Introducing Computer Aided Learning in Teaching Basic Electronics for Technical-Vocational Students

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Abstract
The use of technology in the delivery of teaching and learning is vital nowadays especially in education. Computer Aided Learning Software (CALS) is basically the use of computer in the delivery of instruction with a tailored fit program intended for a specific lesson or a set of topics.
The CALS software developed in this study is intended to supplement the traditional teaching methods in technical-vocational (TECH-VOC) instruction specifically the Consumer Electronics Servicing course.
There are three specific objectives of this study. First is to create a learning enhancement and review materials on the selected lessons. Second, is to computerize the end-of-chapter quizzes. Third, is to generate a computerized mock exam and summative assessment. In order to obtain the objectives of the study the researcher adopted the Agile Model where the development of the study undergoes iterative and incremental process of the Software Development Life Cycle.
The study conducted an acceptance testing using a survey questionnaire to evaluate the CALS. The results showed that CALS was generally interpreted as very satisfactory. To further improve the CALS it is recommended that the program be updated, enhanced and lastly, be converted from stand-alone to a client/server architecture.

Keywords: Computer Aided Learning Software, Computerized Mock Exam, Consumer Electronics Servicing

Introduction

Around the world, there is growing consensus among education leaders, researchers and educators that teaching and learning must change to help students develop the skills they will need to succeed in the 21st century [1]. The educational technology era has arrived accompanied by major changes in both education and technology [2]. Educational technology is the study and practice of facilitating learning and improving performance by creating, using and managing appropriate technological processes and resources [3].

Attention is now moving towards a more integrated approach in Computer literacy education which focuses on three main aspects. These are: (i) training of teachers and students in Information Technology (IT); (ii) integration of IT into all teaching and learning and the delivery of hardware and software, and (iii) research and development of IT in education [4]. According to administrators' and faculty members' opinion, computers and instructional educational technology have a positive impact on the quality of teaching and research. Likewise, students indicate that the availability of electronic information has been helpful in their work [2]. Thus, there is an agreement among faculty and students that technology can be a useful tool for a successful teaching and learning environment.

Future education and training need proper tools that are able to overcome space, time and performance demands. Such demands are highlighted by the increasing geographical distribution of education and training centers, the need for a continuous updating in technology-related information and the learning effectiveness provided by the integrated use of multiple forms of information. Such tools can be developed by the use of multimedia communication systems for educational and training purposes [2]. With the use of Computer Aided Learning Software (CALS), these will somehow answer the demands.

Computer Aided Instruction (CAI) can provide tailored instruction to an unlimited number of students on an individual basis. Given the move by many universities towards larger classes with integrated technology, multimedia instruction and interactive tutorials provide a convenient means to augment classroom instruction [2]. Specifically with interactive multimedia tutorials, a single faculty member could teach multiple, large sections of a course while providing convenient and tailored instruction for individual students.

Literature Reviews

Innovative Teaching and Learning Research

Use of Information and Communications Technology (ICT) by teachers and students is significantly associated with innovative teaching practices more generally. This association is stronger when ICT is used in higher-level ways that promote deeper student engagement with content. More commonly among teachers in the Innovative Teaching and Learning (ITL) Research sample, ICT is used in more basic ways, to access content (for students) and as a presentation tool (for teachers and students). In some countries, these uses may represent important steps toward innovation.

Nevertheless, models and tools for using ICT in ways that powerfully promote deep student learning can help prepare teachers for taking the next step [1].

Software Development Life Cycle and Agile Method

Software Development Life Cycle (SDLC) is a process followed for a software project, within a software organization. The life cycle defines a methodology for improving the quality of software and the overall development process [5]. Since SDLC model is a traditional and predictive approach, an adaptive software development method is needed for integration which is the Agile Method. The Agile Method implements an iterative approach in which each build of the iteration is incremental in terms of features; the final build holds all the features required by the system.

Computer Aided Instruction

Student learning is the focus of teaching learning process. Theorists and practitioners have always been made concerted efforts to facilitate students learning by enhancing the quality of learning experiences. Emergence of learning theories over time reflects the concern of educators to explore process, factors and conditions involved in human learning. Application of predominant learning theories have always been changing and modifying the methods of teaching and learning [8].

Computer-Aided Instruction (CAI), diverse and rapidly expanding spectrum of computer technologies that assist the teaching and learning process. CAI can dramatically increase a student's access to information. The program can adapt to the abilities and preferences of the individual student and increase the amount of personalized instruction a student receives. Many students benefit from the immediate responsiveness of computer interactions and appreciate the self-paced and private learning environment. Moreover, computer-learning experiences often engage the interest of students, motivating them to learn and increasing independence and personal responsibility for education [9].

Methodology

The design for the Computer Aided Learning Software (CALS) was specifically for the Consumer Electronics Servicing Course. Chapter Lessons were identified namely: Tools & Testing Instruments, Electronic Components, Occupational Health & Safety (OHS) Procedures, Assembly/Disassembly Techniques and Inspection & Testing Procedures. Moreover, the user has the option to take the End- of-Chapter Quiz, Mock Exam or to Exit the program.

A selected number of students were chosen to test and evaluate the CALS for validation. Validated survey questionnaire forms are used to substantiate the overall features of the CALS. The questionnaires evaluated specifically the layout & user interface, software content & operations, general functionality, end-of-chapter quiz and computerized mock exam. A survey response were conducted through the user acceptance testing tool. The data gathered from the survey questionnaire were analyzed by calculating the percentage from the total number of respondents.

Figure 1 shows the main menu which has five chapter lessons intended for the Consumer Electronics Servicing course.

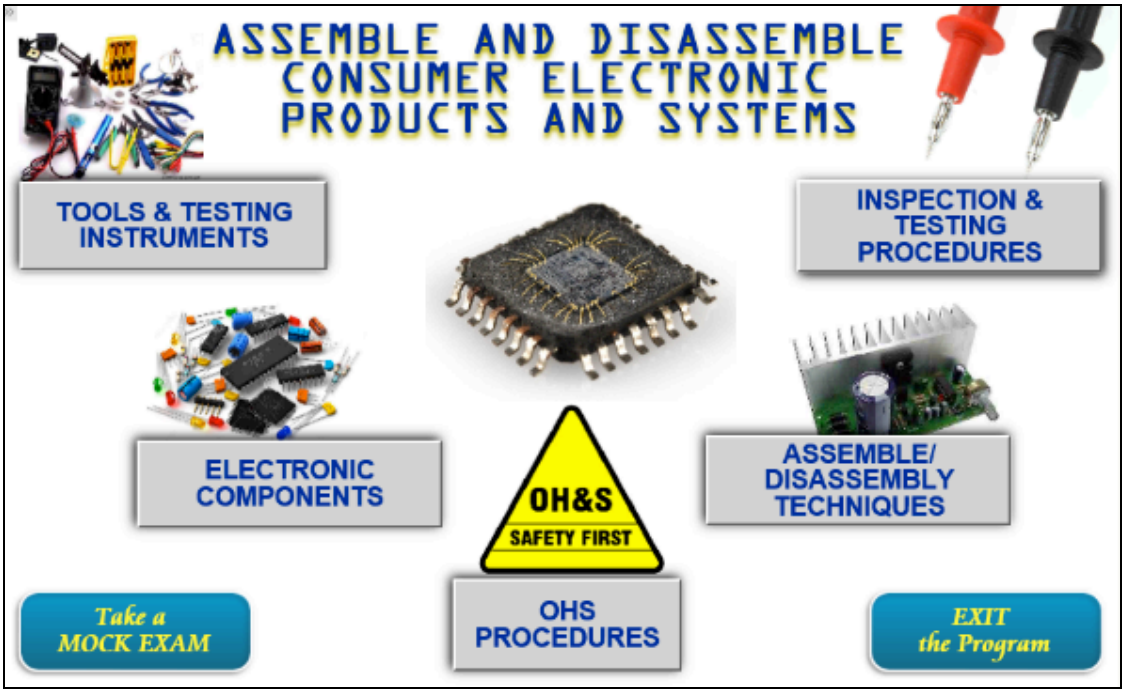

Fig. 1. CALS for Consumer Electronics Servicing - Main Menu

Figure 2 shows the Mock Exam Window which provides the exam assessment compose only of multiple choice exam similar to the electronics competency written exam category. This serves also as a reviewer for the users/students before they take the actual competency exam.

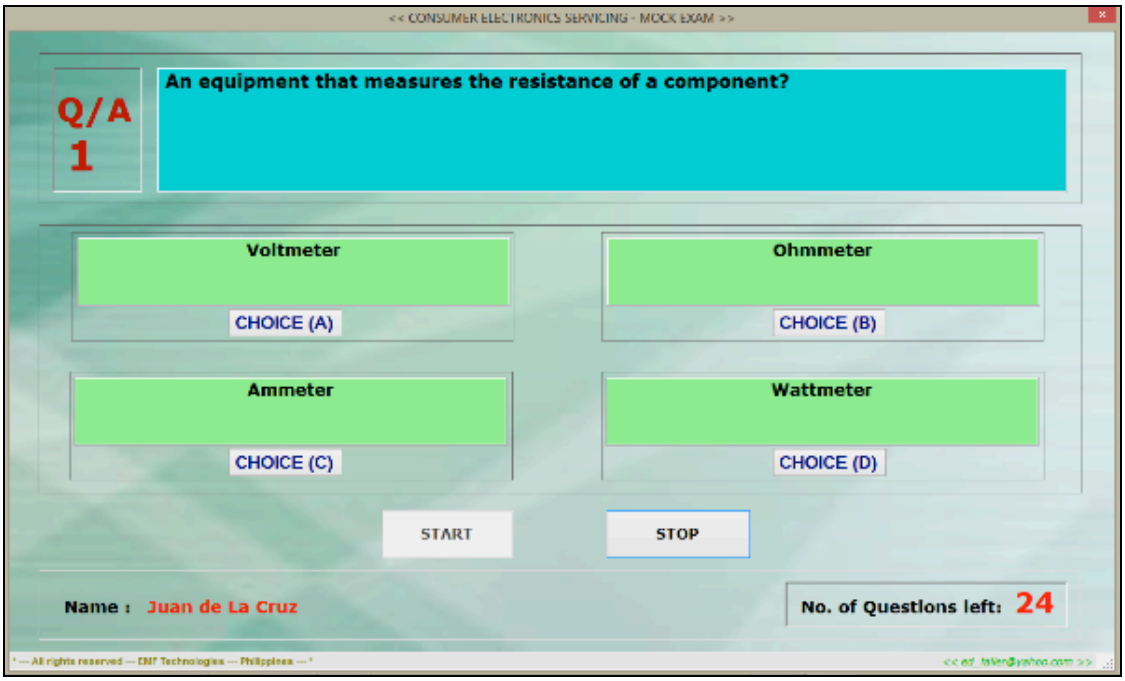

Fig. 2. Mock Exam Window

Results And Discussion

The survey questionnaire is divided into five categories namely: layout & user interface, software content & operation, general functionality, end-of-chapter quiz and computerized mock exam as shown in Table I:

Table I: Survey Results on all 5 Categories

Category Types	Average Percentage
Layout & User Interface	89%
Software Content & Operation	89%
General Functionality	87%
End-of-Chapter Quiz	91%
Computerized Mock Exam	87%
Average Total:	**89%**

Key Results: 90 & above = Excellent, 85-89 = Very Satisfactory, 80-84 = Satisfactory,
75-79 = Good and 74 & below = Poor.

Based on the given results, the average percentage for most of the categories are very satisfactory and an excellent result for the end-of-the chapter quiz. The overall result suggest that the Computer Aided Learning Software has a very satisfactory evaluation.

Conclusions

The proponent developed a Computer Aided Learning Software (CALS) for lessons on consumer electronics servicing course with the aim to supplement the traditional teaching methods in technical-vocational course instruction. The CALS lessons are presented in text as well as graphics and main modules are available for learning. These lessons can be learned with minimal assistance from the instructor and can be reviewed as often as the user wants it. Furthermore, to check or validate the users learning, a chapter quiz for every module was created.

The main objective of the study was met through addressing the specific objectives:
1. The learning enhancement and review materials were developed based on the selected lessons in Consumer Electronics Servicing and it was concluded that it can be used as an alternative teaching material since each chapter contains lessons such as descriptions and graphic representation of the components or tools being utilized in the laboratory.
2. The end-of-chapter quizzes from the selected lessons in Consumer Electronics Servicing was developed and concluded that it can facilitate a one-on-one learning since students can concentrate on a specific topic that they choose.
3. The computerized mock exam with summative assessment from the selected lessons in Consumer Electronics Servicing was developed and concluded that it can serve as a reviewer for National Competency (NCII) written exam since it can be simulated as many times as needed

Lastly, the proponent conducted an acceptance testing using a survey questionnaire. The results showed that the End-of-Chapter Quiz category has an average of 91%

which was interpreted as excellent and the rest of the categories where interpreted as very satisfactory. Thus, the proponent can say that the CALS developed was acceptable and functional.

Recommendations & Future Works

The Computer Aided Learning Software as an acceptable and functional program also has its limitations. From the users as well as the evaluators the proponent came up with the following recommendations to improve the system:

- An improved layout and user interface with more interactive and graphic functionality of the lessons and review quizzes.
- Additional lessons as well as quiz/exam data can be accumulated to the CALS system through a central database for better manipulation and retrieval which will serve as a databank.
- Conversion from stand-alone to a client/server based architecture which will allow the following features:

    - Central database
    - Central monitoring station for student's progress and assessment
    - Support of multi-user functionality

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