

HKDA-IQPGS: A TRUE INTELLIGENT QUESTION PAPER GENERATOR SYSTEM TO FIND PATTERNS OF QUESTIONS THAT HELP STUDENT SUCCESS IN MODERN E-LEARNING

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Abstract

There is a great boom in e-learning in the area of technology-enhanced Intelligent Tutoring Educational Systems where excellent virtual instructors/teachers guide their learners/students. Progress has been made, addressing a variety of educational needs, ranging from supplements to existing “traditional” courses, to complete on-line courses, to complete on-line programs. Despite all this effort, hype, and even product development, most of the courseware material available for use at the educational level is still not judged to be as effective as a teacher lecturing and leading discussions with students.

It is often necessary for a teacher to prepare a test over information for which students have been previously quizzed or to administer multiple versions of same test. When this situation occurs, teachers are required to spend extra time creating equivalent questions. The major difficulty with this problem lies in efficiently creating sets of equivalent questions.

To solve this problem of efficiency, instead of creating the question set, the teacher may create pattern of each question. Once pattern of a question is created for each question in a test, multiple equivalent tests can be generated as necessary. In this paper, authors introduce a specific, topic-based knowledge modeling approach which has been implemented as a Question Agent in HKDA System and used in HKDA-IQPGS. HKDA-IQPGS that aids teachers in creating number of question patterns and in generating equivalent variety of questions for an Intelligent Tutoring System as HKDA System. With HKDA-IQPGS, the students can explore more questions, work on questions more persistently, and accessed a larger diversity of questions. This increased participation resulted in the larger increase of their knowledge at the end of the course.

Keywords: Intelligent Question Paper System, Question Model, Academic Learning, Knowledge Map.

1 INTRODUCTION

Knowledge and wisdom have been regarded as the highest virtues of man in Indian society since the times immemorial. Over the past several years, considerable effort has been devoted to research in the area of technology-enhanced education [7,11]. Progress has been made, addressing a variety of educational needs, ranging from supplements to existing “traditional” courses, to complete on-line courses, to complete on-line programs [4,9,11].

Web-based learning environments are becoming very popular where an array of media resources are employed to facilitate learning and provide channels of communication between the learners and tutors [3,9,10,11]. Typical web-based learning environments, such as Virtual-U [13], Blackboard [1], MUVE [2], QuizPACK [6] and Web-CT [15], include course content delivery tools, synchronous and asynchronous conferencing systems, polling and quiz modules, virtual workspaces for sharing resources, white boards, grade reporting systems, logbooks, assignment submission components, etc.. [5,6].

The problem of the current generation of Adaptive Web-based Educational systems (AWBES) is not their performance, but their architecture. Structurally, modern AWBES do not address the needs of both university teachers and administration [6,8].

Intelligent tutoring systems (ITS) attempt to bring in aspects of a human-teacher delivering personalized tutoring to a student, into online computer-based learning environments [12]. One of the important and challenging issues in conduction of online test/computer aided examination is the construction of question paper that can meet various assessment requirements. Various studies have

indicated that selecting a question paper to best fit multiple assessment requirements can be formulated as an optimization problem. The problem is known to be NP Hard in the literature and hence the development of efficient solution method is difficult. In order to handle such problems we seek quality approximate solutions in a reasonable time.

In the paper, authors proposed an approach for generating the near-optimal question paper from a large question bank. An optimal question paper is one which meets multiple assessment criteria such as the ratio of the relevant concept to be evaluated, degree of difficulty; estimated time limit and distinction of questions. We make use of meta-heuristic search technique for generating the question paper that approaches the specified criteria for an exam.

1.1 A User-Friendly Interface

Researchers use web browser (thin client) as user's interface where the web browser has designed in MVC technology based on AJAX (Asynchronous Java and XML) with SOAP. The user interface has a uniform & consistent and may change based on his preference, Knowledge Agent (KA), Domain Advisory Agent (DAA) or Tutoring Agent (TA). Almost everyone is able to use it skilfully. Therefore it can eliminate the differences of various exam systems and guarantee a fair test. HKDA System includes interfaces as Adapted Presentation, Indicate adaptive navigation support, Course structure display, Concept index display, Show Competence Level and Student response to questions. The system interface is updated by performing measuring.

In this proposed Human Knowledge Discovery Agent-Intelligent Question Paper Generator System (HKDA-IQPGS), authors are broadly focusing on various aspects of question paper generation and graded automatically. Authors have classified the question bank into 7(Seven) different types of question patterns and such are Objective Type, Short, Long, Information Page Type [Upload Page & Raise Question], Hotspot [Graphics/Text], Cross Matching and Free Format.

In this thesis, our focus is to richer types of answers along with annotating the pedagogical material using metadata for facilitating its reusability to the teacher/tutor, student/trainer if anything wrong or go right, so that our HKDA ontology play proactive role in this proposed system.

1.2 Question Types in HKDA-IQPGS

The main purpose of the question bank is to eliminate or reduce to a considerable extent, the defects on setting a question paper. At present, examiners and paper setters usually adopt an ad hoc procedure. The selection of questions is not done systematically and it is not uncommon for paper setters to just repeat questions from the last few years question papers. There is no attempt to work out a table of specifications and to select/write questions to represent all the cells in such a table. A systematically developed pool of questions of evaluation, namely a question bank, offers a chance to set up valid and reliable question papers to compare the performance of a group of students with that of the wider population and to match the examinations to the curriculum that is taught, instead of the other way round.

In this proposed HKDA-IQPGS, authors have classified the question bank into types of question patterns categories of base response types according to the response styles of answers.

This allows rapid learning of test questions to assess students' problem solving knowledge. Authors represent a very promising and expected evolution for the knowledge based agents for question paper generation for facilitating its reusability to the teacher/tutor, student/trainer in this proposed system.

1.3 Simplified System Maintenance

As we all know that questions are at the heart of question paper generator system. Authors support various types of question besides standardizing the created questions. Table 1 shows that there are twenty different types supported in this HKDA-IQPGS.

Question Type	Description	Response Type
true/false	Selecting a response from the choices 'True' and 'False'	LID
single response	Selecting a single response from the choices	LID
multiple response	Selecting multiple responses from the choices	LID

order	reordering the choices that are displayed initially	LID
associate	pairing up the choices that are displayed initially	GRP
match	pairing up choices from a source set into a target set	GRP
gap match	filling gaps from an associated set of choices	GRP
inline choice	filling gaps from a shared stock of choices	LID
text entry	filling gaps by constructing a simple piece of text	STR/NUM
extended text	entering an extended amount of text	STR/NUM
hot text	Selecting choices embedded within a surrounding context	LID
hot spot	Selecting areas (hotspots) in the graphic image	LID
select point	Selecting points in the graphic image	XY
graphic order	reordering the choices that are presented as hotspots on a graphic image	LID
graphic associate	pairing up the choices that are presented as hotspots on a graphic image	GRP
graphic gap	a graphical interaction of filling gaps from an set of choices	GRP
position object	positioning a given object on the image	XY
slider	Selecting a numerical value between a lower and upper bound	NUM
drawing	using a common set of drawing tools to modify a given graphical image	FILE
upload	uploading a pre-prepared file representing the response	FILE

Table-1 Different types of question sets

These questions types can be classified into six categories of base response types according to the response styles of answers. They are:

- LID (Logical Identifier)
 - A category of response styles that presents various choices and provides a mechanism for the test taker to select one or more choices.
- XY (X-Y Co-ordinate)
 - A category of response styles that presents an image, or various images, for the test taker to select a position on the image or images to indicate their choice.
- STR (String)
 - A category of response styles that allows the test taker to enter text.
- NUM (Numeric)
 - A category of response styles that allows the test taker enters a number to indicate their choice. The entered number can be integer or float data type.
- GRP (Logical Group)
 - A category of response styles that allows a test taker to group objects together to indicate their choice. It can be classified into 2 sub-categories: pair and directed-pair.
- FILE
 - A category of response styles that allows a test taker to upload a file.

1.4 Central examination management

Profiting from the central controlled system depicted in figure: 1, various agents playing their role in different areas of functions such as:

- Examination Paper Designing: This functionality is managed by Teacher/Tutor, Expert Agent (EA), Question Agent (QA). Auto generated question are also prepared if agents are busy with other work.
- Examination Maintenance: Major role is played by Domain Advisory Agent (DAA) and passed it to Knowledge Agent (KA): The agents maintaining the examining and they may Teacher/Tutor, EA, QA.
- Examination Supervision: Dedicated and Knowledgebase managed by our YAW Agent of system named as You Are Watching System. From the beginning to end of the examination, monitoring the student/trainer' conditions on the teacher's screen.
- Question Paper Answering: This system is not specific to Student/Trainer but also any level of users can go for test to improve in different domain.
- Paper Scoring and Review: Paper result is declared by the Scoring Agent (SA) and passes it to Answer Agent (AA), KA, EA, DAA, Teacher/Tutor, and Student/Trainer. Review Agent (RA) presents all reviews result and report to all such agents.

Security

All the questions, materials and answers are transmitted in bits stream format after encoding file format [14]. It can ensure not only security in the transmission process, but also protect from invasion.

- When one student starts his test, the system will distribute him a password produced according to his client's hardware and operation system environment. It can prevent cribbers to login from other clients imitating this student.
- The newest method to prevent the distant student from leaving the client or is making use of face detection and recognition technology [14]. Before the start of the exam, the student is asked to sit in front of the computer camera, which can monitor the whole scene. Then the system will automatically recognize the student's face and his identification. As soon as the validation is performed, the student must stay in front of the camera until the exam is finished.
- If there is a change of power failure or Internet disconnect then it can also track by the YAW Agent.

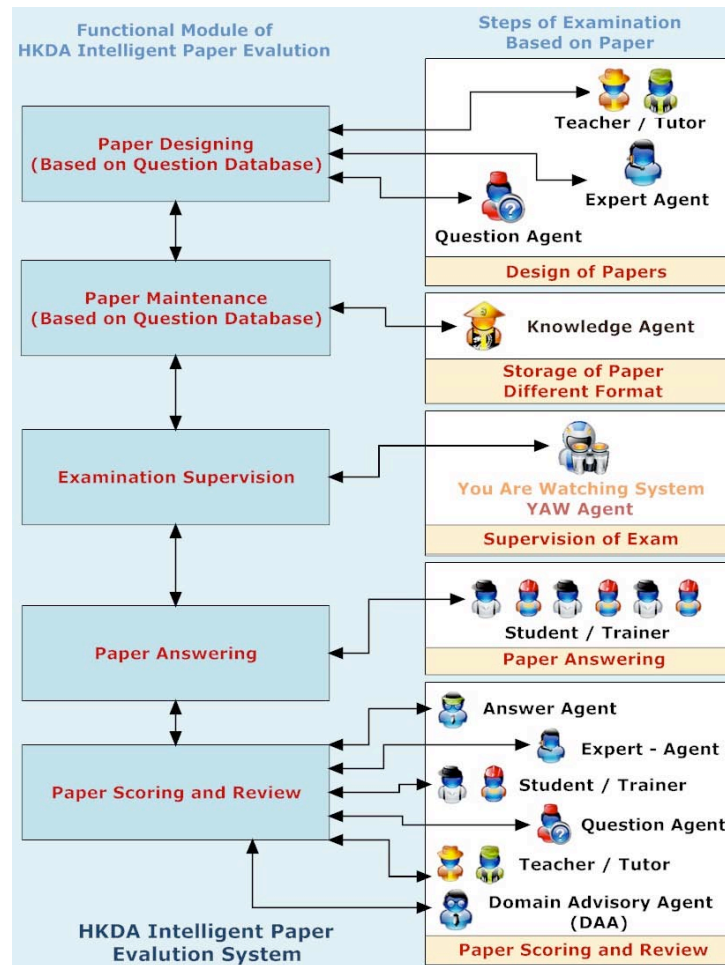


Figure: 1 HKDA Intelligent Paper Evaluation System

2 ESTABLISH A LEARNING STRATEGY

This should be laid out keeping in mind the learning goals, processes, job roles, culture, people and how they learn. You should treat this data as the basis to define how training will support them and help them grow. One more thing to keep in mind while establishing your learning strategy should be that it should not only focus on immediate short term objectives but also keep in mind the long term goals to give it a longer life span. You don't want to get into a similar process 18 months down the line when your educational/industrial system has significantly expanded and your learning strategy did not factor that in.

2.1 HKDA Blue Print

The map given below shows the weightage of educational/industrial objectives, points of content and types of question is known as HKDA Blue Print. This functionality is managed by Teacher/Tutor, EA, QA. Auto generated question are also prepared if agents are busy with other work. The Table given below shows the weightage of educational/industrial objectives, points of content and types of question. Objective behind to develop such type of system is to check the Learner Agents various level which are knowledge, understanding, application and skills. Therefore, whenever there a demand of skill person in this model, Exam Agent/Expert Agent can provide the % level to check his/her skills. Authors provide one example for the University/College/School Exam based on Objective wise weightage.

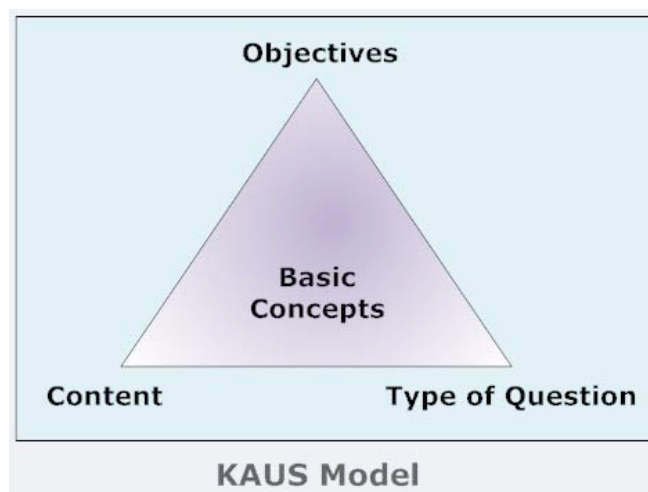


Figure: 5 HKDA KAUS Model

Objective behind to develop such type of system is to check the student/trainer and teacher/tutor knowledge, understanding, application and skills. Therefore, whenever there a demand of skill person in this model, exam agent/expert agent can provide the % level to check his/her skills.

The Objective wise weightage is given below for normal University/College/School Exam:

KAUS Model:

Sr. No.	Objective	Marks	Percentage (%)
1	Knowledge	30	30
2	Understanding	30	30
3	Application	30	30
4	Skills	10	10
	Total	100	100

Table: 2 KAUS Model Table

Industry/Corporate checks the Skills and Application. So Exam Agent/ Expert Agent can change the % of KAUS Model to meet the Industry/Corporate requirement. Similarly Expert Agent can change the % of KAUS Model to keep track of Learner Agent in right path. Based on this KAUS Model author have designed a KAUS Table.

Topics/ SubTopics	Knowledge						Application						Understanding						Skill						Total Questions
	1	2	3	4	5	TK	1	2	3	4	5	T A	1	2	3	4	5	T U	1	2	3	4	5	T S	
TL₁ (e.g. T _{1.1} , T _{3.2})	2	0	0	0	0	2	0	0	2	0	0	0	0	0	0	0	0	2	0	0		0	0	2	2
TL₂ (e.g. T _{2.1} , T _{1.2})	0	2	0	0	0	2	0	0	0	0	2	0	0	0	0	0	0	0	2	0		0	0	2	2

TL₃ (e.g. T _{4.1} , T _{1.2})	2	2	0	0	0	4	0	0	2	0	2	0	0	0	0	0	0	2	2	0	0	0	4	4	
TL₄ (e.g. T _{7.1} , T _{6.3})	2	0	0	3	0	5	0	0	2	0	0	0	3	0	0	0	0	2	0	0	3	0	5	5	
TL₅ (e.g. T _{8.3} , T _{4.4})	0	0	2	0	0	2	0	0	0	0	0	2	0	0	0	0	0	0	0	2	0	0	2	2	
Total Topics/ SubTopics	6	4	2	3	5	20	1	0	6	0	4	2	3	0	1	0	0	6	4	2	0	3	0	15	15

Table:3 KAUS Model Table in Detailed Form

Similarly Expert Agent can change the % of KAUS Model to keep track of Learner Agent in right path. Importance of Blue Print:

- Which topic of the various subject of syllabus should be given how much weightage can be decided from it.
- On the basis of the Chapters, the weightage of different types of question can be decided.
- The complete syllabus can be covered up.
- Various objectives can be given sufficient justice.
- The same weightage is not repeated every time/year.
- The form of question is formed in the accordance of difficulty level of the Chapter.
- The measurement of remembrance ability, retention ability, obtaining skills, application etc. can be done more clearly by the Learner Agents.
- An ideal question paper can be formed.
- The faith, which has been lost from the method of exam, can be reestablished.

This KAUS Table gives us the details of the question paper. While generating question paper, KAUS Model determines for the Industry/Educational Objective Level (OL) requirement. This can be changed by EA, TA to meet the LA requirement. While changing any of the KAUS level, first it will check whether the questions are available in the Bivariate Sample Table (BST) according to Question Level (QL). This BST will then feed in to the Question Bank (QB) according to OL. If questions are not available in the QB then it will ask to BST to pick up another sample and process will be in continuous manner and provide the question set to the EA,TA. No match between BST and QB then change the OL and generate question set.

3 ADVANTAGE OF NEW PROPOSED SYSTEM

3.1 Quantifiable Benefits

- a) Student/trainer belongs to the Institute and even outside student/trainer can give this examination and improve their skills.
- b) This System includes the facility of giving and conducting examination online so it can save time. Apart from just giving examination online, it offers equal opportunities for online learning as well.
- c) Student/trainer belongs to institute are able to manage their information through system.
- d) Student/trainer can plan and schedule their examination keeping in mind of their knowledge; preparation and they have to appear in the regular exams also set by the teacher/tutor members.
- e) Student/trainer can also submit questions to question bank.
- f) Student/trainer can also get more information related to career, websites etc.
- g) Teacher/tutor can manage their question bank well.
- h) Teacher/tutor have enough facilities to plan an exam keeping the individual student/trainer in mind by just setting some of the policies and constraints rather having to bother at setting question papers for individual. Its automatically done by system.
- i) Only the teacher/tutor has rights to display result on the spot or later in the form of reports.

- j) The administrator maintains the teacher/tutor and student/trainer users. He provides various rights to individual student/trainer to appear in examination and teacher/tutor to conduct examination.
- k) System provides vast array of reports to both student/trainer and teacher/tutor.

3.2 Non-Quantifiable Benefits

- a) Learner Agent can call up any Expert Agent to communicate or share knowledge.
- b) Expert Agent also using his cognitive to gain knowledge from Learner Agent.
- c) This *HKDA-IQPGS* supports the security aspect like Session Tracking. In Session Tracking, when one user is logged in with his/her Userid, another user is login with same Userid then previous user's session is going to expire.
- d) This *HKDA-IQPGS* stop Agent Facility to the User when He/she is going for Examination.
- e) Teacher/tutor can spend their time on other activities rather than setting and checking the question paper for Student/trainer.
- f) Teacher/tutor can check the Student/trainer performance in examination in particular subject.
- g) System can get Creative Thinking & Performance, Interpersonal & Social Skills, Attitudes, Appreciations & Values of individuals.

4 CONCLUSION

HKDA-IQPGS is a very encouraging effort of Shrimad Rajchandra Institute of Management & Computer Application for the student/trainer to learn, improve and master their skills effectively with their own pace. Student/trainer can test them from average, normal to even broader depth by setting some of the criteria. Student/trainer get better feedbacks by different agents of the system regarding to their performance, weak points, skills etc. Teacher can schedule and customize examination keeping the individual learner in mind with no extra time. System provides an easy and the best way to teacher/tutor members to monitor the growth of the student/trainer by going through the vast array of useful reports generated by the system. The system provides some of the powerful features, which are basically not found in CBT, CAI systems. It traps individuals learning patterns and gives feedback based on their performances. It sets questions automatically based on such performances rather than randomly setting questions that is normally found in online examination simulators. HKDA-IQPGS also provides enough opportunities to learn as well. HKDA-IQPGS is made in more generous that it can be used in any domain at the cost of little bit configuration and tuning. The system is reviewed by some of the industry experts and experienced academicians and has been able to win their appreciations.

Currently, implementation tasks are being developed. The first prototype is extended to include a rich set of procedures and exercises. Next task will treat the complete integration of the systems.

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