directly from the primary research questions and their supporting propositions. Each survey question was tied directly to one or more proposition.

VI. RESULTS AND DISCUSSION

The following is a presentation of the findings. The first research question is supported by multiple propositional questions. These propositions act as a guide to inform the research questions from across the research tools. Each proposition will be given a preliminary finding, which will then be collected into an overall finding for the first research question.

Research question 1. *How do students perceive video lectures on touch-screen based mobile?*

The first research question is supported by five research propositions. Each of the propositions will be presented with supporting findings from the research followed by an overall finding for the research question.

Proposition 1.1 *How does the replacement of Braille course materials with YouTube video lectures, regarding frequency of listening, affect students?*

The research asked respondents if they listen more or less often when using the prototype than Braille course materials and why they believed they were listening more or less often. 12 out of 25 blind participants felt they were listening more often than with the Braille materials as the novelty of discovering new ways of reading appealed to them and they were easier to learn than touching the Braille letters. 5 out of 25 respondents felt they listened less often, with two giving the reason that they worked in a secure facility in which they were not allowed to take the TS. The other respondents (8 of 25) felt reluctance at exploring the device, lacking confidence with something new, and that they needed time to familiarize themselves to TS before they could adapt to this culture.

Finding 1.1 *48% of students perceived their frequency of listening to YouTube videos to be about the same or more often due to portability (Fig. 2).*

Proposition 1.2 *How does the replacement of Braille course materials with YouTube video lectures, regarding duration of reading, affect students?*

Respondents were asked if they listened for longer or shorter periods of time when using the TS. A majority of respondents (17 of 25) felt their duration of listening to YouTube videos in TS was much shorter than actual lectures in the classroom. Some (7 of 25) felt it took a longer time to listen to YouTube lecture videos than the class room where they can clear doubts instantly rather than having to replay YouTube video lectures for clarification or understanding. Only a minority of student focus groups responded that they did not experience a change in their preparation for class.

Finding 1.2 The majority (68%) of students felt their duration of listening to course materials was shorter than when reading using the Braille course material (Fig. 3).

Proposition 1.3 How does the replacement of Braille course materials with YouTube video lectures, regarding reading speed, affect students?

Participants were asked if they read or listened more quickly or less quickly when using the TS (YouTube lectures). 64% (16 of 25) of the respondents listened easily with TS while 12% listened with difficulty and 24% didn't feel any difference.

Finding 1.3 64% felt more comfortable listening to YouTube lectures over reading Braille material (Fig. 4).

Proposition 1.4 How does the replacement of Braille course materials with YouTube video lectures, regarding understanding of course materials, affect students?

The research asked participants if they found they understood more or less of what they read when using the Braille material. Of the respondents the clear majority 56% (14 of 25) understood more, 28% (7 out of 25) felt that they understood less and the remaining 16% (4 out of 25) felt no difference between the two.

Finding 1.4 The clear majority (56%) of students stated understanding is more readily appreciated in YouTube lectures as they can repeat the YouTube lectures more often than Braille course materials, which is time consuming (Fig. 5).

Proposition 1.5 How does the replacement of Braille course materials with YouTube video lectures, regarding class participation, affect students?

The research asked respondents if they found themselves participating more or less in class after having read YouTube lecture videos in TS. A majority 52% (13 of 25) of the respondents found themselves participating about the same. 28% (7 out of 25) participated more and another 20% (5 out of 25) participated less.

Finding 1.5 The overwhelming majority (52%) of students participated the same amount or more after having YouTube lecture videos on TS (Fig. 6).

Research question 2. How do blind students rate the accessibility of YouTube lectures using touch-screen mobile?

The second research question is supported by feedback of usability features with Likert Scale. Each of the usability features will be presented with supporting findings from the research followed by an overall finding for the research question.

The research reveals that almost all blind users were satisfied with the accessibility features applied to the YouTube lecture videos. Fig. 7 shows the average of the Likert scale used against the usability features. Most of the usability features were above 4. The last usability feature asked the group if they required any more accessibility features for the prototype. Most of the blind participants felt

that all accessibility features were met and needed no further improvement. The overall rating shows they are very much satisfied with the prototype.

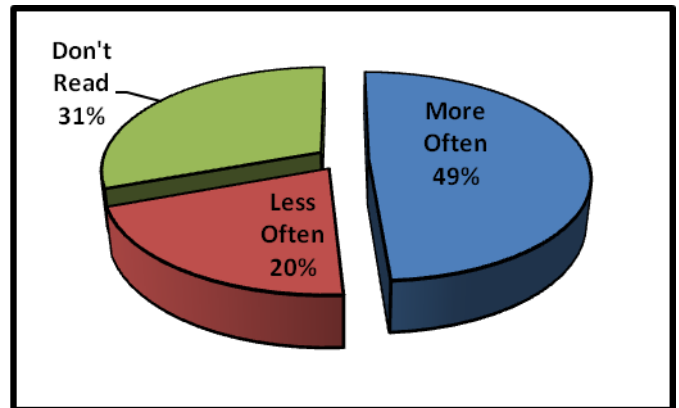


Fig. 2 Frequency of Listing in YouTube lecture

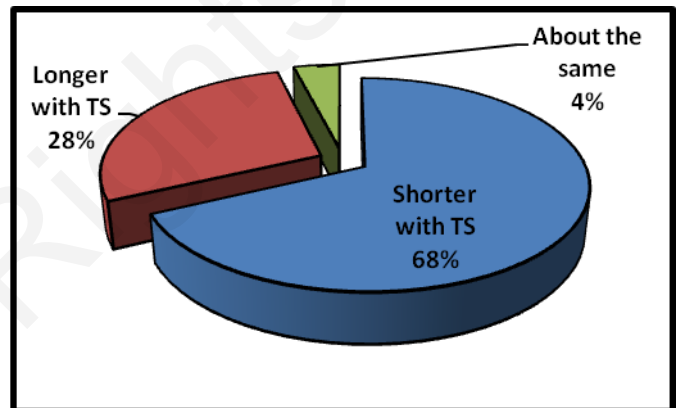


Fig. 3 Duration of reading in YouTube lecture

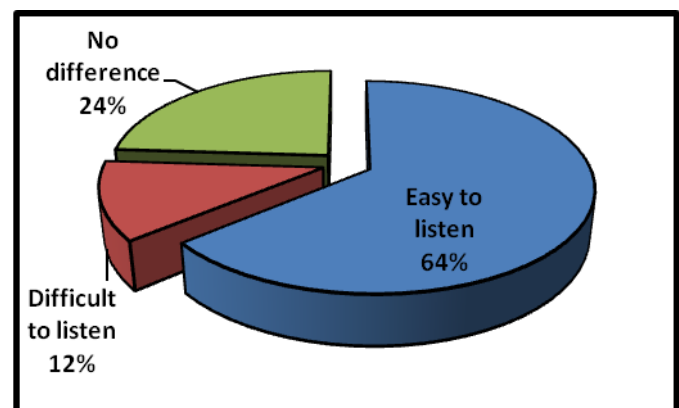


Fig. 4 Speed of reading in YouTube lecture video

VII. CONCLUSION

The purpose of this study was to explore what could be learned from participant experience in a pilot program in regard to replacing Braille course materials with YouTube lectures presented via touch-screen based mobile device. The conclusions of this study follow the research questions, findings, and analysis, and address the following four areas: (a) usability of the touch-screen based mobile device and, (b) the touch-screen based mobile device enhanced learning.

The touch-screen based mobile device enhanced learning.

The first major finding of this research is that the majority of students found that reading course materials on an touch-screen based mobile device did affect their reading duration, speed of reading, reading comprehension, and class participation. It can be assumed that time plays a large part in the learning experience. If something takes a long time to do, such as study reading, students can become fatigued, bored and distracted, or find they have other demands on their time and their study session must end prematurely, perhaps before they have had time to grasp a new concept. By providing technology to overcome these negative aspects of 'lost time', more can be learned in terms of quantity and perhaps quality too when students are motivated to find out more. Repetition of good technique is essential to skill acquisition, as much to operating a touch-screen until it is second nature to the user as it is to listen to an audio book and hear well-constructed sentences, appreciate a scientific argument or construct empathy with novel characters and expand vocabulary beyond a student's current reading age. Mainstream schools are utilizing technology in the classroom to give their students rich experience and to make learning fun. Blind students using touch-screen technology can become part of that mainstream environment more readily if they share similar experiences with colleagues. Two of the elements suggested to improve cognitive function are to develop social connections and curiosity and creativity. This prototype may work towards providing those elements for blind students and to make their classrooms more inclusive.

Usability of the touch-screen based mobile device.

The second and third major findings of this study expressed how the multi-functionality of the touch-screen based mobile device is accessible for blind students. The majority of students perceived the touch-screen based mobile device as a easy to use, easy to navigate, felt in control, intuitive and easy to learn. However, for academic purposes, the touch-screen based mobile device was primarily used as a content consumption device in conjunction with a personal computer. The third finding stated that a clear majority of students found the touch-screen based mobile device personally useful, carried it with them more often, and found themselves using it more academically due to its convenience and portability. Therefore, this study also concludes for blind students in this study, the portability and accessibility of the touch-screen based mobile device contributed positively to academic use of the device.

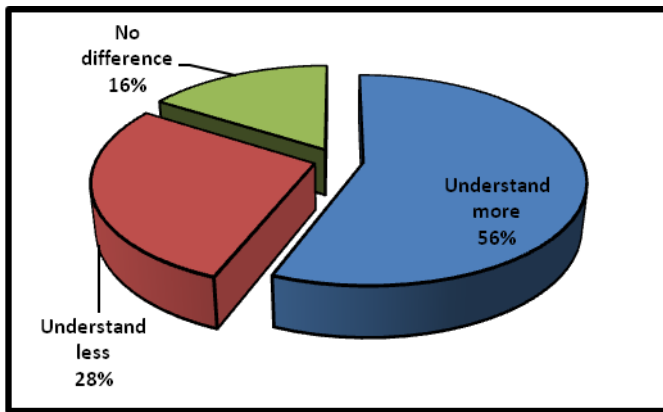


Fig. 6 Understanding of lectures in YouTube versus class room

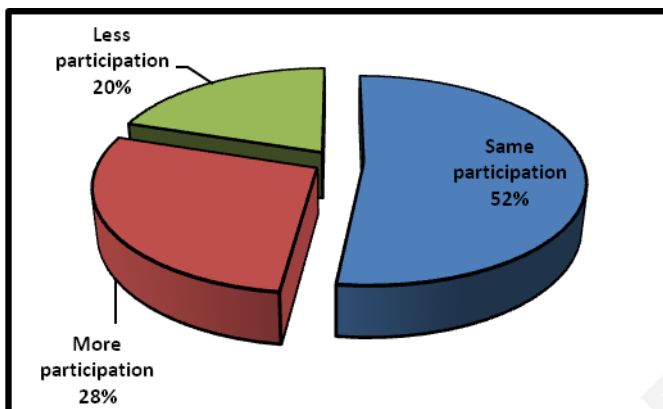


Fig. 7 Class participation after listening to YouTube lecture

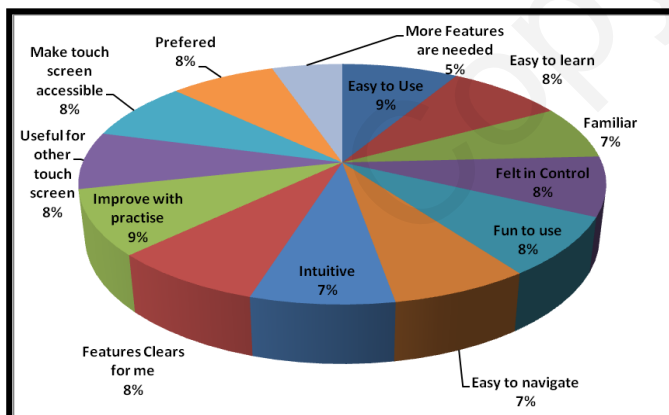


Fig. 5 Usability feature analysis for YouTube prototype

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