Pakistan Journal of Distance & Online Learning
Volume: V, Issue II, 2019, 157-174

An Investigation of AIOU Students' Satisfaction About Formative M-Assessment Using SMS Technology

Kamran Mir [*]
Muhammad Zafar Iqbal [**]
Jahan Ara Shams[***]

Abstract

Open and Distance Learning (ODL) plays an important role in providing education to the students of rural and remote areas. In ODL, learning feedback and assessment process of learners requires time and cost using classical communication techniques. Emerging technologies like Mobile Assessment (M-Assessment) has gained momentum because of its potential as a useful electronic assessment tool available on widely used mobile devices. The mobile phone usage in Pakistan over the last ten years has been increased incredibly but the potential of Short Messaging Service (SMS) technology in assessment activity has not been fully explored. This study focuses on mobile SMS usage for formative assessment in distance learning environment of Allama Iqbal Open University (AIOU). The key objective of this study was to investigate AIOU students' satisfaction about the technology acceptance model for M-Assessment. The software has been developed in open source programming language using SMS web-service on the backend to conduct mobile based quiz. The survey methodology applied to test the technology acceptance model for M-Assessment showed that the majority (87%) of the respondents are satisfied with this mobile assessment method. It was tested on 277 selected students of Intermediate, Bachelor and Master's level enrolled in English and Information Technology courses at AIOU. Around 90% of the respondents regarded it as one of the quickest assessment methods. It was recommended to use this software in the assessment of ODL students.

Keywords: formative assessment, open and distance learning ***(***ODL), M-Assessment, mobile, SMS

[*] Allama Iqbal Open University, Islamabad, Pakistan. Email: kamran.mir@aiou.edu.pk
[**] Lecturer, Allama Iqbal Open University, Islamabad, Pakistan.
Email: mzafar.iqbal@aiou.edu.pk
[***] Assistant Professor, Punjab Higher Education Department.
Email: jahanarashams@gmail.com

Introduction

Like many other developing countries, many people in Pakistan remain deprived of having the opportunity to get education. Education is required to improve the attitude and the skills of an individual for their bright future. The formal education system usually shut its door to such individuals who cannot afford financially or not able to give full-time to continue their formal education. This is where distance learning (DL) plays vital role in providing informal education to the students of rural and remote areas who are unable to continue their formal education. Open and distance learning (ODL) institutes are striving hard to provide education facilities all over the world in an informal way in which students are not bound with respect to time, place and specific teaching method. Some institutions are working in Pakistan for ODL to provide education to the masses and ultimately raising literacy.

Mega institutions like Allama Iqbal Open University (AIOU) and Virtual University of Pakistan (VU) are playing an important role in education sector of Pakistan. AIOU is one of the leading universities of Pakistan providing distance education throughout the country and overseas. It is providing multi-disciplinary education from basic to doctoral level programs to the masses at their door-steps (Sangi, 2008). Keeping in view the importance of distance education system in Pakistan, it is highly desirable to improve the quality and efficiency of this system. The distance learning methodology can be further extended advantageously in m-learning as suggested by Yousuf in 2007. According to Masood, delivery system or the media format is one of the most critical factors in distance education system (Masood, 2004).

To monitor the progress of student's knowledge and learning, assessment activities are performed in ODL. Usually, these assessment activities in AIOU are performed using manual assessment method in which student sends a written assignment to the tutor who marks it and sends it back with comments and feedback. This manual interaction is not sufficient for all the students and this system should be improved which encourages the student and facilitate their interaction with tutor. AIOU has approximately twenty million answer sheets to grade in each semester and more than four hundred examination centers are being managed countrywide. Majority of the examination and assessment activities at AIOU are conducted manually. These manual practices in examination and assessment activities take about 4 to 5 months of total duration (Sangi, 2008).

Educational institutes use variety of assessment methods which includes formal or electronic tests. Assessment does not only mean about taking test it also includes the assessment of knowledge, skills and attitude (Angelo & Cross, 1993). There are different types of assessment in distance learning education. According to Sangi (2008), there are major four types of assessments i.e. formative, summative, diagnostic, and adaptive assessment. Formative assessment is conducted during the session to identify the student's learning. Summative assessment is conducted at the end of the session to evaluate the student's overall performance. Diagnostic assessment is usually conducted before the session starts to verify the capability and eligibility of the student. Adaptive assessment is a testing method which is dynamic; it changes itself based on the student's response. It can be used with other assessment types (Sangi & Ahmed, 2007).

The purpose of formative assessment is to get feedback on performance to improve and accelerate the education quality. In higher education, formative assessment can be used to empower the student as a self-regulated learner. Formative assessment facilitates the development of self-assessment in learning by delivering high quality information to students about their learning. It encourages teachers and provides opportunity to fill the gap between current and desired performance of students. It provides information to teacher that can be used to improve teaching (Nicol &Macfarlane-Dick, 2006).

Recently many information and communication technologies (ICTs) are being used in distance education. The use of ICT based student support system can greatly help the students of open and distance learning (Mir, 2017). Technologies like Geographical Information System (GIS) can be effectively used in allocating resources to the distance learning students (Khan, Mir, Tahir, Awan, Nisa & Gillani, 2018). In the emerging technologies, Mobile Learning (m-learning) has gained momentum because of its potential as a useful education tool available to many learners. Mobile technology has the capability to deliver and enhance the learning curve for the students due to its massive and handy use. These capabilities are quite different in developed and developing countries. The performance and results of mobile learning in developed countries are better than in developing countries because of having reliable and cheap infrastructure (Ramli, Ismail, & Idrus, 2010).

The use of SMS technology for education purposes is getting popularity in many countries of Asia (Ramos, 2005). The SMS can be used for announcements of lecture schedules, examination reminders, promotions of activities, job fairs and alert to parents etc. Its use may be

categorized as academic, extra-curricular, and administrative uses (Belawati, Baggaley, & Dhanarajan, 2010). Limitless mobility and small size of mobile devices are the great advantages in bringing up new dimensions to the learning process of distance learning students. Students must be motivated to learn and believe in SMS learning process. The contents for SMS learning must be carefully designed to keep them simple and easy to understand (Ramli, Ismail, & Idrus, 2010). Mobile learning is rapidly gaining position in ODL because of its low cost implementation. This technology can be implemented with minimum investment. Using mobile in distance education are ideal for 'just in time' education. SMS can be used to overcome the accessibility and interactivity problems in distance learning by using them in conjunction with other educational methods (Belawati, Baggaley, & Dhanarajan, 2010). SMS technology can be used to conduct formative assessment in distance learning and can be very beneficial for institutes like Allama Iqbal Open University. The concept paper on mobile-assessment model for AIOU recommends a software application for university to conduct its formative assessment quizzes using SMS (Mir, 2009).

A number of proposals are under consideration for the use of mobile phones, short messaging service and other mobile enabled technologies to increase student-tutor interaction. This research explores the usage of mobile phone in formative assessment to improve the current assessment method which can be effectively performed by integrating SMS technology in assessment methods of distance learning. Based upon the study of current literature on M-Assessment and e-assessment, mobile assessment application has been developed which AIOU may use it for quick feedback of student's learning. However, there are some limitations in providing education or conducting assessment activities via mobile SMS because of its limited screen, limited graphic support and limited message length. This research study focuses on the formative assessment in which students are assessed during the learning process. In formative assessment, quizzes and assignments are given to the student during a semester. In distance learning, getting students learning feedback and assessment using non-technological methods require time and cost. It is believed that conducting quizzes using M-Assessment application will help the student to keep his/her pace of learning. Quick assessment method through mobile may also provide a quick feedback to distant tutor. This research will therefore focus on to develop M-Assessment software application which can conduct quizzes for formative assessment of distance learning students. In this research quizzes through mobile will be a focal point. These may result in fast and

accurate assessment with minimum time, effort and cost and can provide timely feedback to student and tutor.

Literature studied concludes that m-learning has more potential than e-learning in developing countries because of low internet usage and high mobile usage and familiarity. Delivery system in distance learning is one of key factors in distance learning education. Many problems in conventional learning system can be solved by using mobile as a medium of communication. Distance learning should have combination of all available technologies which is referred as the flexible learning model. Usage of mobile phone is more common than any other technology which supports m-learning and M-Assessment methods. Literature study also shows that potential of SMS technology in assessment activity has not been fully explored. SMS based assessment software for AIOU is a need of time and should be tested on distance learning students. Before implementing such new system, literature suggests that it is necessary to test the technology acceptance model. Therefore, an acceptance survey also needs to be conducted to test the technology acceptance for M-Assessment.

Objective of the Study

The key objective of this study was to investigate the students' satisfaction about new technology acceptance model for M-Assessment.

Requirement and Development of Software for M-Assessment

In this section, M-Assessment software requirements, system design and architecture have also been discussed followed by system implementation and testing.

Requirement Analysis

After analyzing extensive literature regarding mobile learning and assessment, web based mobile assessment application was to be designed which is able to conduct SMS based quiz. Following main requirements were identified for M-Assessment software: i) A simple GUI based application for tutors to manage students, courses and quizzes ii) Distributed application which is accessible by every tutor easily iii) Application which is able to send SMS based MCQs on student's mobile number iv) Application should also be capable to receive SMS reply

from student and interpret result accordingly and v) Student's private information like mobile number should not be made public for database users.

Process Model

The process model used for the development of this software was Modified Waterfall Model (Powell, 2002). This process model was selected because of its iterative nature. It allows going back to make changes from the subsequent stages.

Use-Case Diagram

Use case is a set of scenarios where each scenario covers a particular interaction between a user and the system. It describes the external behavior of the system and the tasks that user can perform. In other words, a use case illustrates how someone might use the system. Use cases take the different approach to traditional methods. It is therefore different from the functional decomposition approach. As functional decomposition focuses on how to break the problem further into pieces that the system will handle, the use case approach focuses first on what the user expects from the system. The use case is the beginning to describe what the system is going to do.

System use-case diagram as shown in Figure 1: System Use-Case Diagram indicates that the administrator has the full control over the system whereas tutor has direct interaction with the all the modules of system except managing tutors data using a web-browser whereas student interacts with the SMS server using the mobile phone device. Student communicates with SMS server using the existing infrastructure of mobile network. The tutor conducts the quiz using the M-Assessment web application. All multiple choice questions (MCQs) are sent on student mobile phones in the form of SMS text message. The student need to answer in a specified format i.e. quiz [question number] [option selected] so that the system can understand the answer and relate it with its respective question in database. Figure 2: SMS Quiz Reply Format shows the template format in which student had to reply the quiz on SMS.

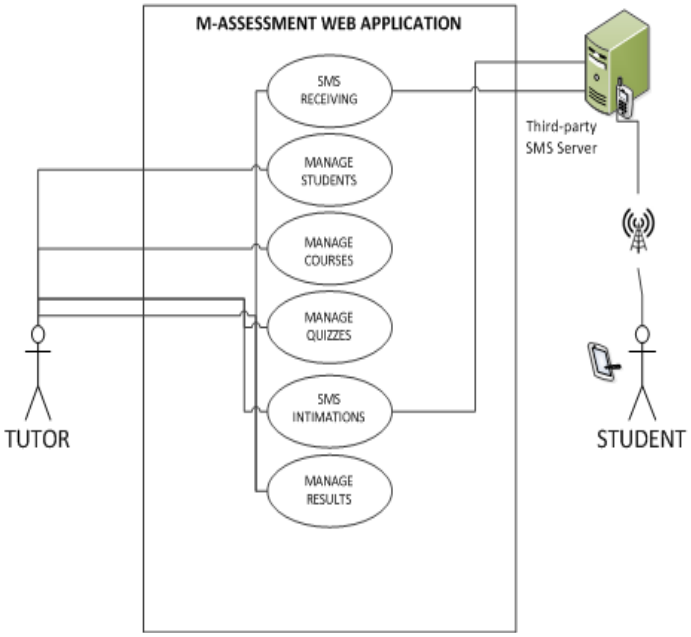

Figure 1: System Use-Case Diagram

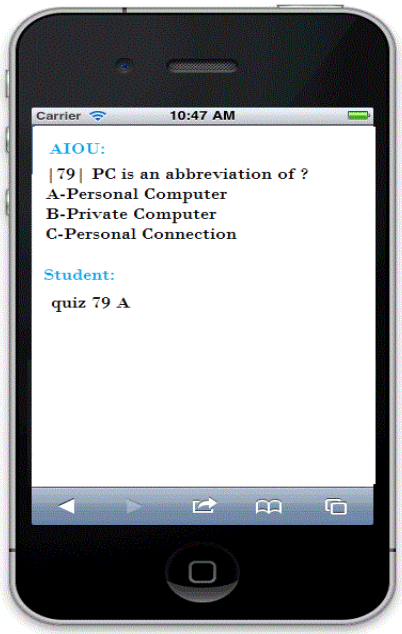

Figure 2: SMS Quiz Reply Format

System Design

The web application was deployed on an apache web-server which communicates with an external SMS server using Representational State Transfer (REST) protocol. SMS were sent through an Application Programming Interface (API). SMS receiving was done using JavaScript Object Notation (JSON) format. Mobile-Assessment application was developed in PHP programming and backed by MySQL database. It communicates with third-party SMS server using REST protocol. The core modules of M-Assessment software have been illustrated in Figure **3**: Three-Tier Architectural Model.

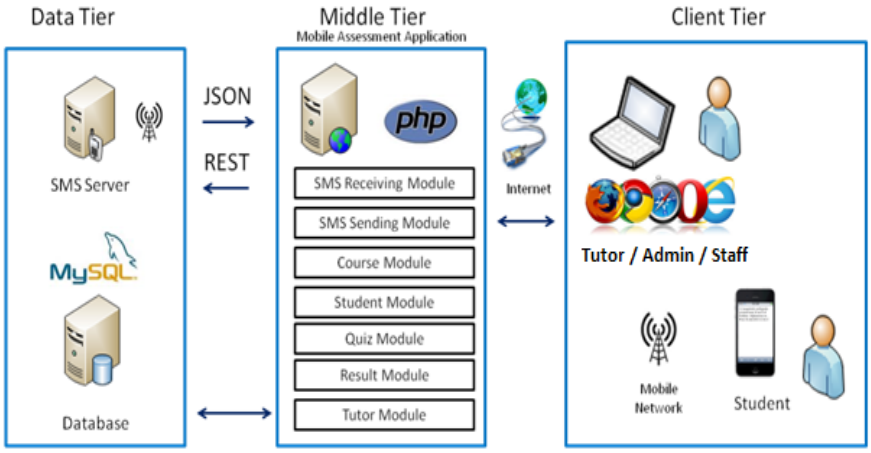

Figure 3: Three-Tier Architectural Model

Tutor communicates with the M-Assessment application using an Internet browser and can manage student data, course data and quiz related activities. Tutor can conduct SMS based quiz which is sent on the student's mobile phone as a text message through a SMS server using REST protocol. SMS server is able to send and receive SMS using the conventional network of mobile phone operators and devices. Basic architecture diagram of the system is shown in Figure **4**: Basic Architecture Diagram

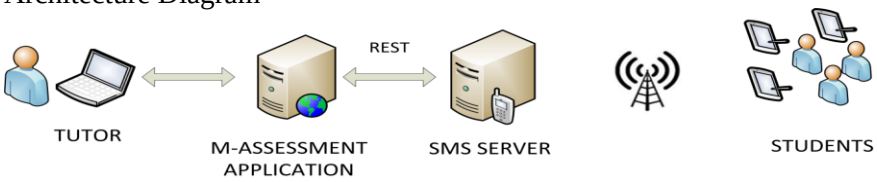

Figure 4: Basic Architecture Diagram

Tutors can use the web-based application sitting anywhere on the Internet to conduct the SMS based quiz. Quiz is sent on student's mobile as SMS text message which student has to reply in a specific format. i.e. Quiz [question number] [answer option] one by one. This SMS is received by M-Assessment application via a third party SMS server using JSON file. The message is analyzed and the answer is stored against respective question and student accordingly.

System Interface

The mobile assessment system is a restricted system only accessible by tutors and administrators. Figure 5: Login Interface shows the interface of login screen where tutor/administrator/staff user will login to enter the system.

Figure 5: Login Interface

After logging in, tutor will be redirected to main interface page as shown in Figure 6: Main Home Page Interface, where tutor will get all the icons and links to further modules accordingly. It will provide access to i) Student Module ii) Course Module iii) Quiz Module iv) SMS Sending Module v) SMS Receiving Module and vi) Result Module

Figure 6: Main Home Page Interface

Research Methodology

In this section, the second part of this research is described i.e. the survey method applied to test the technology acceptance model for M-Assessment. Below Figure **7**: Block Diagram of Research shows the overall block diagram of research work.

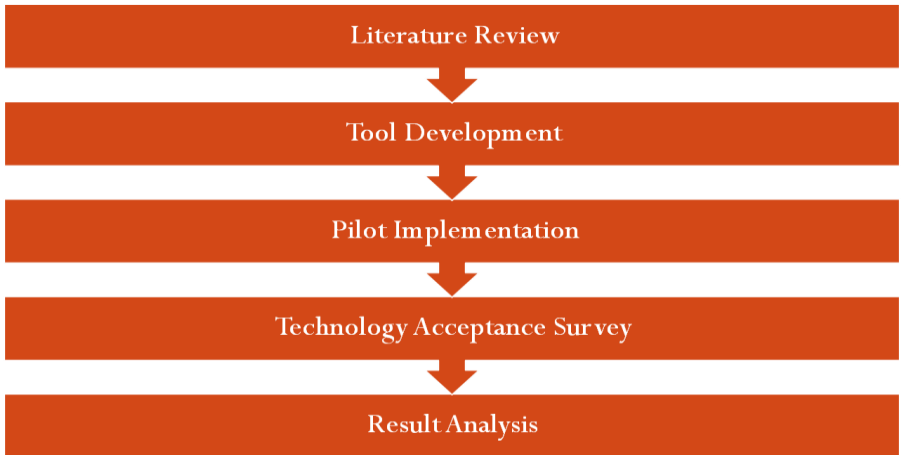

Figure 7: Block Diagram of Research

Population

The primary objective of the survey was to test the technology acceptance model (Lee, Kozar, and Larsen, 2003) for M-Assessment software application. Total population of students enrolled in Compulsory English and Computer/IT course of FA and BA level programs was 54820 out of which only 29509 (54%) had valid mobile numbers in university database. Initially, an intimation bulk SMS was sent to random 1521 students requesting them to participate in this SMS based assessment study. Detail of students who replied and showed their consent to participate is given in Table 1.

Detail of Sample

The system was tested on randomly selected AIOU students enrolled in compulsory English and computer related courses at intermediate, bachelor and master level. 66% of students were male and 34% were female. 38% of students were enrolled in BA program, 36% in FA, 23% in TEFL diploma and 3% were enrolled in COL MBA program as shown in

Table 1

Students in SMS based *quiz assessment*.

Table 1

Students in SMS based quiz assessment

Level	**Male**	**Female**	**Total**
B.A.	94	11	105
Intermediate	54	45	99
Diploma	27	38	65
Masters	8	0	8
Total	183	94	277

Total two hundred and seventy-seven (277) students who gave consent was the sample of the study and they were sent quiz on their mobile phones. Out of two hundred and seventy-seven (277) students

only one hundred and one (101) students responded the quiz. The participating students belonged to different districts of Pakistan. Table 2

*Detail of Respondents Course and Gender Wise*shows the distribution of respondents' gender and course wise.

Table 2

Detail of Respondents Course and Gender Wise

Course	**Male**	**Female**	**Total**
Basics of ICT (1431)	28	2	30
Compulsory English-I (1423)	15	3	18
IT Applications (360)	9	2	11
Compulsory English (386)	7	1	8
TEFL (5663)	8	20	28
Research Methods (5599)	6	0	6
Total	73	28	101

The female students participated less (i.e. 30%) as compared to male students (i.e. 40%). The reason of less participation by female students was due to the cultural environment of Pakistan where females usually feel unsecure in responding or communicating through SMS to unknown numbers. The participating students belonged to different districts of Pakistan. 50% of students belonged to district Islamabad, 17% from district Lahore and 10% from district Rawalpindi. Majority students participated belonged to BA program. The reason of less participation from BCOM and MBA program was due to less number of enrollments as compared to BA program.

Results and Discussion

SMS based quiz was responded by only 101 students out of 277 sampled students. The students belonged to different districts of Pakistan. The participating students belonged to different districts of Pakistan. 50% of students belonged to district Islamabad, 17% from district Lahore and 10% from district Rawalpindi. Result in shows that female students participated less (30%) as compared to male students (40%). The reason of less participation by female students was due to the cultural environment of Pakistan especially in rural culture mobile use is not that common among females and they use a shared communication facility. As a general observation, females usually feel unsecure in

responding or communicating through SMS. Out of 101 quiz responses 28% were female and 72% were male responses as shown in Figure 8: Gender Wise Quiz Response.

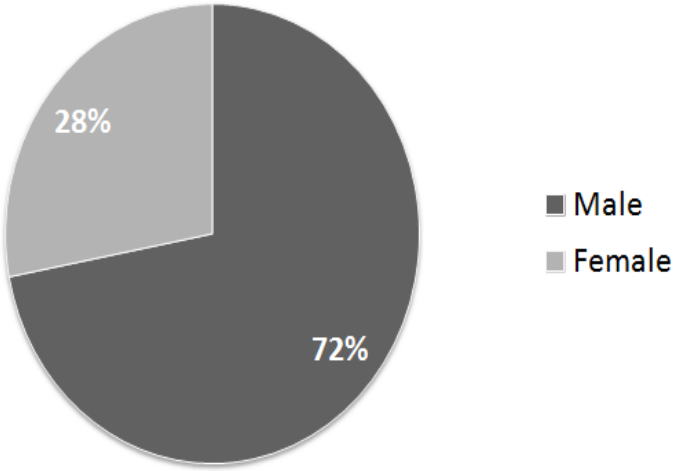

Figure 8: Gender Wise Quiz Response

The satisfaction survey conducted in both online and offline mode. Satisfaction survey question was also sent on SMS to all the participating students.

Figure 9: Satisfaction Survey Result shows the result of this survey question. 33% of the students were highly satisfied with SMS based assessment method, whereas 54% were satisfied and 13% of students were not satisfied. The satisfaction survey was responded by 69 participants that concluded that M-Assessment is very cost-effective method of assessment. 61% respondents were male and 39% were female.

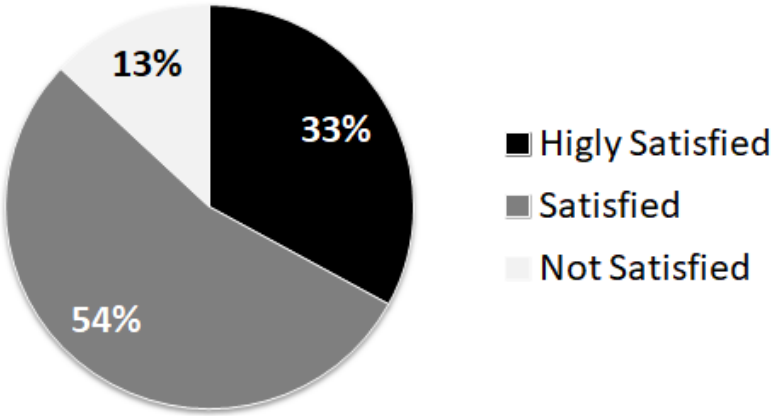

Figure 9: Satisfaction Survey Result

Figure 80: Consolidated Survey Results against major questions asked in survey shows that majority agreement was shown on statement that SMS based quiz is one of the quickest assessment method whereas the least agreement level was recorded against statement that this assessment method is complex in nature.

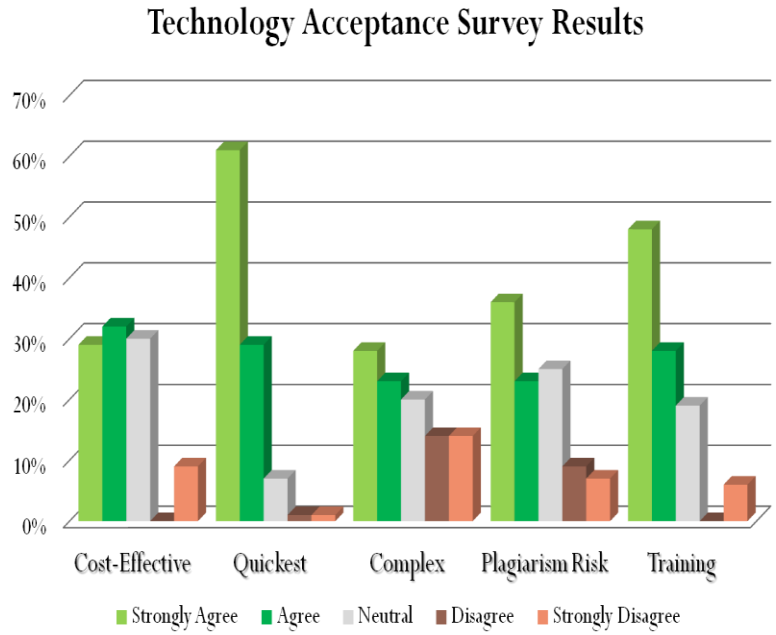

Figure 80: Consolidated Survey Results

Conclusions and Recommendations

Distance learning has an important role in providing non-formal education to the distance learners. Use of ICT is getting popular in both developing and developed countries. Different technological devices and methods are being implemented in teaching, learning and assessment of distance learning. M-learning has more potential than e-learning in developing countries due to the rapid growth of mobiles as compared to Internet and computers. New technologies and services over mobile networks make it more feasible to rapidly interact with masses than any other current technology. Many communication problems in conventional learning and assessment methods can be solved by using mobile as a medium of communication between student and tutor. The use of mobile SMS service has helped in teaching and learning now it can be applied in assessment as well. It can greatly help the tutors and distance education institutes in conducting formative assessment quizzes from students using their mobile phones. This can be started as early as possible to bring awareness of mobile service usage in assessment.

Quiz response showed that female students responded/participated less (30%) as compared to male students (40%). It is considered that no reply mobiles may have been of female students, who are still reluctant to use this service. Therefore, University needs to take necessary measures to build their confidence in use of this service. The reason of less participation or SMS response by female students was due to the cultural environment of Pakistan especially in rural culture use of mobile is not that common among females and they use a shared communication facility. Out of 277 students only 101 (36%) students responded on SMS which indicated that formal student training is also mandatory before implementing such system at AIOU. Secondly, University may obtain package deal in mobile SMS for students to avoid any cost consideration by students. Students were facing issues in understanding the quiz response format. This however is expected to reduce over frequent usage. However, it may be made part of tutor /student briefing training for effective results.

A student satisfaction survey was also conducted to test the technology acceptance model for M-Assessment. The satisfaction survey was responded by 69 participants. This concluded that M-Assessment is one of the quick and cost-effective assessment methods. The technology acceptance survey result also validates that this technology is acceptable and implementable. Survey indicated that the majority (87%) of the

respondents were satisfied with mobile assessment method. Around 90% of the respondents regarded it as one of the quickest assessment methods.

Fifty-nine (59%) percent participants responded that the chances of cheating and plagiarism are very high in SMS based quiz assessment. This is a common blame on all distance education methods. Practically this is not issue for all and would be insult to many good and honest distance learners. Cheating is also problematic in formal system and in many cases it can be more than in ODL. Distance learning has easy material and easy schedules so it discourages cheating at design level. Seventy percent (70%) respondents agreed that use of mobile phone is very high in Pakistan which correlates with PTA published statistics i.e. 70% population is using mobile in Pakistan which is a quite large density. 70% respondents agreed that despite the large number of mobile users, technical awareness level in using ICT is very low in Pakistan. It is highly recommended to conduct student's awareness and training sessions before formally implementing this system in order to make it more valuable to both institution and student. At admission level, the importance of giving valid and active mobile number should be properly communicated to all the students. There should be a mechanism to verify the authenticity of given mobile number. It is also recommended to conduct workshops for tutors to train them on how to use the system efficiently and effectively.

References

Angelo, T. A. and Cross, K. P. (1993). *Classroom Assessment Techniques*. New York, NY: Jossey-Bass.

Belawati, T., Baggaley, J., and Dhanarajan, G. (2010). Distance Education in Asia: the PANdora Guidebook.

Khan, S., Mir, K., Tahir, A., Awan, A., Nisa, Z., & Gillani, S. (2018). Allocation of Tutors and Study Centers in Distance Learning Using Geospatial Technologies. ISPRS International Journal of Geo-Information, 7(5), 185.

Lee, Y., Kozar, K. A., and Larsen, K. R. (2003). The Technology Acceptance Model: Past, Present, and Future. *Communications of the Association for Information Systems, 12*(1), 50.

Masood, M. (2004). A Ten Year Analysis: Trends in Traditional Educational Technology Literature. *Malaysian Online Journal of Instructional Technology (MOJIT), 1*(2), 19.

Mir, K. (2009). Use of Mobile-Assessment In Distance Learning. Presented in *Mobile Government Consortium International conference*, Barcelona, Spain.

Mir, K. (2017). Design and Development of Online Student Support System. *Pakistan Journal of Distance and Online Learning, 3*(1), 1-10.

Nicol, D. J. and Macfarlane-Dick, D. (2006). Formative Assessment and Self-regulated Learning: A model and seven principles of good feedback practice. *Studies in Higher Education, 31*(2), 199-218.

Powell, T. A. (2002). *Web design*. California, San Diego: McGraw-Hill.

Ramli, A., Ismail, I. B., and Idrus, R. M. (2010). Mobile Learning Via SMS Among Distance Learners: Does Learning Transfer Occur? *International Journal of Interactive Mobile Technologies (iJIM), 4*(3), 30-35.

Ramos, A. J. O. (2005). The Viability of Mobile SMS Technologies for Non-Formal Distance Learning in Asia. Presented in *m-learn 2005 Conference*, South Africa.

Sangi, N. A. (2008). Electronic Assessment Issues and Practices in Pakistan: A Case Study. *Learning, Media and Technology, 33*(3), 191-206.

Sangi, N. and Ahmed, M. (2007). E-Learning Initiatives at AIOU: a case study of using ICT in education. *1st E-Learning & Distance Education Conference*, Lahore, Pakistan.

Yousuf, M. I. (2007). Effectiveness of Mobile Learning in Distance Education. *Turkish Online Journal of Distance Education, 8*(4), 114-124.

Citation of this Article:
Mir, K., Iqbal, M. Z., & Shams, J.A. (2019). An investigation AIOU students' satisfaction about formative M-Assessment using SMS technology. *Pakistan Journal of Distance and Online Learning, 5*(2), 157-174.