5 HKDA-IQPS (INTELLIGENT QUESTION PAPER GENERATOR SYSTEM): A TRUE INTELLIGENT QUESTION PAPER SYSTEM TO GENERATE PATTERNS OF QUESTIONS THAT HELP INDIVIDUALS FOR SELF-ASSESSMENT QUIZZES IN MODERN E-LEARNING

5.1 Introduction

There is a great boom in e-learning in the area of technology-enhanced Intelligent Tutoring Educational Systems where excellent virtual instructors/teachers which 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 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.

However, it is difficult to make a fair online evaluation of how well the students understanding. There are several disturbances for realizing fair grading such as mere duplication of answers between the students or illegally pretending to be other persons to answer the exam.

An online question bank and examination system is a relatively new and rapidly expanding system. Although it is an effective solution for mass education evaluation, the fairness of the evaluation is still a big concern. Most of the present systems were designed to grade students based on how well they have done on their examination.

These systems were designed with the concept of traditional paper based examination in mind. There is a need to use a range of different
assessment methods, in order to prevent assessment being biased against students that have particular problems with one particular method.

Another drawback of present systems is that there is no flexibility and there are very limited options for the examination questions. Most of the systems were designed to deliver and mark multiple choice questions. These systems will not precise enough to represent the knowledge of individual users and to select problem to extend the user’s current level of understanding.

On top of that, the definition of the level of difficulty for examination question often creates an argument. There do not have a clear mechanism to define the level of difficulty for each question. Hence, there is a need to come out with a system that can base on question difficulty assessment algorithm to determine the level of difficulty for each question.

It is often necessary for a teacher to prepare a test over subject(s) or various topics for students who have been previously quizzed or to administer multiple versions of the 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.

In this thesis, researcher introduces a specific, topic-based knowledge modeling approach which has been implemented as a Question Agent in HKDA System and used in Human Knowledge Discovery Agent- Intelligent Question Paper Generator System (HKDA-IQPGS). HKDA-IQPGS that aids teachers in creating number of question patterns and in generating equivalent variety of questions for an online 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.

The HKDA-IQPGS provides a user friendly question pattern editor with a GUI and the question generation module. The HKDA System employs a robust Goal Driven Service Oriented Architecture so that a generalized problem description can be represented.

5.2 Model View Control (MVC) Design Pattern

MVC design architecture bases on the separation of three main distinctive components of an application: (i) the presentation layer (view) that deals with the visual display of the application and the whole Graphical User Interface (GUI), (ii) the logic layer (controller) that describes the behavior of the application and connecting components, presentation and data layer to each other. (iii) The data layer (model) that is responsible for the data collected on the client-side.

Figure 5.1 displays the structure of an MVC design pattern. Furthermore, using Java as development language, the MVC design principles can be fulfilled by the binding to the specific Java Interfaces and Components available.

The basic MVC components are programmed in Java, for the case of the model, researcher uses the Java Bean specification, as an example data is stored, updated and selected by setters and getter methods in order to completely separate the logic of the Model from the View or the Controller.

In terms of the web-based approach desired, the View component is managed by means of Java Server Pages, which deliver the required html
code as basic source code to any browser. The AJAX Tag Library is a set of JSP tags that simplify the use of Asynchronous JavaScript and XML (AJAX) technology in JavaServer Pages.

For the case of the Controller, in order to centralize the code the servlet classes are programmed as part of a servlet application. This article will guide you on writing AJAX based application for fetching data from the Servlet and showing it on JSP page. In order to attract the users, researcher uses different panes as left view (in form of tree view), top view (for various links), bottom view (copy right act) and main view (control of left view), which are fast, with a nice GUI as WIDGET and with a great deal of action with various tricks. Furthermore, the HKDA is developed generally only taking into account just the previous concepts, rarely is there an interest to fulfil some didactic material.

In the case of researcher research, first there lies the teaching material, examination and evaluation must be developed to achieve each one of these tasks, while maintaining the design principles mentioned for educational systems. Therefore, much time of the research was devoted to the specifics of the View element, yet its communication with the Java View element was achieved without much difficulty.
Standardization of Intelligent Tutoring System for Adaptive Information Retrieval and Knowledge Discovery by Monitoring Human Interaction
5.2.1 Model

Model acts as the data layer in MVC design pattern and can be responsible for data retrieval from data resources (from same domain or remote servers) through XML HTTP Requests (XHR). Creating a sub module for XHR requests can bring some benefits. Different XHR sub modules (AJAX, cross domain requests, etc.) can stand in model for data retrieval from a remote server.

The model is pure business logic which is nothing of HTML forms or JSP pages. The model defines a set of business functions that only ever get called by controllers, and the controllers act as proxies between the end user (interacting with the view) and the business logic (encapsulated in the model). This means that one can add a new view and its associated controller, and the model doesn’t know or care that there are now two different ways for human beings to interact with the application.

5.2.2 View

View is the actual presentation layer in MVC design pattern. The public methods in view are normally called by the controller to display the retrieved data in the UI. When the user clicks on an html <div> element, some data (here the “name”) is retrieved by the controller and put into a node in Document Object Model (DOM). Templates can be used to reduce the complexity of view and separate the HTML layout from the actual view’s functionality. Figure 5.1 shows this extension in a very simple style for deeper understanding.

The “view” is the user interface, the screens that the end user of the application actually sees and interacts with. In a WebSphere Application Server Community Edition (WASCE) web application, views are JSP files with AJAX. For collecting user input, a JSP that generates an HTML page that contains one or more HTML forms. For displaying output (like a
report), a JSP generates an HTML page that probably contains one or more HTML tables. Each of these is a view: a way for the end user to interact with the system, putting data in, and getting data out.

5.2.3 Controller

The “view” and “model” are in the sandbox of controller (passed as arguments of the closure function). The XML file is deployed as a resource in the Web application archive. Adding a new servlet is as simple as adding a concrete servlet subclass to the application archive and defining a configuration file mapping that associates the request URL with the servlet class. An example of such a mapping appears in Code given below. With no code modification, the sample application controller servlet can dispatch requests using actions that did not even exist when the controller was written.

View Controller

<display-name>eacademia</display-name>

Servlet Controller

Use a servlet mapping to map all URLs with a particular suffix or base URL to a specific servlet. A servlet mapping is a deployment descriptor definition that compares request paths to a pattern and dispatches matching requests to the corresponding servlet. For example, imagine that a Web application’s deployment descriptor defines the following servlet mapping:

<servlet>
  <description></description>
  <display-name>DisplayExamResult</display-name>
  <servlet-name>DisplayExamResult</servlet-name>
</servlet>
Imagine also that the servlet’s context path is http://localhost:8080/academia. The servlet container would direct a request with URL http://localhost:8080/onlineclasses.exam.DisplayExamResult to DisplayExamResult as the request URL matches the pattern DisplayExamResult. Servlet DisplayExamResult can extract the requested operation’s name from the request URL.

**Database Controller**

The following code shows an example of the web.xml file.

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns:xsi="http://www.w3.org/2001/XMLSchema-instance"
xmlns="http://java.sun.com/xml/ns/javaee"
xmlns:web="http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd"
xsi:schemaLocation="http://java.sun.com/xml/ns/javaee
http://java.sun.com/xml/ns/javaee/web-app_2_5.xsd" id="WebApp_ID"
version="2.5">
  <display-name>eacademia</display-name>
  <welcome-file-list>
    <welcome-file>index.htm</welcome-file>
    <welcome-file>index.jsp</welcome-file>
  </welcome-file-list>
  <resource-ref>
    <res-ref-name>jdbc/MyDataSource</res-ref-name>
```

---

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Creating a Data Source Using Administrative Console

In HKDA project select WEB-INF/geronimo-web.xml and add a dependency element. The final web deployment plan will look as follows:

```xml
<?xml version="1.0" encoding="UTF-8"?>
<web-app xmlns="http://geronimo.apache.org/xml/ns/j2ee/web-1.1"
xmlns:nam="http://geronimo.apache.org/xml/ns/naming-1.1"
xmlns:sec="http://geronimo.apache.org/xml/ns/security-1.1"
xmlns:sys="http://geronimo.apache.org/xml/ns/deployment-1.1">
  <sys:environment>
    <sys:moduleId>
      <sys:groupId>default</sys:groupId>
      <sys:artifactId>eacademia</sys:artifactId>
      <sys:version>1.0</sys:version>
    </sys:moduleId>
  </sys:environment>
</web-app>
```
A User-Friendly Interface

Researcher uses Web browser as user’s interface which has designed in MVC (Model View Control) technology based on AJAX with SOAP (see Figure 5.2). The user interface has a uniform and consistent and may change based on his preference, Knowledge Agent (KA), Domain Advisory Agent (DAA) or Tutor Agent (TA). Almost everyone is able to use it skilfully. Therefore in comparison to various examination systems, this HKDA-IQPGS guarantee a fair test.
HKDA System includes interfaces as Adapted Presentation, Indicate Adaptive Navigation Support, Course Structure Display, Subject Index Display, Show Competence Level and Student Response to Questions. The user’s interface is updated by performing measuring by Domain Advisor Agent and YAW Server Agent.

Figure 5.2: User Interface-Administrator Screen
In this proposed HKDA-IQPGS, researcher has broadly focused on various aspects of question paper generation and graded automatically. Researcher has classified the question bank into 5 (Five) different types of question patterns such are Objective Type, Short, Long, Information Page Type [Upload Page & Raise Question] and Cross Matching. One major part of this Objective Type is of subtypes such as True/False, Option Type, Multiple Selection, Fill in the Blanks and Single Line. For Short Type Question, researcher has focused on answer extraction method in the next Chapter.

In this thesis, 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.

5.4 Simplified System Maintenance

As we all know that questions are at the heart of question paper generator system. Researchers support various types of question besides standardizing the created questions. In Chapter-6 of Table 6-1, around twenty different types of question patterns were identified where researcher has exclusively focused on 5 (Five) different types of question patterns supported in this HKDA-IQPGS.

Since the system is based on Web based Service Oriented Architecture, Domain Independent Information (DII) and Domain Specific Information (DSI) can be easily updated [12, 25]. DII such as personal information, Background & Experience, Goals, Preferences etc. and DSI such as Overall competence level, Competence level for each structure unit, Competence level for each subject node, Misconceptions for each subject node are updated using initialization and adaptation algorithm.
This HKDA-IQPGS is helpful to:

• Classify new User
• Set initial values for overlay model
• Distinguishes several typical group of Users
• Learner
• Level-1 ... n
• Expert-1 ... n

System is allowing agents including learner to add questions from their specific domain in the Question Bank. Those agents who are trying to add questions in other domain Question Agent will take care of it. Similarly agents have their own privilege to update the system or the Question Bank or review on demand.

5.5 Question Patterns in Question Bank

Question bank can be described as the databank that keeps all the examination questions whether pre-existing or created by user while web based examination system is an online assessment tool that used to evaluate students’ performance.

In the Question Bank, there are 5 (Five) different types of question patterns treated as base response types according to the response styles of answers. In this section researcher is broadly focused on Objective Type question:

5.5.1 Objective Type

Objective type questions are composed of one question (stem) with Single/Multiple possible answers (choices), including the correct answer and several incorrect answers (distractors). Typically, students select the
correct answer by selecting the option button or multiple choice check box.

Students can generally respond to these type of questions quite quickly. As a result, they are often used to test student’s knowledge of a broad range of content. Creating these questions can be time consuming because it is often difficult to generate several plausible distractors. However, they can be marked very quickly.

In this research, Objective Type questions consist of various subtypes where the levels are defined according to their difficulty level. The levels along with subtypes are given in Table 5-1.

<table>
<thead>
<tr>
<th>Level/Weightage</th>
<th>Subtypes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>True/False</td>
</tr>
<tr>
<td>2</td>
<td>Option Type</td>
</tr>
<tr>
<td>3</td>
<td>Multiple Selection</td>
</tr>
<tr>
<td>4</td>
<td>Fill in the Blanks</td>
</tr>
<tr>
<td>5</td>
<td>Single Line</td>
</tr>
</tbody>
</table>

Table 5-1: Level of Question Types in the HKDA System

5.5.2 Short Type

Short type questions are typically composed of a brief prompt that demands a written answer that varies in length from one or two words to a few sentences. They are most often used to test basic knowledge of key facts and terms. Short type questions are used to test higher thinking skills, including analysis or evaluation. Many teacher/Knowledge Agent report that Short type questions are relatively easy to construct and can be constructed faster than multiple choice questions. Unlike matching, true/false, and multiple choice questions, short type questions make it difficult for students to guess the answer.
Short type questions provide students with more flexibility to explain their understanding and demonstrate creativity than they would have with multiple choice questions; this also means that scoring is relatively laborious and can be quite subjective. Short type questions provide more structure than essay type questions and thus are often easy and faster to mark and often test a broader range of the course content than full essay questions.

5.5.3 Long Type/Essays

Long type questions provide a complex prompt that requires written responses, which can vary in length from a couple of paragraphs to many pages. Like Short type questions, they provide students with an opportunity to explain their understanding and demonstrate creativity, but make it hard for students to arrive at an acceptable answer by bluffing. They can be constructed reasonably quickly and easily but marking these questions can be time-consuming and grader agreement can be difficult.

Long type questions differ from Short type questions in that the Long type questions are less structured. This openness allows students to demonstrate that they can integrate the course material in creative ways. As a result, essays are a favoured approach to test higher levels of cognition including analysis, synthesis and evaluation. However, the requirement that the students provide most of the structure increases the amount of work required to respond effectively.

Students often take longer to compose a five paragraph essay than they would take to compose five one paragraph answers to Short type questions. This increased workload limits the number of Long type questions that can be posed on a single exam and thus can restrict the overall scope of an exam to a few topics or areas. To ensure that this
doesn’t cause students to panic or blank out, consider giving the option of answering one of two or more questions.

**5.5.4 Information Page Type [Upload Page & Raise Question]**

Information Page Type has the adoption of forms supported to a large extent by XLS files. Therefore, Question Paper Generator/Question Agent /teacher use this type configuration file for HKDA System processes with data from an HKDA Repository System. This XLS file has own standard of table structures, coloured output of texts, reusing Font and paragraph formats in forms (Smart Styles), data store in XML format, Form translation is supported by standard translation tools, Flexible reuse of text modules, HTML output of forms (Basis release 6.10), Interactive Web forms with input fields, pushbuttons, radio buttons, etc.

**5.5.5 Cross Matching**

Students respond to Cross Matching questions by pairing each of a set of stems (e.g., definitions) with one of the choices provided on the examination. These questions are often used to assess recognition and recall and so are most often used in courses where acquisition of detailed knowledge is an important goal. They are generally quick and easy to create and mark, but students require more time to respond to these questions than a similar number of multiple choice or true/false items.

5.6 Central Examination Management

Researcher has created a Question Bank and questions are to be stored in the HKDA DB Server as well as in Document Repository of the Data Source Layer after the selection of Category, Area, Subject, Topic, Subtopic, Question type and Objective Level. Here Category refers to the Knowledge areas such as Management, Pharmacy, Information Technology and so on. Area focuses on the Knowledge areas based on Category. For
example, in Information Technology Category researcher can define Area as Programming Language, Networking, Database, Software Engineering, Web technology and so on.

Similarly Subject belongs to the agents’ expertise domain area where few of them are from Programming Language as C, C++, Java, .net, AJAX and so on. Topics and Subtopics are to be added based on the Subject. The Questions are to be stored in the question bank based on the selection of Question Level (QL), Topic Level (TL) and Objective Level (OL). Here researcher provides the Topic Level to check the optimality of hardness of Question Level. Question Level is defined in below table.

<table>
<thead>
<tr>
<th>Question Level</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Very Low</td>
</tr>
<tr>
<td>2</td>
<td>Low</td>
</tr>
<tr>
<td>3</td>
<td>Medium</td>
</tr>
<tr>
<td>4</td>
<td>High</td>
</tr>
<tr>
<td>5</td>
<td>Very High</td>
</tr>
</tbody>
</table>

Table 5-2: Question Level and its Description

Similarly, in a particular Subject there are many topics and sub topics but researcher defines the Topic Levels from 1 (Very Low) to 5 (Very High) irrespective of number of topics.

The purpose of the Order Levels is used to level the Question IDs. All these levels are categorized in to 4 types as shown in Table 5-3. Knowledge and Understanding are based upon Objective & Short type questions but Application and Skill are to be checked through Long type, graphical questions.

<table>
<thead>
<tr>
<th>Objective Level</th>
<th>Description</th>
</tr>
</thead>
</table>

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<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
</tr>
<tr>
<td>2</td>
<td>Application</td>
</tr>
<tr>
<td>3</td>
<td>Understanding</td>
</tr>
<tr>
<td>4</td>
<td>Skill</td>
</tr>
</tbody>
</table>

Table 5-3: Objective Level and its Description

**Question IDs Generation:**

Question IDs are generated on the basic of – Category – Area – Subject – Topic – Subtopic – Question Type – Sub Question Type – Objective Type. The Question ID format is as follows:

X_X_X_X_Y_X_Z_O example 1_1_1_1_0_1_0_1

For Y,

if there are no sub topics
then
flag is set to zero (0)
on otherwise
topics are incremented by one (1)

Similarly,

if there are no Sub Question types
then
flag is set to zero (0).

For O, determines the question type is either Knowledge level, Understanding level, Application level or Skill level.

**Developing a Pool of Questions:**

Question Bank consisting of questions of evaluation may be developed at different levels: an individual teacher/Question Agent preparing a pool of
questions for teaching his subject, a group of teachers teaching the same subject in a college developing the Question Bank for their use, or the preparation of a pool of questions at the University level for the use in examinations for all the students in different colleges.

Here researcher is developing a model for question bank so that relationship between the Question Level and Topic Levels are agreed the analytical requirement using Bivariate Technique. In this technique researcher finds the r value where researcher consider only +ve values to identify the Question Level.

e.g.

<table>
<thead>
<tr>
<th>Range\Question Level</th>
<th>QL1 (Very Low)</th>
<th>QL2 (Low)</th>
<th>QL3 (Medium)</th>
<th>QL4 (High)</th>
<th>QL5 (Very High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bivariate Value</td>
<td>0.00 to 0.19</td>
<td>0.20 to 0.39</td>
<td>0.40 to 0.59</td>
<td>0.60 to 0.79</td>
<td>0.80 to 0.99</td>
</tr>
</tbody>
</table>

Table 5-4: Bivariate Value of Question Level Range

HKDA System generates a pattern of different question sets according to the Topic Level and Question Level range. Here researcher is keeping in mind that the Question Level range is fixed for all subjects and total number of questions to be raised in examination.

Here, researcher has 5x5 matrix of (Topic Level X Question Level) to generate different patterns based on number of questions and considerably the pattern size may increase as the number of questions to be asked in the examination increased. Therefore researcher is fixing up the question size to reduce the computation time to generate question paper according to Topic Level /Question Level and helpful to pick up any one sample from this table.

<table>
<thead>
<tr>
<th>Range\Sample Size</th>
<th>10</th>
<th>15</th>
<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>...</th>
<th>...</th>
<th>...</th>
<th>...</th>
</tr>
</thead>
<tbody>
<tr>
<td>No of Samples</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Table 5-5: Sample Questions in Question Bank
If the teacher/tutor agent wants to set a question paper of Very Low level based on the topics covered by the teacher, then just fix the number of question to be asked in the examination. HKDA System is ready to provide the number of questions from Question Level and Topic Level as one sample given below.

<table>
<thead>
<tr>
<th>Topic\Question Level</th>
<th>QL₁ (Very Low)</th>
<th>QL₂ (Low)</th>
<th>QL₃ (Medium)</th>
<th>QL₄ (High)</th>
<th>QL₅ (Very High)</th>
</tr>
</thead>
<tbody>
<tr>
<td>TL₁ (e.g. T₁₁, T₁₂)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TL₂ (e.g. T₁₁, T₁₂)</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TL₃ (e.g. T₁₃, T₂₃)</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>TL₄ (e.g. T₃₄, T₄₄)</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>0</td>
</tr>
<tr>
<td>TL₅ (e.g. T₅₅, T₆₅)</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 5-6: Bivariate Sample of size 5

For a Bivariate sample of size 5
mean.u ...... = 1.200, stdev.u ...... = 0.980, min.u ....... = 0.000
max.u ...... = 2.000, mean.v ...... = 0.800, stdev.v ...... = 0.980
min.v ....... = 0.000, max.v ....... = 2.000
correlation ...... = -0.167, theta (radians) .. = -0.785, theta (degrees) .. = -45.000

The sample above Table 5-6 shows a Very Low level question set of 15 questions considering the Question Level and Topic Level using Bivariate Techniques.

Jar File: biveriate.jar consists These Files.
+com
| +biveriate
| -+module
| --Biveriate.java
| --MyMathFunctions.java
==============
Biveriate.java
1) Having Logic to create Bivariate Statistics.
2) All the required Function and Methods are included in this class.
3) It also contains .CSV file Creation as well as exporting it to Database.
4) It also has function to remove duplicate records from .csv.

While researcher set up a model for 5 questions, considering the Question Level and Topic Level, following filters are undergo Figure 5.3 and shows the final setup for exporting .cvs file to KAUS-Bivariate Sample Table:

**(before filtering duplicate values)**
- csv file name : cs1.csv
- records : 53131
- size : 3348 KB (3.26 MB)

**(After filtering duplicate values)**
- csv file name : cs1.csv
- records : 2859
- size : 203 KB (0.20 MB)

Comparison ratio : 100.00% (before filter) -> 6.06% (after filter)

### 5.7 Establish a Learning Strategy

This should be laid out keeping in mind the learning goals, processes, job roles, culture, people and how they learn. All these data treated as the basis to define how training will support them and help them to grow. One more thing to keep in mind while establishing ones learning strategy should be such 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. One should not want to get into a similar process till the semester when one’s educational/industrial system has significantly expanded and learning strategy did not factor that in.
5.7.1 HKDA Blue Print as Design of Examination Paper

This functionality is managed by Teacher/Tutor, Exam Agent, Question Agent. Auto generated question are also prepared if agents/teachers are busy with other work. The Table 5-7 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 student/Learner Agents various level which are Knowledge, Understanding, Application and Skills.

Therefore, whenever there is a demand of skill person in this model, Exam Agent/Expert Agent can provides the % level to check his/her skills. Here researcher provides one example for the University/College/School Exam based on Objective wise weightage.

<table>
<thead>
<tr>
<th>Sr. No.</th>
<th>Objective</th>
<th>Marks</th>
<th>Percentage (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Knowledge</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>2</td>
<td>Understanding</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>3</td>
<td>Application</td>
<td>30</td>
<td>30</td>
</tr>
<tr>
<td>4</td>
<td>Skills</td>
<td>10</td>
<td>10</td>
</tr>
<tr>
<td></td>
<td>Total</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>

Table 5-7: KAUS Model

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 researcher has designed a KAUS Table which is shown in Table 5-8.
This KAUS Table provides the details of the question paper. While generating question paper, KAUS Model determines for the Industry/Educational Order Level requirement. This can be changed by Exam Agent, Tutor Agent to meet the Learner Agent 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. Sample example for 5 question pattern KAUS-BST is shown in Figure 5.3. The R-Value and question level is defined.
Figure 5.3: KAUS- Bivariate Sample Table (BST)
This BST will then feed into the Question Bank according to Order Level. If questions are not available in the Question Bank 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 Exam Agent, Tutor Agent. No match between BST and Question Bank then change the Order Level and generate question set.

5.8 Question Bank System
Researcher has generated one question bank. Figure 5.4 shows the question bank history where expert agents/teachers added questions. It also gives the total number of questions are being added in the question bank for a particular subject given to expert agents/teachers. In this question bank questions are added by this way:

Step 1: Select Knowledge Category
Step 2: Select Knowledge Area
Step 3: Select Subject
Step 4: Select Topic and Sub Topic
Step 5: Select Type of Questions like Multiple Choice, Optional Choice, True/False, Fill in the Blank, Single line, Short Type, Long Type
Step 6: Select Question level like Very Low, Low, Medium, High, and Very High
Step 7: Select KAUS Base Objective Level
Step 8: Define Questions and appropriate answer(s) for it and also provide the hint for it
Step 9: Select Add to save to this question to question bank
Figure 5.4: Question Bank Details

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To save Questions in question bank “QBANK” and “MANUALEXAMPAPER
QBANK” tables are used. For generating this task, following application
files are used:
• SelectCategory.jsp
• SelectArea.jsp
• SelectSubject.jsp
• SelectTopic.jsp
• SelectQuestion.jsp
• AddQuestion.jsp
• SaveQuestion.jsp
• ListQuestions.jsp

5.9 Configuration of Exam
Researcher has presented three types of examination for various Agents to
provide best possible way to learn, practice and evaluate. They are 1) Auto,
2) Manual, and 3) KAUS.

Administrator/expert/teacher will configure AUTO and MANUAL Exam by
this way:
Step 1: Select Category
Step 2: Select Area
Step 3: Select Subject

After selecting all above things administrator/expert/teacher will select
Configure button and new page will be seen that is AUTO and MANUAL
Exam configuration page. Here administrator/expert/teacher can select
Type of exam and which type of level he/she wants to define.
After selecting level, he/she will select number of questions with defined marks of different types for the paper. For the hint, system will display how many questions it has for each and every type to help to set the question paper. After all these steps, he/she will click on save button to save the paper format.

To Set AUTO and MANUAL type of exam paper, “SubjectwiseAdmin Parameter” Table is used. Similarly, for to configure AUTO or MANUAL types of exam paper these files are used:

- SelectArea.jsp
- SelectSubject.jsp
- Examconfigure.jsp
- ExamconfigureNext.jsp
- SaveConfiguration.jsp

For KAUS Based Exam Paper, Administrator/expert/teacher first defines how many questions he/she wants to set for question paper. After defines the question numbers he/she will submit it. Behind the submission of question numbers one Bivariate table will generate as random formatter for the exam paper. After the completion of the Bivariate table generation administrator defines Category, Area, Subject and also level of the questions as topic level and question level.

Here administrator/expert/teacher will also give the KAUS based percentage wise weight for the questions. Like 30% for Knowledge, 30% for Application, 30% for Understanding and 10% for Skills. After defining the percentage ratio administrator/expert/teacher will select action button. For KAUS exam configuration these files are used:

- KAUSexam.jsp
- DefineQuestions.jsp
- SelectArea.jsp
• SelectCategory.jsp
• SelectSubject.jsp

Two Classes are used to Create and Save Bivariate Data.
• com.Bivariate.module.Bivariate.java
• com.Bivariate.module.MyMathFunctions.java

To save Bivariate data, “RANDOMQUESTIONS” table is used. “RANDOMSELECTEDQUESTION” used to save selected Bivariate model data. “KAUSQSUMMARY” is use to save summary data for KAUS details.

5.9.1 Auto Examination
When student/trainer select on Auto Examination one another window will open.
Step 1: Select Exam Category
Step 2: Select Exam Area
Step 3: Select Exam Subject
Step 4: Now Rules and Regulations will be seen to student and at the bottom of the page he will agree or disagree to all above things
Step 5: If student is agreed then he/she will choose Level of Exam as Very Low, Low, Medium, High or Very high and press Next button
Step 6: If the selected level exam paper is configured by administrator then and then he/she can give exam
Step 7: if the exam is defined then student will see the summary page of selected subject exam papers with defined numbers of questions with different types and also he/she can see total questions, total marks and total time for whole examination
Step 8: student can select any one layout of exam paper from “View Page Wise” and “View Whole Question”
Step 9: Student will precede the examination and give answer for defined questions
Step 10: After giving all the answer of questions student will get finishing page and can see the result of it
Step 11: Student can see the result of given exam with graphical view

For this examination these tables will affected:
- QBANK
- MEMBEREXAMDETAILS
- SUBJECTWISEADMINPARAMETER
- MEMBEREXAMQUESTIONDETAILS

For this examination these servlets are used:
- onlineclasses.exam.SelectExamCategory
- onlineclasses.exam.SelectExamArea
- onlineclasses.exam.SelectExamSubject
- onlineclasses.exam.SelectExam
- onlineclasses.exam.SelectStartExam
- onlineclasses.exam.StartExamOthers
- onlineclasses.exam.CalculateExamResultOthers
- onlineclasses.exam.DisplayExamResult
- onlineclasses.exam.DisplayAnalysisResult
- onlineclasses.exam. StudentExamReport
Figure 5.5: Auto or Manual Exam Configure
### 5.9.2 Manual Examination

When Student/trainer Select Give Manual Examination he/she will follow these steps:

Step 1: Select Institute  
Step 2: Select Course  
Step 3: Select Semester/Year  
Step 4: Select Subject

After selecting above things student/trainer will see the list of exam paper along with paper id, exam date and marks if teacher/tutor has set exam paper before otherwise student/trainer will see Paper Number Defined.

If Paper id shown their then student/trainer will select the paper id or exam date or Total mark Manual Exam paper will show to him/her. After the examination student/trainer will submit the paper he/she can see the result of the manual exam paper result. For this Examination, these tables are used:

- FacultyWiseManualQPaperDetails  
- ManualExamPaperQDetails  
- ManualExamPaperQBank  
- ManualStudentResult  
- ManualExamPaperResultDetails

For this Examination these application files are used:

- StartManualExam.jsp  
- SelectManualExam.jsp  
- StartManualExamOthers.jsp  
- FinishManualExam.jsp  
- ManualExamResult.jsp
5.9.3 Kaus Examination

When student/trainer wants to give KAUS based Exam, he/she will follow these steps:
Step 1: Select KAUS based Exam
Step 2: Select Category
Step 3: Select Area
Step 4: Select Subject
Step 5: Select Level of Questions
Step 6: Select Size of Questions
Step 7: Click on Submit
Step 8: If the exam paper is available then start button will appear to student and he/she will click on it
Step 9: Exam paper will display to user
Step 10: student/trainer will give exam and after the exam he/she will finish the exam
Step 11: Student/trainer will see the result of the given exam

For this examination these tables are used:
- STUDKAUSRESULT
- STUDENTREGISTRATIONMASTER
- QBANK
- KAUS_EXAMDETAILS

For this examination these files are used:
- StartExam.jsp
- SetExamQuestions.jsp
- FinishKAUSEExam.jsp
Standardization of Intelligent Tutoring System for Adaptive Information Retrieval and Knowledge Discovery by Monitoring Human Interaction

Figure 5.6: KAU5 Based Exam Configure

<table>
<thead>
<tr>
<th>Question Options</th>
<th>Answer Options</th>
</tr>
</thead>
<tbody>
<tr>
<td>Select Category</td>
<td>Select Category</td>
</tr>
<tr>
<td>Select Area</td>
<td>Select Area</td>
</tr>
<tr>
<td>Select Subject</td>
<td>Select Subject</td>
</tr>
<tr>
<td>Select Level</td>
<td>Very High</td>
</tr>
</tbody>
</table>

KAUS Value (100%):
- K: Knowledge
- A: Application
- U: Understanding
- S: Skill

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This Figure 5.6 is the KAUS based Exam Configuration Questions screen which shows the details like category, subject, area, level of the exam, and KAUS Value (i.e. Knowledge, Applications, Understandings and Skills).

5.10 Quantifiable Benefits of Proposed System

• Student/trainer belongs to the Institute and even outside student/trainer can give this examination and improve their skills.
• This site 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.
• Student/trainer belongs to institute are able to manage their information through system.
• 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.
• Student/trainer can also submit questions to question bank.
• Student/trainer can also get more information related to career, websites etc.
• Teacher/tutor can manage their question bank well.
• 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.
• Only the teacher/tutor has rights to display result on the spot or later in the form of reports.
• 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.
• System provides vast array of reports to both student/trainer and teacher/tutor.
5.11 Non-Quantifiable Benefits of Proposed System

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

5.12 Conclusion

HKDA System is a very encouraging for students & dedicated faculty/teacher members of Shrimad Rajchandra Institute of Management to learn, practice, improve and master their skills effectively with their own pace. Students can test them from very low level, average, normal to even broader depth by setting some of the criteria. Students get better feedbacks by different agents of the system regarding to their performance, weak points, skills etc. Faculties can schedule and customize exams keeping the individual learner in mind with no extra time.

System provides an easy and the best way to faculty/teacher members to monitor the growth of the students 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 traditional online examination simulators. 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 also provides enough opportunities to learn as well. HKDA 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.