E-Kankor: Opening New Vistas of Higher Education through an Innovative Intelligent Turoing System

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Abstract
Passing the entrance examination to a university is a major step in one's life. Kankor is the nationwide tertiary entrance examination in Afghanistan. Since the score on the Kankor Assessment Test determines the student's academic future, it is highly recommended to do some test preparation so that the score and consequent placement reflect the student's ability. However, due to poverty and lack of public awareness, Afghanistan severely lacks sufficient resources for providing entrance test preparation facilities. Keeping the aforementioned in mind, web-based test preparation systems offer greater flexibility than the conventional systems, as they can be accessed online anytime. In addition to using easily found practice materials, an online test preparation system is the most efficient, dynamic and relatively cheap method to prepare students for the entrance test. In this thesis, I have proposed the design of a web-based test preparation system, known as e-Kankor, to help high school students learn university standards and give them the tools to pass the university entrance examination on the first try. e-Kankor is a student-focused educational environment designed to increase pass rate success. To measure success in my system, I have done several evaluations with capital and provincial users. The major goal behind this study was to conduct long-term longitudinal study and make difference between capital high schools and provincial high schools on three main aspects: (i) *usability*, (ii) *pedagogical* and (iii) *psychological*. The evaluation demonstrated that the e-Kankor system will serve the needs of students effectively.

Keywords: Learner-centered design; e-Learning; Intelligent Tutoring System

Introduction

Nowadays Information and Communication Technologies (ICTs) have been applied in a variety of fields all over the world. As for instance in education, ICTs have opened up a vistas of opportunities for learners. They have replaced the traditional mode of paper-based learning that offers a more efficient and effective way for teaching and learning. Assessments are an integral part of an educational system particularly at higher school level that is the last door towards higher education. ICTs have been increasingly used to improve the assessment mechanisms at the high school level.

Kankor is an old university entrance examination system all over in Afghanistan. It's the first screening of high school graduates that helps educational authorities to determine whether they are capable to undertake undergraduate courses. Usually those students can pass Kankor Exam who work hard, and prepared well for the entrance examination. Though it is clear that all those who complete high school may not necessarily enter to higher education institutions, it is very common and normal process across the world seeing percentage of students completing higher school studies remain out of the higher education institutions. Indeed, Kankor is a very transparent process to categorize students on the basis of their talents and achievements.

The number of high school graduates has been on the rise in Afghanistan since 2001. Annually, more and more prospective students taking part in entrance examination. In 2012, around two hundred thousand students have taken Kankor, but unfortunately, only four thousand succeeded to enter Afghan public universities. According to (AfghanistanDailyOutlook, 2013) annually approximately 40,000 Kankor participants are accepted from among over 150,000 candidates to particular universities and field of study.

Eligibility of participants to particular field of study based on their Kankor marks and selection priority. For example, if someone selected engineering for her/his career, but she/he cannot achieve the required exam scores needed for the field, he/she will have to study the suggested field which selected from Ministry or discontinue education after several attempts. Although, enrollment in higher education has been rapidly increased in recent decades all around the world particularly in Afghanistan. According to World Bank (WorldBank, 2013). Afghanistan higher education system has grown rapidly in size between 2001 and 2012. As shown in Fig. 1.1 the total number of higher education students in public universities increased from less than 8,000 in 2001 to about 100,000 in 2012. Although, enrollment in private institutions was close to zero in 2001, but by 2012 it increased about 52,000 students, which shows a considerably grown over the same period (WorldBank, 2013).

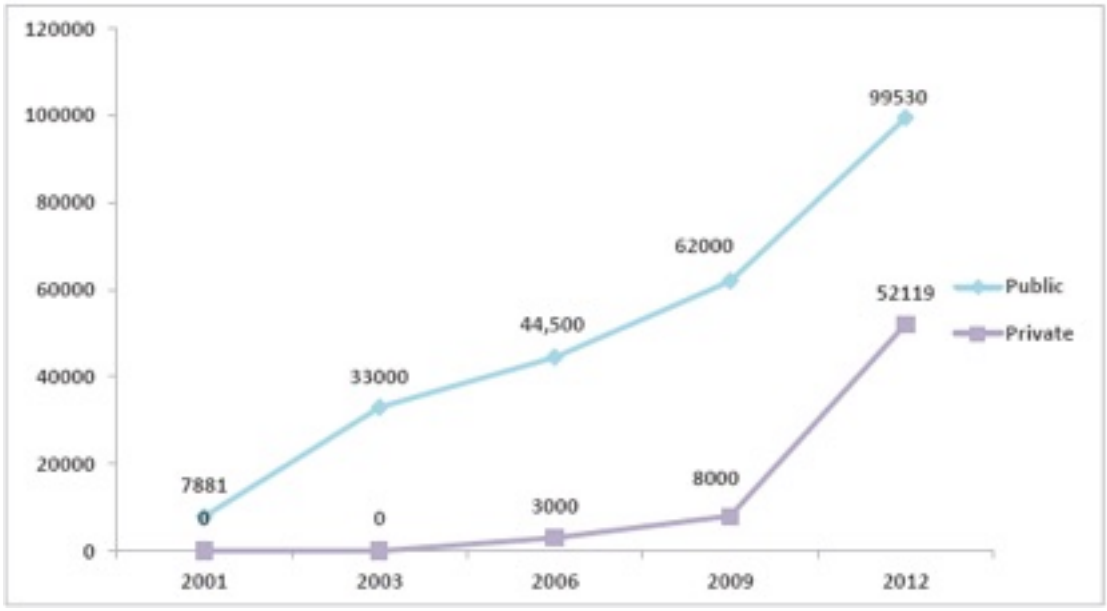

Figure 1: Time trend of enrollments in Public and Private Higher Education Institutions (2001-2012).

The Fig. 1.1 above depicts a significantly rose in Afghanistan higher education particularly from 2009 onwards, and this increase has been the result of expansion of primary and secondary education into Afghanistan higher education sectors and strong demand for higher education. However, every year over 100,000 students remain out of higher education and the majority of them cannot afford to apply for private universities, due to economic problems (AfghanistanDailyOutlook, 2013). Many of the talented students complete their education in misereres economic condition and due to poor economic conditions, several talented students fail to comply with Kankor's requirement. There are no cheap test preparation facilities available to the poor students to compete against the students who have rich background. These students are the only hope for their poor parents against poverty and miseries. If these students fail to get higher education, implies that the deplorable conditions of their families could not be changed. Hence, engulfed in poverty and miseries forever. The following Table1 shows the reports of overall Kankor enrolments, total Kankor eligible participants and those who remain out of education during 2001 and 2014 (Sokout & Paracha, 2015).

Year	2001	2003	2007	2009	2010	2012	2013	2014
Enrolments into particular public universities	No data	15000	18000	35203	25180	32000	42168	67000
Enrolments into undesired institution	2881	No data	No data	No data	16510	8000	13617	41484
Private universities enrolments	0	0	3000	8000	No data	10000	29000	29424
Total Participants took Kankor	No data	42500	50000	89586	117302	147000	175000	228908
Total Kankor eligible Participants	No data	No data	No data	96000	127330	159012	228000	261109
Remain out of higher education	2119	9500	9000	46383	75612	97000	90215	91000
Total enrolments	7881	33000	41000	43203	41690	50000	84785	137908

Table 1: Kankor enrolments time trend 2001 – 2014

As shown in Table 1 above the number of Kankor eligible students has grown significantly year to year, but the enrolments of student into particular universities are not the same and every year they should follow that the ministry of higher education chooses who is eligible for a particular field of study or major which is not suitable for the majority of them.

Research Objectives

The study is focused on Afghan educational challenges particularly university entrance examination where several well deserving candidates fail to pass it, due to lack awareness, lack of test preparation facilities, lack of capability and competency, lack of motivation and so on. To tackle these issues an ICT-based solution called e-Kankor has been proposed, successfully tested and implemented as a pilot in the light of following objectives:

- To highlighted the university entrance examination barriers of high school students and find remedies to it.
- To design and develop an online University entrance test preparation system for Afghan students.
- To evaluate the effectiveness of the system in terms of pedagogy, technically and psychological impacts on the learners (Sokout & Paracha, 2015).

In this study I am going to cover the rest part of the research that has been selected as a future plan; include as follows:

- Long-term longitudinal study will be conducted
- Pilot implementation will be conducted in provincial high schools include rural and urban areas.
- Evaluate the impact of the system to the current situation of Afghanistan.

Research Methodology

The original intended purpose of this research is to provide an innovative e-learning facility to potential students to make them university standard in order to pass the university entrance examination. I would like to investigate:

- How to gauge student learning experience at schools, where there is no special Kankor concern for university entrance exam, no practice facilities and low motivation, particularly in provinces?
- Make difference between capital high schools and provincial high schools.
- Evaluate the impact of the system to final result.

The sub-questions that are generated from this:

- What are the experiences of students based-on none of any Kankor facilities at schools?
- What are the barriers and challenges to improving the learning experience for these students and make ready them for university standard?
- What observation factors could potentially influence these school level effects?
- Does ICT-based system improve the motivation and pedagogical activity of students?
- Does ICT-based system increase the satisfaction of users, urge to use the system?

To address the research question I used Deep-Dive technique (Horwath, 2009), with inductive methods to collect basically qualitative data and some quantitative data. The term "Deep Dive" emanates from a management technique, which utilizes a combination of approaches to help develop solutions for specific challenges. Therefore, I have focus a three-stage mixed method approach (Bergman, 2008). It is a methodology combining quantitative and qualitative techniques to elicit in-depth information from the same subject. It can be considered as a series of data collection efforts from the same participants where I adjusted queries (qualitative and qualitative) to collect through insights to know how they behave and be able to describe why they behave in that manner.

The information has been collected through:

- Semi-structured key information interviews with educational parties;
- Unstructured open environment survey;
- Mini-surveys using structured questionnaires with the participants;
- Literature reviews also has been carried out as source of secondary data.

The multiple sources of information helped me in the triangulation of data to examine the study questions. Therefore, for this research I will prefer to use the same techniques to collect the required and necessary data from the target audience, particularly, provincial high schools.

Research Approaches

The system proposed according to the issues, which identifies in the first section and basically developed according to the investigation and user motivation using two different methodologies. For the developing phase of system, I used Incremental Development Methodology (IDM) in order to have the involvement of users in different stage of system development. This approach helps me to modify the system several times, brought the necessary changes to the system and finally meets the design goals (Online, 2015). In addition, for the experiment of the system prototype we used Motivated Strategies for Learning Questionnaire (MSLQ) to determine the motivation of learners and the means which they expected from the system. These two approaches help us to specify the required needs of learners and develop an appropriate system based-on their expectations.

System Definition

Based-on research investigation we have found that there is no any preparation system in school level to positively effect and make prepare the school graduates to pass university entrance exam. However, according to the collected data there are some preparation courses and Kankor preparation books available outside the schools, which could only take by minority of students who has rich background. Similarly, the existing Kankor books could not enhance the motivation of students and acts as a practice tool to qualify them for higher education. The students should be trained and motivate in order to enhance their skills and aptitude; this could be possible whenever the students directly interacted with some different perspective, practice and create their own understandings.

The proposed system called e-Kankor, which is a web-based system, and based on multiple choices question for Afghan school students in order to make them ready for Kankor exam. According to (Horgen, 2007) multiple choice tests can increase the students knowledge and enhance their motivation, activities and learning in both summative assessment like midterm exams, paper-based exams or final project, and formative assessment which focuses to the monitoring of student's learning and providing the feedback to improve their learning skills like outlining the main point of a lecture by submitting a paragraph or creating something from their prior experience (Sokout & Paracha, 2014).

e-Kankor supports many kinds of questions related to Kankor general exam, ability to grade students automatically, provide pedagogical activity to involve the learners to practice their prior skills and generate their own outcomes, and provide various Kankor materials for students. This system designed with various open source technologies like (PHP and HTML5 for interfaces, JQuery, Java script and MYSQL for database) under the GPL license, in order to give rights to volunteers to easily bring their desired changes to system. In addition, e- Kankor based on Intelligent Tutoring System (ITS), which provides an excellent test-bed for various theories from

cognitive psychologists and stand for immediate feedback and instruction to the users (Goodkovsky, 2004).

Intelligent Tutoring System:

In current century most of the educational environments changed their teaching and learning systems from the traditional way to modern (computer-based) systems. They are easily using computer-based system to increase their learner's motivation and enable them to produce something besides consuming something. This way of learning raises the leaners degree of participation, way of mediation and their thoughts, and is likely to result in learning. Generally, in this century the professionals classified computer-based learning into two categories include classical Computer Based Training (CBT) and advanced Intelligent Tutoring System (ITS). CBT system are based-on manual design which have a predefined structure for all leaners and did not support a specified direction to meet the individual needs and requirement (Boyle, 1998), (Anderson, 2011).

Meanwhile, due to large number of learners and possibility of diverse situations and learning style CBT system strict to provide the necessary materials for learners and provide a quality learning to them. Whereas, ITS are modern and more advanced technique, that enable the learners to motivate and increase their abilities within interactive learning environment (Paracha, Mohamad, Jehanzeb, & Yoshie, 2009). Intelligent Tutoring System (ITS), introduced an essential package of educational technology for learners in order to help them to acquire the necessary skills in their carrier and keep them up-to-date with feedback and instruction. ITS interact with cognitive psychology to provide the best test environment for various theories (Nwana, 1990). ITS unlike other educational technologies, provide considerable ability according to the needs of students to interact with learning materials, representing pedagogical decisions and to achieve their intelligence. It will evaluate each student's ability in order to determine their understandings and skills; and then it will provide the necessary feedback to the learners (Sokout & Paracha, 2015).

Research Design

In order to explore the research sub-questions outlined in section III we have adopted a three-stage mixed method approach introduced by (Sokout & Paracha, 2015). For the first stage we have used grounded theory approach (Glaser, 1992) to collect qualitative data to gain an understanding of underlying reasons, opinions, learning experiences and motivation of students. This was analyzed to identify key factors regarding student experience, problems with current situation, and to identify and propose potential solutions to overcoming the gaps to their understanding and learning environment. In the second stage we have used a creative participatory inquiry technique to involve, parents, teachers and students in our survey to have more focus to solution and propose an appropriate way for them. The result of this stage paves the way for design and content of stage three. The third stage focus to elicit the reaction of proposed solutions with students, to understand their motivation and satisfaction to improve the system for the potential implementation for next phase.

The major aim behind the whole approach was to use tentative research to find the problems that are against the better improvement of school graduates and remain deprived of their right to continue higher education. In addition, to use creative inquiry to develop an appropriate solution to overcome these problems and to acquire students' perspectives on possible solutions that could be used to maximize their motivations and improve their abilities on Kankor entry-exam.

Data Collection Method

The required data has been collected from three different province participants and the result compared with the preliminary data that has been already received from Kabul participants. The preliminary study was carried out in Afghan urban and rural high schools; both private and public schools sample were taken into consideration.
The survey sample size was taken 20 students from each province, which makes it same sample size with preliminary data. During the survey I used sampling methodology, which divided the participants into stages (Clusters), and a simple random sample of the group is selected.

I have collected the required data in each stages of my study using different phases of data collection: (i) Interviews and (ii) questionnaire; in order to explore potential problems and gaps, and draw a conclusion among various perspectives to overcome all the masses. The compression of collected data analyzed and evaluated through four main factors, which cover the vital part of my study. The Fig. 2 and 3 below describe factors statistical result.

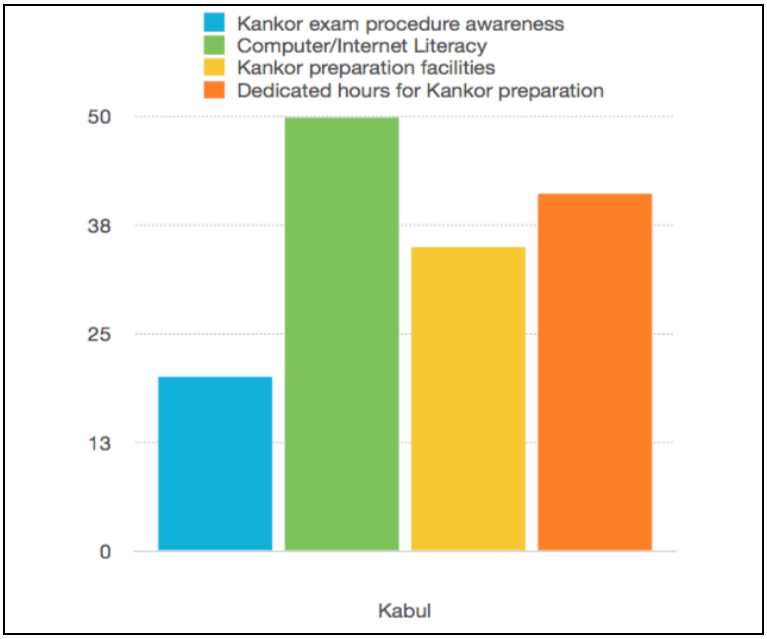

Figure 2: Kabul statistical result

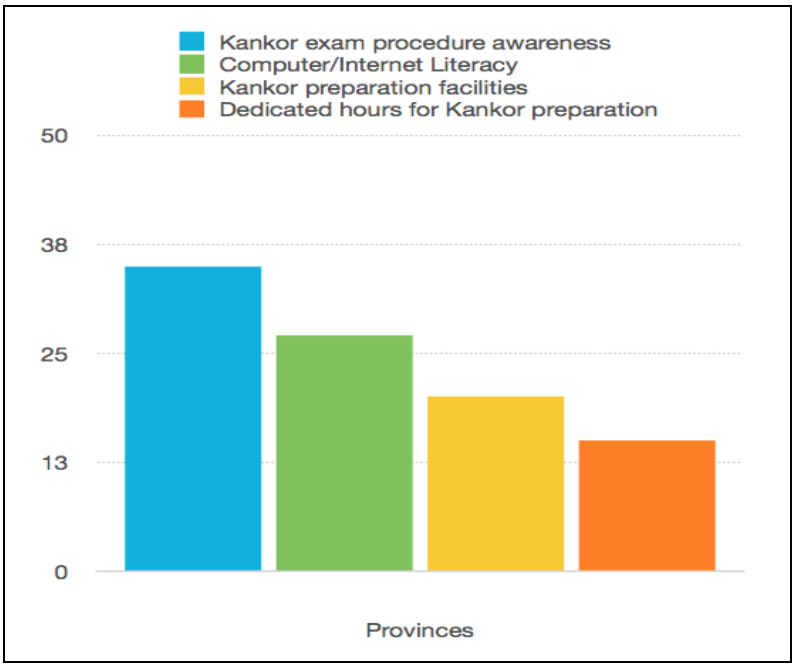

Figure 3: Provincial statistical result

Analysis Method and Tools

The analysis tool was designed in Statistical Package for the Social Sciences (SPSS) to enable us to extract any type of analytic and statistical information as required. I have used Descriptive statistics to define the basic characteristics of our collected data and also used Analytical statistics to describe the association of variables to each other, demonstrate cause and effect relationship between variables and identify the prediction of the behavior of one variable to another. The major goal behind using of these types of statistics is to provide sample and the measures of our data and to determine the relationship between variables (Sokout & Paracha, 2015). The Table 2 explains the result of statistics using SPSS.

The data presented in Table 2 shows the important part of data that has been analyzed during the research. The result of analyzed data was compared with preliminary data and highly highlighted the necessity of the proposed system as an efficient and effective ICT-based solution that could help the learners to motivationally prepare themselves for university standards.

Variables	Type of Variables	Kabul Statistics	Provinces Statistics
Personal Information			
Gender	Dichotomous	Female = 50%, Male = 50%	Female = 50%, Male = 50%
Locations		Urban = 77%, Rural = 23%	Urban = 100%
School Types		Public = 65%, Private = 35	Public = 100%
Questions from the students			
Computer/Internet Literate	Ranked	Strongly Disagree = 50%, Strongly Agree = 50%	Strongly Disagree = 73%, Strongly Agree = 27%
Kankor procedure awareness		Strongly Disagree = 80% Strongly Agree = 20	Strongly Disagree = 65% Strongly Agree = 35%
Kankor preparation facilities	Dichotomous	Courses and available books = 35%, None Preparation = 65%	Courses and available books = 20%, None Preparation = 80%
Dedicated hours for Kankor preparation	Ranked	Inappropriate = 59% Appropriate = 41%	Inappropriate = 85% Appropriate = 15%
Questions from the teachers and parents			
Impact of system to student's knowledge? To what extent are you satisfied?	Likert-type Scale	0 – 25%, 26 – 50%, **51 – 75%**, 76 – 100%	0 – 25%, 26 – 50%, 51 – 75%, **76 – 100%**
Whether the system improves the motivation of students? To what extent are you satisfied?	Likert-type Scale	0 – 25%, 26 – 50%, 51 – 75%, **76 – 100%**	0 – 25%, 26 – 50%, 51 – 75%, **76 – 100%**
Does the system increase the pedagogical activity of student and prepare them for university standard? To what extent are you satisfied?	Likert-type Scale	0 – 25%, 26 – 50%, 51 – 75%, **76 – 100%**	0 – 25%, **26 – 50%,** 51 – 75%, 76 – 100%

Table 2: Kabul statistical result

Results

In this study I have found that there is a big difference between capital and provinces participants, which was verified on different perspectives and draw a conclusion for further improvement of system in future. Furthermore, using of three-stage mixed approach played a key role for collection of data during this research.

The result of analyzed data based-on four main factors, which was used as an outcome of the research and verified the proposed system as a suitable and transparent system. As shown in Table 2 above the first verification was related to Computer and Internet literacy in high school level, in which 50% of Kabul participants using ICT tools in their educational activities that cavers 32.5% private schools and 17.5% public schools. Whereas, the level of ICT usage in provinces schools very low, in which 27% of the learners only interacting with ICT facilities and about 73% of them does not have any interacting with ICTs. According to the Kankor procedure awareness which has the primary priority for succession of Kankor examination, the majority of students especially student from provinces do not access to required Kankor guidance and basically do not have knowledge about the overall rules and procedures; that could help them get through this examination.

The survey shows that only 45% from Kabul participants and 31% from targeted provinces have the basic information about Kankor procedures, which is not more effective and considerable to keep the learners more competent between each other. In addition, for the Kankor preparation facilities only 35% of student's particularly female students from Kabul city and 20% only from the provinces can access to available resources and facilities; but the big number of them taking annually Kankor exam without any preparation. This situation makes the educational environment less competent and minimizes the level of motivation among the learners. Furthermore, according to survey about 41% from the Kabul city and only 15% from the provinces dedicated more than two hours per week their times for practicing of Kankor, but the majority of them appearing in Kankor examination without any practicing and concern. Therefore, e-Kankor system proposed based-on user requirements in the light of research questions mentioned in section III to prove the research hypothesis.

- Hypothesis
- Evaluate the impact of the system between Kabul participants and provinces; do they urge to use such ICT-based solution for preparation of Kankor examination?

Based-on defined hypothesis I compared the result of evaluation that carried out in Kabul and provinces.

Evaluation Result

In order to make sure and address the effectiveness of the proposed system I carried the system in evaluation process and compared the result of evaluation with preliminary data. The overall results that have been completed during the study ended in positive note and the feedbacks gathered and analyzed helped us for further improvement of the system in future.

Field Testing

After the success implementation of system in the first part of research which has been done during 10th March to 8th April 2015 with 20 male and female participants in Kabul city, I have tested the second part of the research in provincial high schools. The purpose of this phase was to receive the feedbacks and comments from provincial participants in order to evaluate the effectiveness of system in various perspectives. The questionnaire was designed according to the three major evaluation aspects (Usability, Psychological and Pedagogical) and basically used to determine student motivation in learning and overall system efficiency. Therefore, we used the Motivated Strategies for Learning Questionnaire (MSLQ) for our experiment. MSLQ is a useful tool in order to address the nature of student's motivation and use of learning strategies in different subscales, which focused to a particular factor. Meanwhile, this reliable tool evaluates the cognitive aspects and differentiate individual in self-regulated learning (Paracha, Mohamad, Jehanzeb, & Yoshie, 2009).

Field Test Result

The second part of the research has been implemented during 16nd July to 6th Sep 2016 with 20 male and female provincial participants including teachers and students. My research questions, for which I have conducted this study include:

- Does the system improve the motivation of students?
- Does the system increase the pedagogical activity of students?
- What is the impact of the system to student's knowledge?

To explore these questions, the majority of participants positively answered the questions and their responses based-on the modified MSLQ. The pie charts below illustrate the evaluation result.

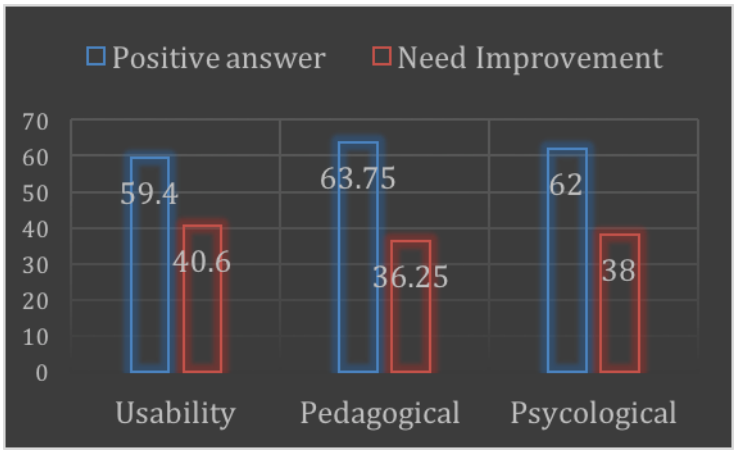

Figure 4: Kabul evaluation result based-on three main aspects

Of the 20 respondents, 60% rated our e-Kankor system as usable, 64%rated it as pedagogically effective, and 62% rated it as likely to motivate students (Fig. 4).

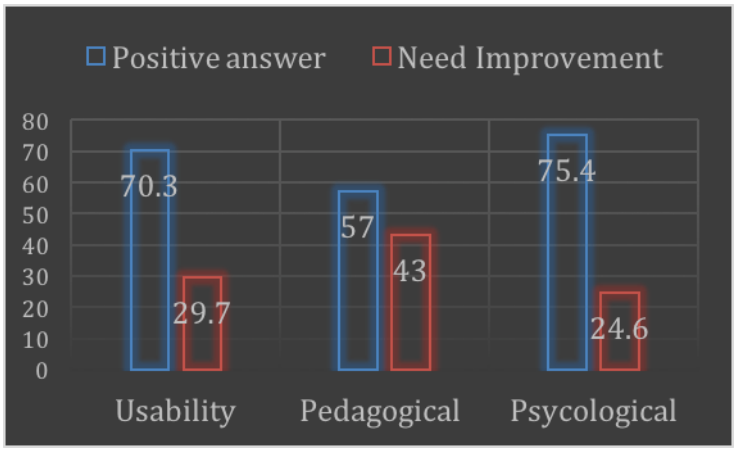

Figure 5: Provinces evaluation result based-on three main aspects

Of the 20 respondents, 70% rated our e-Kankor system as usable, 57%rated it as pedagogically effective, and 75% rated it as likely to motivate students (Fig. 5).

Findings and Recommendations

In Afghanistan, the national higher education entrance examination (Kankor Examination) is held annually by the ministry of higher education. High school student take the examination so that educational authorities can determine who is eligible to enter public and private universities. As the number of student enrollments in Afghan universities has grown rapidly, the existing paper-based Kankor examination system is too tough and flawed for thousands of school graduates who are unable to make it to university.

The proposed system can be a convenient prerequisite for general Kankor examination in the future. It will improve the efficiency and effectiveness of overall Kankor procedure in Afghanistan by replacing the current traditional system. Similarly, the system aimed to create an interactive educational environment between teachers and students to value for effective teaching and learning. The following are specific findings from the overall result of this research:

1. The system pilot that has been tested by students was relevant and satisfactory based on requirements and needs. They were satisfied and expressed their agreements through a variety of system initiatives include (Pedagogical activity, integrative design, exam focus question and contents and Test preparation strategy), which had huge psychological and pedagogical impacts.

2. According to the evaluation result, the system will have a very positive impact in knowledge and awareness of learners, it will not only give them a tool to prepare themselves for university entry examination, but also it will act as an appropriate guider and resource for them.

3. It has been observed and highlighted by the interviewees that the proposed system can be an efficient system, that not only increase their capabilities and competency, it will increase the ICT penetration in high school level that could be an opportunity to access the quality education in school level.

4. According to interviewees however, there are limitations in overall education system that need strong consideration.

However, still long way to go ahead, there are still challenges in Afghanistan education system. Due to long process of the government in enrollment and acceptance of new lecturers for the educational environments (Schools and Universities) particularly for the provinces, it is still need to have more lectures and expand classes and opportunities for young generation. The following are the specific recommendation on the basis of the findings:

1. Increase the capacity building and provide qualified lecturers for the universities to expand the enrollment of students to universities.

2. Provide enough practical practice resources for better teaching and learning.

3. Provide alternative and special practice environment for Kankor practice, also dedicate more time for students to practice.

4. Extend the time of schools from half day to full day.

5. Improve ICT infrastructure in both rural and urban areas.

6. Basic training to school administrations staffs to create a common understanding within the schools.

7. Establish deeper cooperation and coordination with national and international educational sectors.

Future work

The future work will be focused more on the interface to make it more appealing for the user and interactive. Furthermore, we intend to promote the system to general entrance exam, consider new features for secondary and primary level schools and have e-KEPS registration system inside the system as a part of our framework in the future. Similarly, we will cover the whole system localization and make it part of education.

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