A Development of Item Analysis System and Item Banking System with Case Study of Internet Technology for Daily Uses

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Abstract - This is an experimental research aimed at main objectives of a development of item analysis system and item banking system with case study of Internet Technology for Daily Uses. The research was conducted with particular purposes, as follows: 1) To develop an analytical and exam warehousing system systems, via internet, as tools for instructional quality management and quality improvement of exams (applicable to the Internet Technology for Daily Use course) 2) To study the correlation between students’ exam score of the stated course and 3) To evaluate the feasibility for the practical implementation of the developed system. The samples are 4,101 Rajamangala University of Technology Thanyaburi students registered for Internet Technology for Daily Uses consisted of 1,315 in semester 2/2012, 550 in semester 1/2013, 1,543 in semester 2/2013 and 690 in semester 1/2014. The data were collected from the samples’ responses to: 1) an electronic test in Internet Technology for Daily Uses 2) an achievement test for Internet Technology for Daily Uses and 3) an observation form in the test implementation. The statistics used for data analysis in this research consisted of mean and standard deviation. The research study revealed the following findings: Firstly, the item analysis system and item banking system via internet was qualified with content validity and reliability coefficients result was 0.986. Secondly, the final exam score and the electronic test score showed a correlated statistically significantly at the rate of 0.01. Thirdly, the system resulted from this research is convenient to use and improving for the better quality of learning education.

Keywords - Item Analysis System, Item Banking System, Internet Technology for Daily Uses

I. INTRODUCTION

In the current society of learning, education reforms focus on the learner-centered settings in which learners were assumed to be the center of knowledge. This is based on learner’s individual artifact regarding the self-learning ability and self-development skill. This means learners are the most vital element. The learning administration must not only promote natural learning development with full potential beside the importance of the adoption of educational technologies. As stated in the Section 4 of Transcript of National Education Act BE 2542, as amended (No. 2) Act BE 2545 (the Board of Education, 2545), education administration means “the learning process for the prosperity and self-fulfilling of individual and society by knowledge transferring, instructing, cultural conservation, development of academic advancement, knowledge development under the
management of environment, society, learning, and factors supporting lifetime learning”.

As the advancement of internet technologies, e-Learning has been continuously evolved to enhance learning and instructing efficiency. As the application of hypermedia, e-Learning promotes better self-learning controllability. Also, interactivity between a learner and learning content(s) can be effectively enhanced, in which the learning of new skills can be enhanced. In the same token, instructor can also update learning content in matching with learner’s demand. Hence, if technologically enhanced, academic evaluation and learning effectiveness appraisal systems, with item banking system as database for storing good quality exams, would be beneficial for education information technology development. Moreover, the individual course development, learning method, and evaluation can be beneficial as well. This can also be compared between instructors which will be useful for instructional evaluation to support the more suitable and updated learning process (Srisukwattananun, 2000).

Therefore, this is the motivation and origination to develop an item analysis system and item banking systems, via the internet. Course selected for experiment in this study is “Internet Technology and Daily Uses”, division of Computer Science, Faculty of Science, Rajamangala University of Technology Thanyaburi (RMUTT). This course is the fundamental prerequisite with more than 500 enrolled students in each semester. Previously, course exams were manually re-issued every semester. This causes the confusion and complication regarding how to manage exam questions. Some exam questions, although already used, may be able to be re-applied for the current academic year. Hence, the estimation is difficult in terms of conformance to the learning content, index of difficulty or easiness, and discriminant index.

This study is the experiment with objectives in developing an item analysis system and item banking system via the internet for the course stated above. The objectives are:

- To develop an item analysis system and item banking system systems, via internet, as tools for instructional quality management and quality improvement of exams (applicable to the Internet Technology for Daily Uses course)
- To study the correlation between students’ exam score of the stated course
- To evaluate the feasibility for the practical implementation of the developed system

The developed system will solve problems regarding the issuing of exam questions, examination, and analytic of the past exams. Such systems utilizes the advantage of the internet in selecting the exam profile, re-issuing of the exam, and online examination administration which will enhance the overall learning administration with better learning efficiency and effectiveness.

***II. RELATED WORK***

Literature regarding electronic testing is diversified such as the survey of examinees’ satisfaction. Conducted in Pittsburgh Public School, USA, there was a first nationwide online foreign language skill testing which discovered the examinees’ opinion difference after three weeks of continual examination. An examinee mentioned the un-recoded verbal answer which create more worrisome than face-to-face interaction. However, another examinee’s view was opposite since interaction with computer system was more comfortable due to the less shyness (Lee, 2003). Similar study had been conducted in Thailand by Suparbwongchai (2011) in which the examinees’ satisfaction was surveyed via the e-testing of “Corporate Accounting” course. Moodle was used as development tools in which exam questions, answer key, and Likert-scale survey questions were randomly shuffled for each examinee. Results indicated that 13 students rated the online
examination as excellent (61.45%), good (30.77), and fair (7.69%).

Regarding real-time feedback system, Brett (2000) discovered the usefulness of such system, applied on the learning contents, promoted the better content understanding. Jang Syh. Jong [7] proposed that an effective teaching technique must be the combination of lessons and related supplementary activities to promote the better understanding of lesson’s content. The appropriate portion between lesson content and activities enhanced the better learning experience.

Furthermore, the study of Tsutsui & Kato (2001) from the George Washington University had developed a multimedia linguistic skill evaluation system to enable the additional recording of instructor’s comments and corrections into a recorded student’s video clip. This was to enhance the student’s better verbal skill by linking instructor’s comments and corrections to student’s answer(s). Uraiwan (2005) had developed a learning media, using online examination for “Data Structure” course via the Internet. Concurrently, students’ survey regarding testing format, conformance to & objectives of the learning contents, and attitude toward the developed learning system was conducted via questionnaires distributed via 92 students of Rajapat University Pibulsongkram. Pitsanulok. Statistically, frequency, percentage, means, and standard deviations were analyzed and indicated the highest level of suitability of course’s online testing. Regarding online examination format suitability (listed by lesson), “pointer” received the highest rating while “array” received the lowest.

Regarding the accuracy of e-Testing, the study of Carsten (2006) [10] discovered the reliability and applicability via the 1-hour testing duration and short time scoring. Eung (2010) [11] proposed an information system, developed with PHP, for determining necessary statistics from examinees. Such statistics (regarding exam difficulty) were used in issuing and tree algorithm was used for electing exam questions. User’s satisfaction was consequently evaluated and indicated the excellent usability (mean = 4.73 and S.D. = 0.28), excellent satisfaction (mean = 4.78 and S.D. = 0.28), excellent presentation format (mean = 4.38 and S.D. = 0.48), and excellent safety (mean = 4.50 and S.D. = 0.57).

Hence, the development of analytical system and online exam warehouse is proved to be able to support the issuance of online exams. The most important issues to be considered is the design of user interface base on system accessibility and effective workability.

III. METHODOLOGY

A. Scope of Research

In this research we prepared the Item Analysis System and Item Banking System via the Internet to creation and statistical analyzes for determining of the test and stored in Item Banking System. The scope of research we focus on the examination of multiple choices to experimental in Major of Computer Science, Department of Mathematics and Computer Science, Faculty of Science and Technology, Rajamangala University of Technology Thanyaburi. By the test, we used as a retrospective of 4 semesters as the follows: semester 2/2012, semester 1/2013, semester 2/2013, and semester 1/2014.

B. Methodology

The objectives of the research on the development Item Analysis System and Item Banking System with case study of Internet Technology for Daily Uses, we used the theory analysis of structural systems (Shelly, Cashman & Rosenblatt, 2005) [12] for analysis and design by SDLC process (System Development Life Cycle). For the another program we used MySQL for database management system, Macromedia Dreamweaver and Macromedia ColdFusion for developed Text Edition and Web Applications. The procedural steps are as the follow in Fig 1.
IV. EXPERIMENTS AND RESULTS

This is an experimental research aimed at main objectives of a development of item analysis system and item banking system with case study of Internet Technology for Daily Uses.

A. Data in Used

1) The Samples: The samples of this research we obtained by Purposive sampling is divided into 3 parts as the follows:

- The samples data we selected from 4,101 students in Rajamangala University of Technology Thanyaburi and registered for Internet Technology for Daily Uses consisted of 1,315 in semester 2/2012, in semester 1/2013 were 550, in semester 2/2013 were 1,543 and in semester 1/2014 were 690.
- The specialist for evaluation we used two areas as 1) for 3 persons is the professionals in Information Technology and 2) for 3 persons if the professionals in Measurement and Evaluation in Education.
- For 5 Lectures in Major of Computer Science, Faculty of Science and Technology, Rajamangala University of Technology Thanyaburi has the knowledge skills and experience in teaching more than 10 years.

B. Evaluation

The researchers have analyzed and using data from the questionnaire 3 groups such as: 1) the professionals in Information Technology; 2) the professionals in Measurement and Evaluation in Education; and 3) the uses into two groups as the students enroll in Internet Technology for Daily Uses and Lectures in Major of Computer Science has the knowledge skills and experience in teaching more than 10 years. That performs calculations of each number in Mean and Standard Deviation until to the sum of the evaluation form.

C. Results

The research findings Item Analysis System and Item Banking System with case study of Internet Technology for Daily Uses can applied to test with students and using the experiments and results to determine Difficulty index or Easiness, Discriminant index and Reliability by Kuder Richarson method [3] using formula KR-20.

1) Item Analysis: is a process which examines student responses to individual test items (questions) in order to assess the quality of those items and of the test as a whole.

<table>
<thead>
<tr>
<th>Items</th>
<th>#Correct in High</th>
<th>#Correct in Low</th>
<th>Item Diff.</th>
<th>Disc. Index</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>37</td>
<td>26</td>
<td>0.677</td>
<td>0.303</td>
<td>Used</td>
</tr>
<tr>
<td>2</td>
<td>37</td>
<td>29</td>
<td>0.787</td>
<td>0.237</td>
<td>Used</td>
</tr>
<tr>
<td>3</td>
<td>12</td>
<td>11</td>
<td>0.285</td>
<td>0.041</td>
<td>Used</td>
</tr>
<tr>
<td>4</td>
<td>15</td>
<td>6</td>
<td>0.175</td>
<td>0.242</td>
<td>Used</td>
</tr>
<tr>
<td>5</td>
<td>41</td>
<td>22</td>
<td>0.761</td>
<td>0.487</td>
<td>Used</td>
</tr>
<tr>
<td>6</td>
<td>0</td>
<td>0</td>
<td>0.000</td>
<td>0.000</td>
<td>M/R</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>19</td>
<td>26</td>
<td>32</td>
<td>0.677</td>
<td>-0.092</td>
<td>M/R</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
<tr>
<td>32</td>
<td>30</td>
<td>34</td>
<td>0.742</td>
<td>-0.041</td>
<td>M/R</td>
</tr>
<tr>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
<td>...</td>
</tr>
</tbody>
</table>

* M/R = Modified or Removed
Table I demonstrates the results of exam analysis, calculated by the developed system experimented on 460 exam questions, indicated the compliance to the exam analysis concept. For example, exam question no. 1 analyzed from 690 examinees were analyzed and found that 37 excellent examinees could answer this question correctly while only 26 poor examinees could do so. The 0.677 difficulty coefficient indicated the proper level and discrimination index at 0.303 indicated the highly acceptable discrimination index. Conclusively, this exam questions was valid for examination. In the different token, exam question no 6, 19, and 32 should be improved or eliminated due to the low discrimination index. Totally, the 460 exam questions were analyzed but only 306 questions were eligible and 154 (33.48 %) questions should be improved or eliminated, as shown in Table II.

**2) The Correlation between Students’ Exam Score of the Stated Course:** In this research, we analyzed coefficient of Pearson’s correlation for the correlation between the final exam score of the Internet Technology for Daily Uses, as shown in Table III.

**TABLE III**

**CORRELATION BETWEEN STUDENTS’S EXAM SCORE OF THE STATED COURSE**

<table>
<thead>
<tr>
<th>Score</th>
<th>n</th>
<th>r</th>
<th>Sig.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knowledge and Understanding using the electronic media of the stated course</td>
<td>1,315</td>
<td>0.586*</td>
<td>0.0000</td>
</tr>
<tr>
<td>Students’ exam score of the stated course</td>
<td>1,315</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*p < 0.01

Table III the results found that, the item analysis system and item banking system via internet was qualified with content validity and reliability coefficients result was 0.986. And the final exam score and the electronic test score showed a correlated statistically significantly at the rate of 0.01.

**3) Results from Specialist:** In this research, we used two areas as: 1) for 3 persons are the professionals in Information Technology. The experimental results that the Mean of system design as 3.19 shows that medium efficiency levels and Mean of security system as 4.15 shows that good efficiency levels, and 2) for 3 persons are the professionals in Measurement and Evaluation in Education. The results shown that in 3 issues as Input data were 3.67, Item analysis was 3.89 and Objectives was 3.67 respectively. From the analysis, Mean evaluation are equal 3.89 shows that Item Analysis System and Item Banking System have ability very well. As shown in Table IV and Table V.

Table II, for data analysis were as follows: the discrimination and index level of difficulty for item analysis; Cronbach alpha method for content validity and reliability; Pearson’s Product Moment Correlation for the correlation between the final exam score of the Internet Technology for Daily Uses course and the electronic test; and content analysis for the management study. The result shown that item difficult between 0.13 to 0.93, and the discrimination index between 0.27 to 0.79.

For content validity using by IOC (Item Objective Congruence Index) between 0.33 to 1.00, the research findings were the electronic test was qualified with content validity and reliability coefficients result was 0.986.
TABLE IV
EVALUATION INCLUDES ALL ASPECTS OF PROFESSIONALS IN INFORMATION TECHNOLOGY

<table>
<thead>
<tr>
<th>Reviews of respondents</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Efficiency levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>System design</td>
<td>3.19</td>
<td>0.661</td>
<td>Medium</td>
</tr>
<tr>
<td>Security system</td>
<td>4.25</td>
<td>0.577</td>
<td>Good</td>
</tr>
<tr>
<td>Mean</td>
<td>3.72</td>
<td>0.619</td>
<td>Good</td>
</tr>
</tbody>
</table>

TABLE V
EVALUATION INCLUDES ALL ASPECTS OF PROFESSIONALS IN MEASUREMENT AND EVALUATION IN EDUCATION

<table>
<thead>
<tr>
<th>Reviews of respondents</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Efficiency levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input data</td>
<td>3.67</td>
<td>0.577</td>
<td>Good</td>
</tr>
<tr>
<td>Item Analysis</td>
<td>3.89</td>
<td>0.859</td>
<td>Good</td>
</tr>
<tr>
<td>Objectives</td>
<td>4.11</td>
<td>0.718</td>
<td>Good</td>
</tr>
<tr>
<td>Mean</td>
<td>3.89</td>
<td>0.718</td>
<td>Good</td>
</tr>
</tbody>
</table>

4) Results from Users: The evaluation of the users have a mean of data management is 3.60, a mean of item analysis and item creation is 4.30 and a mean of implementation is 4.34 that shows all issues have good efficiency levels. As shown in Table VI.

TABLE VI
EVALUATION INCLUDES ALL ASPECTS OF USERS

<table>
<thead>
<tr>
<th>Reviews of respondents</th>
<th>Mean</th>
<th>Standard deviation</th>
<th>Efficiency levels</th>
</tr>
</thead>
<tbody>
<tr>
<td>Data management</td>
<td>3.60</td>
<td>0.674</td>
<td>Good</td>
</tr>
<tr>
<td>Item analysis and item creation</td>
<td>4.30</td>
<td>0.692</td>
<td>Good</td>
</tr>
<tr>
<td>Implementation</td>
<td>4.34</td>
<td>0.513</td>
<td>Good</td>
</tr>
<tr>
<td>Mean</td>
<td>4.08</td>
<td>0.626</td>
<td>Good</td>
</tr>
</tbody>
</table>

V. CONCLUSIONS

From this study, the evaluation of the item analysis system and banking system, experimented on the “Internet Technology for Daily Uses” course indicated the total good efficiency in all aspects, including examination data storing, online examination via the internet, and exam quality analysis. Moreover, such systems enabled the better quality of exam questions for student’s performance evaluation and promoted convenience in terms of retrievability and time saving when issuing the exams. The backup exam could be randomly issued with the same level of difficulty. Also, systems are suitable for all stage of learning: pre and post learning and individual learning progress.

Regarding the suggestions and recommendations from instructors who experimented the systems, majority were agreed on the ease and convenience of use. However, the further improvement was suggested as the shuffling of exam sub questions, enhancing of multiple exam issuers (as team), and more optional types of exam question (such as true-false and matching). This is to enhance the more comprehensive student’s performance evaluation and the future use.

REFERENCES

(Arranged in the order of citation in the same fashion as the case of Footnotes.)


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