

DEVELOPMENT AND VALIDATION OF WEB-BASED QUESTION BANK AND EVALUATION OF ITS UTILITY AMONG STUDENTS AND TEACHERS

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ABSTRACT

Rushing efforts are taken by developing and under-developed countries to match educational standards of developed countries. Education is a life-long activity and continuing process for which necessary steps are initiated to offer and gain with minimum cost of resources. Creating Open Educational Resources (OER) is preferably right choice in all circumstances, especially in countries like India that has a huge population to educate. Among the many teaching-learning materials, a collection of questions asked in previous examinations called as question bank is one of the needful resource used by all categories of students and teachers. Hence, this study attempted to construct a Web-based Past Examination Question Bank (WPQB) for selected subjects with customized search facilities, and further the constructed website was evaluated to confirm the usefulness among the students and teachers. Realizing its necessity in an Indian Educational Environment, the present study was carried out to create a model WPQB and to evaluate its utility through a web based survey. The findings of the study proved that, the WPQB is useful among the students and teachers for improving the answering ability and questioning skill respectively. Moreover, the customized search facility and organization of questions were agreed as important features of the web based question bank.

Keywords: Question Bank, Higher Education, Open Educational Resource (OER), Web-Based Past Examination Question Bank (WPQB).

INTRODUCTION

Rushing efforts are taken by developing and under-developed countries to match educational standards of developed countries. Education is a life-long activity and continuing process for which necessary steps are initiated to offer and gain with minimum cost of resources. Creating Open Educational Resources (OER) is preferably right choice in all circumstances, especially in countries like India that has a huge population to educate (Bernard, 2009; Downes, 2007). Liberalization, Privatization and Globalization (LPG) penetrated the Information and Communication Technologies (ICT) throughout the world. Now, the challenge to bring equity in education and reach hugely spread underprivileged shall be possible only by the means of ICT. The National Knowledge Commission of India has already prompted the educational policy

implementers to create OER for all possible subjects.

Question bank is a large collection and organization of questions used for teaching, learning and evaluation purposes. It is an essential aspect of educational models (AIU, 1979; Thiyagarajan, 2009). The present evaluation system in educational institutions is dominated by written classroom/semester examinations. Moreover, the descriptive-type questions share more marks in examinations. The previous classroom/semester examination questions are also important for the learning motivation, examination preparation, examination reformation, and question paper setting for teachers as well as learners (Parthasarathy & Ananthasayanam, 2012).

Need for the Study

In Indian higher education system, more than 700 degree awarding institutions and 33,000 colleges are spending

resources to prepare questions for the examinations. After the examination, the institutions keep a copy of a question paper in the library for use. The restriction in library timing and insufficient copies for enormous student strength are not encouraging the usage of Past Examination Questions (PQ). The web is considered to be a flexible electronic medium, and at anytime-anywhere accessibility feature of web technology is more suitable for delivering the past examination question bank. The systematic and organized Web-based Past Examination Question Bank (WPQB) archive with semester-wise, unit-wise and keyword-based question search options will be much useful. Moreover, particularly, this is a necessary element for the affiliating universities to support enormous students and teachers. Realizing its necessity in Indian educational environment, the present study was carried out to create a model WPQB and evaluate its utility.

Statement of the Problem

Two aspects were considered during this research work. First, development and implementation of a website with past examination questions, further validation of its functionalities and features. Second, conduct of a survey to evaluate the utility of website among students and teachers after they were allowed to use. Synchronization and significance of these two aspects was stated in the present study as "Development and Validation of Web-based Question Bank and Evaluation of its Utility among Students and Teachers" Additionally, the involvement of personal variables in expressing the utility of website was also measured.

Research Questions

1. Is it possible to design, develop and implement a valid and reliable Web-based Past Examination Question Bank (WPQB)?
2. Is it possible to construct a valid and reliable tool to evaluate the utility of WPQB?
3. Is WPQB useful to students and teachers?

Objectives of the Study

The objectives were classified into general and specific objectives to clearly indicate the systematic nature of work.

General Objectives

1. To design, develop and validate past examination question bank website.
2. To construct and validate a survey tool to evaluate the utility of WPQB.
3. To study the intervention of personal variables in expressing the WPQB utility.
4. To study the utility of WPQB among students and teachers.

Specific Objectives of the Study

1. To design, develop and implement a valid and reliable website containing past examination questions.
2. To construct a Web-based Past Examination Question Bank Utility Survey (WPQBUS) tool and upload it to the website.
3. To identify the dimensions of WPQBUS tool using exploratory factor analysis method.
4. To study the effect of personal variables in expressing the WPQB utility with respect to WPQBUS dimensions.
5. To study the utilization of website by the students and teachers.

Research Hypotheses

1. Some dimensions will emerge in Web-based Past Examination Question Bank Utility Survey (WPQBUS) based on the relationship between the items.
2. There will be a significant mean score difference between the students and teachers in WPQBUS dimensions.
3. There will be a significant mean score difference between male and female in WPQBUS dimensions.
4. There will be a significant mean score difference between the students of BCA and B.Sc. Computer Science courses in WPQBUS dimensions.
5. There will be a significant mean score difference between the qualifications of teachers in WPQBUS dimensions.
6. There will be a significant mean score difference between the purposes of internet usage in WPQBUS dimensions.

7. There will be a significant mean score difference between the students' year of study in WPQBUS dimensions.
8. There will be a significant mean score difference between the number of logins to website in WPQBUS dimensions.
9. There will be a significant mean score difference between the years of internet usage in WPQBUS dimensions.
10. Web-based Past Examination Question Bank (WPQB) will be useful to the students and teachers.

Research Design

Survey provides a comparable description of the larger population from the sample considered. A non-experimental ex post facto survey method was adopted in the present study to collect the data from students and teachers after they were allowed to use the WPQB.

The ex post facto method was administered by a web survey to study the utility of WPQB. First, a survey webpage was added to the website. Later, an invitation was sent to the respondents through post and email, and further automatically the second time users (non-respondents) of website were redirected to the survey webpage.

Design, Development and Implementation of Website

A systematic, disciplined and quantifiable web engineering approach was applied throughout the

development. The product obtained from the web engineering process was implemented. An incremental web engineering model of Pressman (2005) and Pressman and Lowe (2008) was adopted to design, develop and implement the website as shown in Figure 1. Certain modifications were made on the original model to suit the single-handed educational purpose development. Sub-stages that were exclusive for business environments, very complex applications and multiple-member team were excluded in that web engineering process. Moreover, the deployment stage was carried out during the final increment.

Population and Sample

Population is the theoretical aggregation of elements and it defines the extent to which the outcome can be generalized. Sample is the elements from which the data is collected, and the analyses performed on this data eventually lead to generalization (Babbie, 1973). The following population and sample were considered for this research.

Population

Bharathiar university created courses and conducted external examination for all 85 non-autonomous colleges affiliated to it. The students and teachers of these institutions for which the university conduct examinations, were considered as population for this research.

Sample

The sample for this research was selected from the defined population by using purposive/judgmental and snowball sampling techniques, both are non-probability types. The knowledge of internet, its frequent use and total number of students' strength in a course were considered to decide the sample for this research. Finally, students and teachers of Bachelor of Science, Computer Science and Bachelor of Computer Applications and courses were found more appropriate and useful sample. Moreover, these courses were popular among the students and many opted for these courses. The students of these courses have rich knowledge about internet and also they use internet frequently due to the regular use of computer lab. The WPQB was developed for this sample. Later, Snowball sampling was used to identify those who were interested in

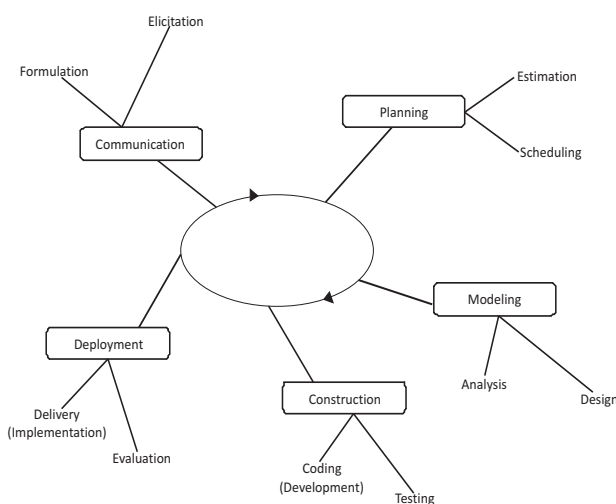


Figure 1. Framework of Web Engineering Incremental Model (Pressman, 2005; Pressman & Lowe, 2008)

past examination question bank. This technique identified a sample size of 218 in this study with 179 students and 39 teachers.

Variables

Variables are the mutually exclusive characteristics of a population, and the values for variables may differ within the population/sample. The surveys aim at observing and describing the distribution of these variables in a population. In the present research, three types of variables were identified viz. independent, dependent and intervening variables.

Independent Variables

In this study, the independent variables were not controlled or manipulated to observe the variation in the influence on dependent variables. However, these variables may have a logical influence on dependent variable. Web-based Past Examination Question Bank (WPQB) was defined as independent variable of this research. The students and teachers were exposed to the WPQB before conducting the survey.

Dependent Variables

Utility of WPQB was defined as dependent variable of this research. After the students and teachers were allowed to utilize the website, the Web-based Past Examination Question Bank Utility Survey (WPQBUS) was conducted. This survey was the observation of dependent variable (utility of WPQB) to evaluate the influence of independent variable (WPQB).

Intervening Variables

Intervening variables may create indirect effect on the dependent and independent variable relationship. Since the magnitude of the effect may be positive or negative, it is also important to observe the intervening variables during the research. Hence, certain variables were observed during WPQBUS and analyzed later for any intervention in the influence of independent variable. The intervening variables considered were the personal variables of the respondents, and they are listed below.

- Academic nature, the student/teacher position in academic institution.
- Gender, the male/female category of the

respondents.

- Number of logins, the occasional/moderate/frequent users of the website.
- Purpose of internet usage, the academic/non-academic purposes for which the respondents mostly use internet.
- Years of Internet usage, the number of past years the respondents were using internet.
- Course of the study, the B.Sc., Computer Science/BCA undergraduate degree which the student respondents were studying.
- Year of the study, the 1st/2nd/3rd year in which the student respondents were studying.
- Qualification of teachers, the research/non-research degree which the teacher respondents were possessing.

Tools

Two important objectives were the part of this research work, first to develop and validate a WPQB and second to construct and validate a WPQBUS tool. Personal information schedule was an additional tool used to identify the intervention of personal variables. All the three tools were prepared especially for this research and standardized with appropriate procedures (Table 1).

Data Collection and Analysis

Once after the website was launched, to introduce semxam.com and invite the respective stakeholders, a letter was written to all non-autonomous affiliated colleges that conduct B.Sc, CS and BCA courses. The letters were

S. No.	Title	Type	No. of Items	Standardization Method
1	Web-based Past Examination Question Bank (WPQB)	Website	Not Applicable	1. Software testing 2. Experts' opinion 3. Users' feedback
2	Web-based Past Examination Question Bank Utility Survey (WPQBUS)	Questionnaire with Scale	57	1. Pilot study 2. Experts' opinion 3. Validation by factor analysis 4. Reliability estimate by Cronbach's alpha analysis
3	Personal information Proforma	Schedule	13	1. Experts' opinion

Table 1. Tools used in this Research

addressed to 'The Principal' and 'The Head of the Department', requesting them to inform the Faculty members and Students about this website. The users who visited through this process were requested by email to inform other beneficiaries.

After using the website, the users were requested to participate in the survey by clicking on opinion menu that exist in all pages of the website. The survey page consisted of WPQBUS tool and personal information preform. The responses were stored into the database after the users clicked on submit button in the survey page. Each WPQBUS respondent was thanked and asked to inform others about the website.

The following statistical analyses were employed on the scrutinized responses/data.

1. Factor analysis.
2. Cronbach's alpha internal consistency reliability estimate.
3. Analysis of Variance (ANOVA).
4. Descriptive analysis.

Findings and Discussion

The construction of WPQBUS tool was validated by factor analysis which also identified four dimensions of the tool viz. Profile of web-based question bank, Question Bank as supplementary supportive tool, Accessibility support to question bank and Motivational factors of question bank.

The first dimension, Profile of web-based question bank, items was explaining about features of the question bank website, specific to the website, and in general. Items specific to the website were associated to website logging, menus accessibility, reliable hyperlinks, language used, simple layout, grammar/spelling errors, regular updates and search facility. Items general to question bank website were archive age, web-based question bank acceptability by teacher/students, and web-based question bank adaptability to other universities/colleges. Both set of items explained the common characteristics that should exist in any web-based question bank.

The second dimension, Question Bank as supplementary supportive tool, explained two aspects. First, the teacher related items explained about the teachers' use of WPQB as a supplementary material to support students in

classroom and also in question paper setting. Second, the student related items explained the importance of WPQB in learning and exam preparation aspects.

Third dimension, Accessibility support to question bank, stressed the necessity of web-based access to the past examination questions. Distribution of past examination questions over website was explained as a substantial accessibility support. Also, explained that, anyone who does not belong to the institution too can use past examination questions for competitive examinations.

Fourth dimension, Motivational factors of question bank, explained the influence of WPQB in existing teaching-learning system. The non-disturbance of existing examination system and extending support to write short-and-sharp answers were formed as motivational factors. Additionally, it expressed the convenience of anytime-anywhere also motivates the use of PQ among students and teachers.

Consequently, the emergence of the utility factors (dimensions) with positive factor loadings confirmed the positive perception towards WPQB among students and teachers, which subsequently authenticated the existence of those factors in the website.

'Cronbach's' α measurement was used for the items of each dimension in WPQBUS tool. The results clearly portrayed that, the maximum internal consistency reliability was achieved.

There was no significant mean score difference between students and teachers with respect to WPQBUS dimensions, but the significant difference was identified in 'Profile of web-based question bank' dimension. This shows that, the teachers were more attracted towards this website than students. Similarly, teachers' perspective was more inclusive, and they accepted Web-based Past Examination Question Bank (WPQB) operate as a supplementary supportive tool and contain motivational influence. Though significant difference was not found in accessibility support to question bank, the mean score of teachers was slightly lower (towards agree) than students. Notwithstanding the significant mean score differences, the teaching and question paper setting experiences could have influenced teachers to have a more inclusive

view on WPQB, while eagerness to know repeated questions and examination preparation could have influenced students.

There was no significant mean score differences between male and female with respect to WPQBUS dimensions. Although female mean scores of all dimensions were lower than that of male respondents, the differences were not substantial due to the agreeable attitude among them towards WPQBUS dimensions and all aspects of WPQB were treated equally by male and female.

There was no significant mean score differences between B.Sc, CS, and BCA students with respect to WPQBUS dimensions. The mean score of B.Sc and CS students was less in all dimensions, but its differences with BCA students were not considerable. This could be due to the homogeneity nature of respondents who belong to computers discipline despite the difference in course syllabus, and all of them shown similar attitude towards the utility dimensions of WPQB. The variations could have emerged if students from non-computers discipline were included.

There was no significant mean score differences between research degree and non-research degree holders with respect to WPQBUS. All college teachers were involved in teaching and conducting internal examinations. Also, research degree and non-research degree holders who serve in the affiliated colleges of Bharathiar University were considered equal in question paper setting and evaluation for external examinations. Obviously, their experience in teaching, question paper setting, evaluation and guiding students for exam preparation could have guided them to make similar observations on WPQB and its utility.

There was no significant mean score difference among academic and non-academic purposive internet users in WPQBUS dimensions. The mean score values of all dimensions points out a slight variation (i.e. not significant) in which the internet users who spent more time for academic purposes were having lesser mean value. Although both kinds of users have similar attitude towards all WPQBUS dimensions, academic purpose users were insignificantly more inclusive than non-academic. Additionally, the easy accessibility support and less time consumed during the

search of past exam questions in the website could have influenced both to have similar attitude on WPQB.

The mean score differences among students' year of study with respect to WPQBUS dimensions was not statistically significant. The common discipline of the students and the exposure to the advantage of internet (since they belong to computers discipline) could have influenced for similar focus on WPQBUS dimensions. However, the 3rd year students (in final semester) concentrating much on their project work during this survey shown an insignificant exclusiveness towards the question bank. But, in total the attitude of all were similar towards WPQB.

There was no significant mean score difference among the number of logins to the website in WPQBUS dimensions. Originally, logins to the website ranged from 1 time to 28 times, later those were classified to three groups viz. among less (≤ 3 logins), average (> 3 and ≤ 5 logins) and more (> 5 logins) number of logins. Notwithstanding the wide range, number of logins did not influence the users' attitude towards the WPQB utility factors. The responses were collected during the first or second login of all users, and this could be too early for those who made more than 10 logins. However, it may be true that the website pleased them by providing the required information to make many. Totally 105 users made more than 5 logins. Despite the early response, the intentions of visitors were similar and so the number of logins did not make any influence.

There was no significant mean score difference among years of internet usage in WPQBUS dimensions. Among the 218 responses, 117 were having three or less years of internet usage, but their attitude towards WPQBUS dimensions did not differ from others who had 5 or less years and more than 5 years of usage. This concluded the inclusive attitude of all users irrespective of the internet usage.

Many of the personal variables did not make impact on WPQBUS dimensions except the academic nature (i.e. students and teachers). Although subtle differences were found between the groups of some of the personal variables' mean values, those were not statistically significant. It was clear that only students and teachers had shown difference towards WPQB. However, their responses

were in agreeable nature, and difference may fall within agree and strongly agree.

'Comments' were one of the 13 items in personal information proforma considered for qualitative analysis. Of 218 respondents 56 had given comments. Mostly, students and teachers had accepted that the WPQB is useful, in their comments. The significant comments pronounced different perspectives of the respondents' views. The students' perspectives on the website was useful to score high marks and to get idea about the pattern and nature of the questions asked in semester examination. The teachers' perspectives were a triangular approach i.e. the website will be helpful to students' community, to set model examination question papers (for teachers), and to set end-semester examination question papers. Some comments were the suggestions to extend the objectives of the website.

The special features added to the website that were not available in any other WPQB archives must have attracted the users. Especially, the features such as, search questions by keyword, syllabus links and unit-wise list would have influenced much. Additional aspects such as helping low scoring students, guiding high scoring students, and assisting question paper setters were explicitly pronounced in the comments.

Further, the views of respondents indirectly expressed that, the question bank do not simply motivate rote learning. It also expressed that the question bank provide opportunity to know the thrust areas and motivate to prepare well for the written examinations.

The web analytics results expressed that, the users were gradually increased from February to April. The semester examination of Bharathiar University is usually conducted in April and November of every year, so during the examination WPQB usage was more. But, the hits during non-examination period may indicate that, the WPQB was also useful throughout the semester for other teaching-learning practices. Number of unique visitors and pages retrieved shows a considerable number of visitors had visited the website and accessed as many as questions.

The hits were more during the working days specifically during Monday to Thursday. It can be interpreted that, the

students and teachers had accessed the website from the college internet facility. Hence, the internet facility available in college increases the WPQB access. However, the considerable visits during Saturday and Sunday cannot be eliminated which shows the anywhere-anytime flexibility of WPQB. Moreover, peer to peer sharing of questions may happen among the students and teachers.

It was obvious that, many students and teachers had utilized the website again and again. Hence, the positive utility of WPQB cannot be denied, and that was already accepted by students and teachers in WPQBUS and also in their comments.

Conclusion

Internet has become one of the major communication medium of this generation. It improves with other electronic innovations around. Speedy transfer of information (text, image, animation, audio and video), reducing size of internet devices and mobile internet connection are the simultaneous developments. Website is one of the services provided through internet and the number of websites increase enormously day-by-day. Usage of web for educational purposes also increase simultaneously. This is true among Indian educational institutions too. But, many educational institutions in India don't use web mostly for teaching-learning material transaction, rather general information about the institution occupy more space. The advantages and outcome of web-based teaching-learning transactions shall be well understood from the international and few national-level institutions. Even though UGC, NKC, NCERT, CEC, DEC/DEB like policy makers (in India) insist on e-learning (especially web transactions), such efforts go in vain.

Among the many teaching-learning materials, a collection of questions asked in previous examinations called as question bank is one of the needful resource used by all categories of students and teachers. Electronic form of any teaching-learning material is easy to distribute, edit, update, duplicate and organize. Similarly, electronic question bank on web will provide more easy accessibility, but does not exist for all universities that conduct examinations.

Starting from email, chat, blog and forum features of

internet, the people (including students and teachers) are using the social networking, document sharing, cloud computing and gaming in the day-to-day common life. Web has brought convenience in our lives, obviously. So, not providing that convenience in education will isolate the educational activities from other general activities. Hence, an attempt was made to construct a Web-based Past Examination Question Bank (WPQB) for selected subjects with customized search facilities. The constructed website was evaluated to confirm the service was useful to the students and teachers.

Question banks have been commonly in use for over four decades and more. Educationists argue in favor and against question banks, but studies specific to question banks are not so familiar. Hence, confirming the utility of past examination question bank among students and teachers is considered as essential. The results of this research shows both students and teachers agree to and aware of various purposes of question bank, than simply searching for repeated questions.

Difficulty in obtaining may lead to neglecting, but easy accessibility provisions will encourage the curiosity of usage. Hence to reach the benefits of past examination questions to all of its stakeholders, internet website shall be the right medium. This was agreed by majority of the participants in this research study.

Improving the answering ability (writing short-and-sharp answers), non-disturbance of existing examination system and anytime-anywhere reach, were accepted as motivating factors to create WPQB. The study exhibits the bound volumes of PQ papers are not at all convenient for use, which may reflect the difficulty in searching questions, non-availability of syllabus in question papers, confusing organization of question papers, and poor topic-based arrangement.

Features of the constructed website convinced the users. The organization of semester-wise questions, introduction of unit-wise questions and provision of keyword based search, are unique features appreciated by the users. The semester-wise list was systematically organized with appropriate syllabus for which questions were prepared. Provision to view the syllabus wherever required was

considered as special features of this website, and the survey result shows that, the website satisfied the expectations of users. Other features such as simple language, unambiguous web structure, login, logout registration were amicable to the users.

Since the students in regular courses are homogeneous, their personal characteristics such as course and year of study did not reflect on differential utility factors of WPQB. Similarly, personal characteristics (i.e. qualification and years of experience) of teachers also did not reflect on differential utility factors. Commonly, students and teachers have identical perception towards WPQB irrespective of their age, gender and internet usage.

Design, development and implementation of WPQB portrayed a model. The measurement of utilization of this model is important to generalize it for other courses and universities. Analysis on the day-to-day use of the website shows that, regular updates, systematic organization and additional features (unit-wise and search options) only can make the effective and efficient use of PQ. The regular usage of the website by students and teachers indicate the necessity to build such website for all courses by all universities. Particularly, State universities that conduct examination to enormous students in affiliated colleges must consider this activity.

Examination systems are continuously changing. Online tests with multimedia-based questions are eye-catching developments that attract examination reformers. In this juncture, is a WPQB for paper-based (consisting only text and images without animation, audio and video) written examination required?

Computerized question banks and computerized tests are researched and used for past four decades in developed nations. Countries like India are unable to establish such facilities in all places until now. The one decade of IT revolution in India was able to at least facilitate computers and internet connection in public institutions, without proper software applications. Obviously, many States are still struggling to establish these facilities in all Educational Institutions. In this moment, rather waiting for implementing complete reformation with multimedia-based online tests which is unreal with present infrastructure, institutions may

concentrate on adding few features like WPQB that support existing system to move on.

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