The development of computer-aided instruction for computer concepts and fundamentals

Angelo C. Arguson
School of Business and Computer Studies
acarguson@sdca.edu.ph

Abstract – *The interactive computer-aided instruction (CAI) software for computer concepts and fundamentals course is a windows-based application that aids Information Technology professors, who then assess their students' academic achievements. The study was conducted on college students enrolled in the said course. These classes were randomly picked as experimental. The selected group was given a briefing, demonstration, and an achievement test of the prototype. The topics presented in the CAI were the lectures of their preliminary period and a scale prepared by the proponent to evaluate the prototype. Computer-assisted instruction practices prepared for this purpose were embedded in the software as a module. The researcher employed a descriptive-developmental methodology in conducting the study. The proponent consulted two (2) Information Technology professors to conduct alpha testing on the CAI prototype. Also, the proponent used prototyping as the software's process model. The software was developed using Microsoft Visual Basic 2015 Community Edition, Adobe Photoshop, and Microsoft Office PowerPoint 2015. The CAI criteria was used as the CAI software's evaluation tool for acceptance testing. The researcher also used the five-point Likert scale to interpret the result. Based on the results of evaluation, the computer-aided instruction software for Computer Concepts and Fundamentals gained an overall mean of 4.08, with a descriptive rating of "Very Good". This demonstrates that the CAI software achieved its objectives.*

Keywords – *Computer, computer-aided instruction, computer concepts and fundamentals.*

Introduction

It is a well-known fact that progress in communication and information technologies has greatly affected social life. Information in our age has undertaken a leading role in the economic development of developed societies. And technology has manifested itself as an increasingly efficient and significant factor in the development of instructional process (Tsungjuang, 2009).

One of the technologies that are efficiently used in the systems of instruction and education is computer-assisted instruction or CAI. The studies conducted in this field have shown that achievement level with CAI is higher when compared with traditional educational methods (Yildirim, Yakar, Cekbas & Savran, 2003).

CAI is an interactive instructional technique whereby a computer is used to present the instructional material and monitor the learning that takes place. This form of instruction offers different methods of delivery. It includes drill and practice, tutorial, simulation activities, games, discovery, and problem solving. Among them, the tutorial is most commonly used method in presenting computer-based instruction. One way of integrating CAI in learning is the use of multimedia courseware. The main advantage of using multimedia is that it does not stick to the textual approach of presenting the topic to the user. Instead, it uses different forms of media such as text, audio, video, animation, and graphics. Upon implementing CAI, computers take over the responsibilities of the teachers: CAI provides most of the instruction to its users and test their

capabilities through practical applications and exercises. Teachers now act as CAI's facilitators. (Cruz, 2014).

Since its establishment in 2003, St. Dominic College of Asia (SDCA) has played a leading role in revolutionizing the education of Caviteños. From that year onward, the institution had been generating research for 11 years.

At present, SDCA houses four schools: the School of Arts, Sciences, and Education (SASE), the School of Business & Computer Studies (SBCS), the School of International Hospitality and Tourism Management (SIHTM), the School of Health Science Professions (SHSP), and the Basic Education Department (BED).

Because every IT professor generates only a limited amount of researches, assessing student outcomes and recording technical knowledge has become a major problem that needs to be addressed. Furthermore, the modern student is averse to reading books, handouts, and presentation lectures to study before their exams. Instead, they focus their time on social networking because they find it more entertaining. Considering this problem, the proponent thought that there is a need for a technology that will cater to the needs of modern-day education, and improve the way of instruction for IT instructors and students.

Challenged by the institution's mission and vision, the proponent continuously looked for a solution to solve the problem of capturing the students' interest in studying. The result of this was a computer-aided instruction application that would help revolutionize traditional classroom instruction.

The paper, "The development of computer-aided instruction for Computer Concepts and Fundamentals" aims to develop a CAI application that will help information technology professors assess their students' academic achievements. The said system will be installed in each workstation within computer laboratory 2, and is expected to provide the students lessons and assessments in computer concepts and fundamentals classes.

Review of Related Studies and Literatures

Many published publications within the literature states the effective use of computers in providing quality education to students.

The acceptability of CAI in teaching Java Programming. The study aimed to design and develop a CAI application in teaching Java Programming. It profiled Java Programming students, and determined the level to which the stakeholders accepted the CAI. The developers employed descriptive developmental research in conducting the study, and utilized Rapid Prototyping in designing and developing the software. After acceptance testing the CAI, the software still needed improvement in certain aspects such as Content, Interactivity, Navigational Elements, and Screen Design according to the respondents' perception. The sections that followed briefly discussed the problems, literatures and studies referenced, and methodologies that the researchers used in order to create the study's findings and recommendations (Sino, Cruz, Hermoso, Manuel, & Lomboy, 2014).

Effects of computer-assisted instruction on the performance of senior high school biology students in Ghana. The study investigated the comparative efficiency of computer-assisted instruction (CAI) and conventional teaching methods in biology on senior high school

students. A science class was selected in two randomly-selected schools. The students in the experimental group learned science concepts (cell cycle) through the CAI, whereas the students in the control group were taught the same concepts through the conventional approach. The conventional approach consisted of lecture, discussions, and question and answer teaching methods. Mann–Whitney U tests were used to analyze the students' pretest and posttest scores. The results indicated that students instructed through the conventional approach performed better on the posttest than those instructed by the CAI. However, the performance of low achievers within the experimental group improved after instruction through CAI. Even though the CAI group did not perform better than the conventional approach group, the students in the CAI group perceived CAI to be interesting when they were interviewed (Owusu, Monney, Appiah, & Wilmot, 2010).

Computer-assisted instruction practices in a computer office program course on academic achievements and attitudes toward computers. The purpose of this study was to reveal the effects of CAI practices in a computer office program course on academic achievements, and the attitudes of vocational high school students toward computers. This study was conducted on junior high students of Beysehir Vocational High School in the spring term of educational year 2009-2010. Two classes consisting of students with equal University Entrance Exam points were chosen for the study, totaling into 70 students. These classes were divided randomly into experimental and control groups. Percentage, frequency, arithmetical mean, standard deviation, and t-test were used in analyzing the study data, and the significance level was set at .05 trust level. In all statistical analyses, the SPSS 15.0 package program was utilized. At the end of the study, it was seen that the students who received CAI practices had higher academic achievement than those who received conventional instruction practices. No significant differences were found in students' attitudes towards computers in the experimental and control groups (Korucu, & Gunduz, 2011).

Visual Studio 2015 community. Visual Studio 2015 Community is a free, fully-featured, and extensible Integrated Development Environment (IDE) for creating modern applications in Windows, Android, and iOS, as well as web applications and cloud services. With IntelliSense, easy code navigation, fast builds, and quick deployment, Visual Studio increases productivity and makes it easy to do one's work alone, or as part of a larger team (retrieved from https://www.visualstudio.com).

MySQL. MySQL is an open-source database originally developed by MySQL AB and owned by Sun Microsystems. As its name implies, MySQL uses Structured Query Language (SQL) as its data manipulation language. MySQL is primarily used for web applications and is extremely popular since it is open source and free (Gosselin, Kokoska, & Easterbrooks, 2011). Many of the world's largest and fastest-growing organizations including Facebook, Google, Adobe, Alcatel Lucent, and Zappos rely on MySQL to save time and money in powering their high-volume Websites, business-critical systems, and packaged software (from https://www.mysql.com).

Microsoft PowerPoint 2013. Microsoft PowerPoint 2013 makes it easy to design and deliver beautiful presentations with ease and confidence. It has a brand-new look, is cleaner, is primed for use on tablets and phones, and allows users to swipe and tap through presentations. Functions include Presenter View (which automatically adapts to projection set-up, and use it on a single monitor) and Themes (a simpler way to to hone in on a certain presentation's look). Also,

when working with others, users can now add comments to ask questions and get feedback (retrieved from https://support.office.com/).

Conceptual Framework

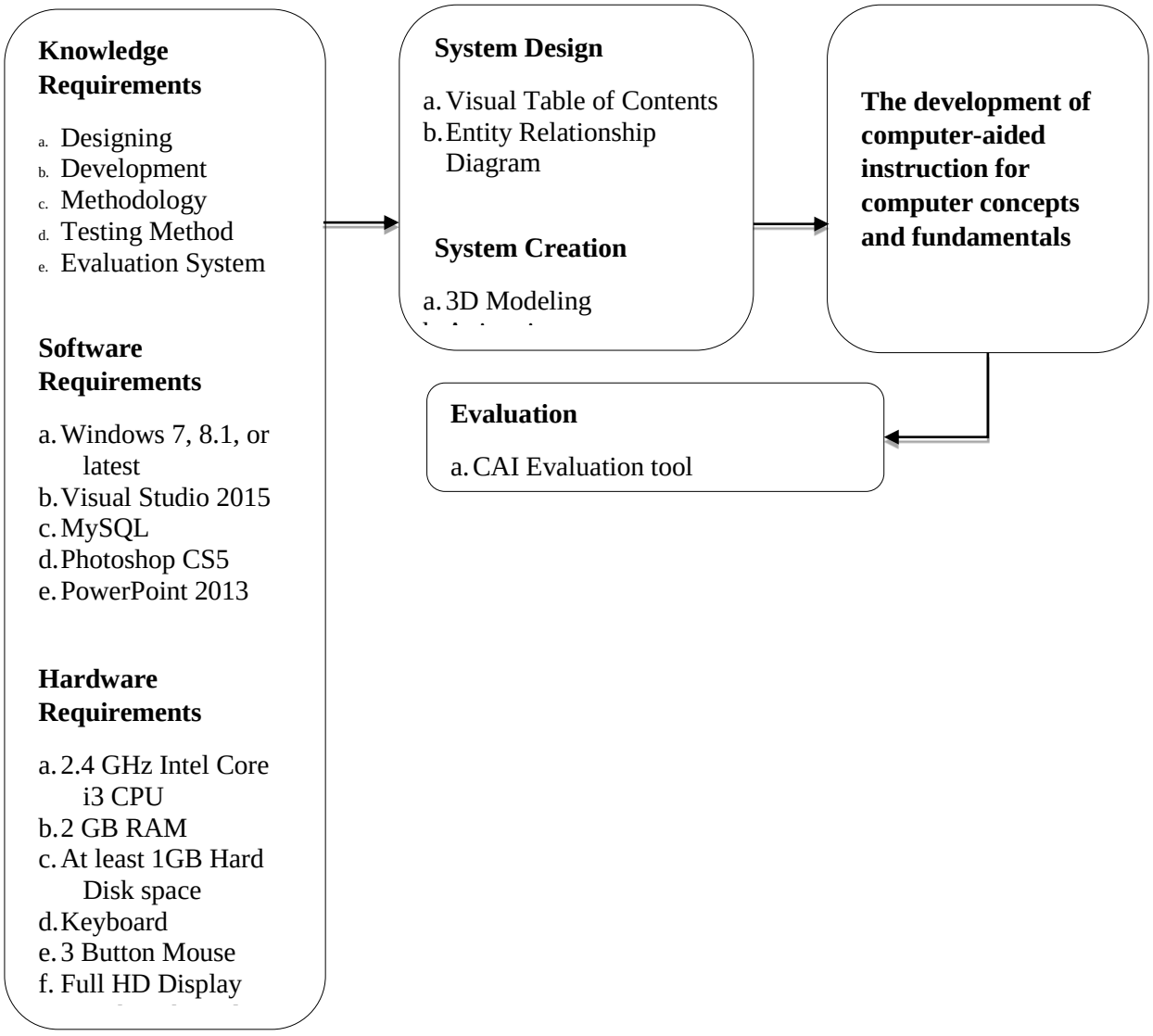


Figure 1. The input process and output (IPO) chart

As stated above, Figure 1 consists of three major elements: input, process, and output. Input contains knowledge, software, and hardware requirements. The knowledge requirements suggest that the researcher must understand the concepts and theories that are needed to design and develop the prototype. This includes the software designing, development, the use of prototyping as the methodology, and choosing the evaluation tool for evaluating the CAI itself.

The software requirements include the tools needed to design and develop the videogame, which includes Windows operating systems (such as 7, 8, and 8.1), Visual Basic from Visual

Studio 2015 Community as the programming language for the program's front-end, MySQL as the programming language for the program's back-end, Photoshop CS5 for creating layouts, and Microsoft Office PowerPoint 2013 for preparing the tutorial. Hardware requirements only consist of a desktop computer to develop the program.

The process suggests a list of activities to be performed for the game's development.

Requirement gathering. Refers to the study's fact-finding techniques and assessment. System design pertains to mapping the behavior of the program before development.

System creation. Refers to the activities that may lead to the development of the software.

System testing. Undertaken to find errors and correct them in order to achieve the desired characteristics.

Using a validated instrument, the developed software is subjected to evaluation in order to rate its performance. The CAI software will be the project's output—the development of CAI for the computer concepts and fundamentals course.

Methodology

Table 1. Likert scale

Numerical Scale	Descriptive Rating
5	Excellent
4	Very Good
3	Good
2	Fair
1	Poor

Table 2. The range of ratings and its qualitative interpretation

Numerical Range	Descriptive Rating
4.20 – 5.00	Excellent
3.39 – 4.19	Very Good
2.58 – 3.38	Good
1.77 – 2.57	Fair
1.00 – 1.76	Poor

Results and Discussion

The developed CAI software for the computer concepts and fundamentals course was evaluated in terms of instructional, student interaction, and technical aspects. A total of twenty (20) respondents evaluated the system. The respondents' ratings were consolidated and computed to get their quantitative and qualitative mean ratings.

Table 3 summarizes the evaluation results, showing the mean per criterion and the corresponding descriptive interpretation. The table also presents the overall mean by getting the average of all the means of the three criteria.

Table 3. Overall summary of respondents' ratings

Criteria	Mean	Descriptive Interpretation
Instructional	3.96	Very Good
Student Interaction	4.18	Very Good
Technical	4.09	Very Good
Overall Mean	4.08	Very Good

The respondents' ratings of the system's instructional aspect obtained a mean of 3.96, interpreted as "Very Good". This indicates that the CAI prototype is accurate, has educational value, has organized lessons, is free from stereotypes, curriculum fit, and its objectives are explicitly explained.

The respondents' rating regarding the system's student interaction aspect obtained a mean of 4.18, interpreted as "Very Good". This means that the CAI prototype implements student roles, has uniqueness of learning, has response to correct and wrong answers, has scoring, and uses graphics and colors.

The respondents' rating regarding the system's technical aspects obtained a mean of 4.09, interpreted as "Very Good". This means that the CAI prototype adheres to screen design concepts, ease of operations, error trapping, and speed of execution.

Table 3 shows the summary of the evaluation results. Student Interaction got the highest rating, with the mean rating of 4.18. On the other hand, instructional obtained the lowest mean rating of 3.96, which is still rated as "Very Good". The overall mean for all criteria for the CAI prototype yielded a mean rating of 4.08, which indicates that the software is "Very Good" in terms of acceptance.

Conclusions and Recommendations

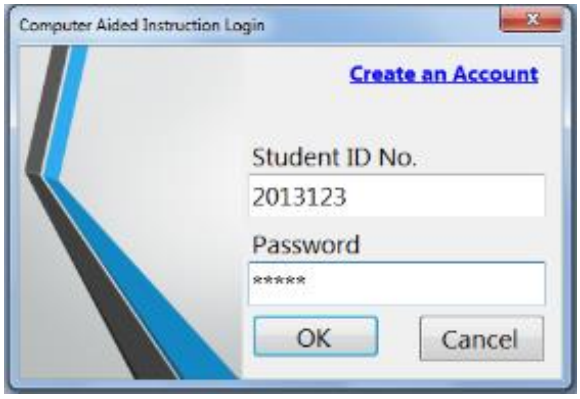
From the results of this study, it can be concluded that the use of CAI in a computer concepts and fundamentals course is acceptable. The researcher concludes that the prototype CAI made a big difference in instruction, and would help the instructors assess the academic achievements of their students with ease.

The researcher would like to recommend the following:

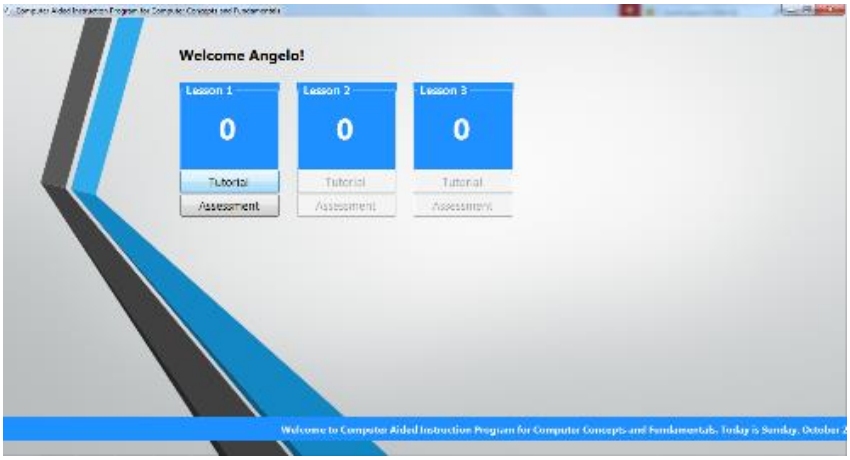
1. Having the right answers to the questions displayed onscreen if in case the student did not perfect the assessments.
2. Utilization of sound effects to enhance students' retention while using the prototype.
3. A more powerful commercial database when the demand for data storage increases.
4. The help of a server which should be integrated with a network system, specifically Local Area Network (LAN).

Appendix

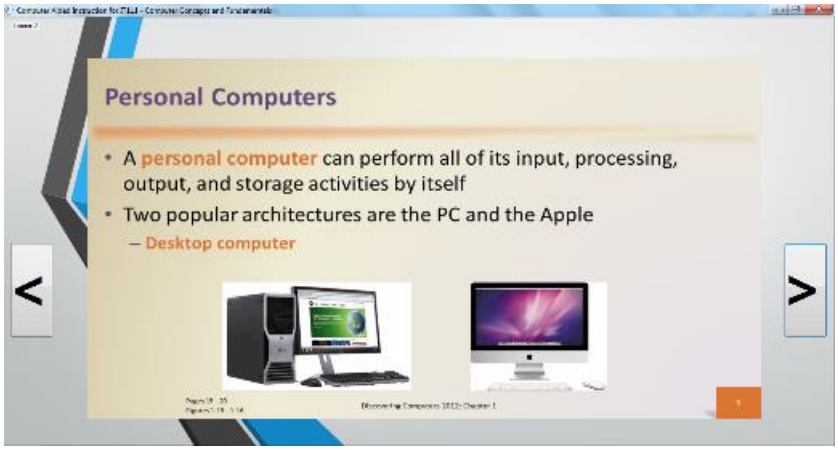
1. **Login form**



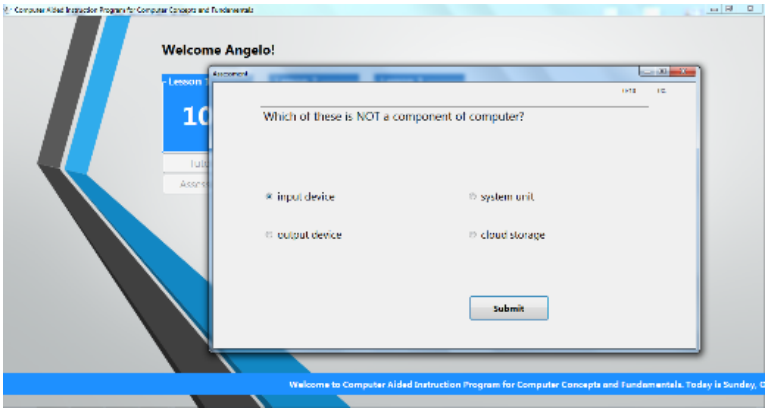
2. **Dashboard**



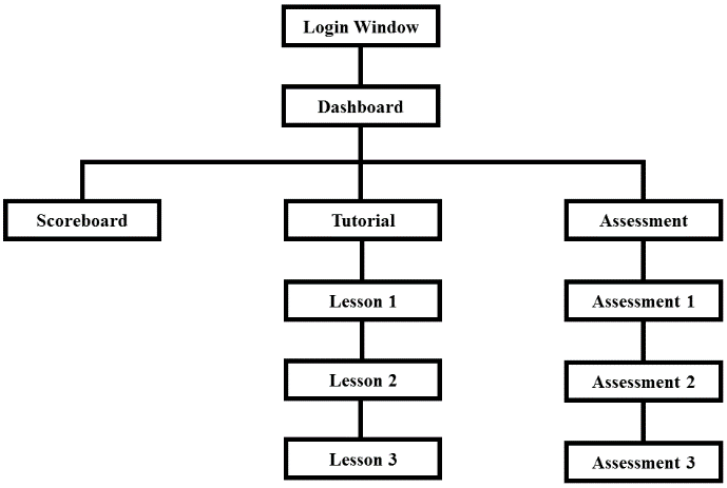
3. **Tutorial**



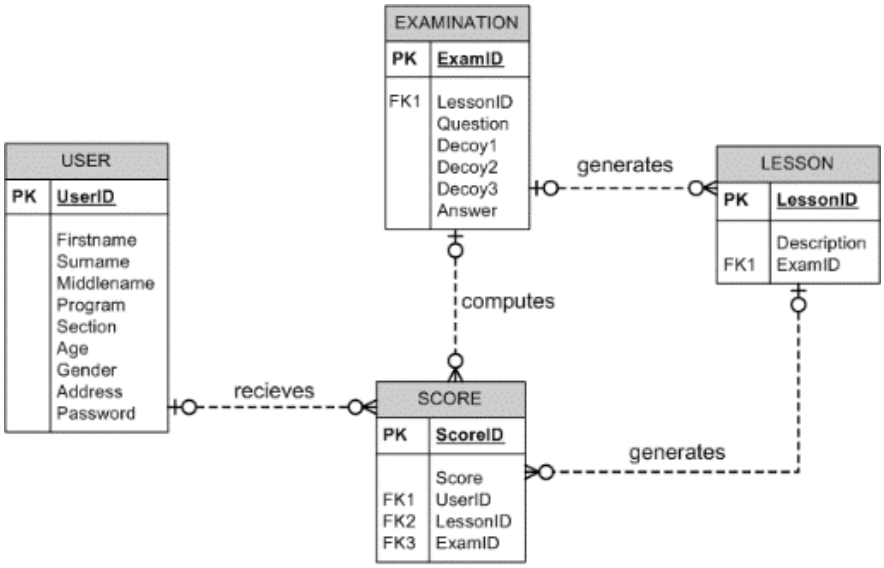
4. Assessment



5. Visual Table of Contents



6. Entity Relationship Diagram of the CAI software



7. Evaluation Tool

School of Business and Computer Studies
Department of Information Technology
Prepared by: Prof. Angelo C. Arguson, MIT

Evaluation Criteria for Computer Aided Instruction

Name: _____ **Date:**_____/_____/_____

Age:_____ y.o. **Address:**_____

Direction: Please evaluate the software by using the given scale and placing a checkmark (✓) under the corresponding numerical rating:

Numerical rating		**Equivalent**
5	-	Excellent
4	-	Very Good
3	-	Good
2	-	Fair
1	-	Poor

Criteria		**Indicators**	**Rating**				
			1	**2**	**3**	**4**	**5**
A. Instructional							
1	Content						
	A	Accuracy					
	B	Educational Value					
	C	Organization					
	D	Completeness					
2	Objectives						

	A	Explicitly defined					
	B	Clarity					
	C	Curriculum fit					
3	Learning Framework						
	A	Learning Assumptions					
	B	Learning theory					
	C	Environment					
	D	Transition					
	E	Internal consistency					
4	Professionalism						
	A	Errors/Bugs					
	B	Free from stereotypes					
		Total: _____					

Criteria		**Indicators**	**Rating**				
			1	**2**	**3**	**4**	**5**
B. Student Interactions							
1	Creativity						
	A	Student role					
	B	Uniqueness of learning					
2	Control						
	A	Sequence of presentation					
	B	Level of difficulty					
	C	Speed of presentation					
	D	Number of items					
3	Feedback						
	A	Response to correct answers					

	B	Prompts					
	C	Response to incorrect answers					
4	Motivational Devices						
	A	Graphics/color/sound					
	B	Timing					
	C	Scoring					
	D	Personalization					
		Total: _____					

Criteria		**Indicators**	**Rating**				
			1	**2**	**3**	**4**	**5**
C. Technical							
1	Screen Design						
	A	Organization					
	B	Spacing					
	C	Transition					
	D	Amount of information					
2	Ease of operation						
	A	Instructions					
	B	Exit/movement					
	C	Reliability					
	D	Free of bugs					
	E	Data entry					
3	Error tapping						
	A	Error messages					
	B	Stops/breaks					
	C	Escape					

	D	Unanticipated responses					
4	Speed of execution						
	A	Amount of time					
	B	Use of distractors					
		Total: _____					

Recommendations/Suggestions:

_____
_____
_____

_____

Signature over Printed Name

8. Tally Sheet

	Name	Age	Gender	Address	Instructional	Mean	Student Interactions	Mean	Technical	Mean	Total
	Cherry Dela Peña	17	Female	Cavite City	46	**3.29**	54	**4.15**	60	**4.00**	**3.81**
	Emelyn Rose, Lebuna	19	Female	Dasmariñas, Cavite	54	**3.86**	47	**3.62**	59	**3.93**	**3.80**
	Jenalyn Pongpong	17	Female	Tanza, Cavite	57	**4.07**	53	**4.08**	63	**4.20**	**4.12**
	Emnas, Shadrach	18	Male	Dasmariñas, Cavite	56	**4.00**	51	**3.92**	59	**3.93**	**3.95**
	Joan Maestrado	18	Female	Las Piñas City	52	**3.71**	59	**4.54**	64	**4.27**	**4.17**
	Justin Granados	19	Male	Gen. Trias, Cavite	66	**4.71**	62	**4.77**	70	**4.67**	**4.72**
	Lyka Jane Torreliza	17	Female	Imus, Cavite	64	**4.57**	52	**4.00**	60	**4.00**	**4.19**
	Anne Mazel Espiritu	17	Female	Bacoor, Cavite	53	**3.79**	45	**3.46**	56	**3.73**	**3.66**
	Minerva Cabiara	19	Female	Bacoor, Cavite	67	**4.79**	64	**4.92**	74	**4.93**	**4.88**
10	Hylyne Mhae Tiangco	17	Female	Bacoor, Cavite	60	**4.29**	53	**4.08**	61	**4.07**	**4.14**
11	Zuriel Ocampo	16	Male	Las Piñas City	54	**3.86**	53	**4.08**	52	**3.47**	**3.80**
12	Jeffrey Pagmanoja	16	Male	Bacoor, Cavite	45	**3.21**	46	**3.54**	51	**3.40**	**3.38**
13	Lance Jan De Guzman	16	Male	Imus, Cavite	59	**4.21**	52	**4.00**	65	**4.33**	**4.18**
14	Lhean Roque	19	Male	Imus, Cavite	70	**5.00**	65	**5.00**	71	**4.73**	**4.91**
15	John Rusel Francisco	16	Male	Bacoor, Cavite	48	**3.43**	68	**5.23**	65	**4.33**	**4.33**
16	Erwin Jean Mercado	17	Male	Bacoor, Cavite	50	**3.57**	50	**3.85**	57	**3.80**	**3.74**

17	Carlos Aldriche Portuguez	18	Male	Imus, Cavite	48	**3.43**	46	**3.54**	57	**3.80**	**3.59**
18	Liwell Wyle Junio	18	Male	Bacoor, Cavite	60	**4.29**	65	**5.00**	60	**4.00**	**4.43**
19	Kenneth Dex Español	16	Male	Imus, Cavite	51	**3.64**	63	**4.85**	75	**5.00**	**4.50**
20	Roi Vince Cruz	16	Male	Bacoor, Cavite	48	**3.43**	40	**3.08**	47	**3.13**	**3.21**
					Mean	**3.96**	**Mean**	**4.18**	**Mean**	**4.09**	**4.08**

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