Computer Assisted Learning in a Less Resource Region

Hamidullah Sokout, Samiullah Paracha, Abdul Rashid Ahmadi

Abstract—Passing the entrance exam to a university is a major step in one's life. University entrance exam commonly known as Kankor is the nationwide entrance exam in Afghanistan. This examination is prerequisite for all public and private higher education institutions at undergraduate level. It is usually taken by students who are graduated from high schools. In this paper, we reflect the major educational school graduates issues and propose ICT-based test preparation environment, known as '*Online Kankor Exam Prep System*' to give students the tools to help them pass the university entrance exam on the first try. The system is based on Intelligent Tutoring System (ITS), which introduced an essential package of educational technology for learners that features: (I) exam-focused questions and content; (ii) self-assessment environment; and (iii) test preparation strategies in order to help students to acquire the necessary skills in their carrier and keep them up-to-date with instruction.

Keywords—Web-based test prep systems, Learner-centered design, E-Learning, Intelligent tutoring system.

I. INTRODUCTION

NOWADAYS Information and Communication Technologies (ICTs) are widely used in a variety of fields all over the world, As for instance in education, ICT in education really change the way of traditional learning to more effective learning. Examination system is one of the more effective ICT tools which enable the learners to be more active in their education activities and interact with better and different perspectives especially 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.

National Higher Education Entrance Examination, or commonly known as Kankor Exam, is an academic examination held annually in Afghanistan. This exam organized by Ministry of Higher Education of Afghanistan.

It has been several years that Kankor exam is taken by more than hundreds of thousand students from across the country who just graduated from high school. However, due to poverty and lack of public awareness, Afghanistan severely lacks sufficient resource for providing entrance test preparation facilities and usages of ICT in school level. Usually those students can pass Kankor Exam who works hard, takes preparation Exam courses, and prepared well for the entrance

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exam. Indeed, Kankor is a very transparent process to categorize students on the basis of their talents and achievements.

Since 2001, in Afghanistan the number of students annually graduating from high school has moved on the quite convenient growth track. Annually, more than thousands increase in number of students taking part in entrance exam. In 2012, around 200 thousand students participated in Kankor exam, but unfortunately, their succession in entering to public higher education has not followed the same course. Every year a large number of graduate students with high number remain out of the higher education because of lack of awareness and enough knowledge about entrance exam especially students from provinces. Similarly, lack of enough practice facilities, insufficient education system and lack of enough ICT usage in school level are the part of main issues in Afghanistan [7].

The other major issue is poverty and economic miseries. Most of these students completed schools with gruesomely economic miseries. Their families tolerate cruel poverty in order to allow their children to study, hoping that one day their children get job and solve their economic problem. Here the chances are too limited. For many, the first try is the first and last one—succeed or live forever with nostalgia of getting higher education. Also Afghanistan is still experiencing the high level of illiteracy, so the supreme task is to take masses from darkness to light, from ignorance to knowledge and from illiteracy to literacy. What greater or better task is there than to educate the masses? That is way higher education is really the key success of a nation. So our people need higher education for this reason the providing of such system is mandatory.

Online Kankor Examination Prep System is a manageable and scalable web based application, which offers a secure and efficient testing solution for both examiners and administrators an easy to use with instant and credible result. This system hosted online examination software using multiple choices is the best test maker solution for training tests, self-study, and practice tests and more.

To promote educational services and to make it available in all over the country, creating such system is basic and fundamental requirement and vitally important and easier to manage and better serve for school graduates to really reach world's standards of education which creates systematic and regular preparation exam in Afghanistan.

In the coming sections, we begin the paper with problem analysis and objective analysis (Section II) In Section III, we describe the failed projects, follow by related work (Section IV). We are following the paper with proposed ICT solution follow by system architecture (Section V). In particular, we

emphasize the general system modules and the sub-function of each module. In Section VI we describe Intelligent Torturing System. In the last two Sections VII and VIII, we will describe the system evaluation methods and conclude the paper with discussions of limitation to be addressed through future work (Section VIII).

II. PROJECT PROBLEM ANALYSIS AND OBJECTIVE ANALYSIS

For the sake of clarity we are going to identify problems by creating of problem tree (see Fig. 1), and proposing the solutions through objective analysis (see Fig. 2).
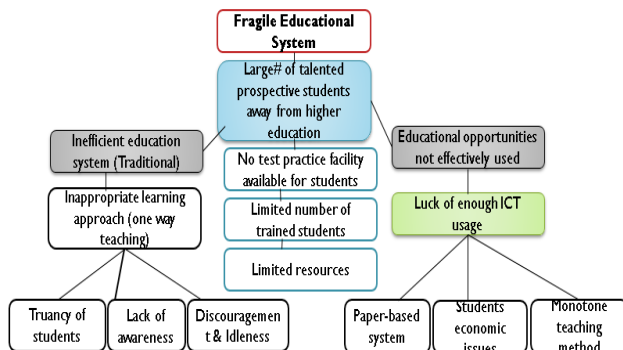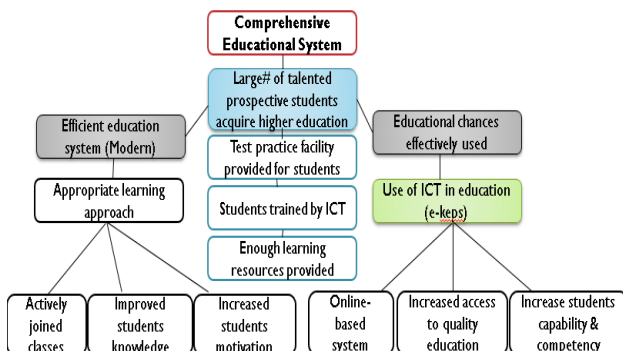

Fig. 1 Problem Analysis

Fig. 2 Objective Analysis

III. STUDYING FAILED PROJECT

The successful implementation of information systems based on better consideration and management of project. Each project (Information System) combines Information technology, people and data to support business requirements. Considering the appropriate technology, involving of people and having enough data help us to manage and implement the project successfully.

The success of IT projects is very few [13]. A big number of projects with huge amount of budget fail every year; and about $1 trillion on IT frameworks spend in 2005. The only reason of unsuccessful projects derived from lack of better system analysis, requirement analysis, risk analysis, use of immature technology, and lack of appropriate stakeholder, which based on unskilled people who are make decisions and manage the

projects. So in order to have successful projects we need strong analytical and interpersonal skills to build and have an accurate model of the proposed system.

Analytical skills enable us to identify and understand an issue, evaluate the key elements, propose and develop a useful solution. Interpersonal skills enable us to communicate effectively with different people in order to balance conflicting needs of users, and involve them in all development process. Today, users typically have a much more active role in projects. Experts now recognize that successful systems must be user oriented and users need to be involved at every stage of development.

Beside analytical and interpersonal skills we need to have strong risk management skills, which help us identify the risks, analysis the risks, and have mitigation strategy to avoid the risks. Risk is an unwanted issue, may accrue or may not; but could be the source failure of project. We face several risks in every development stage of projects; include time, scope, cost, quality, stakeholder expectations and so on.

IV. RELATED WORK

"In present days the availability of the computers and the wide spread nature of the internet has laid a strong foundation paths for conducting most of the prestigious exams on-line" [15]. Most of educational institutions and universities use online examination for their students at different level. These systems have become a promising alternative and replacements of traditional once. Due to improving of science and technology in developed countries, they are easily using such system [12].

System that has developed an Arabic Web-Based Exam Management System [6], for Mansoura University, only support Arabic and English languages, provided at undergraduate level only, and does not provide self-study, and library materials for examiners. Similarly [5] has proposed a non-web-based exam system, which cover a small group of students in a local area network; especially those who are related to computer science. This system support computer related subjects only.

An Automatic Code Homework Grading Based System [1], has been developed on Concept Extraction, which automatically grade student's code assignments. The system proposed only for computer science students, whom related to programming field in order to evaluate and grade student's assignments and overcome the plagiarism. On the other hand an education web-based assessment and testing system [2], has been proposed which evaluate university level subjects especially physics. This system reduced grading load and help students to download their information and feedback papers immediately.

Similarly an online system [12] has been developed for a small number of students to take evaluate themselves and take the exams on-line. These two systems did not have ability to support self-assessment and library materials for examiners.

Furthermore a web-based system [10] has been proposed for basic computer at university level, which provides security to improve on-line examination system. The system designed to

identify students, using biometrics authentication which supports the security control and integrity of online exam process. Similarly the graphic editor is designed as an extension to the dynamic test development tool in distributed e-Testing cluster [9]. This system developed as a multilingual for creation of circuits and graphics, which have database with testing questions. The system generates tests dynamically with dynamic questions.

E-Kankor is different with other online examination systems; it will design according to the rules, policies and requirements of Ministry of Higher Education of Afghanistan. This system considered for school students to enable them to get ready, sense a positive changes to their ability and easily join the university. Fig. 3 indicates the mentioned system and drawing a conclusion between existing system and Online Kankor Exam Prep System. Fig. 3 differentiates the **e-KEPS** from the existing examination systems.

Examination Systems	Web-based	Test	Self-Study	Library	Practice-test	Open-Source	Intelligent Tutoring System (ITS)	Multi-Subject
Non-web-based exam system		✓				✓		✓
Automatic Code Homework Grading Based on Concept Extraction	✓	✓				✓		
Arabic Web-Based Exam Management System	✓	✓		✓	✓	✓	✓	✓
Education web-based assessment and testing system	✓	✓				✓		
Exam System	✓	✓						
Online system	✓	✓					✓	✓
e-Testing cluster	✓				✓			✓
Web-based examination system	✓	✓					✓	✓
Online Kankor Exam Prep System	✓	✓	✓	✓	✓	✓	✓	✓

Fig. 3 e-KEPS related work

V. E-KANKOR EXAM PREP SYSTEM

Online Kankor Exam Prep System (e-KEPS) is a web-based system, which based on multiple choices question for Afghan school students in order to make them ready to join Universities.

This system supports many kinds of questions related to Kankor general exam, ability to grade students automatically and provide various Kankor materials for students. This system will design with various open source technologies like (PHP and HTML5 for interfaces, AJAX for scripting and MYSQL for database) under the GPL license, in order to give rights to volunteers to easily bring their desired changes in system.

The system architecture as shown in Fig. 4 is intended to provide four types of subsystems/ modules to better manage and provide a leaning environment for students. Each module is described below:

A. Exam Management Module

This part of system belongs to teachers, who are responsible to do the following tasks.

1. Question Management which includes (preparation of questions, categorizing of questions, creation of courses, and arrange of question according to subject and topics).
2. Exam Management which includes (organizing of exam, preparation of exam and controlling the exam).
3. Student Management which convers (categorizing of students, organizing of students, and giving the feedback to students).
4. Subject Management which includes (categorizing of topics, preparation of topics).

B. Exam Engine

This part of system related to the students, who are responsible to do the following tasks:
1. Take exam
2. Manage profile

C. Library and Practice Test

This part of the system also related to the students for self-study practice-test and access the library.

D. Maintenance

This part of the system belongs to system administrator in order to keep the system with better performance and monitor the system. Fig. 4 shows the system architecture.
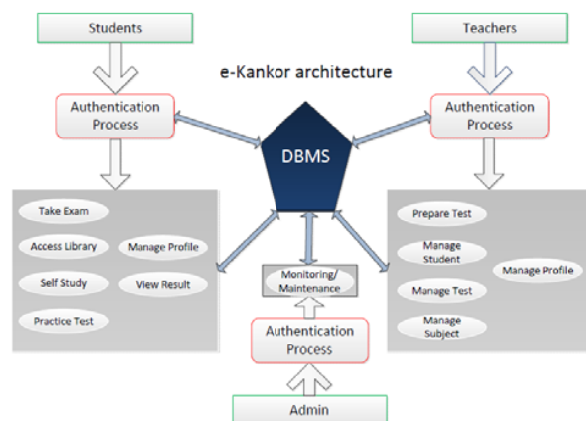

Fig. 4 e-Kankor system architecture

The system will provide authentication ability for different users and switch them to their own page according to their role. All users' information, questions and answers will be managed by DBMS; and the system will have the ability to auto grade the students according to the correct answer.

VI. INTELLIGENT TUTORING SYSTEM

An Intelligent tutoring system is computer-based knowledge that enabling learners to use a variety of computer technologies in an effective manner. ITS provide a multiple benefits of a human tutor to very large number of students and help them to acquire the necessary skills in their carrier and keep up-to-date with feedback and education. ITS interacts with cognitive psychology to provide the best test environment for various

theories [8]. It provides considerable ability according to the needs of students to interact with learning materials, representing pedagogical decisions and to achieve their intelligence. It consist five basic components that includes (Student model, Pedagogical model, Domain knowledge model, Communication model and Expert model [8], [11].
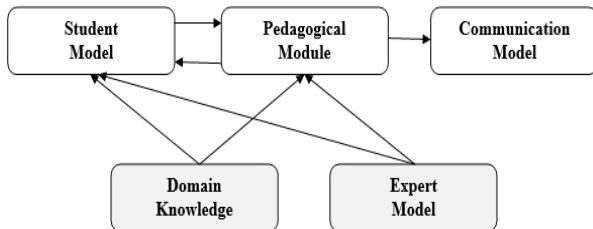

Fig. 5 Interactions of components in an ITS [14]

A. Domain Model

This model (also known as cognitive model) is a knowledge-based model which contains the concept, rules, and problem-solving strategies of the specific domain that has to teach for learners. This model keeps relationship with pedagogical model to play important roles of serving the ordering mechanisms to student model. It also play as a repository of expert knowledge for evaluating the students' performance and ability [16].

B. Student Model

Student model is considered as the kernel part of ITS components that establish relevant information packages for learning process and provide a suitable and flexible learning environment for learners. Students using the *model tracing* process to step-by-step build a solution for problems. The system that build and keep update the student is called student modelling that could be static or dynamic. Static modelling based to the initializing of model that occur only once (usually in the time of student's registration). In contrast, a dynamic modelling keeps the information changing and up-to-date [3].

C. Pedagogical Model

This model provides the necessary information according to the needs of students. Pedagogical model according to the received information from domain and students models makes choices about tutoring strategies and an efficient engineering effort to transfer the exact information to the students. This model provides timely feedback with instant result in a shorter period of time to reach to the desired skills.

D. Communication Model

Communication model is an interface between system and user that control the interconnectivity of learners and offer the educational materials to them. This model provides the means of understanding in both directions for learners. For creation of session we need three types of information. First required information about the model in order to create a session and make awareness of user during the dialogue, second the required information for the contents of communication and

third the necessary information which explain the purpose of communication [4].

E. Expert Model

This model based to the level and ability of students and provides the solving problems through pedagogical model to them. Pedagogical model manage the interaction with the student according to its teaching knowledge and comparisons between student and domain models. This concept is more similar to domain knowledge model according to the [14] but expert model is more specific [16].

VII. EVALUATION STRATEGY

A. Data and Methodology of Data Collection

The overseas research was held from 3rd Aug to 1st Sep, 2014 in Afghanistan. The purpose for the research was to echo the feedback received from the target audience on the overall e-Kankor system, structure, contents, and system usefulness and so on. The evaluation also aims to bring the necessary changes on the project design and requirements. During the overseas research in Afghanistan, the survey was conducted in Kabul city. Due to shortage of time, we only covered six high schools (Boys and Girls), which includes urban and rural areas. The more targeted information has been received from respondents when students fill out the questionnaire and data which have been collected through interviews with right people (teachers and parents).

The survey sample size was taken 30% of total students and teachers that focused to tree high schools classes (10, 11, and 12). To ensure accuracy of sampling the systematic sampling method was used for selection of students using the formula I = N/n, where "I" stands for sampling interval, "N" stands for students size, and "n" is required sample size.

I = 180/60 => 3. (The result identifies that every three students interviewed for survey).

The first school (Zarghona high school) was chosen as the starting point which is the biggest school with huge number students in Kabul city, after that we continued the survey with other public and private high schools. The questionnaire papers were designed in two different formats (national language and English).

For the validity of data and in order to assure the accuracy of data collection, we have officially contacted with two authorized departments (Department of Education and Department of Cultural Affairs) of ministry of education and have received the official reports for conducting interviews and distribution of questionnaires to the stakeholders.

During the developing of system, we prefer to use Incremental development method, which supports the Learner cantered design approach that totally based to education environment and focus to the interest of students. This approach also provides user involvement, which support the learners and instructors in using feedback and make deference between practice and theory. Learner centered design approach

has series of intermediate deliverables. Therefore it makes sure that what is done and what the stakeholder expects.

B. Tool Used for Data Collection

A questionnaire consisting of 14 questions and five sections has been designed to be used as data collection tool. The five sections include Kankor general information, availability of Kankor facilities, times for practice Kankor exam, problems and comments. Questionnaire consisted open-ended questions in order to allow interviewees to present their ideas completely, it included some Yes/No questions as well. Answers to questions were in radio button style, helping interviewers to tick one answer easily to save time as well as to record accurate information.
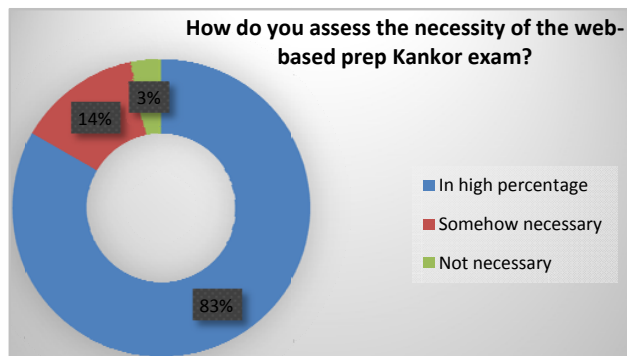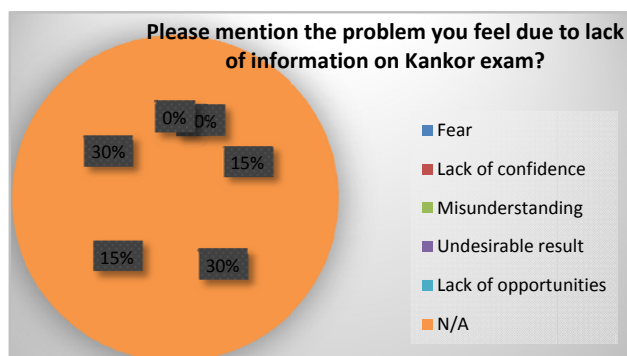

Fig. 6 Close-ended question

Fig. 7 Open-ended question

C. Analysis Method and Tolls

The analyses 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. The information used for this paper was transferred from SPSS to MS. Excel to allow for better and easier analysis and understanding. Fig. 6 shows one of the close-ended questions and Fig. 7 shows one of the open-ended question analysis type format.

83% of the students mentioned the necessity of prep Kankor system in high percentage, 14% of them somehow agree with the system and the only 3% of them selected the last option.

VIII. FUTURE WORK

In compliance of the current requirements and needs of Afghanistan, studying and analyzing of existing web based system especially online based systems builds an image and will find out the effective solution based on regulation and rules of Afghanistan to manage better and improve educational services and standardize computerized system. For future work we are trying to overcome the limitation of system that include user interface; to make it more user-friendly and interactive to participants. Furthermore, we intend to promote the system to general entrance exam, consider new features for secondary level schools and have e-Kankor registration system inside the system as a part of our framework in the future.

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