DEVELOPING A VIRTUAL CLASSROOM MODEL AND ASSESSING ITS IMPLICATIONS TO THE LEARNING PERFORMANCE OF COMPUTER LITERACY STUDENTS

A THESIS

Presented to
the Graduate Faculty of
Master of Science in Information Technology
Ateneo De Davao University
Davao City

In Partial Fulfillment
of the Requirements for the Degree
MASTER OF SCIENCE IN INFORMATION TECHNOLOGY

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January 2005

The Electronic Question Bank (EQBank) and the Automated Educational Measurement and Assessment System (AEMAS)

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June 2005

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INTRODUCTION

The wrenching change in human history goes under many names: Computer Revolution, Information Revolution, Communications Revolution, Binary Age, Information Age, and Information Society. It is preferable to call it the Digital Age (Sawyer, Williams, and Hutchinson, 1999). The use of computers these days is notably unstoppable; its necessity is increasing constantly- be it in public or private organizations, in academic or non-academic institutions, or for personal use. Human experiences and new knowledge come with the arrival of information technology: the latter makes possible the fusion and/or merger of several important industries.

Communications become easy with the use of newer technology, such us the following: satellite, fiber-optic cable, cellular phone, fax machine, or compact disc. These tools in information technology evolve with the emerging concepts of connectivity and interactivity. These concepts become the foundations for telecommunications networks, be it in small and simple industries or in large and complex ones. They realize the process known as **electronic data interchange (EDI)**, which only involves the computer-to-computer transfer of data between companies (Shelly, Cashman, and Rosenblatt, 2001). Sharing and distribution of databases have become the central goal of any organization to attain efficient business processes and to solve the problems that threaten the integrity of the data.

As every organization constantly looks forward to its growth, competition has become a normal phenomenon. The wide range of business competition is measured by how effective and efficient is the

processes in performing business transactions that eventually lead to good production. Shelly, Cashman, and Rosenblatt (2001) mention that information systems must really be aligned with customer expectations and business needs and not the other way around. Indeed, it is in the aspect of performing business transactions where most organizations differ. Definitely, businesses which stand excellently amid close and tremendous competition are the ones which adopt automation in their business processes. Hence, this global business competition is twinned with another aspect of competition: technology.

Background of the Study

Technology has touched almost everything around us. Organizations compete for the adoption of automated processes in their respective transactions. Thousands of businesses grow fast and expand geographically because of the advent of new and complex technology.

The academic institutions have a number of transactions and processes which are part of their daily grind: registration, billing, library, payroll, inventory, and the like. Some of these processes, nowadays, are electronically done through computers. But there seems to be a continuous discovery of new factors that must be automated. New situations are born due to the ever-changing academic needs, and thus they need to be immediately addressed.

One challenging role of any academic institution is that done by the faculty. These academicians handle the most basic mission of transforming human persons for others. They must be equipped to handle all areas of the human person's training. One such aspect that requires electronic knowledge is test construction. It is a crucial and critical aspect of the teachers' role since this serves as one of the major

determinants of the students' future. Here, teachers often spend much of their time on test construction, reproduction, checking, and computation of grades.

Manual checking, scoring, and grading need to be done within a limited period regardless of the number of classes or class size a teacher handles. Returning checked papers and beating deadlines bring pressure to the teacher.

Paper and pencil quizzes, long tests, and major examinations are major determinants of a student's performance; they must also undergo analyses to determine their validity and reliability.

Record-keeping and retrieval are important tasks that teachers do because references are needed at any given time. To manage these records manually is a difficult thing to do. These records continue to grow as school years come and go. The more it grows the more it leads to problems in management and control.

The researcher believes that the particular challenging aspect of a teacher's life involves the giving of valid and reliable tests or examinations. This task is best dealt with through automation. The researcher has developed a tool called Electronic Question Bank (EQBank) and the Automated Educational Measurement and Assessment System (AEMAS) that runs in a network environment to answer this felt need.

Objectives of the Study

The main objective of this system is to develop an Electronic Question Bank (EQBank) of questions for different examinations of all

the subjects in the different curricula of any academic institution. The Question Bank serves as the center and foundation of the educational measurement (tests) and assessment (feedback) for both the teachers or instructors and the students.

Specifically, the system has these objectives:

1. the system provides easy record-keeping, retrieval, and protection of test questions (Question Banking);
2. the system only allows questions that are approved by a Screening Board or any equivalent committee to be deposited;
3. the system is network-based and caters to the following:
    a. Test construction using the Table of Specification (TOS);
    b. Test implementation with randomized questions;
    c. Student Test Assessment (Electronic checking and scoring); and
    d. Generate Exam Feedback -Item Analysis (Difficulty Indices and its levels of difficulty, Index of Discrimination and its Discriminating Powers, Measure of attractiveness of each of the choices), and Test Reliability;
4. the system provides notes or bulletin and messaging features to facilitate teacher and student exchange of feedback; and
5. the system promotes a consistent content coverage among different classes of the same subject.

Significance of the Study

The study aims to develop an application called the Electronic Question Bank (EQBank) and the Automated Educational Measurement and Assessment System (AEMAS) as the tool in the giving of examinations or tests that implements automated checking, scoring, and

also test assessment for these indices: difficulty and level of difficulty, discrimination and discriminating power, measure of attractiveness of each of the choices, and test reliability. This will be the answer to the plan of Cor Jesu College for implementing a question banking mechanism for the different classroom tests. Furthermore, it facilitates electronic record-keeping and easy record retrieval.

Here are some values or points to persons or entities that will benefit in this study:

Teachers/Instructors/Professors. The teachers, instructors, or professors are the direct beneficiaries of this study. The tool will help them in the construction and implementation of examinations. By using this tool, creating and reproducing of tests will be faster since the tests can just be implemented in an existing LAN where the test questions are automatically distributed to the different terminals available for students to take. Since the Question Bank answers to questions have been indicated when they were deposited, electronic checking and scoring are possible. Furthermore, once a test has been created and conducted, all the records are kept in a database which will have future references and queries done easily.

Another automated process can be performed as the testing is conducted electronically (in a LAN environment). The teachers generate different feedback of the test- difficulty index and its level of difficulty, index of discrimination and its discriminating power, the measure of attractiveness of every choice, and the test reliability index.

Lastly, if for some reasons the teacher prefers to conduct the test manually, in a typical classroom setting, the constructed test can be printed and reproduced for the students. The tool provides some of the

automated processes like scoring, checking, and performing item analysis.

Students. The application is really beneficial to the students. The waiting time for a student to get the results of a test is significant. Using the EQBank and the AEMAS, right after the submission of the test its result is immediately generated. When the teacher deactivates the test the student can conduct his/her review on his/her corrected examination. More so, the corrected examination is viewed on screen or sent to a printer for printing. An early assessment helps students to have the much needed feedback they need.

Administrators or School Heads. The EQBank and the AEMAS help the Administrators in monitoring class performances- student and examination, since anytime feedback and reports are generated from the system.

Scope and Delimitation

The Electronic Question Bank (EQBank) and Automated Educational Measurement and Assessment System (AEMAS) is designed to meet Cor Jesu College's need in the area of implementing class examinations and generation of test assessments.

The system caters to a banking of questions for each academic subject offered in Cor Jesu College. This creation of a question bank creates the possibility of automating activities involved in the teaching and learning experiences in class such as the construction, implementation, and monitoring of tests and the automated scoring and generation of assessments. Feedback generated refer to the students' test performance (scores and corrected examinations) and test feedback -

item analysis (difficulty index and its level of difficulty, index of discrimination and its discriminating power, measure of attractiveness of each of the choices), and the test reliability index or coefficient.

The formulation of the questions must be traceable on the taxonomy of educational objectives (Bloom 1965) such as knowledge, comprehension, application, analysis, synthesis, and evaluation. These educational objectives are applied to a structured-response type of exam- the Multiple Choice, hence the type of exam that can be stored in the EQBank. With the purpose of somehow measuring the reasoning capability of the students, a freeform or essay type of test is also covered but requires manual checking.

The primary actors of this system are the instructors, students, school heads, screening board or committee and the system administrator(s) of the EQBank and the AEMAS- all in Cor Jesu College.

The EQBank and the AEMAS is designed to work in a Local Area Network (LAN), specifically, at Cor Jesu College's computer laboratories, though it can also be used by other academic institutions.

The system offers test monitoring. While the test is going on the teacher can monitor the examinees in his/her screen. Scores are automatically reflected on his/her screen and can share these with his/her students. The system acts as a class record of midterm and final grades.

The EQBank and the AEMAS generates various reports such as: class list, attendance sheet, grading sheets, table of specification (TOS), constructed tests, answer keys, and feedback.

Definition of Terms

Taxonomy (of Educational Objectives) – Refers to the hierarchy of educational objectives, set by Bloom (1965), of the cognitive domain. The different levels of taxonomy include: knowledge, comprehension, application, analysis, synthesis, and evaluation.

Question Bank – Refers to a particular storage location where questions of the different disciplines in education are deposited for future use in conducting tests or exams.

EQBank – Stands for Electronic Question Bank. It is part of the EQBank and the AEMAS system that refers to the operations involved in depositing questions from different subjects, within the academic curricula of an academic institution. It is considered electronic because its storage location is a computer database and is driven by computer application.

AEMAS- Stands for Automated Educational Measurement and Assessment System. It is also part of the EQBank and the AEMAS system that caters transactions that circulate on academic measurements- tests, such as, test construction, implementation, and assessment or feedbacks.

Table of Specification (TOS) – Refers to the specified framework where test questions of a certain exam can be traced. Normally, it is a matrix of class topics and the taxonomy of educational objectives.

Item Analysis- To know or identify the difficulty of a certain test item and its discriminating power, an item analysis is done.

Difficulty Index- Refers to the numerical value that identifies the difficulty level of a certain test item.

Index of Discrimination- Refers to the numerical value that determines the test item's ability to distinguish between those who know the answer and those who are merely guessing (Padua and Santos 1997).

Measure of Attractiveness- Identifies the attractiveness of the test item's distractors.

Test Reliability- Refers to the consistency or stability of the test, as a whole.

Tests Feedback- Refers to feedbacks generated after the tests have been taken or conducted, test item analyses results (difficulty index and levels of difficulty, index of discrimination and discriminating powers, measure of attractiveness) and the test reliability.

Knowledge – The first level of Bloom's taxonomy of educational objectives. This pertains to objectives related to simple recall, rote-memory learning, and knowledge of facts.

Comprehension – The second level of Bloom's taxonomy that which commonly refers to "understanding". This refers to activities that display the learner's knowledge of the concepts not merely the repetition of definitions.

Application – The third level of Bloom's taxonomy. It refers to the set of activities which the learner can do utilizing the concepts learned either in the same setting or in a different setting.

Analysis – The fourth level of Bloom's taxonomy which means literally to "break down" into smaller parts.

Synthesis – The fifth level in the taxonomy. It refers to the ability of the learner to put together certain bits of information into whole information.

Evaluation – The sixth and the last level in the taxonomy. It pertains to evaluation and judgment.

LAN – Stands for Local Area Network, which refers to physically or logically connected computers in a small geographic area.

Domain (Computer)- Refers to a computer installed with a network operating system (NOS) that acts as a main server of a local area network.

Network Operating System (NOS)- Refers to a computer operating system (OS) that is used in administering, managing and controlling networking activities in a network environment.

TCP/IP – A networking protocol that provides communication between interconnected networks. In a TCP/IP environment, end nodes communicate with servers or other end nodes.

NetBEUI – Stands for NeBIOS Extended User Interface. It is a nonroutable protocol designed for use in small LANs

IP address- It is the most popular implementation of a hierarchical network addressing scheme, a 32-bit logical address.

Operating System- This refers to a managing program of the computer hardware. Furthermore, it also provides a basis for application programs and acts as an intermediary between a user of a computer and the computer hardware (Silberschatz, Galvin, Gagne 2002).

Algorithm- Refers to the mechanism or set of ordered steps in solving a problem.

Graphical User Interface (GUI)- Refers to the menu-driven interface that provides the means for the user to communicate with the computer. It gives control to the manner of interaction between the user and the system.

Database Management System (DBMS)- Also known as **database software**. This refers to a program that controls the database structure and the underlying interactions and accesses the data.

School Heads – Refer to the Administrators and the different Department Heads of Cor Jesu College.