Development and Assessment of E-Learning Software and Instructional Training Devices

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Abstract

The purpose of this study is to develop and assess different E-learning software and instructional training devices in selected major subjects of the BSIT and BIT Computer Technology of the College of Information and Communications Technology. Subjects like Operating System and Installations (Tech 113); Computer Programming I (IT 213); and Web Development (IT 321); Digital Design and Analysis (IT 113) and Basic Shop Practices (BSP 113) for BIT Comp.Tech students were considered.

For the development of the E-learning projects, different software development tools were used like Adobe Flash CS4 for the special effects and animations, VB.Net for the interface design and Adobe Photoshop CS3 for the graphics enhancement. Web development tools like PHP, HTML, CSS, JavaScript, AJAX and JQuery were used. For designs and other features, Camtasia 7.0, Adobe Photoshop CS5 and Adobe Image Ready CS2 were also utilized. Selected sections in the 1st year BIT Comp.Tech students and 2nd year BSIT students became the study participants. The students under investigation were given Pre-test and Post-test and treated the results with T-Test.

Prototyping model was used to analyze, design and develop the E-Learning software. Upon completion of all the requirements needed in developing the projects, a validated evaluation instrument of the College was used to determine the project’s level of acceptability. Faculty members, selected CICT students and IT experts were asked to evaluate the projects. Findings showed that the performance of the students increases when supplemented the instruction with the use of E-learning programs and instructional training devices.

Keywords: E-Learning Projects, Instructional Training Devices, Web development

1. Introduction

Educational technology when properly applied can provide an effective means of learning. The use of information and communication technologies (ICT) for educational purposes has increased, and the spread of network technologies has caused E-learning practices to evolve significantly [1].

Numerous studies have reported that computer technology, as a tool can help support, improve, enhance and augment student achievement [2].

It is also capable of enhancing student’s creativity and interest where problem solving and intellectual inquiry can flourish.

The ability of the students to interact with computers is an essential skill to meet the challenges of the evolving uses of computers. With the use of computer, student benefit by being actively involved in the learning processes, receiving immediate reinforcement and be able to proceed at their own pace. Drill and practice exercises, collaborative computer-based projects and curriculum-related games can help increase problem solving, reasoning and learning skills, and may be useful for accelerated education [3].

The development and design of e-learning can assist and enhance the teaching-learning function.

Teachers and students can carry forward their work through an E-learning software in ways that are similar to and tightly intertwined with the traditional ways that they learn, teach and study in libraries, classrooms, laboratories, seminars and conferences. The developed E-learning software was also used to instruct the student where the computer contains the instruction which is designed to teach, guide, and test the student until a desired level of proficiency is attained. And when it is successfully integrated becomes a resource that is used seamlessly and on a regular basis by teachers and students to implement goals and objectives of the curriculum.

According to Phillips (2001), classrooms are being equipped with the latest computer technology so that faculty can use the latest software, E-learning materials, incorporate electronic presentations into
their teaching, present video, connect to the Internet, and other training devices and equipment. Clearly, a major goal of all instruction is for the student to be able to retain as much knowledge of the subject as possible through the use of the said technologies [4].

In this study, the researcher focused on the development and assessment of different E-learning software and Instructional training devices in selected major subjects offered by the College of Information and Communications Technology (CICT). These are the major subjects considered for the development of E-learning software: Operating System and Installations (Tech 113); Computer Programming I (IT 213); and Web Development (IT 321). For the Instructional training devices, two (2) major subjects were considered: Digital Design and Analysis (IT 113) and Basic Shop Practices (BSP 113). The course syllabus of each of the mentioned subjects were considered for the specific lessons and activities that were included in the e-learning and teaching aid projects.

Different software development tools were used in developing the E-learning projects in Operating System and Installation and in Computer Programming I like Adobe Flash CS4 for the special effects and animations, VB.Net for the interface design and Adobe Photoshop CS3 for graphics enhancement. Web development tools were used in developing the BulSU Online, one of the E-Learning project made. HTML, CSS, JavaScript, AJAX and JQuery were used for its front end; MySQL for the database as back end of the system; and for designs and other features, Camtasia 7.0, Adobe Photoshop CS5 and Adobe Image Ready CS2 were used.

In developing the instructional training devices, several operational hardware requirements were considered. Specific electronic tools and components were integrated in the project after analyzing the lessons and activities included in the course syllabus of the subject. The researcher conducted an interview with faculty members who are handling the subjects Digital Design and Analysis, Wireless Communications and the subject Basic Shop practices for the actual activities given to the students.

1.1 General Objective

The main purpose of this study is to develop and assess an E-learning software and Instructional training devices in selected major subjects of the College of Information and Communications Technology.

1.2 Specific objectives

Specific objectives are as follows:
1. To integrate the required course content in the E-learning software which should match the course syllabi of the subjects selected;
2. To identify and use the appropriate software tools in developing the e-learning;
3. To identify and use the needed hardware requirements in developing the instructional training devices;
4. To determine the level of acceptability of e-learning software using the following criteria:
   4.1 functionality;
   4.2 reliability
   4.3 usability;
   4.4 portability;
   4.5 speed; and
   4.6 system training and documentation.
5. To determine the level of acceptability of instructional training devices in terms of:
   5.1 functionality;
   5.2 reliability
   5.3 usability;
   5.4 maintainability
   5.5 portability;
   5.6 workability
   5.7 safety; and
   5.8 system training and documentation.
6. To assess the effectiveness of the developed e-learning software and Instructional training devices using the pre-test and post test.
7. To test whether there is a significant difference between the results of the pre-test and post-test of the students who used the developed e-Learning software and instructional training devices.

3. Integrated Review of Related Literature and Studies

In improving the learning in higher education, the primary focus should be on engaging students in a process that best enhances their learning, a process that includes feedback on the effectiveness of their learning efforts. Education must be conceived as a continuing reconstruction of experience which is the process and goal of education.

Technology can help students learn more effectively and at the same time can improve the teacher’s efficiency. Many students are already used accessing information via mobile phones and the web. At school they will be taught using interactive whiteboards and games, whereas, e-learning aims to provide a learning resource for students [5].

For educators, the use E-learning software is associated with other beneficial outcomes, including school attendance, motivation/time-on-task, and student-student cooperation and collaboration than the use of conventional instruction alone. Most programs of computer-based instruction evaluated in the past have produced positive effects on student learning and attitudes. The effects of computer use on a large number of outcome areas were examined, including academic achievement in mathematics, in language arts, in reading, in science, in problem-solving skills, and in health and social studies.

In the study of De Leon (2001), she developed a Computer-Assisted Instruction in the teaching of selected topics in high school chemistry of the Bulacan State University for the school-year 1999-2000 and eventually measures its effectiveness [6]. Her study was conducted among the two (2) sections of the third year high school of the Bulacan State University covering the 66.6% of the total population of the third year high school students. The respondents were chosen based on their previous academic grades in science, mathematics and computer subjects as well as on their intelligence quotient.

Casupanan (2005) also developed an electronic learning approach in teaching selected topics in Physics and determine its effect on the performance of college students [7].

Florida (2009) developed an “Analogy-Integrated E-Learning Module” in order to facilitating students’ conceptual understanding”, presents a unique way of teaching and learning science concepts through the combination of analogy and technology [8].

Same with Salvador et. al. (2007) who developed a Web-based Computer Aided Instruction for Operating Systems better known as OPERASY. They used Moodle course management system to provide e-learning environment. The thesis aims to provide a learning resource for students regarding operating systems. Discussed are the concepts behind operating system design and its main tasks which are the process management, memory management, device management and file system management. These include animations and simulations supported by voice over to stimulate learning for the subject matter and comprehensive quizzes to assess learning among students [9].

Lo et.al. (2006) developed a Computer-aided instruction on universal mobile telecommunications system (UMTS). With the modernized capabilities and advantages of Computer-Aided Instructions (CAI), the proposed thesis would enable the user to learn interactively with less difficulty. Current studies indicate that through this method, students will learn the logic behind a particular concept. The thesis project aims to enhance the knowledge of communications majors and in understanding the underlying principles in the newly developing technology, the Universal Mobile Telecommunications System (UMTS) or third generation mobile system (3G), by supplementing them with sufficient data, facts and additional knowledge [10].

The advancing capabilities and the increasing variety of available computer functions and features result in a continuing need to test for the computer-skills necessary to ensure student success. Universities must accept the challenge of ensuring a technologically-adept student population. Higher education today requires that all students have a certain basic familiarity with the tools used throughout
their educational programs. These basic computer skills are a necessary component of a student’s college education [11].

3.1 Theoretical Framework

In order to have an overall view of this study, a simple conceptual model is presented which illustrates the input, process and output. This explains the flow and the procedures followed by the researcher during the development and testing of the E-learning projects and instructional training devices.

![Conceptual Paradigm of the Study](image)

The first frame is the input which contains resources needed to complete the study. It include the selected major subjects course syllabus of the BSIT and BIT Comp.Tech program of the College of Information and Communications Technology, sample instructional materials that are already developed like e-Learning and Computer Aided Instruction were also considered. Learning modules of the different major subjects like Computer Programming I, Operating System and Installations, Basic Shop Practices, Web Development, Wireless Communications with Cellphone Repair, Digital Design and Analysis were used in developing the projects.

Thesis, dissertation and research journal were also used as reference in conducting this research. Operational requirements in terms of the different software development tools and hardware specifications were considered in developing the e-learning and instructional training devices.

The second frame is the Process in developing the different projects. The researcher used Prototyping method which is one of the most popular techniques in Rapid Application Development (RAD). The researcher used this method because it is team-based technique that speeds up information systems development and produces a functioning system.

The process starts in: **Identifying User Needs; Develop a Prototype; Determine if the prototype is acceptable; Code (fabricate) the operational system; Test the operational system; Determine if the operational system is acceptable; and Use the operational system**.
Assessment of the developed projects was also part of the Process Stage wherein the researcher developed a mechanics of facilitating an actual activities/exercises before and after (Pre-test and Post test) using the e-learning or the Interactive Training Devices. The researcher also selected several sections for each program having the same number of students. T-Test was used to test the hypotheses of no significant difference between the pre-test and post-test scores using the SPSS version 11.5 software.

The third frame is the output which is the expected outcome of this study, the “Development and Assessment of E-Learning Software and Instructional Training Devices”

4. Methodology

This study used a descriptive-survey method of research, which includes the gathering, recording, analysis and interpretation of data. Since the study is descriptive in nature, it attempted to determine level of acceptability as well as the effectiveness of the developed e-learning software and instructional training devices.

For the development of E-learning and instructional training devices, System Development Life Cycle (SDLC) model was used. It is actually a technique that divides complex projects into a more easily managed segments or phases. In this study, the researcher started the process of developing the projects in initiation phase, followed by planning, design, development, testing, implementation, and maintenance phases. These phases provided the researcher a dynamic and flexible guideline for developing the E-learning software and training devices.

A Pretest and Posttest was administered in order to assess the effectiveness of the developed E-learning and training devices. The researcher grouped the selected sections of BSIT 3rd year, 2nd year and 1st year BIT Computer Technology students into Control Group and Experimental Group. The students under the Control group underwent classes through conventional setting. For the Experimental group, the students from the selected sections were asked to use the developed E-learning materials and instructional training devices in Operating System, Turbo C/C++ Programming and Web Development, Digital Design Analysis and Basic Shop Practices.

In determining the level of acceptability of the developed E-learning and instructional training devices, this study adopted the standardized instrument of the College of Information and Communications Technology which is the Evaluation Criteria for E-learning and Hardware Prototype project. The said instrument is composed of several criteria as follows: Functionality; Reliability; Usability; Maintainability; Portability; Workability; Safety; Training and Documentation. Random sampling method was used in selecting the student who will test and evaluate the projects. CICT faculty members who handle the subject concern were asked to evaluate the project related to his or her subject.

To facilitate the interpretation of the weight mean score of the response, the upper and the lower limit of scale was adopted:

<table>
<thead>
<tr>
<th>Range of Weight Scale Mean</th>
<th>Descriptive Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>4.51-5.00</td>
<td>Very Acceptable</td>
</tr>
<tr>
<td>3.51-4.50</td>
<td>Acceptable</td>
</tr>
<tr>
<td>2.51-3.50</td>
<td>Moderate</td>
</tr>
<tr>
<td>1.51-2.50</td>
<td>Poor</td>
</tr>
<tr>
<td>1.5-1.00</td>
<td>Needs Improvement</td>
</tr>
</tbody>
</table>

Data were tabulated and analyzed using frequency, percentage and weighted mean. The hypotheses of no significant difference between the pre-test and post-test scores were analyzed and tested using standard deviation and t-test. In facilitating data processing, SPSS version 11.5 software was used.

5. Significant Findings

The main goal of this study is to develop E-learning software and Instructional Training Devices and eventually determine its effectiveness by allowing students to utilize the projects.
Six (6) different projects were developed namely: (a) E-Learning Software In Operating System Installation; (b) E-Learning Software In Turbo C/C++ Programming; (c) E-learning in Web Development; (d) Electronic Peripheral Trainer With Circuit Assembler; (e) DCT3 Mobile Phone Simulation Trainer; and (f) Mock – Up Multitester for Basic Shop Practice subject.

5.1. E-Learning Software In Operating System Installation

Figure 1 is the main screen of the developed E-learning for the subject Operating system and Installation. The user can select from the menu that appears in this form.

![Figure 2. Main Screen of the ILS in Operating System Installation](image1)

Different lessons were included in the e-learning which was derived from the course syllabus of the subject. Proper BIOS settings was included for the actual BIOS/CMOS configuration as well as the different Operating System.

5.2 E-Learning Software In Turbo C/C++ Programming

The researcher also developed an E-learning software in Turbo C Programming. The lessons and activities were derived from the course syllabus of the subject in Computer Programming I.

The E-learning started with a log-in form. The software was designed to cater different user like the faculty members handling the subject as the admin and the student who can have an account in the system, explore the lessons and take a quiz after each lesson. Sample machine problems were also included.

The faculty adviser as the system admin can create an account for their students, they can also monitor the scores of thier students in thier quizzes. The admin can also change the questions in the quizzes.

![Figure 3. Different Chapters of Turbo C Programming](image2)

The admin can perform the following functions in the Admin account: Add New Student, Edit/Update Student, View/Delete Student, Create Exam Schedule, Log-out, Add new Exam Question,

a. E-Learning in web Development

This project is different from the other e-Learning projects. The researcher through the help of selected BSIT 4th year students developed an E-learning in web development wherein the user can access the different lessons.

![Figure 4. Home Page of the BulSu Online](image)

The student can simply choose an specific course from which they wanted to get certified. Different courses like web development using PHP, HTML, XHTML, CSS, Ajax, Javascript, JQuery etc. are available in the system. Figure shows the Professor List form. The assigned professor can edit and delete the content of the lesson of a particular topic.

![Figure 5. Admin Account for Managing the Professor List](image)

b. Electronic Peripheral Trainer With Circuit Assembler

![Figure 6. Front Panel of the Project](image)
The study also considered developing *Instructional Training Devices* for the major subjects focusing on computer hardware and electronic devices to fully equip the students in the field of information technology.

Figure 6 is the front panel of the project “Electronic Peripheral Trainer with Circuit Assembler” for Digital Design and Analysis subject.

This project is a training device which can be used to design and create different circuit connections using electronic devices and components like diodes, transistors, capacitors, resistors, LEDs, switches etc.

c. DCT3 Mobile Phone Simulation Trainer

For this project, the main objective is to help the students to be familiar with the different troubles and defects of a Nokia DCT3 cellphone. One of the major subjects in the program BIT Computer Technology is the Wireless Communication with Cellphone repair, that why the researcher through the help of selected BIT Computer Technology 4th year students came up with the idea of developing a *Phone simulation trainer*.

![Figure 7. Front Panel of the DCT3 Phone Simulation Trainer](image)

The trainer was composed of several LED indicator to identify the trouble or defects of a particular cellphone.

d. Mock-Up Multitester in Basic Shop Practice

The last project is the Mock-Up Multitester for the subject Basic Shop Practices. The intention for this project is to help the instructor in teaching Multitester.

![Figure 8. Mock-up Analog and Digital Multitester Front Panel](image)

The faculty member will be able to demonstrate clearly the proper testing of electronic components and devices like resistor, capacitor, diode and transistor using the said project. In this way, the students will be able to understand easily the proper reading and procedure on how to use a multitester.
**Level of Acceptability of the E-learning Software**

To facilitate the interpretation of the weight mean score of the responses, the upper and lower limit of scale was used. Table 1 shows the overall mean distribution of evaluator’s rating for the level of acceptability of e-learning materials.

**Table 1.** Overall Mean Distribution of Evaluators Rating for the Level of Acceptability of E-Learning Software

<table>
<thead>
<tr>
<th>E-Learning Software</th>
<th>Functionality</th>
<th>Reliability</th>
<th>Usability</th>
<th>Maintainability</th>
<th>Portability</th>
<th>Speed</th>
<th>System Training and Documentation</th>
<th>Mean</th>
<th>Descriptive Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. E-Learning Software In Operating System Installation</td>
<td>4.35</td>
<td>4.27</td>
<td>4.44</td>
<td>4.45</td>
<td>4.46</td>
<td>4.40</td>
<td>4.40</td>
<td>4.40</td>
<td>Acceptable</td>
</tr>
<tr>
<td>2. E-Learning Software In Turbo C Programming</td>
<td>4.00</td>
<td>3.70</td>
<td>4.20</td>
<td>4.00</td>
<td>4.00</td>
<td>4.00</td>
<td>3.98</td>
<td>4.00</td>
<td>Acceptable</td>
</tr>
<tr>
<td><strong>Overall Mean</strong></td>
<td>4.21</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.51 – 5.00 Very Acceptable; 3.51 – 4.50 Acceptable; 2.51 – 3.50 Moderate; 1.51 – 2.50 Poor; 1.0 – 1.50 Needs Improvement</td>
</tr>
</tbody>
</table>

**Table 2.** Overall Mean Distribution of Evaluator’s Ratings for the Level of Acceptability of Instructional Training Devices

<table>
<thead>
<tr>
<th>Instructional Training Devices</th>
<th>Functionality</th>
<th>Reliability</th>
<th>Usability</th>
<th>Maintainability</th>
<th>Portability</th>
<th>Workability</th>
<th>Safety</th>
<th>System Training and Documentation</th>
<th>Mean</th>
<th>Descriptive Interpretation</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Electronic Peripheral Trainer With Circuit Assembler</td>
<td>4.57</td>
<td>4.64</td>
<td>4.60</td>
<td>4.20</td>
<td>4.50</td>
<td>4.50</td>
<td>4.20</td>
<td>4.46</td>
<td>4.46</td>
<td>Acceptable</td>
</tr>
<tr>
<td>2. DCT3 Mobile Phone Simulation Trainer</td>
<td>4.37</td>
<td>4.00</td>
<td>4.27</td>
<td>4.30</td>
<td>4.18</td>
<td>4.30</td>
<td>4.20</td>
<td>4.23</td>
<td>4.23</td>
<td>Acceptable</td>
</tr>
<tr>
<td><strong>Overall Mean</strong></td>
<td>4.34</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>4.51 – 5.00 Very Acceptable; 3.51 – 4.50 Acceptable; 2.51 – 3.50 Moderate; 1.51 – 2.50 Poor; 1.0 – 1.50 Needs Improvement</td>
</tr>
</tbody>
</table>

Table 3 shows the number of students who participated in this study. The specific course, year level and section were also indicated.

**Table 3.** Study Participants

<table>
<thead>
<tr>
<th>E-Learning Software and Instructional Training Devices</th>
<th>Course, Year and Section</th>
<th>Number of Participants</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. E-Learning Software In Operating System Installation</td>
<td>BIT Comp. Tech 1D-Group 2</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>BIT Comp. Tech 1E-Group 2</td>
<td>30</td>
</tr>
<tr>
<td>2. E-Learning Software In Turbo C Programming</td>
<td>BSIT 1B-Group1 &amp; BSIT 1C-Group1</td>
<td>30</td>
</tr>
<tr>
<td>3. E-learning Software in Web Development</td>
<td>BSIT 3A-Group 1 &amp; BSIT 3B-Group 1 &amp; BSIT 3C-Group 1</td>
<td>25</td>
</tr>
<tr>
<td></td>
<td>BSIT 1A – Group1</td>
<td>25</td>
</tr>
<tr>
<td>4. Electronic Peripheral Trainer With Circuit Assembler</td>
<td>BIT Comp. Tech 1A-Group1</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>BIT Comp. Tech 1B – Group1</td>
<td>30</td>
</tr>
<tr>
<td>5. DCT3 Mobile Phone Simulation Trainer</td>
<td>BIT Comp. Tech 2A-Group1</td>
<td>28</td>
</tr>
<tr>
<td></td>
<td>BIT Comp. Tech 2B – Group1</td>
<td>28</td>
</tr>
<tr>
<td>6. Mock – Up Multitester in Basic Shop Practice</td>
<td>BIT Comp. Tech 1B-Group1</td>
<td>30</td>
</tr>
<tr>
<td></td>
<td>BIT Comp. Tech 1C – Group1</td>
<td>30</td>
</tr>
</tbody>
</table>
To test the effectiveness of the developed E-learning software and Instructional Training devices, the researcher gave Pre-test and Post-test to the Experimental group. The selected students were given a Pre-test before using the E-learning software or the Training devices. After finishing all the lessons, Post-test was given again to the students. Significant Difference between the Results of the Pre-Test and Post-Test of the Students who used the Developed E-Learning Software and Instructional Training Devices. The significant difference between the Pre-test and post-test of the E-learning software in Operating System Installation was shown in Table 4.

**Table 4.** Significant Difference between the Pre-test and the Post-test of the E-Learning Software in Operating System Installation

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>Pre-Test &amp; Post-Test</td>
<td>8.7273</td>
<td>15.99242</td>
<td>2.15642</td>
<td>4.4039</td>
<td>13.0506</td>
<td>4.047</td>
</tr>
</tbody>
</table>

The pretest was given before exposure to the E-learning software. The statistics shows that a high significant difference was observed between the pre-test and post-test. The null hypothesis of no significant difference was rejected at .01 level of significance. This could be interpreted that the performance of the students increases when the teacher’s instruction was supplemented with the use of the E-learning program. The negative sign of t (-34.797) indicates that the mean of the post test is higher than the mean of the pretest. Table 5 on the other hand shows the significant difference of the pre-test and post-test of the E-learning software in Turbo C Programming. Under the t-test for equality of means, the computed Sig. (2-tailed) score is .000 which is less than .01 level of significance; therefore there is a significant difference between the mean of the Pre-test and Post-test.

**Table 5.** Significant Difference between the Pre-test and the Post-test of the E-Learning Software in Turbo C Programming

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>Pre-Test &amp; Post-Test</td>
<td>-2.35547E1</td>
<td>5.41538</td>
<td>.67692</td>
<td>-24.90741</td>
<td>-22.20197</td>
<td>-34.797</td>
</tr>
</tbody>
</table>

The null hypothesis of no significant difference was also rejected at .01 level of significance. A t-value of 4.047 is statistically significant. In this specific situation, the researcher can comfortably conclude that the Post-test is a little bit higher than the Pre-test. This could be interpreted that the performance of the students increased when there is an additional technology used in the learning process like an E-Learning Software.

Table 6 presents the significant difference of the pre-test and post-test of the E-learning software in web development. As can be seen in Table 6, a negative t-value of -8.321 is statistically significant. The null hypothesis of no significant difference was rejected at .01 level of significance.

**Table 6.** Significant Difference between the Pre-test and the Post-test of the E-learning Software in Web development

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>Mean</th>
<th>Std. Deviation</th>
<th>Std. Error Mean</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pair 1</td>
<td>Pre-Test &amp; Post-Test</td>
<td>-4.8667</td>
<td>5.06534</td>
<td>.58489</td>
<td>-6.0321</td>
<td>-3.7012</td>
<td>-8.321</td>
</tr>
</tbody>
</table>
This could be interpreted that the score of the students increases after using the E-learning in web development. Table 7 shows the results of the significant difference between the Pre-test and Post-test of the developed project Electronic Peripheral Trainer with Circuit Assembler. The statistics shows that a high significant difference was observed between the pre-test and post-test.

**Table 7.** Significant Difference between the Pre-test and the Post-test of the Electronic Peripheral Trainer with Circuit Assembler

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error</td>
<td>Mean</td>
<td>Lower</td>
</tr>
<tr>
<td>Pair 1</td>
<td>Pre-Test &amp; Post-Test</td>
<td>-8.0833</td>
<td>5.37506</td>
<td>69392</td>
</tr>
</tbody>
</table>

The null hypothesis of no significant difference was rejected at .01 level of significance. The negative t-value (-11.649) indicates that the mean of the post test is higher than the mean of the pretest.

Table 8 presents the Pre-test and Post-test of the project phone simulation trainer. The negative t-value of -8.638 indicates a significant difference between the pre-test and the post-test scores of the selected students involved in the study.

**Table 8.** Significant Difference between the Pre-test and the Post-test of the DCT3 Mobile Phone Simulation Trainer

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error</td>
<td>Mean</td>
<td>Lower</td>
</tr>
<tr>
<td>Pair 1</td>
<td>Pre-Test &amp; Post-Test</td>
<td>-6.2500</td>
<td>5.41463</td>
<td>.72356</td>
</tr>
</tbody>
</table>

The null hypothesis of no significant difference was rejected at .01 level of significance. Under the t-test for equality of means, the computed Sig. (2-tailed) score is .000 which is less than .01 level of significance; therefore there is a significant difference between the mean of the Pre-test and Post-test.

Lastly, Table 9 shows the Pre-test and the Post-test of the Mock – Up Multitester in Basic Shop Practices. Result of the statistics shows that a high significant difference was observed between the pre-test and post-test.

**Table 9.** Significant Difference between the Pre-test and the Post-test of the Mock – Up Multitester in Basic Shop Practice

<table>
<thead>
<tr>
<th>Paired Differences</th>
<th>95% Confidence Interval of the Difference</th>
<th>t</th>
<th>df</th>
<th>Sig. (2-tailed)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean</td>
<td>Std. Deviation</td>
<td>Std. Error</td>
<td>Mean</td>
<td>Lower</td>
</tr>
<tr>
<td>Pair 1</td>
<td>Pre-Test &amp; Post-Test</td>
<td>-7.9630</td>
<td>3.86286</td>
<td>.74341</td>
</tr>
</tbody>
</table>

The null hypothesis of no significant difference was also rejected at .01 level of significance. The negative value of t (-10.711) indicates that the mean of the post test is higher than the mean of the
pretest. This could be interpreted that the performance of the students increased when the discussion is supplemented by a Mock Up training device project.

Similar with the study of Casupanan (2005) who determine the effect of electronic learning approach in teaching selected topics in Physics on the performance of college students, one of his findings stated that there is a significant difference existed between the pre-test and post-test results of the electronic learning group. Findings revealed that the performance of the students improved after using the training mock-up Multitester.

6. Recommendations

In the light of the foregoing findings and conclusions of the study, the following recommendations are advised:

1. It is recommended that the developed E-Learning Software In Operating System Installation, E-Learning Software In Turbo C Programming, E-learning Software in Web Development, Electronic Peripheral Trainer With Circuit Assembler, DCT3 Mobile Phone Simulation Trainer, Mock – Up Multitester in Basic Shop Practice should be utilized in the classroom instruction since it was found out to improve the performance of the students.

2. A similar study must be conducted in other year level and other courses especially those involving abstract concepts to see the effect of E-learning program and Instructional Training Devices in the classroom instruction.

3. Development of other E-learning software and Training devices for other major subjects should be consider for future researches.

References


