Enhancing Assessment Management through Question Bank System

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ABSTRACT

Managing assessment effectively is not only important, but a necessity for ODL universities that deal with range of assessment complexities due to their operating structure. ODL institutions are demanded to ensure that their assessment standards are able to meet and fulfil multifaceted expectations and requirements. Mechanisms are required to ensure that the set standards are able to be sustained across all courses and programs. Besides that, ODL institutions also need to ensure that its assessment procedures and processes operate in ways that are equitable and consistent across cohorts and semesters. Thus, an effective management system for assessment practices and procedures is fundamental to coherently manage the many and various assessments in meeting the goals while taking accounts of the opportunities and constraints in the ODL settings. One way to achieve is through a Question Bank System which is an online system of databank that archives examination questions that are already existing or created by user from time-to-time and in addition, able to function as an examination system. The design and development of an online Question Bank System (QBank System) at Open University Malaysia (OUM) is discussed in this paper.

General Terms

Online Examination

Keywords

Assessment, Question Bank System

1. INTRODUCTION

Assessment plays a pivotal role in education [1], regardless of whether it is conducted within a conventional or Open and Distance Learning (ODL) environment ([2]). In fact, assessment forms a crucial sub-system within the broader ODL framework ([2]). Effective management of assessments is not merely important but essential for ODL universities, which face unique complexities due to their operational structure. These institutions must ensure that their assessment standards meet a diverse range of expectations and requirements. To achieve this, mechanisms must be established to maintain these standards consistently across all courses and programs.

Moreover, ODL institutions must ensure that their assessment procedures and processes operate equitably and consistently across different cohorts and semesters. A well-organized management system for assessment practices and procedures is vital to manage various assessments effectively. Thus, a robust management system for assessment practices is essential for managing the various assessments coherently, ensuring they meet institutional goals while considering the unique challenges and opportunities within the ODL environment. This system must align with institutional goals while addressing the specific opportunities and constraints of the ODL environment.

In the context of ODL institutions, the implementation of Question Bank systems (QBank System) has become increasingly important [3] and can help create sustainable assessment strategies for them [4]. The concept of a question bank, which allows academics to share assessment content within or across an institution, is not new. However, recent technical developments have made such a resource more feasible than ever before ([5]). A question bank is a specialized repository accessible via a web interface, ensuring platform independence ([5]). It is defined as a relatively large collection of assessment items or test questions, along with associated software that enables the storage of test items to support student learning assessment ([5]). These systems act as digital repositories for exam questions, enabling the creation and retrieval of questions that align with various learning outcomes and assessment formats and exemplifies its role in managing the complexities of assessment within an ODL setting. In addition, online item banks can enhance the reliability and quality of assessments by providing immediate grading of multiple-choice questions and providing item analysis tools [6].

2. OBJECTIVES

This paper provides a comprehensive overview of the design and development process of the OUM's question management system, also known as the QBank System. The specific objectives are given below:

1. To design and develop OUM QBank System, highlighting the key steps and methodologies involved in its creation; *and*
2. To evaluate the effectiveness and functionality of the OUM's QBank System in managing assessments within the Open University Malaysia (OUM) framework

3. DESIGN & IMPLEMENTATION OF QBANK SYSTEM

3.1 Design Considerations

The QBank System was developed to automate the entire test paper creation process, from item creation to the printing of both offline and online test papers. The primary goal of the OUM QBank System was to eliminate the labor-intensive manual processes involved in preparing and administering examination or test items while ensuring the quality of the examination papers produced. Below are some of the key design considerations for the QBank System:

- Management of new and existing assessment questions: Each question is tagged based on its topic, Bloom's Taxonomy of Learning Domains, and ID number to facilitate the development of new assessment questions and the improvement of existing ones.
- Content sharing within the institution and with subject matter experts (SMEs): This feature enables

academics within OUM to share content and participate in a moderation process with external SMEs to ensure the quality of questions.

- Controlled access to items: Different users is assigned varying levels of access, as illustrated in Figure 1, to maintain control over the assessment items.
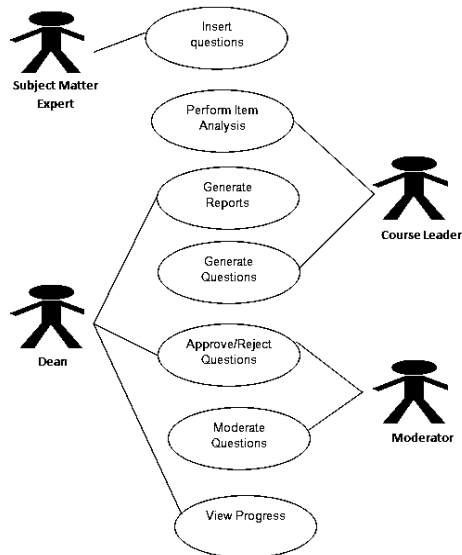

Figure 1: Use case diagram showing the functions accessible by different users of the QBank System

- To manage valuable assessment resources at organizational level;
- To facilitate reuse of assessment items, for example release of items from summative assessment for subsequent reuse in formative assessment;
- To reduce potential for cheating in summative assessment by delivering different sets of test questions to different sets of candidates; and provide a single point of access to information and resources needed to construct assessments

OUM's QBank System provides a complete ecosystem in managing examination question that includes item preparation, test generation, examination, item analyses and item review.

Figure 2 shows the login screen accessible from http://qbank.oum.edu.my/ and Figure 3 shows the dashboard for QBank System users, respectively. The functions that show will vary based on the different roles of the users logged into the QBank System functions for each role are clearly defined and each role will have a different level of security and access (refer Figure 1).
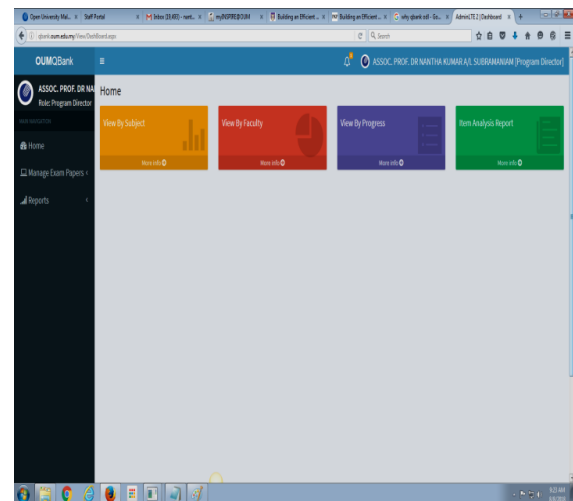

Figure 2: OUM's QBank System accessible from http://qbank.oum.edu.my/

Figure 3: QBank System dashboard that appear after log-in

3.2 Features

An effective and efficient question bank system, or any online test platform, should include several key features to ensure seamless operation, robust security, and a user-friendly interface. These features, which have been incorporated into the QBank System, are discussed in the next subsections.

3.2.1 Systematic Storage Structure

There are three kinds of assessment items to be stored in th OUM's QBank System. These items are: essay-type test items, multiple choice Question (MCQ items) and items in the form of assignment tasks. For the essay-type items and MCQ items, the storage is structured to categorize items based on the subject, topic and cognitive levels of difficulty. Figure 4 illustrates the structure of QBank System item storage. The storage system is organized into storage cells, with each cell categorized by topic and cognitive level. For example, in Figure 4, the notation T1C1 [4/5] in one of the cells indicates that for Topic 1 at a low cognitive level, 4 items have been approved out of 5.

Figure 4: QBank System item storage

3.2.2 Item Entry Interface

OUM QBank System is designed to provide a user-friendly interface for easy entry of items. Figure 5 shows a screen shot of the item-entry interface. The interface design allows the user to type items directly so as to be saved into the system. Alternatively, the user may prepare the items in Microsoft Word and use the normal copy-paste method to deposit items into the system.
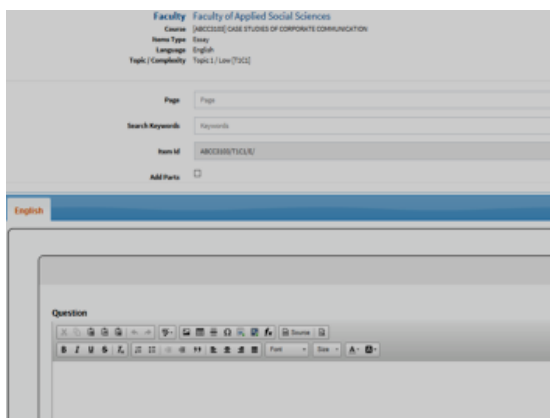

Figure 5: Item-entry interface

Quiz bank has capability to copy the image from word to the QBank System.

3.2.3 Table of Specification

A table of specification serves as a guide in the preparation of examination questions. It helps to ensure distribution of topics and level of difficulty of an examination paper. Therefore, the use of a table of specification is an important step in the preparation of an examination paper. The table of specification is also known as the Item Distribution Table (IDT) and is in the form of a table that displays the distribution of the examination questions for a given subject according to topics to be tested and the cognitive level of the questions. The table of specification is prepared based on the syllabus. This ensures that the test items are representative of the topics being covered in the syllabus. Having a good distribution of questions that are

representative of the whole module also helps ensure content validity ([7]).

Another important dimension to be considered when building the table of specification is the distribution of items according to the different levels of cognition. The levels are based on Bloom's Taxonomy, which states six levels of cognition: knowledge, comprehension, application, analysis, synthesis and evaluation, respectively. These six levels are clustered into three cognitive levels: Low (C1), medium (C2), and High (C3). OUM QBank System is designed to allow the generation of tables of specification based on user-set criteria. Figure 6 shows the item selection or filtering criteria, which includes:

1. Exam Paper Generation Process – The user can choose between automatic generation (auto) or manual settings for creating the examination paper.
2. Exclude Past Semesters – The user can select this option that allows the system to exclude question items from one or more previous semesters.
3. Include Past Semesters – The user can set preferences that allow question items from specified past semesters to be included in the current examination paper, along with the percentage of items to be drawn from these semesters.
4. Total Number of Items in Paper – The user can determine the total number of question items to be included in the examination paper.
5. Item Complexity – The system will automatically calculate and allocate the number of items across Low, Medium, and High cognitive levels. However, the user can make adjustments within the total number of items.
6. Maximum Items Per Topic – The user can set a limit on the number of times items from the same topic are randomly selected for each of the three cognitive levels.
7. Paper Topic Settings – The system provides an overview of the table of specifications, as illustrated in Figure 7. This overview includes information such as the number of items per topic at each of the three cognitive levels. Users can view each generated item and decide whether to keep the question or select an alternative item from the same topic.
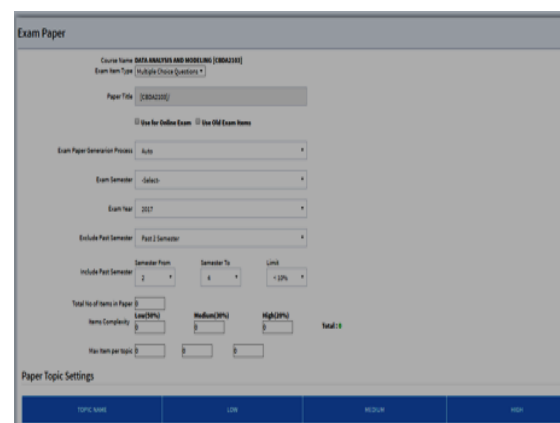

Figure 6: Specification criteria for examination paper generation

Figure 7: Table of specification of the examination paper

3.2.4 Test Paper Generation

To reduce the burden of manual tasks, QBank System has pre-formatted all examination templates within the system. Once the test specification table is generated, the system can automatically produce the test paper in the required print-ready format.

3.2.5 Item Analyses

After an examination, the results can be imported into the QBank System to enable item analysis for MCQ-type questions. The system can generate a difficulty index and a discrimination index for each item. The discrimination index indicates how well a particular test item differentiates between higher-scoring and lower-scoring students, while the difficulty index reflects the proportion of the total group that answered the item correctly. This information gives lecturers valuable insights into the quality of the developed items and helps them evaluate the performance of each item. Consequently, it assists the faculty in identifying poorly performing items that need to be reviewed, enhanced, or discarded (Figure 8).
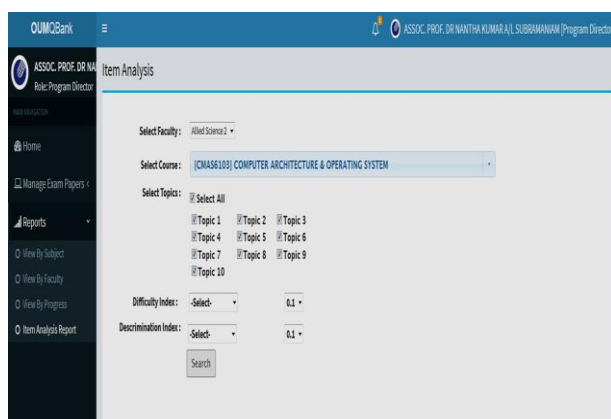

Figure 8: Item analysis facility in the QBank System

3.2.6 Reports Generation

Different kinds of reports are available for the moderators and dean as indicated below:

- View by subject - user gets the report related to essay type items and MCQ type items of the selected course (Figure 9).
- View by progress – user gets to view the progress made for each of the courses with regard to question items that had been deposited (Figure 10).

- Item analysis by progress - user gets to view the progress made for the item analysis for each of the courses (Figure 11).
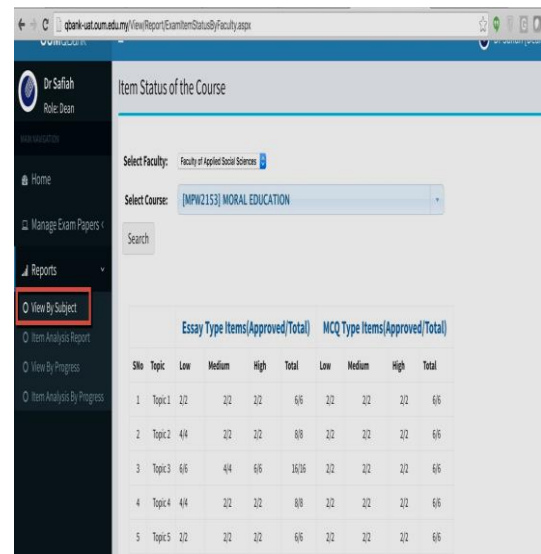

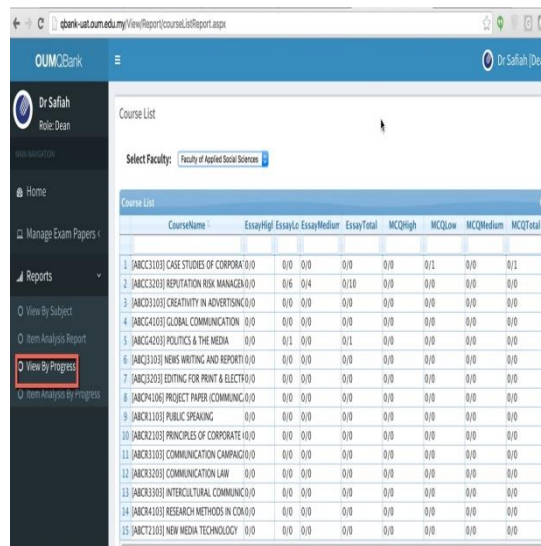**Figure 9: Progress Report- View by subject**

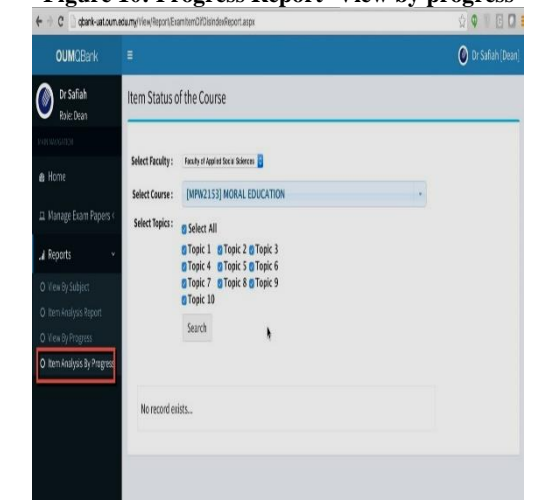**Figure 10: Progress Report -View by progress**

Figure 11: Progress Report- View by item analysis progress

3.2.7 Exam paper management

Dean has authority to approve the questions which were moderated and approved earlier by the moderator. Dean also has option to change the status of the question (Approve/Rejected) as shown in Figure 12 or print and download the paper.
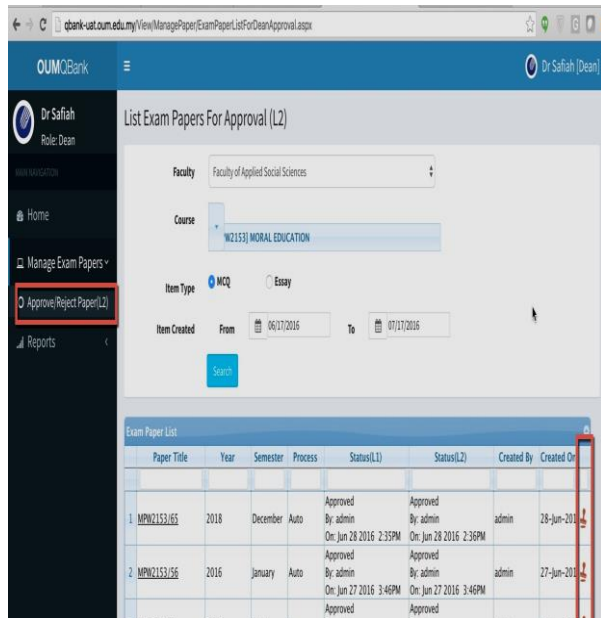

Figure 12: Dean has option to change the status of the question (Approve/Rejected

4. ONLINE EXAMINATION VIA QBANK SYSTEM

The Online Examination System is another unique and important module included in the OUM's QBank System. All the features described earlier are designed for the 'Offline' delivery of examination papers, meaning that test papers generated by the system can be printed as hard-copy examination papers to be administered at various learning centers across the country.

In contrast, the online component of the examination paper generation system extends the capabilities of the QBank System by allowing the generated test papers especially the MCQs to be displayed online for conducting tests in a digital environment. Figure 13 shows screenshots of the online testing system. This feature enables us to offer "on-demand examinations," where students can book their exam dates based on their readiness. The availability of exam dates can be checked online. This is a significant feature of the "flexible learning" approach advocated by OUM. Once a student books their exam date online and pays the fee, they must go to the designated learning center to take the online exam.
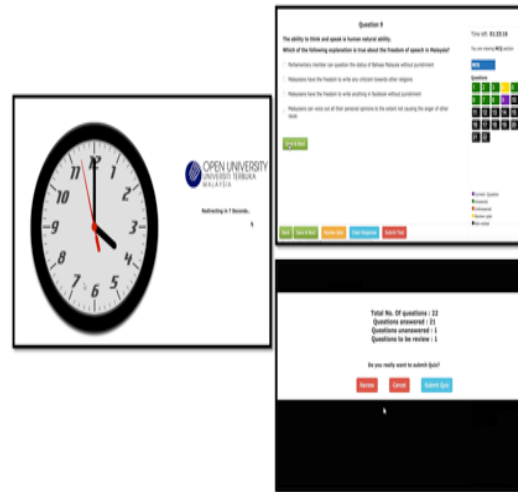

Figure 13: Online Testing subsystem of the QBank System in order to provide "on-demand examination"

Since the examination is conducted online, both the examination results and item analyses can be processed in real-time, providing immediate feedback and valuable insights. This real-time processing enables quick identification of student performance trends, allowing educators to assess the effectiveness of the test items instantly.

5. USERS FEEDBACK

The authors have interviewed several lecturers who have extensively used the QBank System in their course management and assessment processes. The feedback gathered highlights both the strengths of the system and areas where improvements could be made.

The lecturers consistently praised the QBank System for its robust and user-friendly design, which significantly streamlined the assessment process. One of the key strengths highlighted was the systematic storage structure, which allows easy retrieval and categorization of questions based on topic and cognitive difficulty. This feature was especially appreciated by lecturers who often need to construct examinations that accurately reflect a wide range of learning outcomes.

The immediate grading of MCQ-type questions and the item analysis tools were also well-received. These features allowed lecturers to quickly assess student performance and identify any issues with question design, such as items that were too difficult or did not effectively discriminate between high and low-performing students. This real-time feedback was deemed invaluable for making necessary adjustments to improve the overall quality of assessments.

While the QBank System was generally praised, lecturers identified several areas where enhancements could be made. Some users expressed a desire for more advanced customization options during the exam paper generation process. Specifically, they suggested the inclusion of additional filters or criteria to fine-tune the selection of questions based on more granular aspects of the course content or learning objectives.

Another area for improvement mentioned was the integration of more diverse question types beyond MCQs and essay questions. Lecturers noted that the ability to include interactive or multimedia-based questions could enhance the assessment

experience, particularly in subjects where practical or applied knowledge is critical.

While the online examination feature was acknowledged as a valuable tool, some lecturers reported occasional technical issues during the deployment of online tests, particularly in ensuring a smooth experience for students with varying levels of internet connectivity. They suggested that the system could be optimized to handle a broader range of technical challenges, ensuring reliability across different user environments.

Overall, the lecturers who used the QBank System provided positive feedback on its effectiveness in managing assessments within the OUM framework. They highlighted the system's strong organizational features, and real-time assessment capabilities as key benefits. However, they also identified areas for potential enhancement, particularly in customization, question type diversity, and technical robustness for online exams. These insights offer valuable guidance for future iterations of the QBank System, aiming to further refine its functionality and user experience.

6. CONCLUSION

The QBank System described in this paper has been meticulously designed to integrate all the essential requirements for developing a comprehensive and effective question bank system. This integration ensures that the QBank System is not merely a repository for storing and organizing examination questions, but also a dynamic tool for producing tailored tests that align with the specific learning outcomes and cognitive levels required by various courses. By leveraging the structured storage and retrieval capabilities of the QBank System, academics can create assessments that are both rigorous and reflective of the intended educational standards.

In addition to improving the quality of assessments, the implementation of the QBank System is expected to revolutionize the way assessments are conducted within the university. By automating many of the time-consuming tasks traditionally associated with exam preparation, such as question selection, test generation, and grading, the QBank System allows for a more efficient and streamlined assessment process. This efficiency not only reduces the administrative burden on faculty but also enhances the overall student experience by providing timely and consistent evaluation.

The QBank System introduces a new level of flexibility in assessment practices, which is particularly beneficial in an Open and Distance Learning (ODL) environment. The system's capability to support on-demand examinations and the flexible entry and exit of learners aligns with the university's commitment to providing accessible and adaptive learning

opportunities. This flexibility empowers students to take control of their learning journeys, enabling them to progress at their own pace and in a manner that suits their individual needs and circumstances.

In conclusion, the QBank System represents a significant advancement in the management of assessments within the university. By addressing both the technical and pedagogical aspects of assessment design, the QBank System is well-positioned to support the university's goals of delivering high-quality, flexible, and student-centered education. As the system continues to evolve and expand, it is expected to play a pivotal role in shaping the future of assessment practices within the institution, ultimately contributing to the enhancement of learning outcomes and academic success.

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