Effectiveness of Multimedia Based Educational Tool for Computer Hardware and Software Installation

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ABSTRACT

The use of multimedia in teaching and learning processes leads to higher learning and offers a potential avenue for improving student understanding and skills. This research aims to develop an educational multimedia educational tool for Computer Hardware and Software Installation course. The researchers utilized the Analysis, Design, Develop, Implement, Evaluate (ADDIE) instructional design for the completion of the research study. After the development phase, the developed educational tool was evaluated based on the following: (1) level of acceptance in terms of design, ease of use and overall functionality; (2) level of satisfaction in terms of content, tutorials and simulator and; (3) overall effectiveness of the multimedia based tool. A survey questionnaire was developed and utilized to evaluate the level of acceptance and satisfaction of the students and teachers on the developed multimedia tool. For the level of effectiveness, a pre-test and post-test was conducted using the National Competency rating sheet to determine the performance of the respondents.

The evaluation result revealed that design, ease-of-use and the overall functionality of the developed multimedia tool is highly acceptable with a weighted mean of 4.39. On the other hand, the respondents are very satisfied with content, tutorials and simulator with an average weighted mean of 4.31. These results proved that the developed multimedia tool has the features and functionalities to be considered as an effective supplementary tool for teaching and learning the said course. Moreover, the components included on the developed tool are significant to help the users deepen their knowledge about the course. In addition, the integrated hardware and software simulator helped them to strengthen their skills and understand every component of a computer system. The result of the t-test from the two groups of respondents showed that the developed multimedia educational tool is an effective courseware in teaching Computer Hardware and Software Installation.

Keywords: Multimedia Tool, Courseware, Educational Tool, Installation, Hardware and Software.

1. INTRODUCTION

The use of multimedia in teaching and learning leads to higher learning. Multimedia refers to any computer-mediated software or interactive application that integrates text, color, graphical images, animation, audio sound, and full motion video in a single application. Multimedia learning systems offer a potential venue for improving student understanding about language. Teachers try to find the most effective way to create a better foreign language teaching and learning environment through multimedia technologies [1].

Most of the educational multimedia applications fall into the category of an interactive and graphical application. These applications are fully capable multimedia tools that can handle all media formats, as well as providing interactivity with the user [2].

The presence of interactions and interactivity in technology based instructional materials have become synonymous with enhanced learning [3]. The primary application of the interactive multimedia for instruction is in an instructional situation where the learner is given control so that maybe reviewed the material at their own space and in keeping with their own individual interests, needs, and cognitive processes [4]. With the capability of creating a more realistic learning context through its different media and allowing a learner to take control, interactive multimedia can provide an effective learning environment to different kinds of learners [5].

The researchers recognized that instructors provide actual computer parts and software applications to teach hardware and software installation. When an instructor is teaching the lessons about the parts of a computer, there's a scenario wherein not all parts of the computer unit has been provided by the instructor. Like when it comes to installing the parts to its proper position, it takes a long time to install parts. Not all students were given opportunities to touch, hold and try to install the parts because of lack of time and they were content to see others in actual installation.

During the development of the educational tool, the researchers utilized different multimedia elements such as animations, text, images, audio and videos. A two– dimensional (2D) design was considered to support better interaction between the user and the application. By clicking and dragging the 2D representation of each computer and system unit parts, users can familiarize and simulate the actual installation. In addition, the educational tool has the capability to simulate the actual installation of the operating system to provide the user with the realistic experience and knowledge.

Objectives of the study

This research aims to develop a multimedia-based educational tool for teaching hardware and software installation that would help the instructors and students in teaching and learning basic computer hardware and software installation. Likewise, it aims to

determine the effectiveness of the developed tool for teaching hardware and software installation.

Specifically, the study sought to answer the following objectives:

1. To evaluate the level of acceptance of the respondents on the developed educational multimedia tool in terms of:
   1.1. Design
   1.2. Ease of Use
   1.3. Overall Functionality
2. To evaluate the level of satisfaction of the respondents on the components of the educational multimedia tool in terms of:
   2.1. Content
   2.2. Tutorials
   2.3. Simulator
3. To determine the effectiveness of using multimedia based educational tools in teaching Hardware and Software Installation.

2. MATERIALS AND METHODS

Software development

In developing the said multimedia tool the researchers used the Analysis, Design, Development, Implementation, and Evaluation (ADDIE) instructional design model as shown in Figure 1, as the framework in developing the multimedia educational tool. The ADDIE model is a generic process traditionally used by instructional designers and training developers [6].

Figure 1 shows the ADDIE Model which consists of five cyclical phases – analysis, design, develop, implement and evaluate. In the analysis phase the researchers determine the objectives and the student's needs. Researchers start to create storyboards and the prototype of the multimedia education tool in the design phase. In the develop phase the researchers start to create the multimedia education tools, which would be implemented in the implement phase. In the evaluate phase the researchers gather the feedback from the user to be able to improve the multimedia education tool.

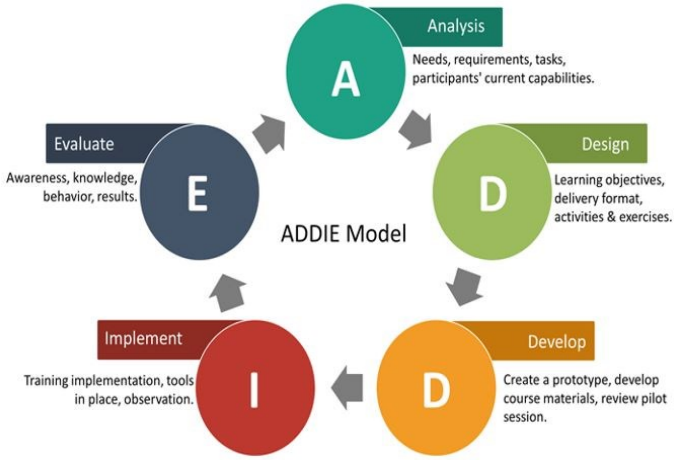

Figure 1. ADDIE Model.

Conceptual framework

Figure 2 shows the conceptual framework of the study which consists of the input, development phase, output, evaluation and feedback. Inputs are necessary for the completion of the multimedia educational tool, while ADDIE instructional design model was used as the framework in developing and finishing the project. The output was the Multimedia Based Educational tool for Computer Hardware and Software Installation. The developed multimedia educational tool must be evaluated to determine the level of acceptance and satisfaction as well as the effectiveness of said tool. After evaluation, feedback was gathered for further enhancements and improvements of the educational tool.

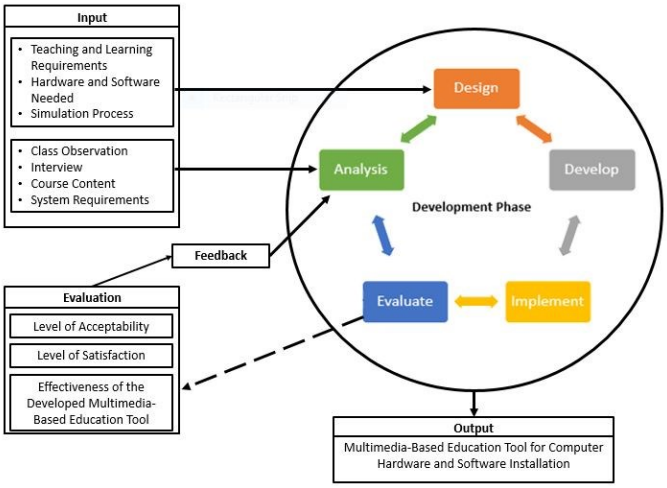

Figure 2. Conceptual framework.

Analysis

In this phase, the researchers determined the objectives and the student's needs. The first objective was to identify the student's needs in terms of learning computer hardware and software installation. To be able to identify what learners need, the researchers conducted class observation and a series of interviews of students and course facilitators were conducted to be able to gather data regarding hardware and software and installation problems. The second objective was to determine the appropriate software and what are the modules needed to develop the multimedia tool.

Design

After gathering and analyzing the objectives and problems encountered, the researchers started designing the multimedia tool. The researchers first used the paper prototype method to design the flow of the system. User interface and video clips sequencing were also done during this stage. The flow of the content of the video clips shows the standard procedure in installing computer hardware components and as well as the operating system installation. Construction of a questionnaire for software evaluation was also part of this phase.

Develop

After the design phase, the researchers translated the paper prototype into a working system. Actual development, animation and coding to incorporate the needed features of the multimedia tool that will satisfy the needs of the students To develop the educational tool, Adobe Flash was used because of its capability to produce and display text, produce animations, and embed audio and video as its content. For the interactive animations, Actionscript 3.0 was used as a programming language. The researchers also used video editing software to enhance the video clips.

Since Adobe Flash was utilized, the content and interactivity can be viewed and experienced using web browsers with installed Adobe Flash Player. In addition, it can also be accessed using Adobe Air or Shock Wave Flash (SWF) player for desktop computers [7].

Figure 3 displays the index screen of the application. On this interface, users can choose between hardware configuration and software installation.

Figure 3. Index screen of the multimedia educational tool.

Figure 4 shows the hardware configuration Interface of the application. On the left side of the screen, the 2D representation of each hardware component is displayed. Every component can be dragged and placed to the proper position on the motherboard which is on the right side of the screen.

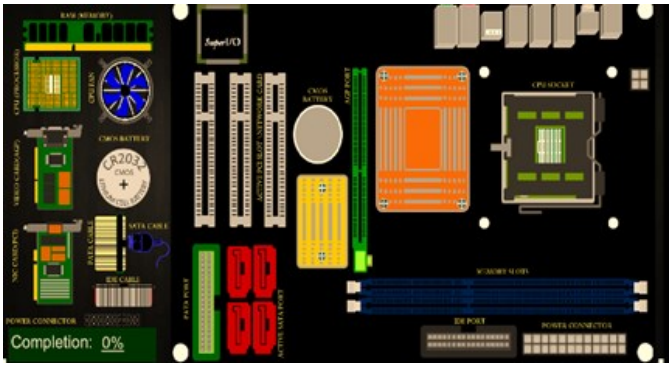

Figure 4. Hardware configuration screen.

As shown in Figure 5, video clips will be displayed after each component is placed on the proper location on the motherboard. Video clips discussed the proper way of installing every part to strengthen the learning of the users.

Figure 5. Video clip in installing motherboard components.

Figure 6 displays the boot selection interface of the application. The user will choose to arrange the boot sequence by pressing the function key F5 or F6.

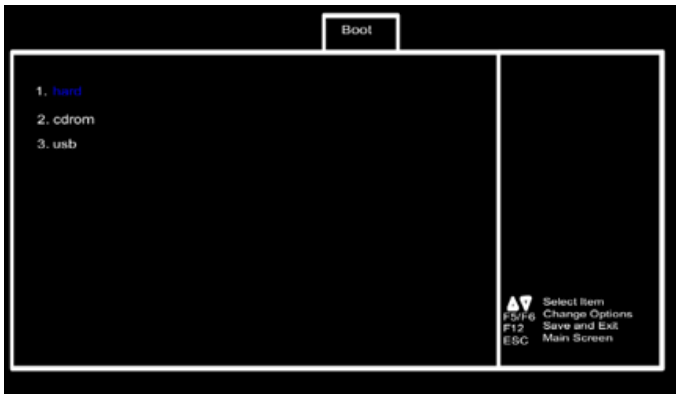

Figure 6. Boot selection menu simulation screen.

Figure 7 shows the operating system installation window. On this interface, the user will select the following: language to be used, time and currency format, keyboard and input setup. This process simulates the actual installation of an operating system.

Figure 7. Operating system installation simulation screen.

Implementation

Upon completion of the multimedia tool, it was released and introduced to the third year BSIT students from the university in Nasugbu, Batangas.

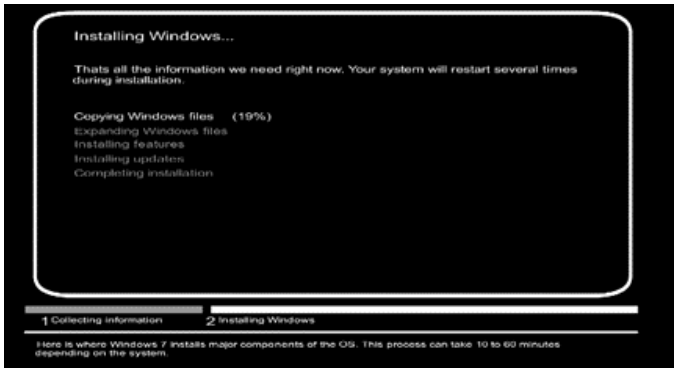

Figure 8. Installing operating system simulation screen.

Hardware and Software Requirements

To evaluate the effectiveness of the developed multimedia tool, two equivalent groups of respondents were selected using a simple random sampling technique. Each group consisted of thirty (30) students that were selected randomly. First was the experimental group, composed of students who were exposed to the developed tool in their learning process. The second group was the controlled group composed of students who were not exposed to the said tool.

Table 1. Hardware and software requirements.

	Specifications
Hardware	
Processor	2.0 ghz
RAM	4 Gigabyte
Graphic Processing Unit	2 Gigabyte Shared Memory
Software	
Operating System	64-bit Operating System
Web Browser	Google Chrome Mozilla Firefox
Flash Player	v. 32.0.445
Flash Player Projector	v. 32.0.445

Evaluation

After the implementation phase, the educational multimedia tool underwent evaluation process. This phase included the actual software evaluation as well as the evaluation of its effectiveness.

In software evaluation, the students from the experimental group and ITE instructors evaluated the multimedia tools components in terms of design, ease of use, overall functionality, content, tutorials and simulator. The evaluation was done utilizing a self - made questionnaire as shown on Table 2. A scale of 1 to 5 was used with 5 as the highest and 1 as the lowest.

Table 2. Components of the evaluation questionnaire.

Software quality
Design
• The visual design of the multimedia tool is interesting and effective.
• The layout features appropriate use of text, visuals, and backgrounds.
• Animations and graphics used are of a high quality and are used appropriately to enhance the learning experience of the users.
Ease of use
• The multimedia tool is simple, easy to use, and understand.
• Components of the multimedia tool (buttons, labels, hyperlinks) are appropriate for each function.
• The user can easily learn how to use the multimedia tool.
Functionality
• The multimedia tool is useful and suitable to the needs of the intended users.
• The multimedia tool produces the user's expected output and displays accurate information.
• The multimedia tool performs its intended functionality.
Software features
Content
• The content is significant in teaching and learning computer hardware and software installation courses.
• The content of the multimedia tool is complete and accurate.
• The content is well organized and structured.
Tutorial
• The tutorials included are congruent with the learning objectives.
• The tutorials are relevant with the classroom lectures and discussions.
• The tutorials encourage active learning among the users.

The answers from the evaluation questionnaire were tallied and tabulated. Weighted Mean and T-test was used by the researchers for statistical treatment of data. After computing for the average weighted mean, Likert scale was used to interpret the corresponding verbal interpretation as shown on Table 3. In addition, the researchers have utilized Stata® as the statistical software package for the analysis of the collected data

Table 3. Likert scale for level of acceptability and satisfaction.

Average weighted mean range	Descriptive equivalent (acceptability level)	Descriptive equivalent (satisfaction level)
4.21 – 5.00	Highly acceptable	Extremely satisfied
3.41 – 4.20	Acceptable	Very satisfied
2.61 – 3.40	Neutral	Moderately satisfied
1.81 – 2.60	Slightly unacceptable	Slightly satisfied
1.00 – 1.80	Highly unacceptable	Not at all satisfied

To determine the effectiveness of the Multimedia tool, the experimental and controlled groups underwent a pre-test and a post-test to see if the scenario would cause a change in the performance of the respondents. The National Competency rating sheet was used to determine the performance of the respondents. Their performances were compared statistically using T-test.

One of the objectives of the research is to determine the effectiveness of the multimedia educational tool. With this, both null *(Ho*) and alternate (*Ha*) hypothesis were stated as shown on Table 4.

Table 4. Null and alternative hypothesis for pre-test result of controlled and experimental group

Test	Null hypothesis (*Ho*)	Alternative hypothesis (*Ha*)
Pre-test	There is no significant difference between the results of the pre-test of controlled and experimental groups.	There is a significant difference between the results of the pre-test of controlled and experimental groups.
Post test	There is no significant difference between the results of the post test of controlled and experimental groups.	There is a significant difference between the results of the post test of controlled and experimental groups.

3. RESULTS AND DISCUSSION

This section presents the results of the collected data with reference to the objectives of the study.

Table 5 shows the level of acceptance evaluation of the respondents, it reveals that the multimedia based education tool is highly acceptable. The multimedia tool is easy to use, navigate, understand, and learn at the same time.

Table 5. Level of acceptance of the multimedia based educational tool.

Software quality	Mean	Level of acceptance
Design	4.33	Highly acceptable
Ease of Use	4.53	Highly acceptable
Overall Functionality	4.31	Highly acceptable
Average Weighted Grand Mean	4.39	Highly acceptable

The result showed that the developed multimedia tool has the features and functionalities to be considered as an effective supplementary tool for teaching and learning the said course.

As indicated on Table 6, the respondents are very satisfied with components included in the multimedia tools. The tutorial component got the highest evaluation since the included tutorials promote learning among students and are relevant to support classroom activities and learning objectives of the course.

Table 6. Level of acceptance of the multimedia based educational tool.

Multimedia tool components	Mean	Level of satisfaction
Content	4.3	Very satisfied
Tutorial	4.38	Very satisfied
Simulator	4.27	Very satisfied
Average weighted grand mean	4.31	Very satisfied

This result revealed that components included are significant to help the users deepen their knowledge and the simulator helped them to strengthen their skills and understand every component of computer hardware and software.

Table 7. Pre-test and post test result of controlled and experimental group.

	Mean	Test statistics	p-value	Decision on H_o	Interpretation
Pre-test					
Controlled group	59.11	0.73	0.47	Failed to Reject H_o	Not significant
Experimental group	55.78				
Post test					
Controlled group	94.32	-2.88	0.0056	Reject H_o	Significant
Experimental group	98.49				

Based on the Table 7, the p-value = 0.4692 with the t-test value = 0.7286 which is greater than α = 0.05, therefore the null hypothesis (Ho) was failed to reject.

There hasn't been found a significant difference between the controlled and experimental groups in the pre-test application in terms of success level. Furthermore, it shows that both groups are all in the same level of knowledge regarding hardware and software installation.

The post test showed that the p-value = 0.0056 with the t-test value of -2.879 which is less than the α = 0.05, hence rejecting the H_o

There has been a significant difference between post test grades of experimental and control groups in favor of the experimental group. From the result of this test, it yielded that using the developed multimedia tool for teaching hardware and software installation as a supplement can be more effective.

4. CONCLUSIONS

1. Because of its simple and easy- to-use design, the developed multimedia tool will be an effective supplementary tool to support teaching and learning processes inside the classroom.

2. It was proven that the features and functionalities of the developed multimedia tool fit the needs of the users. The components included on the developed multimedia tool will be of great help to the instructors and to the students for teaching and learning Hardware and Software Installation. The content, discussions and tutorials included are significant to help the users deepen their knowledge on the said course. Furthermore, the simulator will help them to strengthen their skills and understand every component of computer hardware and software.

3. The result of the pre-test / post-test of the two groups showed that the developed multimedia educational tool is an effective courseware in teaching Hardware and Software Installation.

4. For future researchers, it is recommended to utilized Unified Theory of Acceptance and Use of Technology (UTAUT) and ISO 25010 to further explore the level of acceptance and software evaluation of this multimedia educational tool.

5. To further strengthen the effectiveness of the developed multimedia tool, evaluation of the IT experts can also be considered.

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