

E-Math Version 2.0, a Learning Management System as a Math Reviewer Tool for Engineering Students in the Philippines

Maila R. Angeles, Arnel C. Fajardo, and Bartolome T. Tanguilig III

Abstract— E-Math Version 2.0 is a learning management system (LMS). Its main objective is to assist math reviewers in their Engineering Licensure Examination in the Philippines. One of its features includes automatic evaluation feedback. This is designed in order to easily assess the student's ability in mathematics. The capability of the system to track student profile while managing their progress in the activity became its advantage over its predecessor. The acceptability of E-Math as a reviewer tool was determined through the 3.58 average mean satisfaction rate given by the students as compared to 2.75 in the previous version.

Index Terms— Engineering licensure examination, learning management system

I. INTRODUCTION

Most universities in the Philippines nowadays are giving much consideration regarding licensure examination performance, the school administrator offering a review program for all graduates and graduating students [1][2].

The E-Math Version 2.0 (E-Math) is about a mathematics reviewer tool, tailored to Engineering students. The design was developed as an open source learning management system (LMS) with the contents that is aligned to the Engineering course syllabus. It is conceptualized because one of the subjects the students have difficulty in reviewing is mathematics, despite the availability of review materials provided to them. This project was developed as an alternative reviewer tool for students in order to give assistance in their studies.

Checking on student's performance should be done regularly to ensure that low performing students would be given enough attention and proper direction [3]. The objective of this project was to enhance some monitoring weaknesses of the previous version that includes monitoring the student's performance in the activities and dealing student's profile. This project incorporates the additional features of tracking student's progress in the activities and managing student's profile [4]. This paper discusses a brief literature review, the construction and the design element of the system, and evaluation. One of the questions in evaluation

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are how useful the system as a reviewer tool, based on the 4-likert scale result the 3.40 average mean score for this version showed that the enhancement made had a great contributor for the success of this project as compared to 2.50 preliminary version.

II. LITERATURE REVIEW

Before the students can practice his/her profession as an Engineer, they are required to take and pass the Philippine Licensure Examination. The students who opt to take the usual road of reviewing before taking the board exam, has five to six months preparation before the day [5].

Presently a day's learning has gotten to be more worldwide and students are searching for learning with the assistance of web [6]. To deal with this LMS are rapidly expanding in most academic institution. The LMS offers online instruction that can be delivered anytime and anywhere through a wide range of electronic learning solutions [7]. It gives a framework that empowers an organization to arrange, convey, and oversee learning program in any format it chooses [8]. LMS made set up the educator supervises and control understudy progression and take after along on student performance [9].

There are a several LMS that are accessible and conveyed through the web. Some of the LMS utilized by the universities are Blackboard and Moodle [10]. Blackboard is a commercial LMS that permits teachers to post course data, course materials, readings, and assignments [11]. Moodle is an open source that allows educators to convey substance to understudies, for example, standard SCORM (Sharable Content Object Reference Model) package and asses learning utilizing assignments or tests [12]. The commercial LMS has licensing payments for its proprietary software while open source software is free to access and download [13].

There are LMS for Mathematics such as EducoSoft and MathMedia. EducOSOFT offer text book, and internet learning framework for college courses [14]. Mathmedia gives school self-paced instructional programming program that give a complete intelligent math training from rudimentary through school level math [15].

Allowed that a greater part of students typically invest a lot of time playing video games, schools should investigate the utilization of games on their Learning administration framework to consolidate a component of diversion in their learning methodology [16]. E-learning game is an organized activity that includes a particular test, data to react to, and standards for attaining the objective [17]. E-learning games

are created to convey, help, and upgrade educating, learning, evaluation, and assessment [18]. The advantages of educational gaming are their powers to keep students focused and motivated [19]. The students can be also persistent, risk-taking, attention to detail, and problem solving skills by playing the game [20].

III. DESIGN AND APPLICATION OF THE SYSTEM

The three layer architecture was used as a part of creating this project. These are composed of presentation layer, network layer, and transport layer. An advantage of three-layer architecture is its partition of information and configuration, with which projects can be effortlessly extended and adjusted to enhance the coding reusability, once the project requirements are changed [21]. Figure 1A show that the project runs online via web server and only accessible using windows XP operating system or a higher OS. All features of E-Math are programmed in PHP and supported in a MYSQL database as shown in Figure 1B.

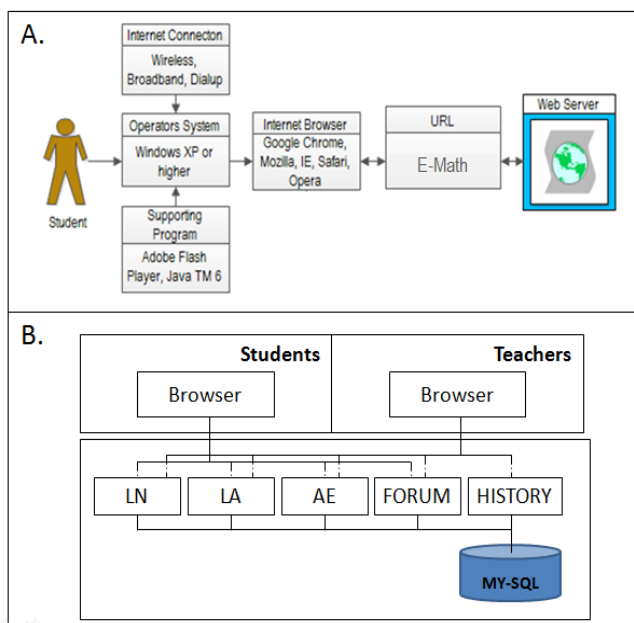


Figure 1. The Graphical Architecture of the System. (A) The Process of Student Interaction to the Web Server (B) Project Development of the System

students need to log-in first before accessing the system. The username and password will be given by the teacher which is also act as administrator. Once the student login to the website, they can choose whether to study the lecture notes (LN), proceed to the learning activity (LA), take the assessment exam (AE), or start the forum as also shown in figure 1B.

The LN focuses on different subjects of mathematics. These subjects are composed of Algebra, Geometry, Trigonometry, Differential & Integral Calculus, Differential Equation, and Advanced Math.

LA apply the Outcome Based Education that currently advocate for some schools. The mechanism for playing the activity is meant to be simple so the students can adopt it easily.

The name of LA is lottery. The lottery is one player game that contains multiple choice questions. Same as real game, the money will increase every time the student has correct answer and it will decrease for every wrong one. For playing the lottery the students need first to select the subject. Once the subject was selected, the student can now play lottery by clicking the click here button. Once the button is click for the first time, the initial money will appear together with the first questions. Every question that appears on the screen is randomly selected by the system. The initial money will increase every time the student has the correct answer and it will decrease for every wrong one. The process of increasing and decreasing will be based on the money that appears for every question. The student has an option to use “50-50” risk, switch questions, hint button and lessen the money options. The student can use these options once per game. The 50-50 will be use if they have doubts in their answer. The program will automatically cut the choices into half, eliminating 2 incorrect choices. This will limit selection into two. Next is the hint button, if the students click this button the pop up message showing the first letter of the correct answer will appear. Then the switch question, if the student think that the original question is hard for them to answer they can change the question using this button. Lastly is lessen the money option, if the student think that they don’t know the correct answer for the question they can lessen their money into half. In order to win the game, the student needs not be bankrupt and finish all the questions.

The AE is developed to assess students’ progress and help students in learning [22]. The teacher has full control to the components to the questions at the exam while the students are the one that take the exam. The AE contains evaluation in which the results were being automatic analyzed by the system to assess topics with difficulties and provide written feedback to students

Every set of exam are composed of forum. It creates to make an online discussion for continuing tutorials to the students. Only the students that are assigned for the given exam can access the forum.

IV. VALIDATION

In order to check the performance and acceptability of the project, the students need to participate to the evaluation process of the preliminary and final version of the system. For the final version, the 50 engineering of the National University need to undergo on the pre-test and post-test. The students involved are from 3rd year to 4th year of Electronics Engineering and Electrical Engineering. The students did the activity in a 5-week period beginning from November to December 2014. The two hour time period had been given to the tests. The test is consisted of 50 questions that accessible in AE. These questions were divided into different subjects in mathematics, composed of 10 questions for Algebra, 10 Geometry, 10 Differential Calculus, 10 Integral, and 10 Differential Equation.

The pretest was posted in the first two days of the session and has been removed once the student completed the test. After two days the LN and LA was given to the student account, this will serve as review material before taking the

post test. At the end of the session, students had to take the post-test.

The students who participated in pretest and posttest also did the evaluation to the preliminary version of the system. They evaluated the features of the preliminary and compare it to the final version based on how it differ in-terms of its effectiveness as review material and satisfaction to the users. Enumerated below are the enhancement made from preliminary version:

- a) Administrator can give limitations to the access to the students (whether the students can only access the LN, LA, or AE)
- b) Amount of winning money for the activities are automatically recorded for both admin and students account.
- c) First timer students cannot proceed to any functions of the system until they finish fill-out the login profile.
- d) The student profile and result of LA can be converted in MS. Excel document for admin account.

The feedback of the respondents with regards to the enhancements made as well as the result of the pretest and posttest will help us assess the changes made and if 'E-Math' will be an effective review tool for the students. The 4-likert scale was used to answer the questions with responses ranging from 'Very Satisfied' to 'Very Dissatisfied'.

In order to strengthen assessment of the project, interview of the two experts were also seek and conducted. The experts gave their review and comments regarding the contents of the project. The first expert has years of experience in the industry and now currently working as an in-house lecturer for some engineering school in the Philippines. The second expert is a department head of Math and Physics in Technological Institute of the Philippines (TIP-QC).

V. RESULTS AND DISCUSSIONS

The graph in figure 2 showed the highest and lowest subjects that the students got in pretest and posttest. Majority of the students in this figure had a highest score in algebra for both pretest and post. Based on the result, 18 of the students had a great score in algebra questions for pretest with an average of 58%. These values were increase in posttest by 2 in-terms of the number of students and 28.53% in average score.

Majority of the students had a lowest score in integral calculus questions for pretest while differential calculus in posttest. The pretest show that 18 of the students found difficulty in integral calculus question these students got an average score of 22.78%. The result for integral calculus was better in posttest because the number of the students who got lowest score in this subject decreased by 9 compared to pretest and the average of the correct answers increased by 36.11%. However differential calculus got a lowest score for 16 students in posttest with an average rating of 56.62%.

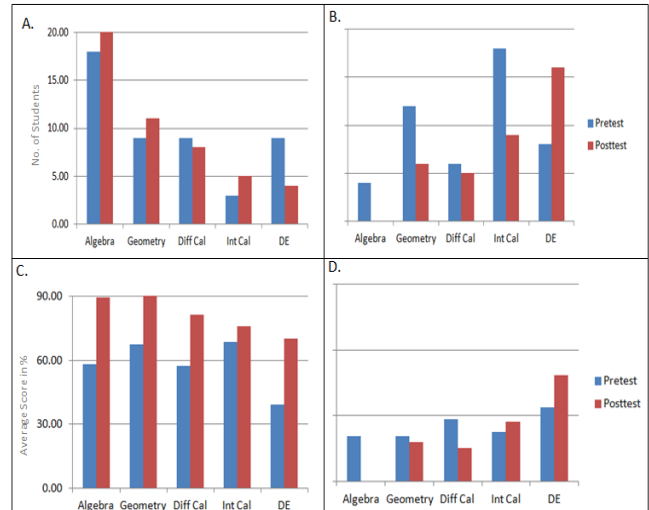


Figure 2. Comparative results between highest and lowest subject of the students from pretest to posttest. A-B are the number of students got highest (A) and (B) lowest score. C-D are the equivalent average score of the students; highest (C) and Lowest (D).

Overall result showed an increase in scores for the five subjects included the questions in pretest and posttest. This only shows that there was a great improvement in the performance of the students after they under gone the LA and LN.

For the figure 3, all the categories included in evaluation for version 2 (VII) show an advantages as compare to preliminary (VI). The categories presented with highest rated value were obtained for both usefulness and satisfaction with a mean score 3.58. This data will show that the students are satisfied in utilizing E-Math and agreed that the system is highly useful as review material. The VII also got a positive result in-term of ease of use with the mean value of 3.58.

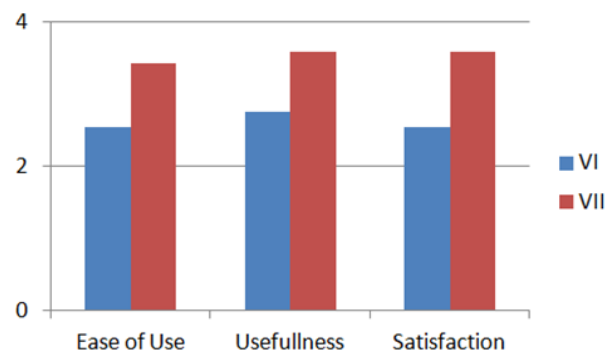


Figure 3. Average rating scale comparative result between preliminary and version 2 of the system (Based on 4 point scale).

The experts also provide their positive comments toward the project and suggestions for some improvements we already addressed.

For the comment of the first expert he said that the project is satisfying, well organized, crafted, and presented. While his suggestions; that the topics must be re-arranged according to subject level, the points and lines topic must be include in geometry, the advanced mathematics subject must need to add in lectures and activities, and lastly the source references are not needed to include as part of the lectures

problem solving. For the second expert, he said that the content is comprehensive. For his suggestions, he asked to proof read because he noticed some typo errors and alignment of symbol for some equations.

VI. CONCLUSION

This project shows that E-Math successfully meet the objectives. From findings obtained at the evaluation process, it is concluded that the E-Math project is truly acceptable as math reviewer tool for engineering board exam. The development paid more attention to the sufficiency and richness of the content in order to attain the learning effectiveness. The idea of having an automatic tracking for student progress in activity is also a great tool to know what areas to improve and this facility achieved a positive satisfaction rate from the respondents.

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