**CHAPTER i**

**PROBLEM AND ITS SETTINGS**

This chapter includes the introduction, statement of the problem, objectives, theoretical framework, the significance of the study and scope and limitation.

**INTRODUCTION** According to Ferriman (2013) “A virtual classroom is an online classroom that allows participants to communicate with one another, view presentations or videos, interact with other participants, and engage with resources in work groups. It allows both learners and instructors around the world to participate in live classes to collaborate and interact. MOOC programs like Courser a are a great example of this concept in action. The low costs of virtual classrooms are considered to be a major advantage. Learners can save money by [not having to worry about travel expenses](http://www.learndash.com/6-reasons-to-be-grateful-for-elearning/). Participants also save time, since all that is needed is an internet connection. Online classes also allow for the ability to record class as it happens, including any presentation audio and visuals. This means that the content is accessible even after being delivered, an added benefit for those who want a quick refresher, or perhaps did not fully understand the first time. Synchronous learning is a learning environment where everyone takes part in the learning at the same time. A traditional lecture is an example of this type of learning, and has been used for hundreds of years. Online learning enables this same type of experience, but with far more conveniences and tools. Virtual classrooms can be used to deliver lectures, or even tutorials online. They are also great options for impromptu meetings and group projects where members need to check-in on progress and bounce ideas of one-another. With the virtual environment, ideas and collaborators are never far away.”

Today’s students require laptops, tablets and reliable, high-speed internet access. Webinars and other virtual training methods are now becoming more prevalent in the classroom. Virtual classrooms mainly focus on the implementation of a technology platform that can enable a highly interactive and collaborative learning environment while delivering any content, anytime, anywhere and to any device. The approach used by a virtual classroom is an ideal technology, especially for colleges looking to attract students and offers an alternative to students who are facing high tuition fee costs. A virtual classroom allows the teachers to create and edit content and then post the content for students to download to their device. With this new way of learning, the future generations are going to become accustomed to online learning and acquiring the benefits it can provide.

The main purpose of the study is to implement a technology platform that enables highly interactive for the students and at the same time serves as an alternative to them. To provide tools that an experienced facilitator can use to create a collaborative learning environment. The students can utilise the digital environment to create some very unique experiences. The virtual classroom will provide tools for the teachers to create and edit content for their students in their lessons and the students will experience a new way of learning that emphasizes on collaboration, tools will also be provided to them for their studies.

**Current System**

The Graduate School of the College was established in 1980 with only one program, Master of Arts in Education, Major in Educational Administration, with Dr. Socorro C. Espiritu, the noted sociologist and written, as its first Dean. The Graduate faculty was originally composed of five members. They were Dr. Socorro C. Espiritu, Dr. Lucila Manlutac Madreo, Dr. Nestrio D. Trinidad and Mr. Ross Nozuelo. Dr. Norma Ravelo as installed as the new Dean in the beginning of School Year 1982-1983. There were also new faculty members who replaced the original ones. Dr. James Philips and Dr. John Tucker, both visiting American-professors attached to the Department of Defense School at Subic joined Santos-Reyes. Her thesis was entitled: A Proposed Employee Development Program for the Filipino National Employee of the Management Palanning, Division Planning and Computer Department, U.S. Naval Supply Depot, Subic Bay R.P. Dr. Ester Roque joined the Graduate school faculty list for School Year 1983-1984, replacing D. Nestor Trinidad who was appointed Superintendent of Schools for Zambales. The enrolment for that year went up to fifty-six students with Cecilia Reyes added to the graduate list.Mrs. Lolita de Perio joined the faculty in the School Year 1984-1985. Two more graduates of Master ofArts in Education were added to the Graduate school’s list. They were Maria Antonia M. Balde and Virgilio G. Sison.

The process of traditional teaching in undersigned students are the same with the Graduate School in Columban College. The professors follow the syllabus as a reference for the activities and lessons that they are going to do in the classroom with their students. When the students are going to enroll their subjects, they will have to go to the graduate school to get the form that requires the necessary information needed from them. The students need to have subjects that have the total of 12 subjects in order for them to be enrolled in the Masters course that they want. Students attend their class on a different schedule, but the most common time will be from 7am to 7pm. The classes are held every Saturday. The professors are actively involved in research and creative activities, as well as providing excellence in the classroom. The professors allocate not more than 3 hours per subject. The professors usually give individual reports to each student. They also give requirements to the students such as action paper to their students. The professors will tell the students when the report to be passed on. Sometimes the students will prepare their reports at home. Also the professors provide photocopies of modules and he will distribute it to the students. During class hours there are individual examinations for the students provided by the teacher . They will provide sheets of paper and the students will answer the given exam. Most of the students have a job which means that most of them has to manage their time in school and work.

**Disadvantages of the Current System**

1. **Limited time for studies at school**

* The students of Graduate School attend the class only Saturday. There’s a possibility that the students will not able to learn their lesson about the subjects properly. It will be having a lot of sessions to finish before the discussion. Because the professors have only 3 hours to discuss the lesson. Sometimes the students forget the lesson because of one day class, they have to review the topics, to be able for them to remember the study.

1. **Conflict of schedule on work and school**

* Since that this is a School system where a student and a teacher meets in the classroom, the students are attending the School once. The other students are basically employed outside the school. This means that their schedule of work and school might have a conflict, especially when they work full time. Because of this, it can result to absences in their class. This is also means, most of the students have to manage their time according to their schedule at work and school.

1. **Absence of other Professors due to appointments**

* The student cannot guarantee if his/her teacher is not around. So it's like the student wasted his/her time going to school. The professors of graduate school have other activities inside and outside the school. This means that they are absent sometimes because of their other priorities outside and inside the school. This would be inappropriate for some students, especially when they do not know that they don’t have classes because they have no professor.

1. **Quality of learning materials/modules used in school**

* Having a Virtual Classroom doesn’t guarantee you a less miscellaneous fee in the School you are enrolling in. In fact, it is just the same whether you use this online system or just regularly attend the class. But one thing that is important here is the materials/papers used to create or print modules. The materials and papers used in school are expensive. And since the modules are printed, it may be misplaced or damaged.

1. **Communication of students with other students and teachers**

* The students might have problems doing the report given by their professor since they only meet once a week. Students have difficulty in communicating with each other, especially when they have questions about the topic discussed by the professors. Creating decisions will take some time for them in doing their report. Most students have other concerns, especially during weekends where they go to their work. And these students have different schedules on their work, others have night shifts while the others work in the morning, that’s why students have problems in their communication with each other,.

**Proposed System**

The proposed system aims to carry out the following:

1. A system that can help the students facilitate and manage their time in attending school where they can have an option to go to a Virtual Classroom, it will help the graduate school students to study and gain more knowledge without concerning about time.
2. A system that will allow the teachers to set the schedule of a class notifying the students for the time of the class and can be accessed by the use of a computer and internet connection which will give ease for the class schedule of students and saving money for the transportation to school of students and teachers.
3. An online-based system that will add an option for choosing the traditional way of attending the school, it will help the student to save time in their class schedule.
4. To provide a learning modules and activities online, where the teachers can no longer print a lot of papers for students.
5. To provide a database for the uploaded activities, assignments, examinations and reports.

**General Statement of the Problem:**

The study will focus on the design and creation of “Virtual Classroom System of Graduate School, Columban College, Olongapo City”. This system will provide collaborative tools through an online based learning to the graduate school students. Teachers will also be aided in teaching their students through the use of virtual classroom system.

**Specific Problems:**

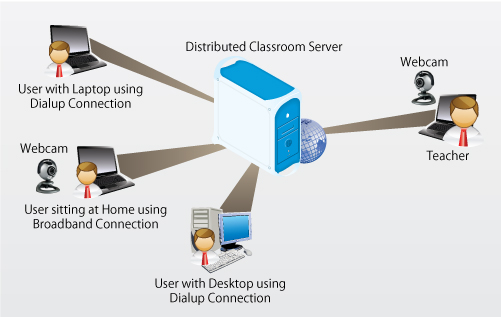
1. What authoring tool will be used to allow the users to collect, manage, organize and publish content on the application?
2. How can the students access the application online?
3. What user interface will support the virtual learning of students to increase their knowledge, performance and skills?
4. What programming languages will be used to make the application responsive and appealing?
5. What are the software and hardware requirements needed to make the system accessible in different devices?

**General Statement of the Objective:**

The study aims to design and create “Virtual Classroom System of Graduate School, Columban College, Olongapo City”. The system will help the graduate school students to lessen their time going to school and implementing online based learning by the use of the Virtual Classroom System.

**Specific Objectives:**

1. To provide and incorporate tools for the user to collect, manage and organize data on the application.
2. To develop an application that can be accessed by the students using the internet.
3. To implement and design a user interface that will support virtual learning to increase the knowledge, performance and skills of the students.
4. To integrate programming languages that will make the application responsive and appealing.
5. To develop a system that is flexible to use on different devices.

**Theoretical Framework**

**Figure 1: Dialup Based Distributed Classroom Solution by Marlene Kalapp**

According to Kalapp “Knowledge society demands transmission of knowledge across all sectors of society breaking the geographical barriers. It aims to facilitate the best quality education and intellectually satisfying learning experience to every learner. The concept and technology of Distributed Classroom. Therefore,is implemented so as to resolve the ‘last mile’ problem of good and quality education. Objective is to make the best teachers, domain experts, scholars from renowned educational institutions accessible to the learners distributed at many locations: including rurban, semiurban, rural and tribal areas. Usually a distributed classroom requires high bandwidth for audio-video streaming, costly advanced technologies for audio-video-data transmission, archives and play back of multiple streams and shared workspace. However, MKCL has deployed two distinct modes of the distributed classroom (Broadband based Video Conferencing Solution and Dialup Based Distributed Classroom Solution). Broadband based Video Conferencing Solution: Full TV Quality Video Conferencing and has Separate Recording and Streaming System is required to Archive and Play Back Sessions / Lectures. Dialup Based Distributed Classroom Solution: Only Two way Audio / Data Collaboration (Webcam can be connected for Video support) and it built in recording and playback of Sessions / Lectures is available. User Interface- for comprehensive interaction between Teachers & Students and amongst Students themselves (on 24x7 basis, Synchronously & Asynchronously, using e-Mail & Multimedia Tools for On-line Collaborative Working of all kinds, including One 2 Many & One-on-One Chats, Recordable Video Conferencing Facility with White Board & Document Sharing capabilities).”

**Significance of the Study**

* Graduate School Students

The students will benefit in the study. The study is important to the students because it will help them in understanding their lessons through the use of suitable tools like e-books and compiled video tutorials.The benefit that the student’s obtained from the study is the user friendliness of the system and it will help them to take classes through online basis. It will increase student’s confidence and interest in listening and participating in every class discussion. Through the use of virtual classroom it will help the students to study online. They don’t need to attend the class every Saturday. It will help the students to review their lesson even they are at work.

* Professors

The Professors will benefit in the study through being to provide an online discussion for the students. The study is important to the Professors because it will be easy for them to measure the success of the students within each core of curriculum lesson. The benefit that the Professor’s obtained from the study, they can plan additional instruction time to focus on lessons that the students are struggling to learn. It will prevent low cost and without wasting paper during an examination. They can able to discuss the lesson anytime and anywhere.

* Graduate School

The Graduate School of Columban College will mainly benefit in this study. The study is important to the graduate school because it will help them to settle the issues experienced by the graduate school and enhancing the graduate school’s way of teaching. By implementing the use of the virtual classroom, the graduate school’s traditional way of teaching will be innovated and improved with the use of the latest technology. The graduate school will be engaged in the latest technology and implement new things that will innovate the graduate school. The virtual classroom will provide different tools for the professors teaching and for the graduate school student’s learning.

* Columban College

The School of Columban College, Inc. will benefit in the study through acknowledging the virtual classroom system. The study is important to the school because it will help the graduate school students to learn and attend the online class as a collaborative process. The benefit that the Columban College obtained from the study is to improve the traditional teaching of the teachers. The Columban College will benefit from the study by implementing the system that focuses on the service of graduate school students, which in return will gain positive feedback and desirable for future enrollee. It will encourage future students of graduate school to enroll because of the new process and good teaching online in Columban College.

* Future Researchers

The future researchers will benefit in the study. Through additional features and can add modules as this system is open for further improvements and developments due to fast pacing changes in technology. The study is important to the future researcher in the study as they reference because they will help them to gather more information and to help them to improve their future research. The benefit that the future researchers obtained from the study is to gain more knowledge and skills upon making a system. It will also benefit the future researchers by improving the study to become more useful and to have more features for the users.

**Scope and Limitation**

The scope of the study will focus on the main core of the system which is the E-Learning. The beneficiaries of the study are the Students and the Professors of Columban College, Graduate School. The virtual classroom system will be used by the students and teachers communicate online. They’re must create their account for them to be able to login to the system. The system focuses on how the students and teacher interacts with one another. The teacher can post the modules or learning materials such as powerpoints, exams, pdf(s) and reviewer that can be used by the Students. They can set a date on when to be live in the discussion. It will provide a dashboard that the students and teachers could write on while the teacher discussing the lesson. The system has its function where the student and teacher can have a real-time chat and live chat communication. It is also being like a webinar where there’s a speaker and the students act as the audience of that Webinar. If the teacher added test exams or reviewers, it will directly notify to the account of the students. The students and teachers can access the system anytime and anywhere. The system can be used inside and outside the campus. The proposed system can access easily using their own device such as PC, Laptop and tablet as long there’s a connection of internet.

The limitation of the study is that the system can only be accessed through the internet using the web browser. Only the students and professors of the Graduate School can access the system using his/her respective account. It will only cover the Columban College, Inc. Olongapo City. Only the professors can able to start the live chat session. The system is a web-based system which means it will be primarily accessed using a computer's web browser. The system can run on a mobile device like smartphones and tablets, but only some of the features will work since the system is optimized only for the computer's web browser. It is only accessible with the use of computer's web browser since mobile devices lack some of the specifications of a computer. Using a mobile device in accessing the system will be inconvenient.

**Definition of Terms**

For better understanding of the study, the following terms are clearly defined:

**Authoring Tools.** A program that helps you write hypertext or multimedia applications.

**Bandwidth.** The range of frequencies within a given band, in particular that used for transmitting a signal.

**Database.** A structured set of data held in a computer, especially one that is accessible in various ways.

**Dashboard.** Anorganizes and presents information in a way that is easy to read.

**Digital Environment.** A simulated "place" made through the use of one or more computers.

**Collaborative Learning.** An educational approach to teaching and learning that involves groups of students working together to solve a problem.

**Collaborative Tools.** A catchall term used for different types of software and online services that allow people to work together on common projects, regardless of their physical location.

**E-Learning.** Learning conducted via electronic media, typically on the Internet.

**Internet.** The largest system of connected computers around the world that allows people to share information and communicate with each other.

**Learning Modules.** A method for presenting course materials in a linear fashion, with a table of contents and the ability to control the release of the material one screen at a time.

**Live Chat Session.** Students and Professors post messages in real time.

**Module.** is a part of a program. Programs are composed of one or more independently developed modules that are not combined until the program is linked

**Online Discussion**. A site where people can hold conversations in the form of posting messages.

**Platform.** A group of technologies that are used as a base upon which other applications, processes or technologies are developed.

**Programming language.** is a formal language that specifies a set of instructions that can be used to produce various kinds of output.

**Traditional Classroom.** Usually requires everyone travel to a single location, and there is a fixed amount of time for interaction.

**Traditional Learning Materials.** Tteachers use in the classroom to support specific learning objectives, as set out in lesson plans.

**Traditional Teaching.** The expectation that students will learn because we tell them to.

**User Interface.** The industrial design field of human and computer interaction, is the space where interactions between humans and machines occur.

**Video Chat.** A face-to-face conversation held over the Internet by means of webcams and dedicated software.

**Virtual Classroom.**  A teaching and learning environment where participants can interact, communicate, view and discuss presentations, and engage with learning resources while working in groups, all in an online setting.

**Virtual Learning Environment.** A set of teaching and learning tools designed to enhance a student's learning experience by including computers and the Internet in the learning process.

**Web-based Application.** Users can easily access the application from any computer connected to the Internet using a standard browser.

**Web Browser.** A software program that allows a user to locate, access, and display web pages.

**Webinars.** A presentation, lecture, workshop or seminar that is transmitted over the Web using video conferencing software.

**CHAPTER II**

**RELATED LITERATURE AND STUDIES**

This chapter covers the review of related studies and literature (local and foreign) which are closely interconnected to the proposed system, giving the proponents some additional background information in determining the different kinds of approach that can be added to the study.

**A. RELATED LITERATURE**

**Foreign**

Hiltz (2012) stated that “We have observed in all studies that there are significant differences among courses in grade distributions, and in all other outcome measures. Underlying these differences among courses are differences in the number and types of online activities required or facilitated by the instructor, and in the frequency and style of online interaction between the instructor and the students. Probably the single most important behavioral practice which produces relatively good results in online courses is the timely and "personal" (in tone) response by instructors to questions and contributions of students online. We have seen that a Virtual Classroom is a teaching and learning environment located within a computer-mediated communication system. As a teaching environment, it provides a set of tools, strengths, and limitations which are available to an instructor for delivering course materials and structuring learning experiences. Its characteristics are merely potentials, just as the empty classroom with its chalkboards and desks awaits the efforts and creativity of the instructor and the students to make it come alive. This view of a Virtual Classroom allows the instructor complete control over the learning materials.The tools that will easily weave in the learners as Co contributors to a growing web of course knowledge. Beyond the current basic tools of the Virtual Classroom it will discuss the future role for hypertext, gaming and simulation, animation and multimedia and the role of the educator as a facilitator of a collaborative learning process. Both the proper software and the proper pedagogical techniques are necessary in order to obtain maximum effectiveness in the asynchronous computer‐mediated environment."

Coleman (2012) presented “The students enroll in online courses for a variety of reasons, which include anywhere/anytime learning, increased student interaction, acquiring skills in using technology, and instructors being more approachable. Asynchronous online courses offer anytime/anywhere learning to the students; whereas, in synchronous online courses, students have the freedom of place but have to login at a specific time. Studies have shown that students succeed in online courses when they are active participant and therefore interaction is crucial to student satisfaction and engagement in online courses. Virtual classrooms allow instructors and students to interact online synchronously. The best advantages of synchronous online instruction are that faculty and students can talk to each other using text, audio, and video and express emotion using emoticons. Synchronous virtual classrooms provide the instructors with the ability to poll students instantly and afford the students the chance to participate in group activities in the breakout rooms, while having the feeling that they can still interact as if they were face-to-face. These interactive elements are unavailable in an asynchronous course. The features available in the synchronous virtual classroom play an important role in maintaining interaction. Most of the virtual classroom technologies have a content frame to share the instructor’s PowerPoints, an eboard where an instructor can write, breakout rooms for group activities, text chat so the instructor and other students in the class can interact using words and emoticons, and audio chat to talk via microphone or telephone with the instructor and other students. Instructors can administer student polls, share their desktop, or have the students share their own desktops through application sharing.”

Bouton (2012)pointed that“Virtual Classroom is a teaching and learning environment located within a computer-mediated communication system. Rather than being built of steel and concrete, it consists of a set of group communication and work "spaces" and facilities that are constructed in software. Thus, it is a "virtual" facility for interaction among the members of a class, rather than a physical space. Specifically, the Virtual Classroom is NJIT's trademarked name for a version of its Electronic Information Exchange System (EIES2) with special software structures designed to support collaborative learning. Participation is generally asynchronous that is the Virtual Classroom participants may dial in at any time around the clock, and from any location in the world accessible by a reliable telephone system. The fact that the educational process is asynchronous means each student may engage in more reflective thinking before having to answer or discuss issues. Virtual Classroom is an environment that facilitates collaborative learning among students, between students and instructors, among teachers, and between a class and wider academic and nonacademic communities. It also supports independent learning and generative, active learning techniques that are self-paced by each participant. For distance education students, the increased ability to be in constant communication with other learners is obvious. But even for campus-based courses, the technology provides a means for a rich, collaborative learning environment that exceeds the traditional classroom in its ability to "connect" students and course materials on a round-the-clock basis.”

Spector (2014)explained that **“**When it comes to education, the model has been pretty straight forward - up until the early ‘00s education was in a classroom of students with a teacher who led the process. Physical presence was a no-brainer, and any other type of learning was questionable at best. Then the computer evolution happened and it radically changed the learning landscape. In essence, e-learning is a computer based educational tool or system that enables you to learn anywhere and at any time. Today e-learning is mostly delivered through the internet, although in the past it was delivered using a blend of computer-based methods like CD-ROM. Technology has advanced so much that the geographical gap is bridged with the use of tools that make you feel as 6 if you are inside the classroom. E-learning offers the ability to share material in all kinds of formats such as videos, slideshows, word documents and PDFs. Conducting webinars (live online classes) and communicating with professors via chat and message forums is also an option available to users. There is a plethora of different e-learning systems (otherwise known as Learning Management Systems, or LMSs for short) and methods, which allow for courses to be delivered with the right tool various processes can be automated such as the marking of tests or the creation of engaging content. E-learning provides the learners with the ability to fit learning around their lifestyles, effectively allowing even the busiest person to further a career and gain new qualifications.”

Gale (2012) cited “Virtual reality began as a training tool for pilots, and flight simulators are still among the most popular virtual reality training programs. Whether designed for military or commercial pilots, flight simulators greatly reduce the amount of time a pilot must spend in the air during training. They therefore cut down on both expense and risk. Critics warn that simulators can never completely replace actual flight experience because, for instance, they cannot show all the things that can happen to a plane in bad weather. Some types of aircraft, especially helicopters, are also hard to simulate accurately. Still, even relatively simple simulator programs that run on home computers have proved very useful in training pilots. A navy study found that student pilots who used Microsoft's Flight Simulator program were 54 percent more likely to obtain above-average scores in real flight tests than pilots who had trained without the program. Like the military and the air industry, large businesses are starting to see VR as the best way to teach workers how to do jobs that are complex, dangerous, or both. VR training programs are not yet widespread because they are expensive to develop, but they can save companies money in the long run by cutting down on the amount of costly real equipment, such as heavy machinery, that must be used in training. Simulation programs also reduce risk to machines, the environment, and even human lives. Finally, the computers that run the programs can be set up to keep records of the students' actions, giving teachers, students, and researchers an opportunity for review that live training cannot offer.”

Buckley (2015)found that “Future e-learning will use technology that will deliver a course in the same way as happens in a physical classroom. The inherent characteristics of the lesson sequence in a face-to-face classroom which would be reproduced in the e-learning framework will be so accurately replicated so that the learner will feel physically in the presence of both his or her teacher and fellow students.The student will be consequently unaware of the distance and the technical device that separates him or her from the teacher and other students.Technological developments tend to spawn new working methods that, in turn, require new skills. This will spur workers to embrace distance learning as it would allow them to continue their education while pursuing their professional activities. They will not need to take time off from work to attend evening classes - the class can take place at home or their place of work.Telecommunications networks will become dense and easily available at lower prices.E-Learning as practised today emphasises written communication – messaging, chat, forum, and wiki - to the detriment of audio-visual communication. But the arrival of smartphones and tablets, given their popularity within the student community, will boost audio-visual communication. Although smartphone and tablet screens might appear inadequate for audio-visual communication, with the extension of the projection of holographic images in three dimensions a great revolution is being ushered-in.”

Bruffee (2012)learned that “Collaborative learning is defined as a learning process that emphasizes group or cooperative efforts among faculty and students. It stresses active participation and interaction on the part of both students and instructors. Knowledge is viewed as a social construct, and therefore the educational process is facilitated by social interaction in an environment that facilitates peer interaction, evaluation and cooperation. The "teacher" becomes primarily a facilitator who structures learning opportunities, serves as a resource, and encourages the students to work together to build a common body of knowledge. It is important to establish collaborative learning through substantive contributions by students to the class discussion from the very beginning of a course. However, with distance students, there are often problems in obtaining the books, videotapes, or other materials by the first week of the course. Students are told to order the materials ahead of time, but they often do not get around to it until the day before the course is supposed to start. Therefore, the first week's assignment, in particular, should draw upon the students' own experiences and general knowledge, rather than requiring the reading and synthesis of specific assigned materials. Studies have indicated that this style of learning results in better retention and understanding of a given topic.This will unquestionably make a pre-eminent contribution to the field of e-learning.”

Turoff (2012)indicated **“**The educational methodology utilized for the concept of the Virtual Classroom (a classroom in an electronic space) reflects asynchronous group communications and collaborative approaches to education and training. The student is an active part of a learning group, but proceeds to learn and understand on an individual basis independent of the speed of other learners in the group. The Virtual Classroom is a teaching and learning environment located within a computer-mediated communication system. The objectives of a Virtual Classroom are to improve access to advanced educational experiences by allowing students and instructors to participate in remote learning communities. Using personal computers at home or at work and to improve the quality and effectiveness of education by using the computer support a collaborative learning process. By collaborative learning is meant a learning process that emphasizes group or co-operative efforts among faculty and students, active participation and interaction on the part of both students and instructors, and new knowledge that emerges from an active dialog among those who are sharing ideas and information. Learning can be perceived as a particular type of co-operative work. Studies of the use of computer-mediated communication facilities that form components of a Virtual Classroom environment have tended to support the point of view that for mature, motivated learners, this mode of learning can be more interactive and more effective than the traditional (physical) classroom. Historically, the use of computers to facilitate human communication quickly introduces the key problem of "information overload".Those who have attempted to conduct remote education with a significant number of students utilizing electronic mail can appreciate the truth of this observation.”

As Milan (2012)said that “A key element in the design of software to support distance education is the minimization of information overload for both the instructor and the students. In our view the process of transferring knowledge from an instructor to the students is one of the students learning how the instructor thinks about and solves problems, within the application domain, and incorporating that process into the student's own cognitive processes. To accomplish this mental process, problem solving and task execution must be shared among the students and the instructor. The instructor must perceive the degree to which the knowledge has been incorporated by the students in order to proceed with effective delivery of further material.One cannot, for example, learn to paint by viewing a finished painting, rather, one must see the evolution of the painting from blank canvas to finished product. The student must observe the instructor's mental process and the instructor must observe that of the student. It is this view that underlies much of the functionality for multimedia, Hypertext, and group communications that comprise our current research into the evolution of the Virtual Classroom. The power of multimedia technology can be used to assemble course materials in various media forms such as text, slides, full motion audio-video, live video and interactive software on a single powerful interactive platform, referred to as simply "courseware." The introduction of multimedia into courseware allows the instructor complete freedom to incorporate into a remote course those learning situations that previously could only be accomplished in a face-to-face environment. An example would be, the manipulation of complicated machinery by simulation, animation and multimedia presentations.”

Wood (2012) pertained that “Virtual classes have come a long way from the correspondence courses once advertised on matchbook covers. In those early programs, students received assignments in the mail, shipped back their completed work, and waited for the mail carrier to bring a response from the teacher. Today, thanks to electronic whiteboards, digital animations and labs, threaded discussion groups, chat, and email, online learning, in a good course, can be more immediate than some face-to-face instruction."I love it," says FLVS student Katarina Williams. "My online teachers make me feel like they're my private tutor." Students converse with the teacher and classmates, give online presentations of offline work, perform virtual and traditional lab work, and meet in virtual conference rooms.They have happily discovered that you don't have to wait long for feedback on a project or test. "When you turn in an assignment, the teacher will email you a response telling you what you did wrong and what you can do to fix it," says Nick Petrecca, another FLVS student. "From that email, you can click on the assignment, go back into it, and take their advice."This immediacy, combined with the physical separation inherent in the online environment, can give students a sense of freedom and openness that isn't always present in a typical classroom.The freedom of expression some students find online can shine a light on talents that go unnoticed in the typical classroom fray."

As Bein (2015)discussed “Shrinking people down small enough so they can travel through the human circulatory system is no longer just for sci-fi films from the 60s or half-baked Archer episodes based on said sci-fi films. One Toronto man is trying to make the virtual classroom a reality.He started with a tour of your circulatory system. “Instead of reading a textbook or watching a PowerPoint slideshow, you and your guide have to dodge the blood cells while swimming through the arteries”. When you take off the virtual-reality goggles, you find yourself still seated in your classroom. But there's more than just biology in the virtual world. History, geography, and the sciences all have potential for immersive education. Studying ancient Rome would be a hell of a lot more interesting if you could go there and explore it for yourself—talk to some of the locals, walk through the Coliseum, check out a [ludus](http://en.wikipedia.org/wiki/Ludus_%28ancient_Rome%29). Virtual reality, thought to be dead after it failed in the hands of 90s technology, is back. And this time it could change education for the better. Growing up in a technology-oriented generation makes for entrepreneurs who understand the real-life potential of VR, especially after the [failed wave of VR in the 90s](http://www.bbc.com/news/technology-23877695). The multimedia Virtual Classroom course ware can be viewed as a computer-mediated application, where the computer acts as a mediator between the application author, who publishes the on-line classroom courseware or "encyclopedia", and the user, who browses the available information and contributes to the authoring as a participant. The author is not just restricted to publish his original work, but has capabilities to reference, include and publish all the relevant information available on the Internet in a multimedia environment.”

Smith (2012) assured that **“**Stepping in front of a classroom of skeptical students can be nerve-wracking for first-time teachers, but a new teaching platform at the University of Central Florida gives educators-in-training the option of conquering their classroom jitters in a virtual environment. Educators must navigate social, pedagogical and professional hurdles all at once. And [TeachLive](http://teachlive.org/) is the first of its kind — a classroom simulator that can emulate these challenges and scale its difficulty to the specific needs of the teacher.TeachLive places a teacher-in-training in a virtual classroom populated by computer-generated students. A Skype conference call and a [Microsoft Kinect](https://www.cdwg.com/shop/products/Microsoft-Kinect-for-Xbox-One-motion-sensor-wired/3504378.aspx?pfm=srh) motion sensor power the high-tech pantomiming behind the platform. It's currently being used at more than **80 campuses across the U.S.** to train some of the next generation of educators, and it appears to be working. “We don’t see this as replacing teaching — but it is a great tool to practice discrete skills in a classroom setting,” says Lisa Dieker, one of TeachLive’s principal investigators. "In four 10-minute sessions, teachers can experience a personalized learning environment where they have to exercise behavior management in classrooms, where the avatars misbehave, act in strange patterns, or ask difficult questions. Dieker, formerly of Lockheed Martin, is familiar with the use of simulators to familiarize people with weapons systems for combat environments. But the classroom comes with its own unique set of challenges, not the least of which is that it is untested territory for simulators, she says They've invested hours of research to ensure TeachLive can meet its goals.”

Morrison (2016) imagined “A traditional classroom with a teacher and a group of students. Depending on the class roster, a single lecture could be given to people with various knowledge levels. These situations present a difficult choice for teachers: Either repeat the material and lose time, or go ahead and risk being misunderstood. It is also important that the students are fully involved in the studying process. A skilled teacher always watches for feedback and encourages discussion. However, often the topic of the lecture itself implies a different delivery mode, more conducive to studying in a real working environment instead of a classroom.The analysis of such situations shows that effective eLearning can take the best from traditional education and even surpass it. Modern learning tools should allow instructors and students to create, edit, and comment on all presented materials. This will [encourage discussion](https://elearningindustry.com/4-ways-teachers-can-encourage-online-interaction) and keep everybody updated on the latest news. Webinars and instant messagesin chats are especially necessary in the corporate sector, for example when new products are put on the market and the first hands-on experiences are highly valued.”

**Asean**

Tsaramirsis (2016) considered “E-learning is modern trend of learning with the advantage that people can learn anytime and anywhere. In an e-learning environment the students use online material such as lecture notes, videos or e-books to support or substitute partly or fully the normal lecture. E-learning can support the normal lecture like using an online material in the lecture, for example the students can access the university website then download the slides or other learning material. Additionally it can accommodate distance learning, where the students can be in a different physical location than the instructor. There are two main types of distance learning; synchronous and asynchronous. Synchronous distance learning occurs in real time, usually with the help of communication software such as Team Viewer and Skype and it allows instructor to deliver lectures over the Internet. This mode has high learning efficiency because the students can watch the lecture in real-time, learn from the interaction with the instructor as well as the interaction of their classmates with the instructor. This interaction is in the form of questions about the parts of the lecture asked by classmates or the student himself. Additionally, the lecturer may ask a question to the students. This is possible by understanding the lesson and providing a well managed learning environment.”

Wai (2012) concluded that **“**Most universities today enhance their classroom teaching and learning. Some kind of online learning system or learning/course management system, as it is commonly believed that instructors can better manage their courses and students through the systematic delivery of course material and tight monitoring of student progress. The students learn better at their own pace and with easy access to learning materials and more frequent interaction with fellow learners. However, individual differences among students are always a concern to both educational academics and practitioners. A mismatch between learning styles and instructional methods can create conflicts that affect cognition, affect, and behavior during the learning process. The unified implementation of an online learning system may therefore be less effective for all individual learners than previously thought. To devise more effective institutional implementation strategies in online learning system deployment, a better understanding of the determinants that affect the use of these systems is urgently needed.While communicating face-to-face, we follow our colleagues or classmates unconsciously, and an effective eLearning program should provide a similar possibility. Creating a rating system will manage group dynamics, and encourage people to study better. In addition, eLearning in the academic sector should use the collected data in order to set up comparative ratings among cities, regions and even countries.”

Toles (2016) commented that “In any individual who opts for a virtual learning environment is missing on the physical essence of a classroom which provides face to face interactions with not only the teacher but also the peers1. Input from and interaction with peers is also a major part of learning and virtual education does not usually provide that. We, in our proposed system, have attempted to introduce the peer-to-peer education element by including the facility of group discussions among students using audio and video conferencing. Usually, this video conferencing facility is provided by third parts tools in existing systems. Another issue raised by Toles is that of trained professional teachers; instructors are usually fully adapted to traditional classroom teaching environment and may lack the expertise to deliver lectures on an online class. In this paper, we propose that the virtual environment should strive to be as close to the traditional environment as possible to reduce the environment-specific learning required and increase the comfort level of both the instructors and the students. modern eLearning systems should provide an opportunity to share both knowledge and experience. In addition, online courses should be individualized, but still offer a way to give and receive feedback. There should also be a track record of everybody’s progress and achievements.All these facilities make modern eLearning highly effective, and demonstrate the advantages of a [virtual classroom](https://elearningindustry.com/?s=virtual+classroom) over a traditional one.”

Yang (2016) specified “The two parts of the virtual classroom: Instructional Communicating Environment (ICE) that contains learning materials and lecture videos and the Collaborative Learning Environment (CLE) that supports active learning by providing the environment with learning tools, learning materials and contextual discussion for learners2 . These learning processes were compared and it was found that CLE is more efficient than the ICE as it provided more interaction. This indicates that some interaction, even if it is via video conferencing, improves the learning experience. The authors state that learning efficiency is determined by learning methodology. Our proposed system is more similar to their Collaborative Learning Environment in that we also provide direct interaction facilities. Open University Malaysia provides a virtual classroom environment which has been created on myVLE learning management system which is an asynchronous-based online learning framework. The aim of this study was to explore student’s perception about virtual classroom and the factors that enhanced their learning capabilities and also how virtual classroom has contributed in their self-managed learning skills. The virtual classroom provided by OUM comprised of many learning materials and tools which collectively include iBook, iTutorial, iLecture, iForum, cForum, Smart Forum, iHelp and self-assessment activities. The primary results indicate that students give priority to real time classroom environment over virtual classroom. Students consider virtual classroom as a secondary choice and it has moderate impact on their learning skills .”

Parker (2016) conducted “A research study in Southeastern University in the United States to compare student perception about completely online and blended courses. A completely online course is one where students and instructors cannot meet in-person whereas in a blended course half of the class meetings will have face to face interaction and the rest will be conducted online. The study aimed to examine student behavior towards the features and characteristics of a virtual classroom. Studies shows that there is no significant difference between online versus blended course performance. Yet there might be some differences in terms of course delivery model. The study was conducted on Horizon Wimba virtual classroom. Online course students gave highest priority to stored virtual classroom sessions while polling and hand raising feature were rated second. Students from blended courses give highest points to desktop sharing and viewing presentations features. Comparatively, students in completely online courses rated all features higher than blended course students . The main functional objectives of the virtual classroom are to create and offer courses, enrol students in offered courses, provide a platform to present and discuss materials related to a particular course, store course materials online such that they are easily accessible, and providing the tools necessary for student evaluation and feedback.”

Banjong (2013) quoted that “The virtual classroom is teaching and learning environment settled in a computer-mediated communication system. Virtual Classroom as interactive class that facilitate collaboration and liveliness of learners in which teachers can control teaching process like common classroom. The structure of virtual classroom is similar to common classroom but the differences include technology and equipment to convey data in which online and distance learning play vital role as virtual learning tools in current education system. New learning tools can fulfill learners’ needs promote liveliness and attractiveness without limitation in terms of time and location of class. Therefore, virtual classroom support information and idea sharing that learners can participate create pleasant learning environment, thus understanding diversity of each learner. This research and develop is divided into 4 steps of An Argument Performance Task in A Virtual Classroom for Enhancing Graduate Students’ Analytical Reasoning as follows; Analysis process of argument topic from questionnaire. Argument will be identified to set learning topic and analyze the contents. Task preparing process by scenario and questions will be set in this process and verified by specialists. Learning process requires pre-test before attending class. Virtual classroom divided in 3 rooms; the first room is for fallacy practice which include 3 situations – Ambiguity,Fallacies of Relevance and Reasoning based on unverified assumption. Reasoning can be divided into 4 steps as follows; Identification of argument and reasoning, reasoning support in terms of agreement or disagreement, evidences in terms of contents, documents, verifications to support reasoning, Rationale or combination of related content, documents, verifications to create reasons.”

**Local**

Santos (2012) wrote that “E-textbooks will have multimedia features like educational videos, full-color pictures, instructional audio content, customizable text, interactive quizzes, online connectivity allowing external links to resource websites, study tips, and many more. Teachers will be able to use the annotated teacher’s edition of the e-textbooks that includes a lesson guide, answer keys, and teaching tips to help the teacher guide the students in using the e-textbooks. MANILA, Philippines – Can you imagine a classroom without chalk and blackboard, manila paper, cartolinas, one-fourth sheets of paper, pencils, erasers, and attendance sheets? The leading Philippine educational materials publisher Vibal Publishing House Inc. and international computer software company Microsoft have not only imagined it, they are working on making that a reality.Vibal and Microsoft, in cooperation with the Department of Education (DepEd), have partnered to create a new kind of classroom set to enter the digital era. They are making this possible through the introduction of e-textbooks that can be accessed by students on tablet computers.Chris Datol, operations manager of Vibal’s subsidiary Vibe Technologies Inc., said during the Annual Microsoft Philippines Innovative Education Summit last March 2 that “a child becomes smarter when he or she uses a digital device and consumes digital material.” He cited a study conducted by the United Nations who found that students “exhibited better performance” because of the highly visual and multimedia content that Tablets can show to students. Simulation in last classroom enhances ability of learners in evaluation and conclusion. A virtual classroom simulated a non-graphic learning interaction using Learning Activity Management System. Learning Activity Management System has many tools to support the learning such as Noticeboard, Forum, Chat, Share Resources etc.”

Laping (2016)informed that “It has predefined templates or built-in designs that are user-friendly and easy to share. It is useful in interactive reporting, story-telling, lesson planning or presentation, website layouting, catalogue and brochure making, journal writing, blogging, etc. The one app that was warmly received by educators at E2 was OneNote in the Classroom or Class Notebook. It is a free add-in for OneNote desktop (2013 or 2016). It helps teachers organize their course content, create and deliver interactive lessons, and collaborate and provide feedback.Everyone thought Minecraft in the Classroom was awesome. A game-based learning app, it transforms gamers into learners. Teachers know the devastating effect of computer games on students.It is not just a computer game but can also be used to develop students’ reading, writing and problem-solving skills. It is expected to make learning engaging and absolutely fun.Technology alone cannot develop in students the skills necessary to succeed in today’s world. Teachers and parents should teach and guide the young to use technology the right way productively for teachers who are afraid to integrate technology in the classroom, I have this to say: “You don’t need to become a computer expert to use technology in the classroom. You need willingness to innovate and time to explore every possibility presented at your doorstep. You have to remember that information and communication technology integration is not just the use of technology but its proper use in the classroom.”

Dimitov (2012)reported that “In accordance with the development of technology, new educational methods have appeared, such as e-learning and virtual learning environment. Virtual learning environment is involved in grouping both of the students and teachers in a virtual place using different software, such as Avatar, 3D, and SimCity to enhance the educational process. The modernity of this environment attracted both of the teachers and students to be trained by professional programmers. Students and teachers revealed that there are many positive and negative impacts which affect the process of learning in general especially those who work with new technologies. Education is considered as the key for all knowledge fields, and the essential factor that any society depends on to improve its human resources. Therefore, the educational process depends firstly on the tutors' role to enhance the performance of their students in schools or universities, manage the process of education towards development, and overcome the challenges that students may face. The combination of technology and education is essential in human development. Both education and technology affects each other in order to enhance the performance of education process. There are two main relations between education and technology. The Technology Education, which is considered as the first type, refers to the study of technological sectors that contribute to solve the human problems through the deep knowledge about technology fields.”

Natividad (2016)answered the question“As technology evolves, so does our realm of possibilities take education? Just a decade ago, the path to become a teacher was very narrow. You take up a degree in education, apply to be a schoolteacher, and conduct your classes with readings and manila paper visual aids in tow. But these days, teachers have access to more sophisticated tools that can break the monotony of everyday lectures and facilitate the learning experience in different ways. In the modern age, teaching is no longer limited to the physical classroom. Any experienced teacher can tell you that no two people [learn](http://lyceumbooks.com/pdf/howtoteacheffectively_typesoflearners.pdf) the same way. There are visual learners, auditory learners, read-write learners, and kinesthetic learners. And because all these types of learners are mixed in one classroom, teachers need to be able to find ways to accommodate these disparities. Through aids such as projectors and presentation software, teachers can now make learning a multi-sensory experience through the use of photographs, diagrams, videos, and sound files. This not only diversifies the learning experience for learners, especially those with short attention spans, but it also keeps them on their toes. Technology also makes access to learning tools easier. Teachers can make use of course management tools like [Canvas](http://itconnect.uw.edu/learn/tools/canvas/canvas-help-for-instructors/) to upload and organize resources such as syllabi, assignments, or readings. Teachers can even choose to share their presentations or record their lectures. While this might seem a little generous on the teacher’s part, studies [show](http://www.washington.edu/teaching/teaching-resources/engaging-students-in-learning/teaching-with-technology-2/)that sharing recorded lectures doesn’t negatively affect attendance. Learners appreciate the opportunity to review lectures at their own pace.”

De Tagle (2012)developed “A Learning Revolution: Multiple Intelligence and the Virtual Classroom. The ground presentation live before 250 participants in the audience and online in six countries with 14 sites using the Virtual Classroom platform. The whole presentation was an Internet learning demo, conducted with the use of a multi intelligent distance learning (MIDL), a protocol developed by Perez de Tagle while he was a professor at Syracuse University in New York in 1986.  Multiple Intelligence is a Harvard-based approach that uses six more intelligences in addition to linguistic and logic-math, the two intelligences usually used in teaching. The six other intelligences - musical, intra-personal, inter-personal, naturalist, visual, and body-kinesthetic - are combined in the Internet to present a "Webucation" standard that overcomes the usual obstacle to distance learning boredom and ineffectiveness. Games are played while disco and soothing music, group interaction and emotional impact are employed to reinforce the learning process successfully.  VirtualUniversity.edu, a new dotcom company that syndicates world class providers of distance learning into a quality education, uses the Multiple Intelligences approach in its distance e-learning program.  Lyn Hudson, the English resident manager of Morgan & Banks, said that it was "an interactive, fun and stimulating journey demonstrating how the e-learning revolution has something to suit the needs of every learner. The sole Filipino presenter among the internationally distinguished speakers, Perez de Tagle presented some future training and education scenarios.  Fifty to 75 percent of adult learning will be Internet-delivered. The quality of teaching will be enhanced with the affordability of netcasting world class educators. Ten to 80 percent reduction of education/learning cost per learner. Major redesign work of learning programs will use the MIDL protocol as the standard.”

Ferrer (2013)agreed that “Current education reforms promote student-centered instruction that develops thinking, encourages active participation, and arouses interest to explore concepts. In reality, these goals are rarely achieved because the classroom learning environment puts heavy premium on lectures and class discussion. In an earlier study on student-centered instruction in science, the elements of collaborative learning, which include group participation; exploration, and choice, were not regularly observed in teaching. This paper presents various strategies used to address the inadequacy in the use of collaborative learning in the classrooms. Twenty teacher candidates in the methods practicum course and their students served as participants in this study. Science was taught for six weeks using various collaborative/cooperative learning strategies in the elementary schools in Guam. A developed and validated group participation instrument composed of 10 items was administered to the elementary students at the end of the teaching period. The overall ratings from the evaluation instrument indicate the teacher candidates‘ engagement of K-5 students in active collaborative learning. All the strategies used obtained very high ratings for frequency of occurrence. The interaction skills developed in these strategies enabled groups to function effectively the strategies used in this study broadly encompassed the essence of learner-centeredness, which fundamentally emphasizes the act of learning together.”

Aguirre (2012)asked the readers “Everybody knows what a traditional classroom is, but how does one envision the classroom of the future? Computer-equipped classrooms are now a dime a dozen and computer-aided instruction is fast becoming the norm in well-funded educational institutions. Information is exploding on the World Wide Web and technology is making almost everything possible. How does one sift through a plethora of possibilities to conjure up the perfect image of a high-end electronic classroom that will be the norm in this side of the world a few years down the road? With the very fluid and dynamic technological landscape at the moment, it isn’t so hard to imagine what the future holds up its sleeve. In fact, in one of the country’s top universities, the nucleus of this fully wired "e-classroom" is now taking shape. Smart learning Smart Class No. 1: Picture a roomful of smart computers – 42 fully interactive multimedia workstations with high-speed Internet access hooked to a master workstation; a not-so typical classroom fitted with state-of-the art apparatus from electronic interactive boards to wide-screen projectors to video cameras. Each student is furnished with a headset and a set of state-of-the-art gizmos that allow him to communicate with the instructor directly and vice versa. Want to raise a hand or ask a question without bothering the entire class? Press a button and the instructor can speak to you in private. Lost or in need of in-depth assistance? Press another button and the instructor will be able to peep through your screen to monitor your work or take control of your workstation to demonstrate a process. Wish to confer with group mates seated at the opposite end of the classroom without leaving your seat, click several buttons and your little group can hold a mini-conference.The options are much more varied: In a truly paperless classroom, students take exams online; submit assignments, reports or seatwork online; project one’s work onto the wide screen for everybody to see or comment; surf the Web for information while a class is in progress; or hold classes outside the classroom via e-mail, or chat sessions.”

Hernandez (2015)clarified “Wiring Students for Success, Digital technology, we’re within sight of being able to personalize learning so that each student gets exactly what he or she needs, which is what good teachers have strived for since the invention of chalk and blackboards. All great teaching boils down to a 4-step, cyclical process. The first step is understanding what students need to learn. The second step involves sharing this information in a manner that students can take in. The third step is practice, giving students the chance to engage in content and master their new skills. The fourth is feedback, so that mistakes can be corrected and students can progress. This is what great teachers strive and what emerging technologies can help them attain. If the teachers teaching in a tech-enabled classroom today, it will easy for them to interpret the data that identified each of students’ needs every day. They can share that data, allowing each student to see exactly how much of the curriculum he or she had mastered and what challenges still remained. The same software that produces these reports would suggest materials and activities tailored to individual needs. Many Philippine classrooms, whether elementary, high school or college, are far from being that digital.”

Salvador (2015)studied that “Learning Circles consist of 6-9 teachers that, together with students in their school carry out activities in cyberspace on a topic of interest to the group. The concept of "learning circle" involves both school and local community. One can refer to it as a virtual classroom because once formed the group is working together for a period of 4-5 months based on a curriculum established in relation to the selected topic. At the end of the activity, the group publishes their work product. Such materials can be educational materials for other teachers and students who did not participate in the project. Each session at the start of a new "learning circle" will form a new virtual classroom. The major advantage of the activity in this type of project is that both students and teachers acquire new experiences.It can be said that activities allow members of the local community as well (scientists, artists, etc.) to participate in projects. Support received from the business environment allows teachers to acquire high managerial skills.For primary education it is considered "circle time" the time of day in which students exchange messages with each other. One purpose of the circle is to develop skills of oral communication in front of the group members.”

Fernandez (2015)insisted that “There is a consensus among educators that enhancing 21st century skills will allow nations to prepare the future workforce to succeed in a fast-paced, highly competitive global economy. This was the opening statement of Gordon Payne, divisional director of i21 Events Group-UK, at the opening of the second Bett Asia Leadership Summit in Singapore on Wednesday. Payne welcomed 100 speakers from 30 countries and over 600 conference delegates to the annual gathering of top educators, policymakers, and school leaders across Asia to discuss technology’s evolving role in education. Indeed, there was a consensus among speakers and presenters that transformation is happening across society, not just in education, and the challenge for educators is to be able to gaze into the looking glass with a clear sense of purpose and adapt to the sweeping changes. Our kids are not the same people we were when we were in school, commented Marc Prensky, founder and executive director of The Global Future Education Foundation and Institute. “Education needs to be more than just an academic exercise.” Prensky, who is credited for coining the words “digital natives” to refer to the generation born into “the digital language of computers, video games and the Internet,” emphasized that the possibilities are endless for transforming education as we now know it. Keeping up with these changes, however, is another thing. “Your students are already running without you, reading without you, studying without you, learning without you. It’s all happening outside the school,” affirmed Bruce Thompson, director of Asia, worldwide ducation, Microsoft. World Wide Web client software is utilized to integrate the virtual library resources of the information highway as well as the group communication facilities of EIES to provide a comprehensive fully interactive collaborative learning multimedia environment.”

**B. RELATED STUDIES**

**Foreign**

Hodhod (2012) considered “E-learning as a kind of education that consists of both information and communication technologies (ICT). This type of learning facilitates the distribution of contents and exchange information based on ICT among students themselves and their teachers. Students depend on many tools that contribute to facilitate the process of exchange information such as e-mail and chat. Elearning and virtual learning have many results in common; both of these methods depend on using software in learning and teaching that facilitate the online interaction between students and their teachers, so, it is considered as a type of webbased learning that improve the connection between students and internet. Virtual Learning Environment can be defined as software that contributes to facilitate the process of getting on-line courses. It also can be called as CMS (Course Management System) and LMS (Learning Management System). The importance of virtual learning environment stems from its using by teachers either in schools or in universities that allow them to access to any resource within short time and without any effort. In addition, virtual learning environment can make upload information easy and fast. Virtual learning environment includes tutors, learners, students, and support staff. However, these members have different roles, for instance, students teach themselves, teachers become learners, and support staff can work anytime and under any conditions.”

Varga (2013)demonstrated that “ The teachers play a significant role either in real educa**ti**onal environment or in the virtual one. Teachers are the instructors, evaluators, and the builders of virtual classroom. In addition, the distinctive role of the teachers refers to their ability to deal with any obstacle that they face within learning process, and recognize the students' differences in intelligence levels and attitudes. In the virtual classroom, teachers' roles appear through three main domains, namely, intellectual, organizational, and social domains. Starting with intellectual domain, teachers must understand their students' attitudes towards learning process, create new educational methods, and develop these methods in line with their students' educational needs. When talking about the organizational role, teachers adjust the time of online lesson, determine the objectives of the course, and decide the strategies they will follow during their course. Within social role, teachers start their courses by sending welcome messages for their attended students, encourage their students to participate in online assignments and lessons, send feedback for their students friendly. They must get some training to make them able to enhance the educational techniques and courses, improve the virtual learning environment, and solve any problem they may face. teachers may suffer some stress during their training process; this stress refers to their frightening of dealing with new educational method, and their lack of time. Teachers are helped to get rid of their frightening through training them by professional and expert trainers. This training contributes to improve the teachers computer skills, develop their ability to deal with any obstacle during their online learning process, and enhance their skills to improve the software of virtual classroom.”

Gardner (2012) illustrated that the “Virtual learning environment passed through many stages to reach its current status. This development in virtual learning environment started with supplying the teachers with the required resources to follow in their teaching process. Subsequently, some educational institutions provided required information for the resources that are used in learning process. Lastly, teachers and students were connected together in order to understand these information for achieving the professional level and improving their communication skills especially when they are interacting with students in other nations. The simulating of classroom is an important feature of virtual learning environment. This simulation depends mainly on the settings of traditional classrooms such as solving problems, hypothesis tastings, and models development. The environment of real classrooms also affects the environment of virtual learning. Through three basics domains, namely, coaching, scaffolding, and feedback. Furthermore, classroom simulation can refer to the process of internal form of traditional classroom to make the virtual learning environment. Closer to reality, which contributes to create practical experiences for students by testing hypothesis and finding their results by themselves.”

Lovatt (2013) noticed that the “Students of e-learning perform better than those of traditional learning. This performance of students can be measured through solving the online assignments of their courses, and feedback that they get after solving assignments. The e-learning motivates the students to enhance their performance through online resources of their materials.Getting help from experts in order to understand their materials, and taking some online notes to decrease their feedback. E-Learning can help the student of sciences, such as physics and chemistry. That refers to the difficult materials and the strategies of teaching which depend mainly on the scientific component rather than the motivation side of the courses. Teachers contribute to enhance their students’ behavior through e-learning process. They provide the server with their digital courses, manage the discussion, and control chat rooms and software of virtual environment. Teachers evaluate the students’ behavior through providing students with comments and attachments, making a discussion with peer students and teachers, assessing the students’ participation in virtual environment, and finally asking the students to prepare for the next discussion. The materials on the following discussion are uploaded by teachers to be distributed to the students.”

Voss (2013) established the “MOOCs are demonstrating the ability to provide access to education on a massive and international scale. Most students now enrolled in MOOCs are global—outside the United States. Most are also older, nontraditional students who use MOOCs for continuing education objectives. They are not students currently enrolled in an undergraduate or graduate program. Students who take MOOCs today appear to be doing so either as an “experience experiment” or as a way to augment their previous education for skill-enhancement purposes or personal self-actualization. But that balance could shift at any moment, as the uses of MOOCs to enhance existing educational programs develop. MOOC providers are already capturing a great deal of data about the classes and learning processes currently under way, and analytics on these data vis-à-vis the learning experience of MOOCs are emerging. That data and analysis will very likely play a major role in the ultimate value proposition of MOOC companies (and potentially their participating institutions) by enabling those companies and institutions to market the data that they’ve gathered to interested parties. Venture capital investors in MOOCs do eventually want to get a return on their investment in the $1-trillion market that is education. As a result, the focus has been on the new MOOC approach itself and its potential impact on the way we deliver higher education.”

Thompson (2015)instructed that“The Internet has become a common medium for interaction, communication, and collaboration within which learners and teachers engage in ‘unique and irreplaceable learning opportunities. Increases in the number of online programs and course offerings are changing the role of the teachers and the nature of teaching, with more and more faculty and support staff required for online. Teachers, who are at the center of this increasing demand and pressure to teach online, are being challenged to rethink their underlying assumptions about teaching and learning, and the roles they take as educators.This growing interest in online education challenges higher education institutions as well to rethink their cultural, academic, organizational, and pedagogical structures in adapting to a new culture of teaching and learning. The experiences of early adopters have created a discourse around online education focusing on the definition of online teacher roles and competencies. The notion that teaching online requires the development of new skills and sets of pedagogies has led researchers to study the roles that online instructors take in online education environments. While educators and organizations around the world are becoming more involved in online learning, the growth in faculty involvement and acceptance has been modest, accompanied with limited change in online pedagogies. Given the expanding interest and demand for online learning, coupled with the results of studies showing that higher levels of learning are not easily achieved in online courses, there is an imperative to advance our understanding of how to facilitate effective online learning activities. Studies of online teacher roles and competencies are important as they provide information about how online teachers might be trained and supported, as well as factors that might affect the design of online learning environments. Often the roles and competencies suggested for online teaching have had limited impact on the professional development programs that address teachers’ needs, individual dispositions, external social demands, and capabilities within their unique teaching contexts..”

Battencourt (2013) characterized “A virtual learning environment(VLE) have specific characteristics such as the fact that they are information and socialization places, and where students are not only active but also actors, are not restricted to distance education and integrate multiple tools, complement the physical space of the classroom and are represented explicitly. A VLE is then "a set of teaching and learning tools designed to enhance a student's learning experience by including computers and the Internet in the learning process. Much of our daily activity occurs in the virtual environment, using online tools, it can be said that almost every citizen has a virtual profile on any social network; these may have a more or less informal dimension. Can be found social networks of professional, academic, social or entertaining, being used by almost everyone, regardless of gender, age or social status. In the educational sector social networks, web tools, collaborative virtual environments and immersive virtual worlds, have been gradually introduced. At first tertiary education institutions have started to use learning management systems (LMS) and learning content management (LCM) allowing teachers to share documents to support their classes. In LMS students can only share information if the teacher set this option, which does not always happen. In most cases, students use the platform to access documents made available by the teacher or to deliver work – similar to an information repository. More recently, social networking, web tools and collaborative virtual environments have been integrated into the learning environment, bringing changes so great that, in the near future, we will not imagine ourselves teaching without them.There are three aspects that define the social online educational environments: The ability to collaborate with others both synchronously and asynchronously; The ability to create a personal profile built just around the specialties and interests and educational curriculum, making it easier to find other people, resources, events and discussions around the same interests;   
The ability to more easily find, organize, manage, and share information and content.”

Norton (2015) lectured to their students that “Collaborative Classrooms are active, engaging places where instruction centers on student thinking. Collaborative Classroom teachers are skilled facilitators who use evidence‐based practices to support student development. Lessons in these classrooms provide rich opportunities for students to work together, grow ideas, revise their thinking, and construct meaning. Lessons in the Collaborative Classroom usually begin with students constructing knowledge. A lesson might start with students working on a shared problem, analyzing a piece of text, or drafting an idea. Then, once the students have worked and struggled for a bit, the teacher might model strategies, or share alternative ways of thinking. This is the reverse of the usual paradigm in classrooms where lessons begin with the teacher modeling and doing the thinking before the students have had a chance to struggle with the problem and construct knowledge first. Teachers in the Collaborative Classroom also recognize that in order for this rigorous learning to take place, students must be engaged and motivated. Schools can’t make students learn. We can only establish the appropriate conditions for the learning to occur. In the end, students have to do the work, and in order to do the work, they have to have experiences that are motivating and engaging.”

Blackman (2013)mentioned that “Experienced teachers often recall team or collaborative teaching experiences as their best and worst experiences in a classroom.  Like any form of collaborative scholarship.Successful collaborative teaching integrates the strengths of multiple viewpoints in a synthetic endeavor that no single member of the project could have completed independently. It also provides an expanded number of teaching styles that may connect with more student learning preferences.At its best, collaborative teaching allows students and faculty to benefit from the healthy exchange of ideas in a setting defined by mutual respect and a shared interest in a topic. At its worst, collaborative teaching can create a fragmented or even hostile environment in which instructors undermine each other and compromise the academic ideal of a learning community and civil discourse. **Traditional team teaching** involves two or more instructors teaching the same course. The instructors are involved in a collaborative endeavor throughout the entire course. Some team teaching is more like tag-team teaching, in which only one instructor meets the class to cover a segment of the material. Tag-team teaching has its benefits, but it misses out on the benefits of dialogue and the give and take engaged by the team of instructors.”

Ya Ni (2014) defined that “An important component of classroom learning is the social and communicative interactions between student and teacher, and student and student. A student’s ability to ask a question, to share an opinion, or to disagree with a point of view are fundamental learning activities. It is often through conversation, discourse, discussion, and debate among students and between instructors and students that a new concept is clarified, an old assumption is challenged, a skill is practiced, an original idea is formed and encouraged, and ultimately, a learning objective is achieved. Online learning requires adjustments by instructors as well as students for successful interactions to occur. Online courses often substitute classroom interaction with discussion boards, synchronous chat, electronic bulletin boards, and e-mails. The effectiveness of such a virtual interactive venue is not without debate. Student-to-instructor and student-to-student interactions are important elements in the design of a Web-based course because learners can experience a “sense of community,” enjoy mutual interdependence, build a “sense of trust,” and have shared goals and values. Some scholars suggest that interaction in an online environment promotes student-centered learning, encourages wider student participation, and produces more in-depth and reasoned discussions than a traditional classroom. Interaction in an online environment is less intimidating between individuals and also has less time pressure on students than does interaction in a face-to-face setting. Online discussions also can encourage more reticent students to participate to a greater extent.

Brecht (2012) chosen “The instructional value of online video lectures – videos that a course's instructor prepares to supplement classroom or online-broadcast lectures. The study examines data from a classroom course, where the videos have a slower, more step-by-step lecture style than the classroom lectures; student use of videos is voluntary, can be tailored by students to meet their learning and topic-review needs, and can occur when and where students learn most effectively. The study's specific objectives are to identify and measure types of learning benefits that video lectures provide, gauge students' acceptance and use of this form of computer-based instruction, and compare results from alternative video designs to determine if learning is differently affected. The course is highly technical (financial accounting) and is required of all business school students as they enter the school. The university is middle-tier and located in a medium-sized metropolitan area. Students are highly varied in their academic abilities and motivation, and they often have substantial off-campus job responsibilities. Three video designs were tested, each with an alternative learning environment designed into the videos. Design 1 had a complete absence of attention to relief and change-of-pace elements. Design 2 included graphics/cartoons and sounds/music clips that were strongly presented to provide relief from study tedium. Design 3 used a greatly reduced number of graphics and sounds and subtly presented them so that they did not command viewer attention.”

Frost ( 2014) maintained an “Online class observations are meant to facilitate an instructor’s professional growth. They will be used to create an opportunity for reflection and stimulate ideas for improvement in the online environment. Discussions, before and after the observation, should be positive experiences that emphasize sharing information and allow the instructor to contribute to his or her own development. Online peer classroom observation involves observing faculty teaching in the online environment, analyzing related activities, and providing feedback. Observers will complete classroom observation form and schedule a follow-up visit with faculty member. Associate Dean or Dean will review comments and initial form before follow-up meeting. Constructive feedback including instructional enhancement suggestions and/or recommendations will be communicated to the instructor during the follow-up visit. Observer will review the documentation with the faculty, invite faculty’s comments, and request faculty’s signature and date. Faculty will receive a copy of the Classroom Observation Form the original will be filed in the department. Each school will determine their process for tracking face to face and online classroom observations. This information will be stored electronically on the K: drive.”

Deale (2012) defined that“Virtual classrooms allow instructors and students to interact online synchronously. Synchronous tools are also helpful in the social aspects of education. The best advantages of synchronous online instruction are that faculty and students can talk to each other using text, audio, and video and express emotion using emoticons. Synchronous virtual classrooms provide the instructors with the ability to poll students instantly and afford the students the chance to participate in group activities in the breakout rooms, while having the feeling that they can still interact as if they were face-to-face.These interactive elements are unavailable in an asynchronous course. The features available in the synchronous virtual classroom play an important role in maintaining interaction. Most of the virtual classroom technologies have a content frame to share the instructor’s PowerPoints, an eboard where an instructor can write, breakout rooms for group activities, text chat so the instructor and other students in the class can interact using words and emoticons, and audio chat to talk via microphone or telephone with the instructor and other students. Instructors can administer student polls, share their desktop, or have the students share their own desktops through application sharing. Web sites can be displayed for students, and with a stable Internet bandwidth webcams can be used so students and instructors can see each other. Some of the common virtual classrooms available in the market today are Elluminate, Adobe Connect, Webex, and Horizon Wimba.”

**Asean**

Guri (2012)indicated that “Many policy makers, scholars and practitioners in higher education use the terms ‘distance education’ and ‘e-learning’ interchangeably as synonyms, emphasizing the continuous blurring of boundaries between conventional and distance education. ‘‘The terms ‘distance learning’, ‘distance education’, ‘distributed learning’ and ‘online learning’ are used more or less interchangeably’’. It is important to mention that the various forms of learning through ICT are defined in the relevant literature by at least a dozen different terms, such as web-based learning, computer-mediated communication, telematics environments, e-learning, virtual classrooms, online instruction, I-Campus, electronic communication, cyberspace learning environments, computer-driven interactive communication, distributed learning, borderless education. In this article, all forms of learning/teaching through ICT are referred to as ‘e-learning’. Some scholars even go to extremes and claim that the new technologies challenge the very existence of campus-based universities. For instance, argued that the new information technologies create the appropriate scientific learning environments in the knowledge society, and given this ‘it is an extremely small step that distance studies will take the place of face-to-face studies in the future. In the preface of the book Virtual University – Educational Environments of the Future, which provides an overview of the ICT implementation in European universities, Henk van de Molen stated that: ‘‘In the network society it is inescapable that the universities will have to deal with the information and communication technologies (ICT), not only for research but also for education. Some even think that universities as educational institutions will become totally virtual.” However, distance education in most higher education systems is not delivered through the new electronic media, and vice versa: e-learning in most universities and colleges all over the world is not used for distance education purposes. ‘Distance education’ and ‘e-learning’ do overlap in some cases, but are by no means identical. According to a recent survey in the China, for example, more than 85% of the students in post secondary institutions use various forms of e-learning, but only 7.6% of 468 Sarah Guri-Roseblitundergraduate students take some distance teaching courses, and only 2.2% of them study their whole degree program through distance education. The lack of a distinction between ‘e-learning’ and ‘distance education’ accounts for much of the misunderstanding of the ICT roles in higher education, and for the wide gap between the rhetoric in the literature describing the sweeping future effects of the ICT on educational environments and their actual implementation.”

Falloon (2013) observed the “Technological improvements in many countries have meant that institutions offering distance education programmes now have more options available to them to communicate and interact with their students, and increasingly, attention is being turned to the potential of Web2 technologies to facilitate synchronous interaction. The study explores the affordances and limitations of an online virtual classroom, Adobe Connect Pro, when used in the learning programmes of two groups of undergraduate and postgraduate education students. Results indicate that while both groups gained value from using the classroom, they also found it a completely new environment, and one to which many had trouble transferring the interaction and communication skills developed in other contexts. The reasons for this related to three specific areas of knowledge – technical, proceduralandoperational, that were identified as being critical to student performance in this environment. The study suggests that educators and course designers need to embed strategies into their online offerings to enable students to develop these, if they are to gain substantial benefit from the availability of virtual classrooms. Additionally, the study identified that when making design decisions about online learning environments, it is very much a matter of horses for courses when selecting tools for specific purposes. While the virtual classroom proved useful for developing social connection and a sense of community, it may not be so beneficial for supporting deeper learning. Recent technological developments have stimulated significant changes in the distance learning landscape. Meaning that students have greater choices and flexibility in how, when, and where they learn. No longer are students tied to place and time – needing to physically attend classes, lectures or tutorials –but rather, are able to access and interact with tutors, other students and learning materials, using an array of digital devices such as laptop and tablet computers, and even mobile phones.”

Chen(2014) measured that “Virtual Classroom (VC) not only has the function to replace a traditional classroom but also has less expense related to transportation, building new facilities, or the maintenance or repair of existing facilities. This study proposes some factors which influence the success of E-teaching. The subjects include students who have experience of attending related e-teaching system.A credible E-classroom system is one of the factors to build a successful Virtual Classroom. E-classroom continues to grow as teacher/students interactive system, the trust of online teaches and study is already built. In using learning device, there is no gap between traditional teaching method and teaching by using e-learning system. This study hopes that E-classroom will provide a solution with less investment for the need of higher education expansion for a country education in an elite or mass stage because the pc and internet is affordable for a family. Due to the rapid development of new networking technology, E-teaching has been widely used in most institutions since the growth of the Internet availability. Many classes are adapting to the computerized internet environment. Some systems such as, Elluminate, Centra, Webex, JoinNet, Live Meeting, Co-Life, Gogrok and Team Viewer, have become an alternative teaching system. Most of them provide real-time online teaching environment that creates a Virtual Classroom.”

Teehankee (2013) understood that “Online learning courses will work if there is definite quality in itscontents and support services, and are able to adapt to the demands of ever-changing society. It is even said that thosestudents who are likely to drop out of courses that are traditional wouldlearn better and faster when going through an online course. It is also claimed that students undergoing online learning are more motivated to learn, and they develop moreindependence, discipline and responsibility. But of course, this cannot be possible if the foundations of employing online learning are not established. Enrolling in an onlinelearning course may be cheaper than the traditional way of schooling, butto set up the infrastructure to support the technology and creating thesimulation classroom takes a considerable amount of money.This is true especially for the rural areas, where problems of even the basic needs are still not being met, and that even basic education is of poor quality, what more for the building up of thenecessary infrastructure if the infrastructure hasalready been setup, technical problems can still arise especially when accessing the actual website or connecting into the Internet in the first place. Online learning cannot be utilized maximally as well if the studentsthemselves are not ready for it. For one, students must have a working knowledge of how to use the technology even in the basic level of accessing the Internet and using it. Also, as most websitesare written in English, students must be able to understand the content andthink critically in English as well, else the whole course will be of no useto them and learning is minimal or not occurring at all. They must also be able to express themselves competently, especially inthe written word in order to contribute to thediscussions online.”

Luchoomun (2014) pertained “A growing number of universities and education authorities are in the process of implementing the enhanced use of e-learning in Personal Development Plans (PDPs). The main means of students‟ learning and assessment. This, in turn, would cause a reduction in the number of courses utilising formal lecture and written examinations. The emphasis on e-learning during the process of PDP development is particularly informed by peer assisted collaborative learning and assessment using the Virtual Learning Environment (VLE). One of the major components of the VLE at University of Dundee (UoD) and elsewhere is the growing importance and utilisation of e-learning because it offers the potential to promote collaborative learning and other forms of learning. Collaborative learning and peer assessment has undergone significant development for the past decade. Researchers and practitioners, for example Thorpe and Phillips, Parsons, Duranton et al. suggested the use of Computer Mediated Communication (CMC) and computer-based activities in continuous assessment as a means to promote collaborative learning. It was highlighted that effective opportunities can be created to enhance feedback on learning and develop skills of group work and using information technology which have not before been possible. Acknowledging the transition from paper-based assessment to the use of VLEs and e-learning as a means for more collaborative learning, Eccestone raised concerns about the impact of critical reflection. For example, researchers and practitioners were cautioned against over-optimism in the use of PDPs and e-learning because of the tendency to gather a number of artefacts without reflecting on their significance.”

Rajakumar(2013) reassured the “Educational Technology (ET) is the efficient organisation of any learning system adapting or adopting methods, processes, and products to serve identified educational goals. This involves systematic identification of the goals of education, recognition of the diversity of learners’ needs, the contexts in which learning will take place, and the range of provisions needed for each of these. The challenge is to design appropriate systems that will provide for and enable appropriate teaching-learning systems that could realise the identified goals. The key to meeting this challenge is an appreciation of the role of ET as an agent of change in the classroom, which includes not only the teacher and the teaching-learning process but also systemic issues like reach, equity, and quality. Over the past decades, educational technology in India has taken two routes. The first route involved a large number of experiments aimed at the qualitative improvement of schools, adopted the systems approach to analyse the problems plaguing the particular situation, and have evolved a range of solutions. These have included the development of flexible systems, alternative curricula, multilevel organisation of classes; low-cost teaching-learning materials, innovative activities, continuous support systems for teacher training, etc. While many of these experiments have demonstrated intrinsic merit, they have been restricted to pockets of intense practice and have failed to influence the larger school system. The second route is government sponsored schemes such as the Educational Technology (ET) Scheme and the Computer Literacy and Studies in Schools (CLASS) and their present-day analogues, including partnerships with global players. This included the supply of radio-cum-cassette players, colour televisions, microcomputers, present-day computer labs, and even satellite-receiving terminals, these schemes have largely remained supply-driven, equipment-centred, and disseminative in design.”

Geri (2012) remarked that the “Collaborative learning is considered one of the most effective ways to improve learning. Students help each other gain better understanding of the studied themes by discussing their assignments . Furthermore, the value of collaborative learning also stems from the social interaction among students and their mutual support, which increases retention. E-learning systems offer new ways of collaborative learning that may enhance student performance. One of the benefits of e-learning is that it enables collaborative learning, which involves all the students in a particular class. There are many sorts of collaborative online learning activities, e.g., wikis and blogs or different levels of collaborative document writing and peer reviews or collaborative projects that require team work and use the online environment for communication. Discussion boards (i.e., forums) are one of the primary tools of e-learning. Student learning in forums includes two main sorts of activities.Passive reading of the forum content and active participation by writing their own posts. Prior studies indicate that the extent of views is much larger than the extent of posts.”

Sufeng (2013) started to define the “Virtual classroom refers to courses offered via the internet. It is a teaching and learning environment located within a computer mediated communication system. It consists of a set of group communication and work spaces and facilities that can surpass that of the traditional classroom, a process in which students and instructors are actively involved in creating and carrying out learning activities together like group discussion, joint projects, and debates, sharing of solutions to homework problems by emails, bulletin boards, chat rooms and conferences. The development of IT technology and the internet is the basis of virtual classroom . Thus the virtual classroom possesses some of the characteristics of the internet which is what the traditional classroom does not have. For example, there is no limit of time, place, distance, and it is more convenient for both the students and the teachers to get more information from the internet. It seems that this is hope for both teachers and learners to overcome all the problems existing in the traditional cleanroom and many people even are trying to use as much as virtual technology as possible in the real campus. They ignore the differences between virtual classroom and the traditional classroom. it also has its weaknesses which make it impossible to replace the traditional classroom education, especially in traditional college. And for some people, they really should think about the reason why they use this technology.”

**Local**

Santos (2015) suggested that “There is a growing trend in education and training towards the use of online and distance learning courses. This delivery format provides flexibility and accessibility; it is also viewed as a way to provide education in a more effective way to a broader community. Online courses are comfortable, they are built under the missive of “anyone, anywhere, anytime”. Everyone can participate from home or workplace. Online courses can be developed in a variety of ways, for example, using a LMS (Learning Management System), a LCM (Learning Content System), or a Web 2.0 tool (or some mixture). These options, however, show limitations in terms of communication and interaction levels that can be achieved between students. Most learning systems are asynchronous and don't allow an effective real-time interaction, collaboration and cooperation. Whilst they typically have synchronous chats and whiteboards, these capabilities are often sterile and don’t stimulate the appropriate interactions that enhance learning. A rich interaction does not necessarily involve just verbal exchange since there is an huge learning value to be gained from interacting with the learning content in a more visual and practical way. For instance, imagine the learning benefits from collaborating on a 3D construction jointly and in real-time? Imagine watching the impact of soil erosion, or building and walking inside an heart model or a car engine? All this is possible in a 3D immersive virtual world.”

Martin (2012) sympathized that “The traditionally, interaction focused on dialogue between students and teachers in the classroom. This concept has expanded to include synchronous online discussions (text, audio, and video chat) and asynchronous online discussions (discussion forums, text, and voice mail).The interaction among participants is the most important requirement for successful online education. Frequency and quality of interaction between student and lecturer determines the effect of instruction. The social rapport and increased collaboration lead to greater levels of interaction. The successfully fostering interaction in online courses requires incorporating both instructional and social types of interaction. Effectively designed courses should impact students in such a way that there is an increased and spontaneous use of opportunities for interaction within the courses. Some studies have to found no significant differences in assessing interaction between students in a synchronous and asynchronous course. On the other hand, several studies have found that well-designed courses can be more interactive than others. Roblyer and Ekhaml designed a four-dimensional rubric that helps to score the interactivity of distance education based on four criteria: social goals of interaction, instructional goals of interaction, types and uses of technologies, and impact of interactive qualities as reflected in learner response.”

Arimbuyutan (2013) shared that“E-Learning is still an emerging market in the Philippines. Its use is still sporadic and most users represent only a small segment of the Philippines education and business communities. There are no stereotypical e-learners; schools large and small can be found using the technology. There is a slow adoption of e-learning mainly due to underdeveloped infrastructure, high cost and the propensity of the Filipinos to maintain the status quo instead of implementing changes in training and learning system and processes. Two major types of e-learning solutions have begun to emerge in the Philippines first prepackaged, off-the-shelf courses; and second custom solutions. Currently, cost is a major consideration in adopting an elearning solution, especially given the current exchange rate. Some schools and businesses elect to outsource their e-learning needs from some local distributors such as SkillSoft, Thomson NetG, Datatrain and Element K, while others build their own materials using Microsoft Office products and the Web. Many technical schools provide certification preparation and training by applying e-learning methods. IBM has also ventured into a customized on-site training, consulting, course delivery transformation and outsourcing. Yapster, Inc. (2studyIT), a local distributor of Thomson NetG, Element ,Datatrain and other software providers for elearning has penetrated the market. Also, some Asian neighbors have provided customized content such as ICUS and PurpleTrain.com (Informatics) from Singapore which offers business, IT, and health sciences program fully online. The design for a good formula to suit the Filipino preference will open the opportunity for growth of e-learning in the Philippines.”

Trinidad (2012) announced that “UNESCO report written in 2010 that the Philippines is part of a group of countrieswith newly created policies regarding information and communicationtechnologies, or ICTs, and they are just starting to apply variousstrategies to integrate online learning in schools. We have come a longway after that report in 2010, but we are still shall we say, toddler stagein having online learning in the country. It has been said in Pena-Bandalaria’s paper as well that using ICTs such as the internet andsupporting hardware and software puts us in a fourth generation of distance education, loosely categorizing it from the most prominenttechnology used for delivering educational content and its supportsystems. This shows us that we are already starting to institutionalizeonline learning, but there are still areas in great need of improvement,especially with the support systems in bringing online learning to morestudents and people who would want to experience online learning.Right now, papers and studies that look into online learning ismostly on how the foundations for it can support the system, and if Filipinos are prepared for it in the first place. There is concern toimprove infrastructure if online learning is to be available to a largenumber of people. Currently, a lot of Filipinos still do not own their own phone lines, much less even a computer in their own homes. Consider thestatistics: there is only seven percent of more than 16 million Filipinohouseholds that own personal computers, and only three out of 50 publichigh school students have access to the Internet as of 2010 With the majority of the population still in poverty andeven under the poverty line, they would be more concerned with fulfillingthe basic needs rather than something they view as a luxury item. There are also plans to include the technology of thecellular mobile technology; specifically the smart messaging services(SMS) to facilitate online learning as well . This is because of the phenomenal increase of ownership of cell phones and their services although, the current use of cellular mobiletechnology is mostly for entertainment and business purposes at the most.”

Lim (2012) professed that “Online learning is another method in which to convey education to students. This is actually a type under distance education, a non-formaltype of education that uses different media in transferring lectures, notes,discussions to students and the teacher. The University of the Philippines started the Open University as its fifthconstituent university, headed then by Chancellor Felix Librero, and currently by Dr. Grace Alfonso. It is the first school to give a formal education undergraduate and graduate courses)\ in a non-traditionalformat to qualifying students. It was the first university to offer educationin such a format. Currently, they are now implementing plans to have courses that are fully online.The succeeding years saw the development of the Internet and theWorld Wide Web. Former president Ejercito Estrada passed RA 8792, or the Electronic Commerce Act. This Actrecognizes that information and communications technology, or ICT, isvital to the development of the country and legalizes and protects the useof it in businesses, government transactions and even education. It provides the legal structure for the country’s involvement in e-commerceas well.From this, the creation of the Information Technology and E-Commerce Council (ITECC) came about from Executive Order 18, whichPresident Gloria Macapagal-Arroyo signed last May 25, 2001. This council aimed to create what they touted as e-Philippines, that is, acountry that is globally competitive through the use of ICT. Several projects were undertaken, specifically the development of businessopportunities and information infrastructure. They also created policiesthat would develop online learning and supplement the needs in basiceducation, creating programs that would also develop IT skills on avocational level.”

Morgan (2014) confirmed that “eLearning continues to be a topic of interest in many Philippine companies and organizations who would like to deploy an effective Learning Management System that does not only make use of traditional face-to-face and chalk-and-talk training sessions but effective, cost-efficient, and flexible technology-enabled learning solutions.If you ask who the experts are in eLearning in the Philippines, there aren't a lot of companies to go to. In fact, if you would have some ideas in mind, most of them offer very expensive and enterprise-wide eLearning products. In addition, not many of them are experts on learning and development but only specialists on information technology and computer systems. You would end up buying a product but not entirely a solution because you may have the platform but you will have challenges optimizing its use because of a lack of support from a learning principle standpoint. his is where Bay Hewitt can help you. Bay Hewitt lives and breathes learning and has a very proficient understanding of deploying effective and affordable eLearning solutions. It doesn't matter if you're a small-to-medium scale organization, Bay Hewitt can help you with your computer-based or web-based trainings and eLearning questions without spending an eye-popping amount of money. We can help you with Learning Management Systems deployment, Content and Knowledge Management Systems, and Course Authoring and Development. We understand that cost savings is one of your priorities and that's probably why you're considering eLearning. Imagine, if you send 10 participants to a 7,000 peso program per year, you can use the same amount of money to build an eLearning system whose courses you can use over and over again. If you're a company in the Philippines, whether in Manila, Makati, Mandaluyong, Quezon City, Cebu, Davao, Iloilo, Tagbilaran in Bohol or other parts of the country like Baguio, Dumaguete or Camarines Sur and would like to know how best to fit eLearning into your organization, you have come to the right place! And no, we will not charge exorbitant costs! We can work together so you can jumpstart those eLearning dreams!”

Mendoza (2013) uttered “A criticism often levelled at digital learning is the isolation of learners. Similarly, face-to-face training imposes a geographical restriction on learners – in short, they must all be in the same place. Virtual classrooms bridge this gap, bringing together learners in different locations and creating a peer group to learn. If your virtual classroom has been successfully targeted, the people around you are likely to be highly motivated, forming a potentially global support structure for any learning need. Instead of limiting your learning peers to the people who happen to be booked on the same classroom course, you can bring together experts from around the world, and make them available wherever your learners are. Today, geographically dispersed organisations are looking for ways to bring together a disparate workforce, forming global learning communities. Virtual classrooms ensure that training can be standardised across locations, rather than relying on the varying skills and knowledge of classroom trainers and experts in a particular location. Additionally, we know that learning with our peers increases learner motivation. People are naturally competitive, and equally inspired by the sharing of ideas around them, In learning terms, a group of learners is ‘greater than the sum of its parts’. Collaboration and discussion allow learners to bounce ideas off each other in a way that a more traditional digital learning course doesn’t allow.”

Madrigal (2012) recited to the front of the listener “Along with the real-time, ‘just-in-time’ capabilities of virtual classrooms, they are also endlessly reusable. Most virtual classroom tools allow session-recording, which will record both the on-screen action and the audio/video footage. Combined, these become a resource to return . There are two key groups who benefit here: First, learners unable to attend the virtual classroom can reap some of the benefits by catching up on what happened. This is beneficial for learners who were busy or ill, but also people with a new need – perhaps who have just joined an organisation or moved into a new role. Organisations with a high turnover of staff may find this particularly useful. Second, virtual classroom attendees themselves can return to the recording as a reminder or to refresh their learning ofcourse, the live, collaborative nature of virtual classrooms is mainly lost in viewing a recording – although there is still something to be said for learning from the questions and mistakes of your peers. But they are certainly more reusable than a classroom seminar, and more collaborative than a typical e-learning course. It is much harder to walk out of a classroom session before the end than it is to simply close the browser window and do something else. But the same etiquette that means we don’t walk out of a classroom session is also seen, perhaps to a lesser extent, in virtual classrooms. A real person has taken time out of their real day to present, discuss and encourage you. It would be rude not to stay and take part.Lack of motivation in more traditional e-learning methods can in part be attributed to a lack of support and encouragement.”

Pascual (2013) performed that “Web-based education tools provide many ways to increase communication between class members and faculty, including discussion boards, chats, and emails. Researchers have found that adding these elements to a course increases student motivation and participation in class discussions and projects. Students are "more willing to participate and a measure of anonymity, which serves as a motivator people feel more empowered. They are daring and confrontational regarding the expression of ideas. Online forums, like CourseInfo's Discussion board and Chat, provide public areas to post information. Each student can view another student's answers and learn through the exposure to different perspectives. This benefits students because they can combine new opinions with their own, and develop a solid foundation for learning. Research supports that "as learners become aware of the variations in interpretation and construction of meaning among a range of people construct an individual meaning. Another benefit to using web-based communication tools is to give all students a reinforced sense of equality. Each individual has the same opportunity to "speak up" by posting messages without typical distractions such as seating arrangements, volume of student voices, and gender biases, Shy and anxious students feel more comfortable expressing ideas and backing up facts when posting online instead of speaking in a lecture room, studies prove that online discussions provoke more confrontational and direct communication between students.”

**Technical Background**

**Software Specifications**

Html 5

Kelly (2012) stated “The HTML5 case studies have been commissioned in order to demonstrate development approaches, taking place across the higher education sector by early adopters in order to support a variety of use cases which are particularly relevant in a higher education context. The case studies are aimed primarily at developers and technical managers who wish to gain a better understanding of ways in which development approaches based on the use of HTML5 and Open Web Platform can be used. Whilst the examples described in the case studies are being used across a number of higher educational institutions we appreciate that not all institutions will wish to make use of the approaches described in the case studies – in particular, we recognize that institutions may not have the development and support expertise to emulate the approaches described in the following documents. However, increasingly we are seeing commercial vendors making use of HTML5 in new versions of their products. This suggests vendor support for HTML5 may be a relevant factor that in the procurement of new applications. The core aims of HTML5 are to improve the language with support for the latest multimedia while keeping it easily readable by humans and consistently understood by computers and devices. HTML5 has been developed as a response to the observation that the HTML and XHTML standards in common use on the Web are a mixture of features introduced by various specifications, along with those introduced by software products such as web browsers, those established by common practice, and the many syntax errors in existing web documents It is also an attempt to define a single markup language that can be written in either HTML or XHTML syntax. It includes detailed processing models to encourage more interoperable implementations; it extends, improves and rationalizes the markup available for documents, and introduces markup and application programming interfaces (APIs) for complex web applications.”

Css

Bert (2014) explained that “Cascading Style Sheets (CSS) is a collection of formatting rules that control the appearance of content in a web page. Using CSS styles to format a page separates content from presentation. The content of your page—the HTML code—resides in the HTML file, and the CSS rules defining the presentation of the code reside in another file (an external style sheet) or in another part of the HTML document (usually the head section). Separating content from presentation makes it much easier to maintain the appearance of your site from a central location because you don’t need to update every property on every page whenever you want to make a change. Separating content from presentation also results in simpler and cleaner HTML code, which provides shorter browser loading times, and simplifies navigation for people with accessibility issues (for example, those using screen readers). CSS gives you great flexibility and control over the exact appearance of your page. With CSS you can control many text properties including specific fonts and font sizes; bold, italics, underlining, and text shadows; text color and background color; link color and link underlining; and much more. By using CSS to control your fonts, you can also ensure a more consistent treatment of your page layout and appearance in multiple browsers. In addition to text formatting, you can use CSS to control the format and positioning of block-level elements in a web page. A block-level element is a standalone piece of content, usually separated by a new line in the HTML, and visually formatted as a block. For example, h1 tags, p tags, and div tags all produce block-level elements on a web page. You can set margins and borders for block-level elements, position them in a specific location, add background color to them, float text around them, and so on. Manipulating block-level elements is in essence the way you lay out pages with CSS.”

PHP

Kennedy (2013) indicated that “PHP as it's known today is actually the successor to a product named PHP/FI. Created in 1994 by Rasmus Lerdorf, the very first incarnation of PHP was a simple set of Common Gateway Interface (CGI) binaries written in the C programming language. Originally used for tracking visits to his online resume, he named the suite of scripts "Personal Home Page Tools," more frequently referenced as "PHP Tools." Over time, more functionality was desired, and Rasmus rewrote PHP Tools, producing a much larger and richer implementation. This new model was capable of database interaction and more, providing a framework upon which users could develop simple dynamic web applications such as guestbooks. In June of 1995, Rasmus » released the source code for PHP Tools to the public, which allowed developers to use it as they saw fit. This also permitted - and encouraged - users to provide fixes for bugs in the code, and to generally improve upon it. In September of that year, Rasmus expanded upon PHP and - for a short time - actually dropped the PHP name. Now referring to the tools as FI (short for "Forms Interpreter"), the new implementation included some of the basic functionality of PHP as we know it today. It had Perl-like variables, automatic interpretation of form variables, and HTML embedded syntax. The syntax itself was similar to that of Perl, albeit much more limited, simple, and somewhat inconsistent. In fact, to embed the code into an HTML file, developers had to use HTML comments. Though this method was not entirely well-received, FI continued to enjoy growth and acceptance as a CGI tool --- but still not quite as a language. However, this began to change the following month; in October, 1995, Rasmus released a complete rewrite of the code. Bringing back the PHP name, it was now (briefly) named "Personal Home Page Construction Kit," and was the first release to boast what was, at the time, considered an advanced scripting interface. The language was deliberately designed to resemble C in structure, making it an easy adoption for developers familiar with C, Perl, and similar languages. Having been thus far limited to UNIX and POSIX-compliant systems, the potential for a Windows NT implementation was being explored.”

Jquery

Based onMurphey (2012) “Jquery is fast becoming a must-have skill for front-end developers. The purpose of this book is to provide an overview of the jquery JavaScript library; when you're done with the book, you should be able to complete basic tasks using jquery, and have a solid basis from which to continue your learning. This book was designed as material to be used in a classroom setting, but you may find it useful for individual study. This is a hands-on class. We will spend a bit of time covering a concept, and then you’ll have the chance to work on an exercise related to the concept. Some of the exercises may seem trivial; others may be downright daunting. In either case, there is no grade; the goal is simply to get you comfortable working your way through problems you’ll commonly be called upon to solve using jquery. Example solutions to all of the exercises are included in the sample code. A jquery plugin is simply a new method that we use to extend jquery's prototype object. By extending the prototype object you enable all jquery objects to inherit any methods that you add. As established, whenever you call jquery() you're creating a new jquery object, with all of jquery's methods inherited. The idea of a plugin is to do something with a collection of elements. You could consider each method that comes with the jquery core a plugin, like fadeOut() or .addClass(). You can make your own plugins and use them privately in your code or you can release them into the wild. There are thousands of jquery plugins available online.”

Materialize Css

According toPrusty (2015) “Materialize css Materialize is a Responsive CSS Framework based on Google’s Material Design Language. In this tutorial I will explain what material design is and then we will build a portfolio website using Materialize. I will also compare Materialize with other popular CSS frameworks like Foundation and Bootstrap. Material Design is a Design Language that challenges to create a visual language for users that synthesizes the classic principles of good design with the innovation and possibility of technology and science. Other competitive design languages

are flat design, metro design, realism design etc. Material differs from them on the basics of color schemes, shapes, patterns, textures, or layouts. Material is the only design language that adds motion and depth to elements. In material design, everything should have a certain z-depth that determines how far raised or close to the page the element is. According to Narayan Prusty, "Materialize is a modern responsive front-end framework based on Material Design". So it's just one of the many CSS frameworks like Bootstrap, Foundation etc. The difference between Materialize, Bootstrap, and Foundation is that Materialize is based on Google's Material Design language where as bootstrap and foundation are based on the mobile first design language and flat design language, respectively. Materialize provides all CSS and JS components that are provided by bootstrap and foundation.”

Ajax

Ort (2013) described “Jax has different implications for developers working in different roles. For example, component developers creating custom components for web applications, build Ajax functionality into the design. Page authors use these Ajax components, along with widgets, JavaScript technology, and other techniques, to incorporate Ajax functionality into their web applications. Ajax impacts other roles too. For example, enterprise application developers need to add logic in server-side components to handle Ajax-related requests directed to the server. It's almost impossible today to be involved in web application design or development and not be aware of Ajax, a technology that includes but is not limited to Asynchronous JavaScript and XML. That's because Ajax is currently the primary technique for driving the high responsiveness and interactivity of some of the most popular applications on the web such as Google Maps and Flickr. These applications are representative of a new generation of highly responsive, highly interactive web applications, referred to as Web 2.0 applications, that often involve users collaborating online and sharing content. Ajax enables high responsiveness because it supports asynchronous and partial refreshes of a web page. A partial refresh means that when an interaction event fires -- for example, a user moves the cursor across a Google map -- a web server processes the information and returns a limited response specific to the data it receives. Significantly, the server does not send back an entire page to the client of the web application -- in this case a web browser -- as is the case for conventional "click, wait, and refresh" web applications. The client then updates the page based on the response.”

WebRTC

Flores (2014) explained the “WebRTC (Web Real-Time Communications) is a technology which enables Web applications and sites to capture and optionally stream audio and/or video media, as well as to exchange arbitrary data between browsers without requiring an intermediary. The set of standards that comprises WebRTC makes it possible to share data and perform teleconferencing peer-to-peer, without requiring that the user install plug-ins or any other third-party software.WebRTC serves multiple purposes, and overlaps substantially with the Media Capture and Streams API. Together, they provide powerful multimedia capabilities to the Web, including support for audio and video conferencing, file exchange, identity management, and interfacing with legacy telephone systems by sending [DTMF](https://developer.mozilla.org/en-US/docs/Glossary/DTMF) signals. Connections between peers can be made without requiring any special drivers or plug-ins, and can often be made without any intermediary servers. Connections between two peers are created using represented by the [RTCPeerConnection](https://developer.mozilla.org/en-US/docs/Web/API/RTCPeerConnection) interface. Once a connection has been established and opened, media streams ([MediaStream](https://developer.mozilla.org/en-US/docs/Web/API/MediaStream)s) and/or data channels ([RTCDataChannel](https://developer.mozilla.org/en-US/docs/Web/API/RTCDataChannel)s) can be added to the connection. Media streams can consist of any number of tracks of media information; tracks, which are represented by objects based on the [MediaStreamTrack](https://developer.mozilla.org/en-US/docs/Web/API/MediaStreamTrack) interface, may contain one of a number of types of media data, including audio, video, and text (such as subtitles or even chapter names). Most streams consist of at least one audio track and likely also a video track, and can be used to send and receive both live media or stored media information (such as a streamed movie). You can also use the connection between two peers to exchange arbitrary binary data using the [RTCDataChannel](https://developer.mozilla.org/en-US/docs/Web/API/RTCDataChannel) interface. This can be used for back-channel information, metadata exchange, game status packets, file transfers, or even as a primary channel for data transfer.”

**Hardware Specifications**

Web Server

Beal (2015) mentioned that “A Web server is a computer system that hosts websites. It runs Web server software, such as Apache or Microsoft IIS, which provides access to hosted web pages over the Internet. Most Web servers are connected to the Internet via a high-speed connection, offering OC-3 or faster data transmission rates. A fast Internet connection allows Web servers to support multiple connections at one time without slowing down. Any computer can be used as a Web server, as long as it is connected to the Internet and has the appropriate software installed. However, most Web servers are 1U rack-mounted systems, meaning they are flat, trimmed down computers that can be mounted on a server rack. Most Web hosting companies have several server racks, which each contain multiple servers. This is the most space-efficient way to host a large number of websites from a single location. Web servers typically host multiple websites. Some only host a few, while others may host several hundred. Web servers that host websites for multiple users are called "shared hosts." This is the most common type of hosting solution and is used for personal sites, small business sites, and websites run by small organizations. Web servers that only host websites for a single person or company are called "dedicated hosts." These types of servers are appropriate for high-traffic websites and sites that require custom server modifications. Dedicated hosts are also more reliable than shared hosts, since there are fewer sites that can cause bottlenecks or other issues with the server.”

Desktop

Westbrook (2015) mentioned that “A computer is a device that accepts information (in the form of digitized data) and manipulates it for some result based on a program or sequence of instructions on how the data is to be processed. Complex computers also include the means for storing data (including the program, which is also a form of data) for some necessary duration. A program may be invariable and built into the computer (and called logic circuitry as it is on microprocessors) or different programs may be provided to the computer (loaded into its storage and then started by an administrator or user). Today's computers have both kinds of programming. Most histories of the modern computer begin with the Analytical Engine envisioned by Charles Babbage following the mathematical ideas of George Boole, the mathematician who first stated the principles of logic inherent in today's digital computer. Babbage's assistant and collaborator, Ada Lovelace, is said to have introduced the ideas of program loops and subroutines and is sometimes considered the first programmer. Apart from mechanical calculators, the first really useable computers began with the vacuum tube, accelerated with the invention of the transistor, which then became embedded in large numbers in integrated circuits, ultimately making possible the relatively low-cost personal computer. Modern computers inherently follow the ideas of the stored program laid out by John von Neumann in 1945. Essentially, the program is read by the computer one instruction at a time, an operation is performed, and the computer then reads in the next instruction, and so on. Recently, computers and programs have been devised that allow multiple programs (and computers) to work on the same problem at the same time in parallel. With the advent of the Internet and higher bandwidth data transmission, programs and data that are part of the same overall project can be distributed over a network and embody the Sun Microsystems slogan: "The network is the computer."

Laptop

James (2015) mentioned that “A laptop computer, sometimes called a notebook computer by manufacturers, is a battery- or AC-powered personal computer generally smaller than a briefcase that can easily be transported and conveniently used in temporary spaces such as on airplanes, in libraries, temporary offices, and at meetings. A laptop typically weighs less than 5 pounds and is 3 inches or less in thickness. Among the best-known makers of laptop computers are IBM, Apple, Compaq, Dell, and Toshiba. Laptop computers generally cost more than desktop computers with the same capabilities because they are more difficult to design and manufacture. A laptop can effectively be turned into a desktop computer with a docking station, a hardware frame that supplies connections for peripheral input/output devices such as a printer or larger monitor. The less capable port replicator allows you to connect a laptop to a number of peripherals through a single plug. Laptops usually come with displays that use thin-screen technology. The thin film transistor or active matrix screen is brighter and views better at different angles than the STN or dual-scan screen. Laptops use several different approaches for integrating a mouse into the keyboard, including the touch pad, the trackball, and the pointing stick. A serial port also allows a regular mouse to be attached. The PC Card is insertable hardware for adding a modem or network interface card to a laptop. CD-ROM and digital versatile disc drives may be built-in or attachable.”

Wifi Modem

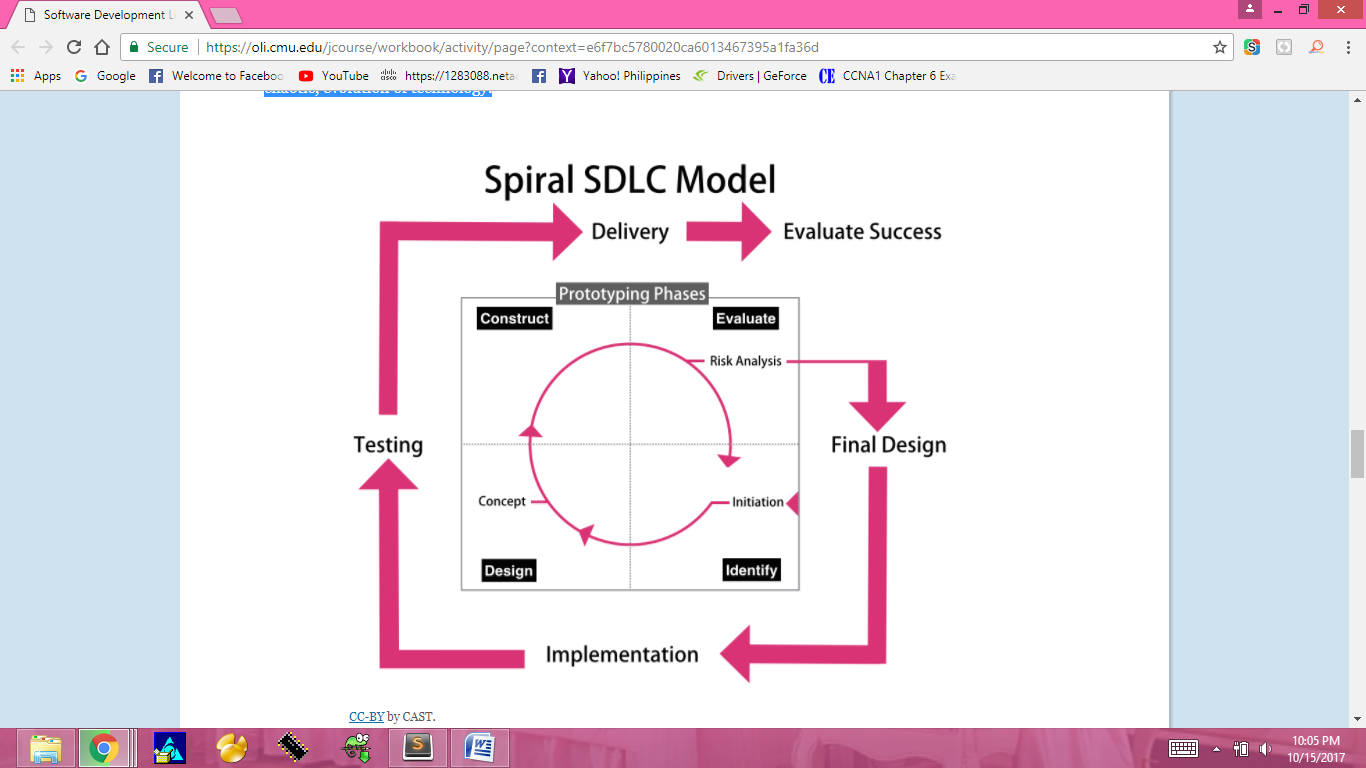
Ullah (2013) Mentioned that “Wireless networking technologies (Wi-Fi) allows computers and other devices to communicate over a wireless signal A typical Wi-Fi network includes three parts: a wired connection to a broadband provider, an access point, and a computer connected by wired and wireless connections It offers different broadband speeds and operates in Industrial, Scientific, and Medical band (ISM band). The communication between nodes or computers is done via Access Points (APs). The access point has also played a role as a wireless ethernet adapter. Wi-Fi has gained popularity because of installation simplicity and the increased number of Wi-Fi radio equipped laptops. Currently, many businesses like airports, cafés, restaurants, and shopping areas offering wireless internet-services to customers. Demand for wireless technologies has gained more importance in business and everyday-life, as the population is getting denser by closely spaced buildings. WiFi networks have easy deployment in markets, offices, airports, and other locations providing the advantages like flexibility, mobility, ease of use, and low cost. Companies that wish to enter this market needs intelligence in this area to make appropriate business decisions based on the properties of present and future technologies. Knowledge of the technologies in terms of security issues, performance and installation and maintenance cost are of interest There are various emerging wireless network technologies allowing data communication and Intemet access for homes and business. Two groups of these technologies deserve particular attention. First is the circulatory network that extends communication far beyond just telephone service. Then there is the wireless fidelity (Wi-Fi) that denotes equipment conforming to the institute of Electrical and Electronics Engineering technical specifications for wireless Local Area Network (IEEE 802.11a, b, g standard). Wi-Fi network utilizes unlicensed radio frequency (2.5 and 5GHz) and are compatible with and may be connected to a wired Ethernet Local Area Network.”

**System Development Life Cycle**

Thomas (2015) explained “The software development life cycle (SDLC) is a process which is used to develop software. SDLC is a step by step procedure need to be followed by the organization to design and develop a high quality product. The phases of the software development life cycle are which describes that how to develop, maintain particular software. The life cycle aims to develop a good quality product/software. SDLC produces intermediate products that can be reviewed to check whether they work according to customer requirement. SDLC is also known as software development process. It is an approach creates considerable documentation where this documentation helpful to make sure that requirement can be traced back to stated business requirements. It is a framework which has a set of tasks performed at each phase in the software development process. SDLC is a step by step procedure or systematic approach to develop software and it is followed within a software organization. It consists of various phases which describe how to design, develop, enhance and maintain a particular software. The Spiral Model is concerned primarily with risk awareness and management. The risk-driven approach of the spiral model ensures your team is highly flexible in its approach, but also highly aware of and prepared for the challenges they can expect to face down the road. The spiral model shines when the stakes are highest and major setbacks are not an option.”

The proponents will be using the Spiral Model as SDLC. According to Gurendo (2015) “The spiral development model combines features of one or more SDLC models to best fit the development project at hand. The spiral model repeats earlier phases as the project progresses. Each cycle produces an early prototype representing a part of the entire project. This approach helps demonstrate a proof of concept early in the cycle and more accurately reflects the disorderly, even chaotic, evolution of technology. In the spiral model the process begins in the center of the spiral with initiation and then cycles repeatedly through prototyping phases that include four parts: identify, design, construct, and evaluate. In the first cycle, the development team initiates the project with the customer, identifying business requirements and determining the concept for the design. A prototype is built and is processed through design, construction, and evaluation. A risk assessment is performed before a second prototype is created, and a new cycle begins. At each iteration, system requirements are identified, the prototype is tested, and further input is gathered until all concerns have been adequately addressed. The early cycles involve the initiation, concept, and risk analysis for each new build of the prototype. Once the prototype is accepted by the customer, the cycles shift into implementation of the final design, testing of the design, and finally delivery of the final product. The spiral development model is intended for large, expensive, and complicated projects where client responsiveness is a significant issue, risk factors include cost over runs, operating cost miscalculations, and a less than satisfactory product.”

In order to create the system positively, the researchers will be use the Spiral Model as SDLC to serve as a guide on the phases of the system development they must undergo. The researchers will be select the spiral model that will help them organize the correct step that need to be done to develop the system in the best and easiest way. Since the researcher will be develop a virtual classroom system this model is appropriate because it will be requires a prototyping phases such as identify, design, construct, evaluate and accurate result that are needed in the system. By using the repetition of the life cycle the development of the system that ensure the concrete result. It will assist the researcher to identify first the needed module in the system before going on the next procedure. The design that will can make the researcher more convenient for the using the system. It will construct all the identified modules and design before to evaluate the system.With spiral model it will approach even prototypes are accepted. It has a continuous technical attention and providing a good design and to be as competitive as possible. As the development progresses, it will give understanding into a what the development really involves and the best results will come more naturally.

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**Figure 2: Spiral SDLC Model**

**CHAPTER III**

**RESEARCH AND METHODOLOGY**

This chapter describes the research methodology that will be used in the study. It contains the method, the respondents, the instrument that will be used to collect data, the administration of the instruments and statistical treatment of data.

**Research Method**

The research design that will be used in the study is the descriptive method employing the research and development strategy. According to Medel (2015) “Descriptive research involves the description, recording, analysis and interpretation of the present nature, composition or the processes of phenomena which focuses on prevailing conditions, or how a person, group or thing behaves or functions in the present. It is used to describe characteristics of a [population](https://en.wikipedia.org/wiki/Statistical_population) or phenomenon being studied.  It often involves some type of comparison or contrast. In other words, descriptive research maybe defined as a purposive process of gathering, analyzing, classifying and tabulating data about prevailing conditions, practices, beliefs, processes, trends and cause effect relationships and then making adequate and accurate interpretation about such data with or without the aid of statistical methods. Descriptive studies are closely associated with observational studies, but they are not limited with observation data collection method, and case studies, as well as, surveys can also be specified as popular data collection methods used with descriptive studies. This research method is used for frequencies, averages and other statistical calculations. This method is used to gather information in order to test hypothesis or to answer questions concerning the currents status of the subject of the study. Often the best approach prior to writing descriptive research, is conducting a survey investigation. Descriptive research often illustrates a relevant but nonquantified topic involving a well-focused research question. Data must be subjected to the thinking process in terms of ordered reasoning. It gives either a qualitative or quantitative, or both, description of the general characteristics of the group or case under study”

The researchers selected this method appropriate to gather and analyze information from the respondents. Descriptive method collects information without changing the environment, simply it is done by observation. It is also used to obtain information concerning the current status of the phenomena to describe “what exists” with respect to variables or conditions in a situation. The researchers will gather quantifiable information that can be used for statistical inference on the respondents through data analysis. This means that the form of questions for the respondents will be closed-ended which limits its ability to provide unique insights. However, if it is used properly it can help the researchers to better define and measure the significance of something about a group of respondents and the population they represent. By implementing the descriptive method, the researchers will be able to gather information from the respondents and will be able to describe with respect to the conditions and variables on the respondent’s environment. Descriptive method can be quantitative or qualitative method. The researchers select quantitative method, it refers to the systematic and empirical investigation of observable phenomena via statistical, mathematical or computational techniques. Quantitative method has been selected by the researchers since the information that will be gathered from the respondents will be in numerical form such as statistics, percentage, discrete or continuous.

**Respondents**

This study will involve a total number of 73 students from different courses offered in Graduate School for the first semester of trimester. The respondents will be composed of students of Columban College, Graduate School as shown in Table 1.

**Table 1**

Distribution of Respondents

|  |  |
| --- | --- |
| **Respondents** | **No. of Respondents** |
| Doctor of Education | 11 |
| Master in Business Administration (Thesis) | 8 |
| Master in Business Administration (Non-Thesis) | 1 |
| Master in Public Management | 3 |
| Major in Religious Education (Thesis) | 1 |
| Major in Religious Education (Non-Thesis) | 2 |
| Major in Educational Administration | 31 |
| Major in English Language Teaching | 5 |
| Major in Science Education | 5 |
| Major in Values Education | 8 |
| **Total** | **73** |

**Instrument**

To satisfy the aim and purpose of the study, the survey questionnaire will give to 73 students for them to fill out. The researcher conduct observation after questionnaire, will identify the problems based on the observation in order to decide and apply the possible solution. The questions dealt accordingly. The main points and substance will be explained to the respondent to gain clarity and definitiveness if the questionnaire. The copies will be distributed and retrieved by the researchers personally.

**Data Gathering Procedure**

A permit will be secured from Dr. David C. Bueno, Dean of the Graduate School, through the endorsement of Engr. Noel H. Yap, Dean of the College of Computer Studies, for the distribution of the survey questionnaire to the respondents.

After the approval the researcher go to Columban College and personally distributed the survey-questionnaire to the college per department of Graduate School Students. A total of two weeks will be allotted for the distribution and retrieval of the survey form.

**Statistical Treatment of Data**

The data that will be gathered will be recorded, tabulated, and analyzed by means of the following statistical measures:

1. Percentage. This is used to determine the proportion of the respondents in terms of their survey questionnaire.

Formula:

% = f/n x 100

Where:

% = Percentage

F = Frequency

n = Total number of cases

100 = Constant value

1. Mean. This will be used to determine the average number of student-respodents in terms of their personal related variable.

Formula:

Weighted Mean X = ∑fx

n

Where:

X = weighted mean

F = frequency

x = individual score

n = number of voters

## 3. Average Weighted Mean. This will be used to determine the assessment of the respondents with regards to their personal profiles.

Formula: X = **Fx**

**N**

Where:

X = Weighted Mean

F = Frequency

x = Weight of each item

N = Number of Cases

4. Frequency. The frequency measure the number of times the event occurred in an experiment or study.

Formula:

Where:

*F*  = Frequency

*T*  = Period, the time required for one cycle

*N*  = A number of cycles

*t*  = An amount of time

**CHAPTER IV**

**REQUIREMRENT ANALYSIS AND SPECIFICATION**

**Summary of the Complete Requirements for the Proposed System**

The Virtual Classroom System of Graduate School Columban College, is a Web-based system. It requires an active Internet connection to be able to be accessed by the user. The users of the system are students and professors of Columban College. The system has six modules, Account Module, Subjects Module, Requirements Module, Announccements Module, Message Module, Live Chat Module. The database is designed to allow saving the data information on student, professor, requirements and subjects.

The Account Module lets the user to register, login, update and logout their account. The Subject Module allows the professor to register their subjects and add students on that particular subject. The Requirements Module allows the user to view, upload and download requirements. The Announcement Module allows the user to post and view announcements. The Message Module let the user send and view messages to each other. Lastly, the live chat module allows the user to set the schedule and join the live chat.

The Account Module allows the user to create their account. First the user will enter their full name, username, password and their id number to register. Then they will login using their username and password. The user can update his/her account information. The professor will register his/her subjects using the Subjects Module. After the professor has registered the subjects, he/she can now add the students on that particular subject. The Requirements Module allows the professor to post and the students to view the requirements. The professor can post a requirements, announcements and acitivities for their students. The professor will have to enter the details of the requirements such as the name of the subject, date and the name of the professor. After the requirements are posted, the students can now view the uploaded requirements on a particular subject by their professor. Students can download the uploaded requirements or activities that they will answer. The uploaded requirements can be updated by the professor. The Announcement Module allows the professor to post an announcement. First , the professor will enter the details of the announcement. After the announcement is posted, the students can view the announcements. The announcements can also be updated by the professor. The student and the professor can send messages to one another using the Message Module. The professor can set for a live chat session using the Live Chat Module. The professor will enter the details of the live chat such as the date of the session and the subject. After the live chat session is set, the students on that particular subject will be notified that they will have to join the live caht session on this particular date.

There will be two users in the application. The professor and the student and each of them has their own corresponding interface. The requirement needed for the student in order for him/her to access the application is through the use of a web browser. There will be different actions provided on each of the modules for the student. The student can register for an account so that he/she can login and logout on the application. The student can also view the posted activities for them, they can upload their requirements, view their subject schedules, download uploaded requirements, and send messages to other users. For the professor, he/she can also register for an account in order to login and logout on the application. The professor can post activities, lectures and schedules. The professor can also upload requirements for their students, he/she can download the uploaded activities from the students. The professor has also the privilege to view the schedule for each subject, he/she can also send messages, and set a schedule for a live chat session. All of the hardware interfaces of the Virtual Classroom does not require a high end specification for a desktop or laptop. The application is accessible even on computers with low end specifications since the application will only consume the computer’s CPU usage and Memory Usage. The minimum hardware requirements would be Intel Pentium for the processor, it will require atleast 8gb of ram and 500gb of internal storage. In order to avoid system crash, the system must have a plenty space to hold the data. In order for the application to run, it will need a web browser. It can be Google Chrome, Mozilla Firefox and Internet Explorer as long as it is compatible with the components of the application. It is hardly recommended to use web browsers since all of the modules are designed for it.

The system doesn't need a high level of performance in terms of hardware specifications. The system can gather information such as information about the student, professor and other information about the activities and announcements uploaded in the system. Also the heat may affect the execution of the system make sure that all of your PC's vents, grates, and the filters are unhindered by dust and other gross materials that prevent proper airflow. Speed, the system can be used properly and quickly depending on how fast the Internet connection on their devices. Availability, the system can be accessed by the Internet anytime and anywhere for the viewing of updated activities, exam, report requirements, lessons must be studied and most especially the use of virtual session scheduled by the professors. Response Time, In terms of response time this will depend on the WAN (Wide Area Network) connection using the router to connect the users to the system. The execution of the system depends on the router, thick walls may cause of loss of connection. The router must be placed in an open area to ensure a good network connection. Capacity, the server has the capacity to hold the maximum number of students, it will also have a backup server in case of server down.

The system must tested in terms of accuracy to maintain the functionality of the system it will use preventive maintenance on the application from errors and bugs during the development process. These errors are encountered due to faulty design or wrong assumptions during the development and also on the application’s run time. It will also be used to increase the application’s maintainability and reliability in order to prevent further problems in the future. During the development process of the application, we have encountered a minimal number of errors or bugs on the application. The bugs are approximately 10%. If the application encounters a problem, it will execute a diagnostic protocol to fix the errors. This will be used for the maintainability of the application since it will handle large amounts of data by the users. The account of the professor has been given the privileges. These privileges are to update, upload and edit contents on the application. This means that the professor’s account will also serve as the Administrator. He/she is the only one that could execute these actions.

The application is a web-based system which means that it is connected to a web server. The desktop or laptop that will be used must have a web browser in order for the user to access the application. These are the required standard for the application, if one of these requirements are not met, the user won’t be able to access the application. Different software and programming languages are used for the development of the application. HTML, CSS and Materialize CSS are the languages used for the front end of the application. Javascript has been used to make the application interactive. The logic of the application has been developed using PHP, it is also used for the different modules of the application. MySQL is the database of the application. The User-Interface Design constraint of the application will be the type of the user that will use the application, their knowledge on the use of the application. The application will help the beneficiary by improving their current process of teaching and learning on the graduate school. It will also minimize the use of resources in teaching like papers and etc. The required standard is needed to be met for the operating environment of the application. The application can run to its given computer hardware and software specifications but the higher the specification, the performance and output would be better. The minimum and recommended requirements are shown in the technical feasibility, both for it’s hardware and software specification.

**System Architecture Diagram**

Diagram # 1: System Architecture Diagram of Virtual Classroom System of Graduate School, Columban College, Olongapo City

**UML Diagram**

Diagram # 3:UML Diagram of Virtual Classroom System of Graduate School Columban College, Olongapo City

**Data Dictionary**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| UserID | Int | 14 | ✔ | ✔ | ✔ |
| username | Varchar | 45 |  |  | ✔ |
| password | Varchar | 0 |  |  | ✔ |
| type | Varchar | 45 |  |  | ✔ |

**Table 3.1: User**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| StudnetID | Int | 14 | ✔ | ✔ |  |
| Firstname | Varchar | 45 |  |  | ✔ |
| Middlename | Varchar | 45 |  |  | ✔ |
| Lastname | Varchar | 45 |  |  | ✔ |
| Studentusername | Varchar | 45 |  |  | ✔ |
| Gender | Varchar | 45 |  |  | ✔ |
| Birtdate | Varchar | 45 |  |  | ✔ |
| Photo | Varchar | 45 |  |  | ✔ |
| Email | Varchar | 45 |  |  | ✔ |
| Contact | Varchar | 45 |  |  | ✔ |
| Address | Varchar | 255 |  |  | ✔ |
| Studentnumber | Int | 45 |  |  | ✔ |
| UserID | Int | 45 |  |  | ✔ |
| Datecreated | Timestamp | 6 |  |  | ✔ |

**Table 3.2: Student**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| StudentLoadID | Int | 14 | ✔ | ✔ |  |
| StudentID | Int | 14 |  |  | ✔ |
| FacultyLoadID | Int | 14 |  |  | ✔ |

**Table 3.3: Student\_Load**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| FacultyID | Int | 14 | ✔ | ✔ |  |
| Firstname | Varchar | 45 |  |  | ✔ |
| Middlename | Varchar | 45 |  |  | ✔ |
| Lastname | Varchar | 45 |  |  | ✔ |
| Facultyusername | Varchar | 45 |  |  | ✔ |
| Gender | Varchar | 45 |  |  | ✔ |
| Birtdate | Varchar | 45 |  |  | ✔ |
| Photo | Varchar | 45 |  |  | ✔ |
| Email | Varchar | 45 |  |  | ✔ |
| Contact | Varchar | 45 |  |  | ✔ |
| Address | Varchar | 255 |  |  | ✔ |
| Facultynumber | Int | 45 |  |  | ✔ |
| UserID | Int | 45 |  |  | ✔ |
| Datecreated | Timestamp | 6 |  |  | ✔ |

**Table 3.4: Faculty**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| FacultyLoadID | Int | 45 | ✔ | ✔ |  |
| FacultyID | Int | 14 |  |  | ✔ |
| SubjectID | Int | 14 |  |  | ✔ |
| timeStart | Time | 0 |  |  | ✔ |
| timeEnd | Time | 0 |  |  | ✔ |
| dayCode | Varchar | 3 |  |  | ✔ |

**Table 3.5: Faculty\_Load**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| SchoolworksID | Int | 14 | ✔ | ✔ |  |
| SchoolWorksTitke | Varchar | 255 |  |  | ✔ |
| SchoolWorksContent | Text | 0 |  |  | ✔ |
| SchoolWorksFile | Varchar | 255 |  |  | ✔ |
| SchoolWorksUploader | Int | 45 |  |  | ✔ |
| SchoolWorksDate | Timestamp | 6 |  |  | ✔ |

**Table 3.6: Post\_Schoolworks**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| SubjectsID | Int | 11 | ✔ | ✔ |  |
| Subjectcode | Varchar | 45 |  |  | ✔ |
| Subjecttime | Varchar | 45 |  |  | ✔ |
| Subjectdatecreated | Timestamp | 20 |  |  | ✔ |
| SubjectDescription | Varchar |  |  |  | ✔ |

**Table 3.7: Subjects**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| AnnouncementID | Int | 14 | ✔ | ✔ |  |
| AnnouncementTitle | Varchar | 255 |  |  | ✔ |
| AnnouncementContent | Text | 0 |  |  | ✔ |
| AnnouncementDate | Timestamp | 6 |  |  | ✔ |
| AnnouncementUploader | int | 45 |  |  |  |
| AnnouncementSched | Varchar | 255 |  |  | ✔ |

**Table 3.8: Announcements**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| Log\_id | Int | 14 | ✔ | ✔ |  |
| Log\_session | Int | 14 |  |  | ✔ |
| Log\_sender | Int | 14 |  |  | ✔ |
| Log\_message | Text | 0 |  |  | ✔ |
| Log\_dateCreated | Timestamp | 6 |  |  | ✔ |

**Table 3.9: Message\_Log**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Name | Type | Length | Primary Key | Auto Increment | Default |
| Session\_ID | Int | 14 | ✔ | ✔ |  |
| Session\_status | Varchar | 45 |  |  | ✔ |
| Session\_dateCreated | Timestamp | 6 |  |  | ✔ |
| Session\_dateUpadated | Timestamp | 6 |  |  | ✔ |

**Table 3.10: Message\_Session**

**Use Case Diagram**

****

Diagram # 2: USE-CASE Diagram of Virtual Classroom System of Graduate School, Columban College, Olongapo City.

**Use Case Descriptions**

|  |  |
| --- | --- |
| Use Case ID: | 001 |
| Use Case Name: | Register Account |
| Actors: | Student and Professor |
| Description: | This process will enable the user to have an account |
| Pre-Conditions | The user information exists in the database. |
| Post-Conditions: | The student and professor can use their accounts to login. |
| Normal Flow: | The user will fill out the needed information able for them to have an account. |

**Table 2.1: Register Account**

|  |  |
| --- | --- |
| Use Case ID: | 002 |
| Use Case Name: | Login Account |
| Actors: | Student and Professor |
| Description: | This process will enable the user to login. |
| Pre-Conditions | The user must have an account to login |
| Post-Conditions: | The student and professor will be logged-in in the system and they will see the dashboard of the system. |
| Normal Flow: | Begin by logging into the "Virtual Classroom System of Graduate School Columban College, Olongapo City” by entering the user's Username and Password. |

**Table 2.2: Login Account**

|  |  |
| --- | --- |
| Use Case ID: | 003 |
| Use Case Name: | Register Subject |
| Actors: | Professor |
| Description: | This process will allow the professor to register their different in the system. |
| Pre-Conditions | The professor must be logged in. |
| Post-Conditions: | The professor can register subject. |
| Normal Flow: | The professor will register their for they can able to add students. |

**Table 2.3: Register Subject**

|  |  |
| --- | --- |
| Use Case ID: | 004 |
| Use Case Name: | Add Students |
| Actors: | Professor |
| Description: | This process will allow the professor to add students in the system. |
| Pre-Conditions | The professor must be logged in. |
| Post-Conditions: | The professor can add students. |
| Normal Flow: | The professor will get the information about the students to add in the system. |

**Table 2.4: Add Students**

|  |  |
| --- | --- |
| Use Case ID: | 005 |
| Use Case Name: | Post School Requirements |
| Actors: | Professor |
| Description: | This process will allow the professor to post activities, lectures and schedule in the system |
| Pre-Conditions | The professor must be logged in. |
| Post-Conditions: | The professor can post school requirements |
| Normal Flow: | The professor will post updated activities, lectures and schedule in the system and it will be notified the student. |

**Table 2.5: Post School Requirements**

|  |  |
| --- | --- |
| Use Case ID: | 006 |
| Use Case Name: | View Uploaded School Requirements |
| Actors: | Student and Professor |
| Description: | This process will allow the students to view the posted activities and lectures updated by the professor in the system. |
| Pre-Conditions | The student and professor must be logged in. |
| Post-Conditions: | The student and professor can view activities and lectures. |
| Normal Flow: | The students and professor will view the updated activities and lectures. The system will direct the student and professor in the dashboard of the system. |

**Table 2.6: View Uploaded School Requirements**

|  |  |
| --- | --- |
| Use Case ID: | 007 |
| Use Case Name: | Upload Answered School Requirement |
| Actors: | Student |
| Description: | This process will allow the student to upload the answered school requirement in the system. |
| Pre-Conditions | The student must be logged in. |
| Post-Conditions: | The student can upload the answered school requirements. |
| Normal Flow: | The student will upload the school requirements in the system for able the professor check the answered requirement. |

**Table 2.7: Upload Answered School Requirement**

|  |  |
| --- | --- |
| Use Case ID: | 008 |
| Use Case Name: | Check the Answered School Requirements |
| Actors: | Professor |
| Description: | This process will allow the professor to check uploaded requirements of the students. |
| Pre-Conditions | The professor must be logged in. |
| Post-Conditions: | The professor can check the uploaded requirements |
| Normal Flow: | The professor able to check the uploaded requirements answered by the student.  The professor will check the uploaded school requirements. |

**Table 2.8: Check the Answered School Requirements**

|  |  |
| --- | --- |
| Use Case ID: | 009 |
| Use Case Name: | Post Announcements |
| Actors: | Professor |
| Description: | This process will allow the professor to post announcement in the system. |
| Pre-Conditions | The professor must be logged in. |
| Post-Conditions: | The professor can post an updated announcement |
| Normal Flow: | The professor will login to the system and will post announcements to update the students. |

**Table 2.9: Post Announcements**

|  |  |
| --- | --- |
| Use Case ID: | 010 |
| Use Case Name: | View Announcements |
| Actors: | Student and Professor |
| Description: | This process will allow the students and professor to view the announcements in the system. |
| Pre-Conditions | The student and professor must be logged in. |
| Post-Conditions: | The student and professor can view an updated announcement. |
| Normal Flow: | The students and professor will login to the system and they will view the updated announcements. |

**Table 2.10: View Announcements**

|  |  |
| --- | --- |
| Use Case ID: | 011 |
| Use Case Name: | Send Message |
| Actors: | Student and Professor |
| Description: | This process allows the student and professor to communicate each other using the system. |
| Pre-Conditions | The student and professor must be in their respective accounts |
| Post-Conditions: | The student and professor can communicate a private and public message. |
| Normal Flow: | The student can send messages directly to the professor.  The professor can communicate with the group of students |

**Table 2.11: Send Message**

|  |  |
| --- | --- |
| Use Case ID: | 012 |
| Use Case Name: | Set Schedule for Live Chat Session |
| Actors: | Professor |
| Description: | This process allows professor to set schedule for live chat session in the system. |
| Pre-Conditions | The professor will be the one to set a schedule for the live discussion. |
| Post-Conditions: | The professor has the authority to manage the live chat session. |
| Normal Flow: | The professor will set the date of schedule for live chat session and the students will notify on the system when the live chat session begins. |

**Table 2.12: Set Schedule for Live Chat Session**

|  |  |
| --- | --- |
| Use Case ID: | 013 |
| Use Case Name: | Join Video Conference |
| Actors: | Student and Professor |
| Description: | This process allows the student and professor to join the live chat session in the system. |
| Pre-Conditions | The student and professor will be joined in the live chat session for the discussion. |
| Post-Conditions: | The student and professor can join in the live chat session. |
| Normal Flow: | The student and professor will start and they can join the live chat session for them to be able communicate face to face with each other. |

**Table 2.13: Join Video Conference**

|  |  |
| --- | --- |
| Use Case ID: | 014 |
| Use Case Name: | Update Account Information |
| Actors: | Student and Professor |
| Description: | The process allows the student and professor to update the information about their account. |
| Pre-Conditions | The user must be logged in. |
| Post-Conditions: | The user can update account information. |
| Normal Flow: | The student and professor will view, edit, delete the information about their account. |

**Table 2.14: Update Account Information**

|  |  |
| --- | --- |
| Use Case ID: | 015 |
| Use Case Name: | Logout Account |
| Actors: | Student and Professor |
| Description: | The process allows the users to logout in the system |
| Pre-Conditions | The user must login to logout the account |
| Post-Conditions: | The user can logout account. |
| Normal Flow: | All users can logout account. |

**Table 2.15: Logout Account**

**Database Design**

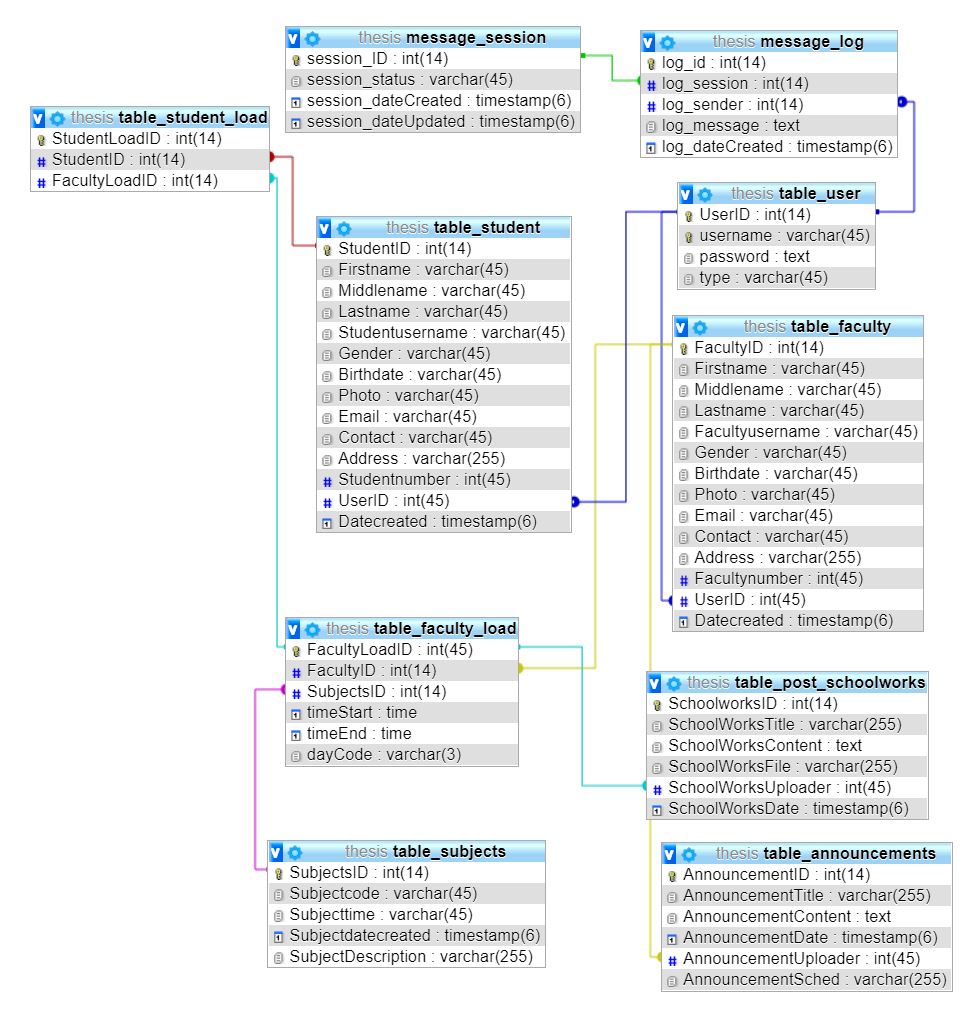


Diagram # 4: Database Design of Virtual Classroom System of Graduate School Columban College, Olongapo City

**Feasibility**

**Organizational Feasibility**

Organizational feasibility is conducted to determine whether a proposed system has expertise, organizational competence, and resources. The proposed system is “Virtual Classroom System of Graduate School, Columban College, Olongapo City**”** was created to facilitate the learning process of Graduate School Students enrolled under Columban College, that will support the objectives of the organization’s strategic plan, by providing the students through making the learning process easy and hassle free in attending the school. The Columban College Graduate School objectives are: 1) to deliver quality graduate education responsive to local and international demands for professionals; 2) to utilize support services to accommodate professionals of diverse backgrounds, interest, and abilities; 3) to serve as linkage between higher education institutions and other research-oriented organizations; 4) to ensure healthy and safe environment on campus with adequate physical resources and to maintain fiscal responsibility and accountability. The proposed system designed will be user-friendly, easy to use for the students to learn anytime and anywhere. At the same time the traditional way of teaching process will be eliminated. Virtual Classroom offers increased convenience to the students of the Graduate School, encourages them to participate the online discussion by the professors and increases the likelihood of participation in online learning through the used of technology. It means all the students will have their own account to access the system using their devices through a web browser. The activities and exam will be free from using of printed material and it can provide a real time posting of lessons and other requirements from time to time. Also, it has a potential for the students to see the system if there’s an updated task to do. Through these goals the purpose of the proposed system is to allow students to learn for personal accomplishment without physically attending a traditional way of teaching in the school. To enhance the ability of the students in their different skills and interest in learning. To produce professionals through the use of technology that can lead the organization. To ensure the security and environment of the resources in the school and outside the campus. With the latest development tools used to create the system. The server has the capacity to hold the maximum number of students and their information and this will serve as a backup information of every student of the Graduate School, Columban College, Olongapo City.

**Economic Feasibility**

The main component for maintainable accomplishment of the development of the project is their economic feasibility. During the time spent the improvement of the proposed system, it is feasible to the required medium requirement to be procured with a specific end goal to run the system. This is to guarantee the correct way for the accomplishment of the system, evaluation of the economic feasibility will be consider to settle on the correct choices for the project investment. To assess the economic feasibility, the administration needs to break down expenses and advantages related to the proposed system. The capital cost of a project affects the economic evaluation. Cost estimating is essentially an intuitive process that attempts to predict the final outcome of a future capital expenditure. The hardware cost PHP 11,849/yearly and the software cost PHP 4,099/yearly. PHP 15,948, that will be the total expenses of the requirements needed. The hardware required in the implementation of the proposed system is all available in the marketplace. The Identification of Cost shows the expenses of the requirements needed in the implementation and deployment of the proposed system.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Cost | 2017 | Year 1 | Year 2 | Year 3 |
| Hardware cost | ₱11,849 | ₱11,849 | ₱11,849 | ₱11,849 |
| Software cost | ₱4,099 | ₱4,099 | ₱4,099 | ₱4,099 |
| Total cost | ₱15,948 | ₱15,948 | ₱15,948 | ₱15,948 |

**Table 13: Identification of Cost**

**Technical Feasibility**

This study shows that the main technical feature both hardware and software requirements of the proposed system. For the hardware requirements of the proposed system entitled “Virtual Classroom System of Graduate School, Columban College, Olongapo City” with the following requirements. The Hard disk has a minimum requirement of 80GB and recommended by 1200GB above that stores and provides relatively quick access to large amounts of data and information about the students and professor. The processor that a least requirement of 1.8GHz and recommended by 2.13 GHz. The RAM (Ramdom Access Memory) that required 4GB to 8GB that allows information to be stored and retrieved on a computer. The Screen Resolution requires 1024 x 768 to 1250 x 800 that the student and professor will be more comfortable while using the system. Four (4) ports are the minimum and recommended requirements of a router that allows to forwards data packets to the computer networks will be used for the connection of the computer devices to access the system and to send and receive data from the system. LCD monitor, Mouse and keyboard to complete the hardware requirements that will use the student and professor to navigate the system. Computer devices with at least has an operating system of Windows 7 and other higher version of the operating system such as Windows 8 and Windows 8.1. For the software requirements the user must have an operating system of Windows 8.1 or Windows 10 not least than a Windows 7 version for user-friendly to the student and the professor. The system can be accessed using web browser Chrome and Safari to be exact. And for the development of the system, PHP, JavaScript, WebRTC, JQuery and Ajax are used to build the function of the system. The Web development tool are used to build the front-end and the back-end of the system are Atom and Sublime. MySQL and Xampp is used to build the database of the system. These software requirements, are all available in the market and some application can be downloadable over the web. This diagram shows the minimum requirements of software and hardware.

|  |  |  |
| --- | --- | --- |
| **Hardware** | **Minimum Requirements** | **Recommended** |
| Hard Disk (HDD) | 80GB | 120GB or above |
| Processor | 1.8 Ghz. | 2.13 Ghz or above |
| RAM | 4GB | 8GB |
| Screen Resolution | 1024 x 768 | 1250 x 800 |
| Router | With 4 ports | With 4 ports |
| LCD Monitor | 15” | 16” |
| Mouse | Ordinary mouse | Ordinary mouse |
| Keyboard | Ordinary Keyboard | Ordinary Keyboard |

**Table 14: Hardware Specification**

|  |  |  |
| --- | --- | --- |
|  | **Minimum Requirements** | **Recomended** |
| **Operating System** | Windows 7 | Windows 8.1 |
| Windows 8 | Windows 10 |
| **Browser** | Internet Explorer 5.5 | Internet Explorer 8.1 or Higher version |
| Mozila Firefox 10 | Mozila Firefox Current Version |
| Google Chrome Version 24.0.1312.52 | Google Chrome Current version |
| **Development Language** | PHP, JavaScript, WebRTC, JQuery, Ajax | |
| **Web Development Tool** | Atom, Sublime | |
| **DataBase** | Xampp, MYSQL | |

**Table 15: Software specification**

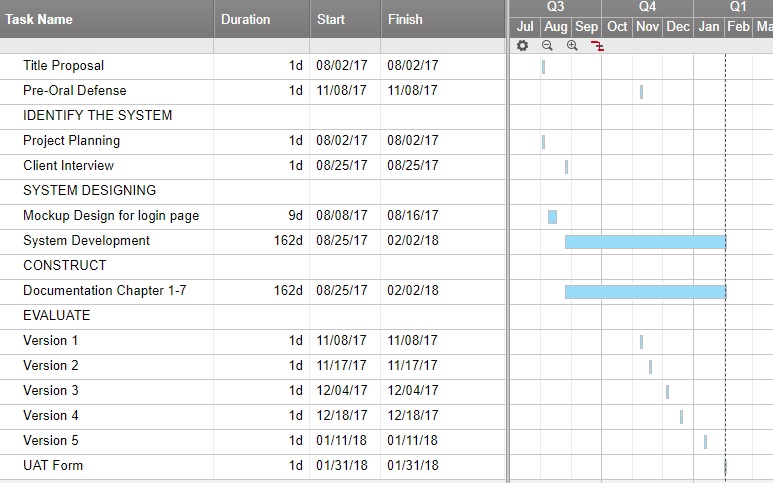
**Operational Feasibility**

Operational feasibility is the ability to utilize, support and perform the necessary tasks of a system. The organization supports the operation of the system “Virtual Classroom System of Graduate School Columban College, Olongapo City”. The proposed system required a professor to facilitate the entire online discussion, for the use of this system the professors can save time to discuss the lesson. The organization can adapt the system easily because of the user friendly environment of the system and it can be accessible through the use of a computer that as of now is being used by the intended users. The proposed system provides the benefit of consistency and continuity of content among multiple sessions of the same course, the preparation of an online class requires detailed planning and more preparation time on the part of faculty compared to a traditional course. Course documents and content must be frequently reviewed and updated. The proposed system can help the professors and students to lessen the cost of needed materials for their study. In terms of security, the proposed system allows both online and campus based student access to course materials through the use of password protected sites. By the used of the technology, it will increase the benefits of the Virtual Classroom System over the process of Traditional Classroom. The proposed system has reliable services in terms of learning because the users can able to access the system on and off campus. In simple terms, it allows professors to conduct online class sessions anytime and anywhere by bringing the engaging level of a face-to-face learning experience to the Internet. It also provides a self-paced learning option for students to study on their own interest, progress, pace and time schedule. The Columban College Graduate School professors can use the system to conduct online discussions. The education and skills of students of the organization will increase because they are engaging in a new process of teaching through the use of technology. Through the technology, the organization already has the hardware needed in the implementation of the system such as router and personal computer. Some of the students of the Graduate School Columban College have their own personal devices such as desktop at home, tablet and laptop to use to access the system.

**Scheduling Feasibility**

Developing system is not easy with the researchers/developers since it requires too much time from the proposal of the system, Data gathering, Identify, System Designing, Construct and System Evaluate. The development of the system is not easy with the researcher and developers through proposing of the system, system planning and data gathering it requires too much time that will fit in their schedule. The Gantt chart shows the start and finish of every task of the system entitled “Virtual Classroom System of Graduate School Columban College, Olongapo City.” The proponents began last August 2, 2017 in order to make the title proposal that took 1 day to the proponents to finish and proposed it which is ended the same date. To identify the proposed system the researcher conducted interview last August 25, 2017 to gather information about the organization of the proposed system. August 8, 2017 - August 18, 2017 the proponents started the design for the proposed system and do the mockup design for login page. The System Development started last August 8, 2017 until February 02, 2018. While planning and developing the mock up design the proponents started to analyze and work for the Chapter 1 last August 8, 2017 until August 24, 2017 to finish the documentation. Under the construction the researcher still doing the revision of Chapter 1 and 2 documentation and searching for the possible related studies and literature of the proposed system, it takes 11 days to finish the research and revision of the document. The proponents still gathering data in the organization and searching information about the virtual classroom and also include the Chapter 3 for the last checking of the documentation. It tooks 6 days started November 2, 2017 the proponents preparing and studying the proposed system until November 8, 2017 the day of the pre-oral defense and get the possible recommendation as a version 1 of the system. The researcher started to do the requirement analysis and specification of the proposed system which is the Chapter 4 and 5, the proponents accomplish the documentations it is started November 16, 2017 until December 15, 2017. Under the evaluation of the system, while accomplishing the chapter 4 and chapter 5 documentation the proponents went to their mentor’s last November 18, 2017 and December 15, 2017 to show the version 2 and 3 of the system and asked the possible recommendation of the proposed system. The process of the revision of the documentation and versions is still on going. In gathering the data we gather all the problems that deal with the proposed system that the organization will do by the survey questionnaires, the respondents will be asked about their opinions and probable solutions of the existing system it started last November 19, 2017. The proponets still working on the documentation chapter 4 to 7 started of the month of January and versioning of the system last December 4, 2017 until January 11, 2018. Also the proponets show the system to the Graduate School Students last January 31, 2018 and gave form as a User Acceptance of the system. In Analysis, the proponents analyze what should be the existing of the proposed. In terms of system designing, the proponents focus on the design to make it presentable to the users. In developing the system will provide the feature and the functioning of the proposed system.

**Gantt Chart**

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Gantt Chart of Virtual Classroom System of Graduate School Columban College, Olongapo City

**CHAPTER V**

**PRESENTATION, ANALYSIS AND INTERPRETATION OF DATA**

This chapter presents the data gathered and collated in this study. The data were carefully analyzed and interpreted.

**1. Profile**

The following tables present the results of the survey conducted on the profile of the respondents. The profile included the following: (1) Gender, (2) Civil Status, (3) Age.

* 1. **Gender**

Table 2 shows how the respondents’ gender was distributed. The data reveals that fifty three or 72.6% were female, while twenty or 27.4 % were male. The figures show that there were more female respondents than the male.

These figures only reveal that the majority of the students of Columban College Graduate School were female.

**Table 2**

**Distribution of Respondents by Gender**

|  |  |  |
| --- | --- | --- |
| **Gender** | **F** | **%** |
| **Male** | **20** | **27.4** |
| **Female** | **53** | **72.6** |
| **Total** | **73** | **100.0** |

**1.2 Civil Status**

Table 3 displays the distribution of respondents’ by Civil Status. The data reveals that forty three or 58.9 % were single; thirty or 41.1% were married.

These figures only reveal that the majority of the respondents fell under the civil status were single.

**Table 3**

**Distribution of Respondents by Civil Status**

|  |  |  |
| --- | --- | --- |
| **Civil Status** | **F** | **%** |
| **Single** | **43** | **58.9** |
| **Married** | **30** | **41.1** |
| **Widow** | **0** | **0** |
| **Separated** | **0** | **0** |
| **Total** | **73** | **100.0** |

**1.3 Age**

Table 4 defines the distribution of the respondents according to age.

The figure tells that forty two or 57.5% of the respondents fell under the 21-30 age bracket; sixteen or 21.9% of the respondents fell under the age bracket 41-50; eight or 11.0% of the respondents fell under the age bracket 31-40.

These figures only reveal that the majority of the respondents were between the 21-30 age bracket.

**Table 4**

**Distribution of Respondents by Age**

|  |  |  |
| --- | --- | --- |
| **Civil Status** | **F** | **%** |
| **21-30** | **42** | **57.5** |
| **31-40** | **8** | **11.0** |
| **41-50** | **16** | **21.9** |
| **50-above** | **7** | **9.6** |
| **Total** | **73** | **100.0** |

2**. Technology Approach**

The following tables present the results of the survey conducted on the technology approach of the respondents. The technology approach included the following: (1) Technology Comfortable to Use, (2) Technology to be used inside the classroom, (3) Technology Interested to be Used.

**2.1** Technology Comfortable to Use

Table 5 shows the computation of the technology comfortable to use by the respondents in online learning, the weighted mean was 4.26 for Use of Computer, 4.01 for Discussion Boards, 3.94 for Chat Room and Online Tutorial Learning.

These figures only reveal that the majority of the respondents were fairly comfortable to use the computer.

**Table 5**

**Weighted Mean and Descriptive Interpretation**

**of Technology Comfortable to Use**

|  |  |  |
| --- | --- | --- |
| **Technology Comfortable to Use** | **W x** | **Descriptive Interpretation** |
| **Discussion Boards** | **4.01** | **Fairly Comfortable** |
| **Chat Room** | **3.94** | **Comfortable** |
| **Video Conferencing** | **3.90** | **Comfortable** |
| **Virtual Reality** | **3.94** | **Comfortable** |
| **Use of Computer** | **4.26** | **Fairly Comfortable** |
| **Online Tutorial Learning** | **3.66** | **Comfortable** |
| **General Mean** | **3.95** | **Comfortable** |

**2.2** Technology to be used inside the classroom

Table 6 depicts the computation of Class Routine by the respondents. The weighted mean was 4.44 for Classmates and Instructor Communication, 4.31 for Flexible Learning Schedule, 4.29 for the Individual Learning Environment.

These figures only reveal that the majority of the respondents were fairly comfortable to communicate with their Classmates and Instructors.

**Table 6**

**Weighted Mean and Descriptive Interpretation**

**of Class Routine**

|  |  |  |
| --- | --- | --- |
| **Class Routine** | **W x** | **Descriptive Interpretation** |
| **Curriculum and Contents** | **4.17** | **Fairly Comfortable** |
| **Reading Materials** | **4.08** | **Fairly Comfortable** |
| **Project Activity** | **3.90** | **Comfortable** |
| **Classmates and Instructor Communication** | **4.44** | **Fairly Comfortable** |
| **Feedback from the Instructor** | **4.24** | **Fairly Comfortable** |
| **Flexible Learning Schedule** | **4.31** | **Fairly Comfortable** |
| **Individual Learning Environment** | **4.29** | **Fairly Comfortable** |
| **General Mean** | **4.20** | **Fairly Comfortable** |

**2.3** Technology Interested to be Used

Table 7 expresses the computation of the online services used by the respondents. The weighted mean was 4.25 for Uploading Activities, 4.19 for Lecture Capture, 4.06 for Online Submission Activities.

These figures only reveal that the majority of the respondents were fairly comfortable to use the uploading activities in the virtual classroom system.

**Table 7**

**Weighted Mean and Descriptive Interpretation**

**of Online Services**

|  |  |  |
| --- | --- | --- |
| **Online Services** | **W x** | **Descriptive Interpretation** |
| **Lecture Capture** | **4.19** | **Fairly Comfortable** |
| **Online Live Discussions** | **3.87** | **Comfortable** |
| **E-mail to, from, between students** | **4.01** | **Fairly Comfortable** |
| **Uploading Activities** | **4.25** | **Fairly Comfortable** |
| **Online Submission Activities** | **4.06** | **Fairly Comfortable** |
| **General Mean** | **4.07** | **Fairly Comfortable** |

3**. Problems Encountered**

The following tables present the results of the survey conducted on the problems encountered by the respondents. The problems encountered included the following: (1) Home Technology Services, (2) Student’s Skills towards Computers, (3) Classroom Problems towards Technology, (4) Support Instructor’s Online Distatnce Courses.

**3.1** Home Technology Services

Table 8 illustrates the computation of the technology more interested to be used by the respondents. The weighted mean was 3.21 for Lack of Internet Connection, 3.05 for Lack of Devices.

These figures only reveal that the majority of the respondents disagree in lack of Internet Connection at home.

**Table 8**

**Weighted Mean and Descriptive Interpretation**

**of the Problems Encountered in Home Technology Services**

|  |  |  |
| --- | --- | --- |
| **Home Technology Services** | **W x** | **Descriptive Interpretation** |
| **Lack of Devices** | **3.05** | **Disagree** |
| **Lack of Internet Connection** | **3.21** | **Disagree** |
| **General Mean** | **4.65** | **Agree** |

**3.2** Student’s Skills towards Computers

Table 9 specifies the computation of the technology more interested to be used by the respondents. The weighted mean was 2.89 Lack of Self-Motivation, 2.86 for Lack of Computer Literacy, 2.84 for Lack Time in Learning.

These figures only reveal that the majority of the respondents strongly disagree in lack of self-motivation towards computers.

**Table 9**

**Weighted Mean and Descriptive Interpretation**

**of the Problems Encountered in Student’s Skills towards Computers**

|  |  |  |
| --- | --- | --- |
| **Student’s Skills towards Computers** | **W x** | **Descriptive Interpretation** |
| **Lack of Computer Literacy** | **2.86** | **Strongly Disagree** |
| **Lack of Self-Motivation** | **2.89** | **Strongly Disagree** |
| **Lack of Time in Learning** | **2.84** | **Strongly Disagree** |
| **Lack of Computer Experience** | **2.80** | **Strongly Disagree** |
| **General Mean** | **2.84** | **Strongly Disagree** |

**3.3** Classroom Problems towards Technology

Table 10 traces the computation of the technology more interested to be used by the respondents. The weighted mean was 3.27 for Lack of Internet and WiFi Connection in Classroom, 3.12 for Shortage of Computer Systems for Students, 3.10 for Smartphones and tablets distract class sessions.

These figures only reveal that the majority of the respondents disagree in lack of Internet and WiFi Connection in classroom problems towards technology.

**Table 10**

**Weighted Mean and Descriptive Interpretation**

**of the Problems Encountered in Classroom Problems towards Technology**

|  |  |  |
| --- | --- | --- |
| **Classroom Problems towards Technology** | **W x** | **Descriptive Interpretation** |
| **Smartphones and tablets distract class sessions** | **3.10** | **Disagree** |
| **Lack of Internet and WiFi Connection in Classroom** | **3.27** | **Disagree** |
| **Shortage of Computer Systems for Students** | **3.12** | **Disagree** |
| **General Mean** | **3.16** | **Disagree** |

**3.3** Support Instructor’s Online Distatnce Courses

Table 11 tells the computation of the technology more interested to be used by the respondents. The weighted mean was 3.17 for Instructors’ lack of knowledge about how to design courses utilizing technology to promote learning, 3.13 for Unreliable Technology, 3.08 for Inconsistent Technology.

These figures only reveal that the majority of the respondents disagree in Instructors’ lack of knowledge about how to design courses utilizing technology to promote learning.

**Table 11**

**Weighted Mean and Descriptive Interpretation**

**of the Problems Encountered in Support Instructor’s Online Distatnce Courses**

|  |  |  |
| --- | --- | --- |
| **Support Instructor’s Online Distatnce Courses** | **W x** | **Descriptive Interpretation** |
| **Faculty’s lack of knowledge about technology** | **3.04** | **Disagree** |
| **Faculty’s lack of confidence to use technology in teaching environment** | **3.01** | **Disagree** |
| **Inconsistent Technology: platforms, tool, software vary** | **3.08** | **Disagree** |
| **Unreliable Technology: Network /software crashes during teaching session** | **3.13** | **Disagree** |
| **Keeping up with instructors’ demand to learn emerging/cutting edge technology** | **2.94** | **Strongly Disagree** |
| **Instructors’ lack of knowledge about how to design courses utilizing technology to promote learning** | **3.17** | **Disagree** |
| **General Mean** | **3.06** | **Disagree** |

4**. Suggestions/Recommendations**

**Table 12**

**Distribution of Respondents by Recommendations**

|  |  |  |
| --- | --- | --- |
| **Recommendations** | **F** | **%** |
| **Digital whiteboard for discussion** | **34** | **46.6** |
| **Invest more computer systems for Students** | **38** | **52.1** |
| **Training for Students that lack in computer literacy** | **29** | **39.7** |
| **Document sharing** | **33** | **45.2** |
| **Chat Box** | **29** | **39.7** |
| **Annotation** | **15** | **20.5** |
| **Hand Raise and Status Change** | **11** | **15.1** |
| **Breakout Groups** | **13** | **17.8** |
| **Screen Sharing** | **14** | **19.2** |

**CHAPTER VI**

**IMPLEMENTATION, TESTING AND DEPLOYMENT**

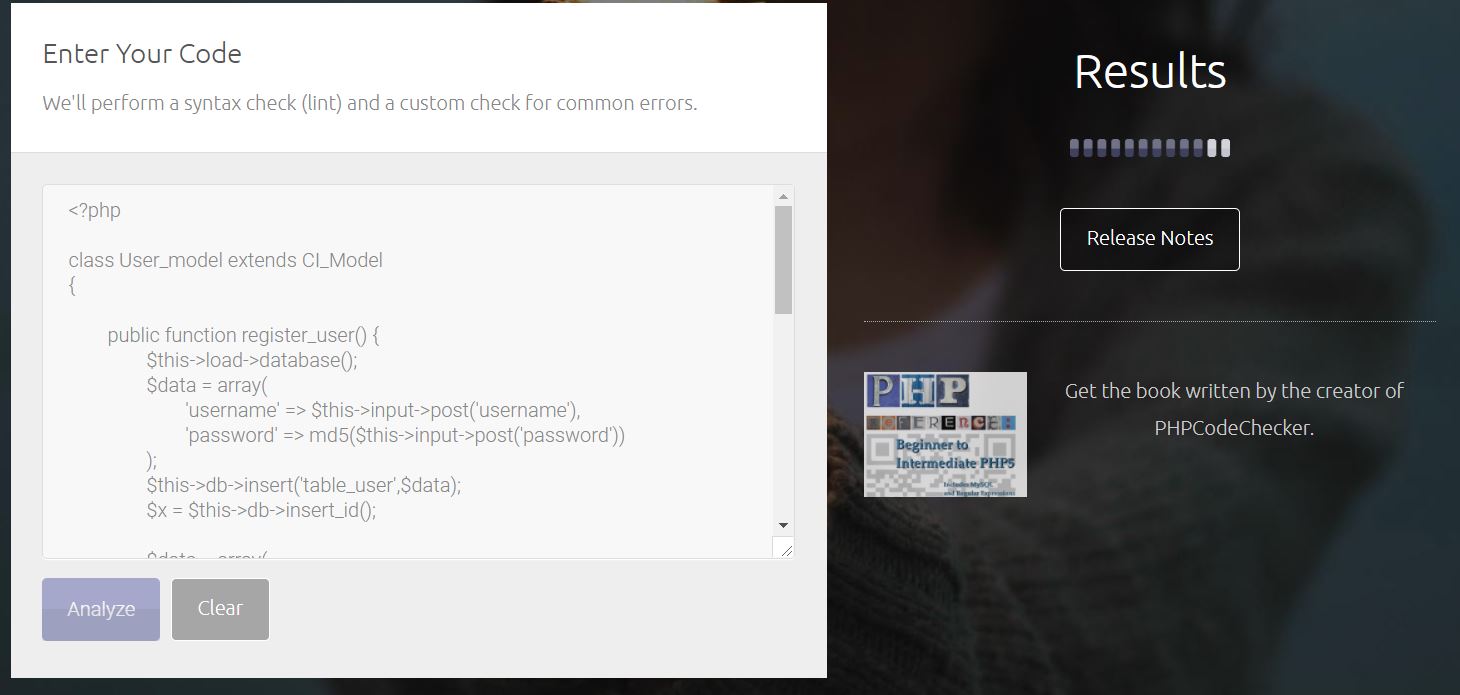
1. **Testing**

**A.1 Unit Testing**

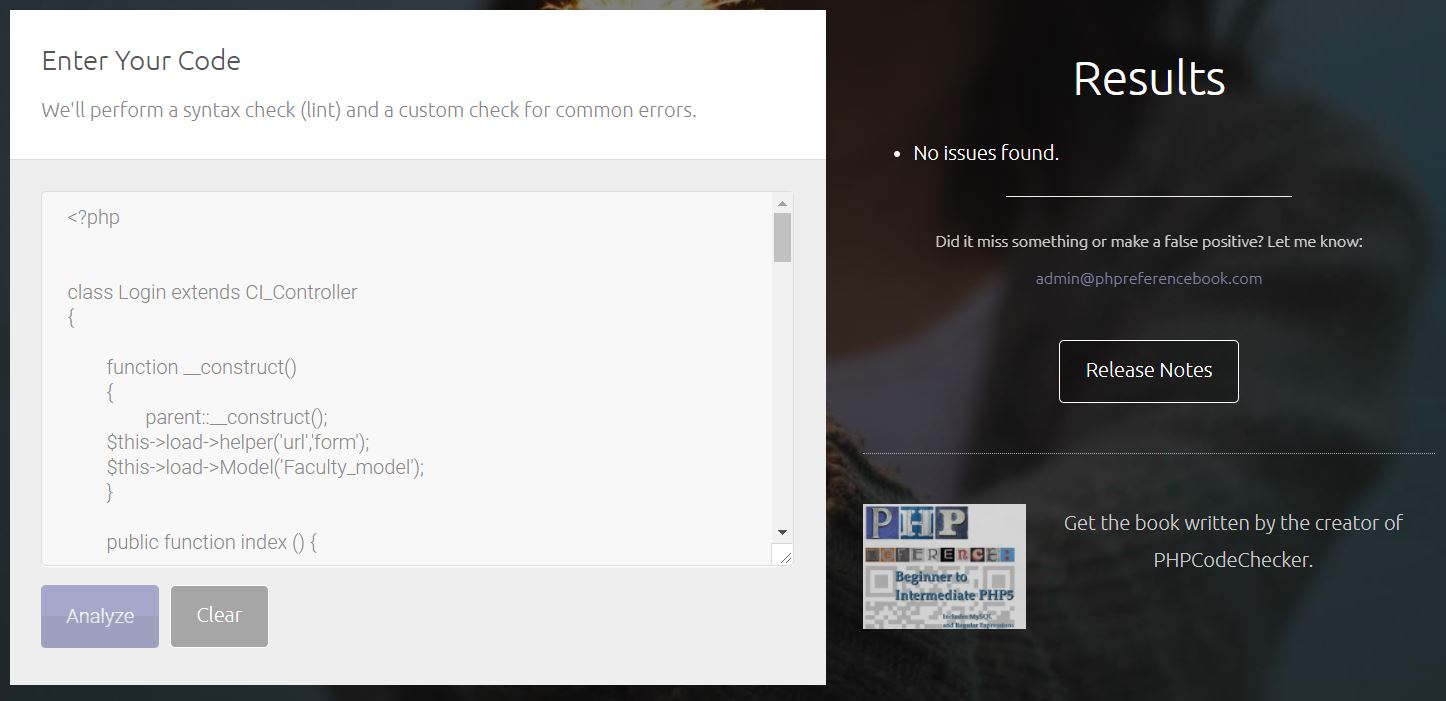
Solove (2014) stated that “Unit testing is a component of [test-driven development (TDD)](http://searchsoftwarequality.techtarget.com/definition/test-driven-development), a pragmatic methodology that takes a meticulous approach to building a product by means of continual testing and revision. Test-driven development requires that developers first write failed unit tests. Then they write code and refactor the application until the test passes. TDD typically results in an explicit and predictable code base. Unit testing involves only those characteristics that are vital to the performance of the unit under test. This encourages developers to modify the [source code](http://searchsoa.techtarget.com/definition/source-code) without immediate concerns about how such changes might affect the functioning of other units or the program as a whole. Once all of the units in a program have been found to be working in the most efficient and error-free manner possible, larger components of the program can be evaluated by means of [integration testing](http://searchsoftwarequality.techtarget.com/definition/integration-testing).”

The unit testing was conducted by the proponents to test the behavior of the code according to the use cases identified in the USE CASE Diagram. The proponents have used as testing tool the PHP Code Checker Version 2.83. It is a free testing tool that is designed to be very fast, simple and powerful. This testing tool provides checking the source code focusing on mistakes that wouldn’t already be found, ensuring the tool would add value for everyone.

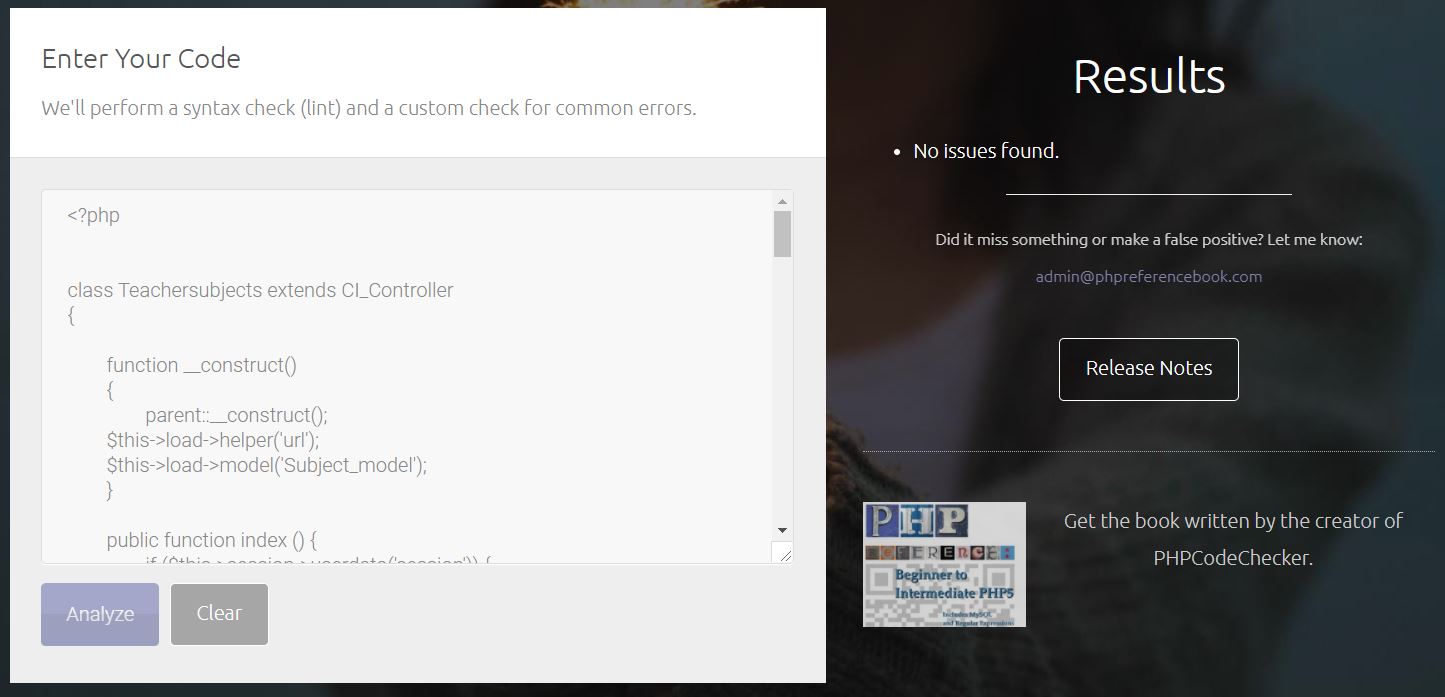
**A.1.1 Unit Testing Using Software Tool**

****

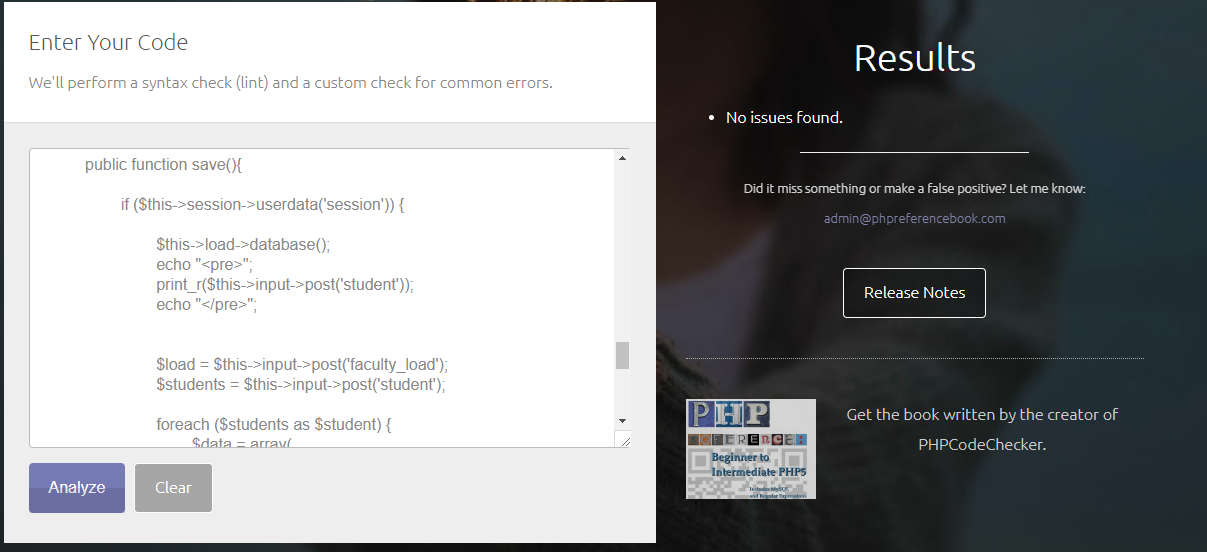
**Figure 3: Register Account**

****

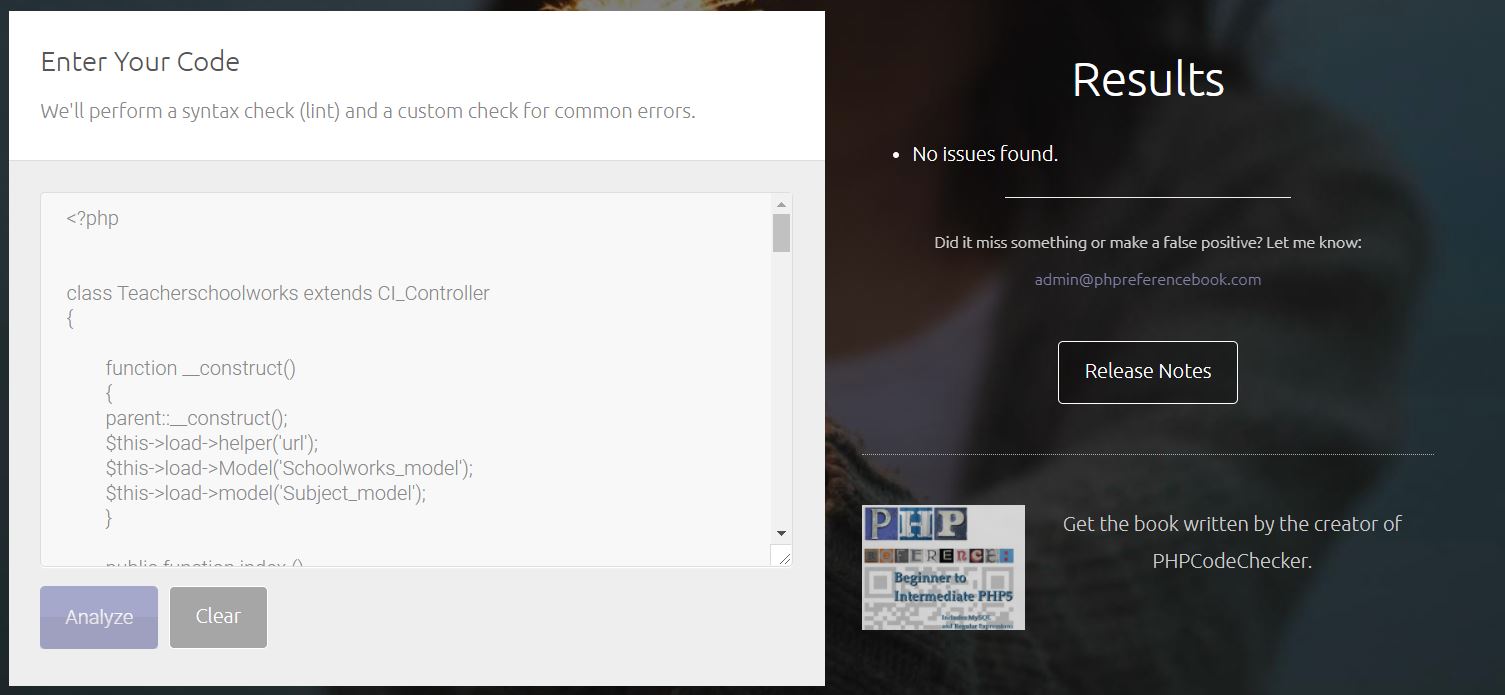
**Figure 4: Login Account**

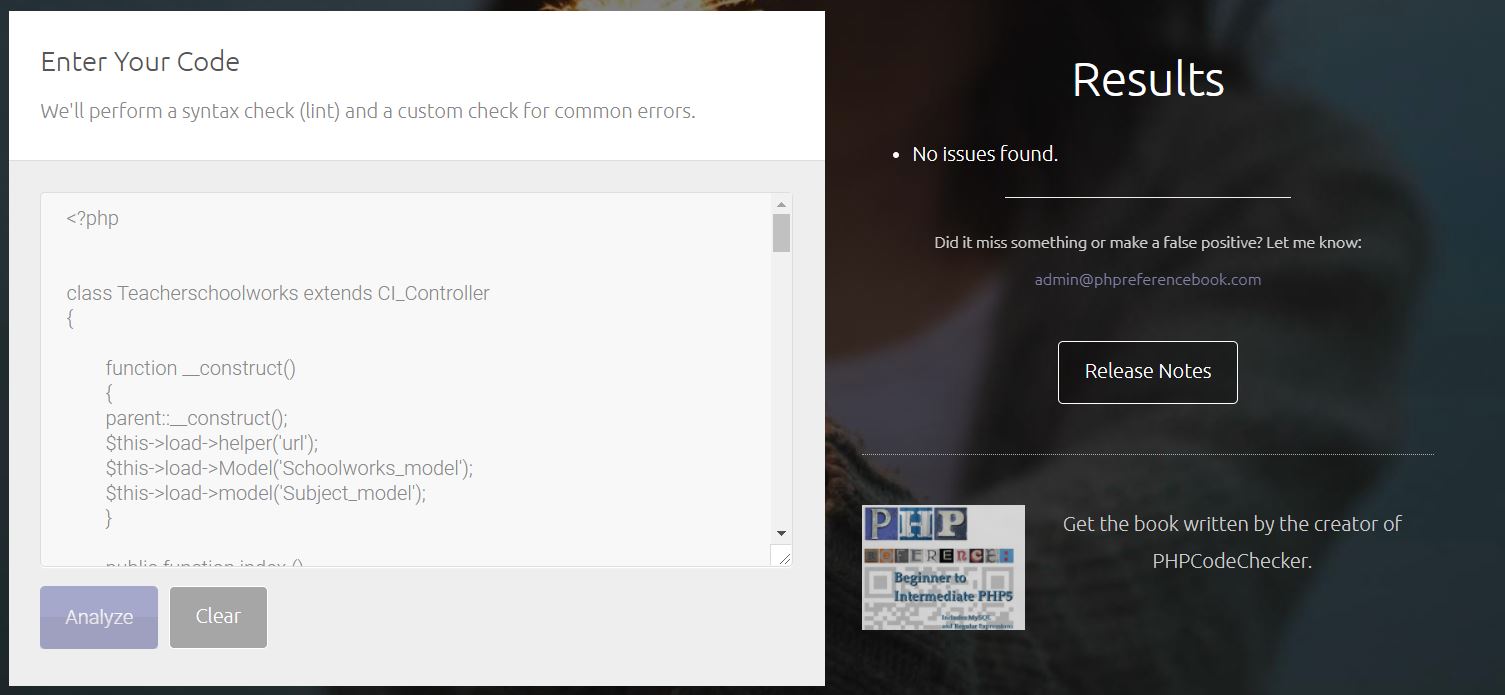
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**Figure 5: Register Subject**

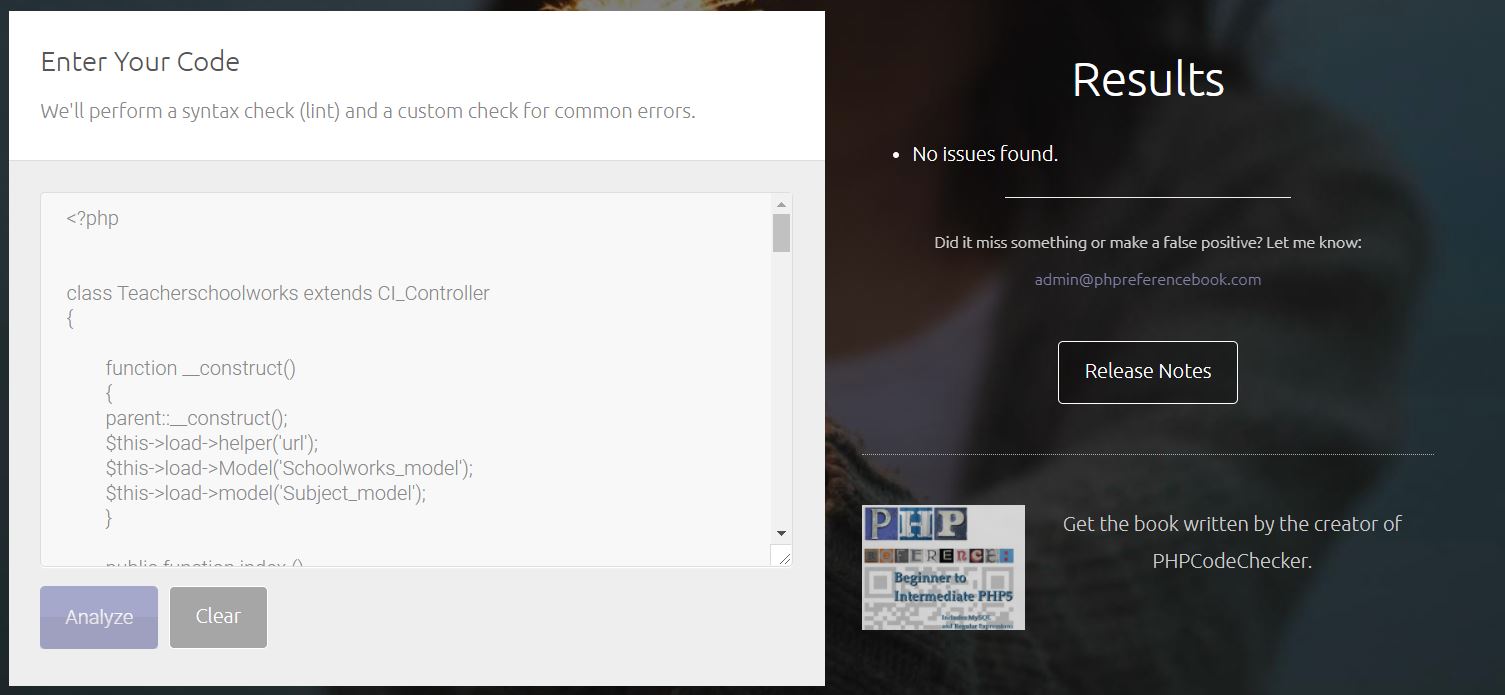
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**Figure 6: Add Students**

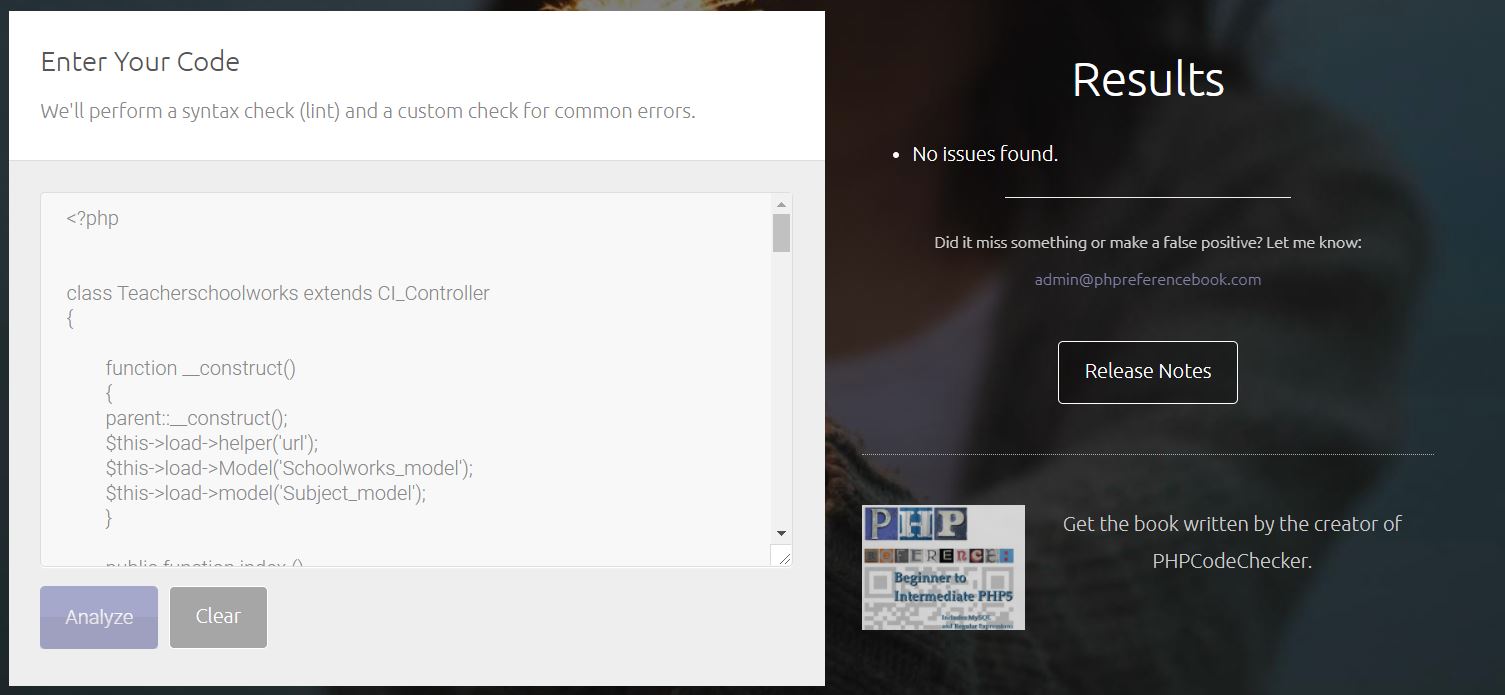
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**Figure 7: Post School Requirements**

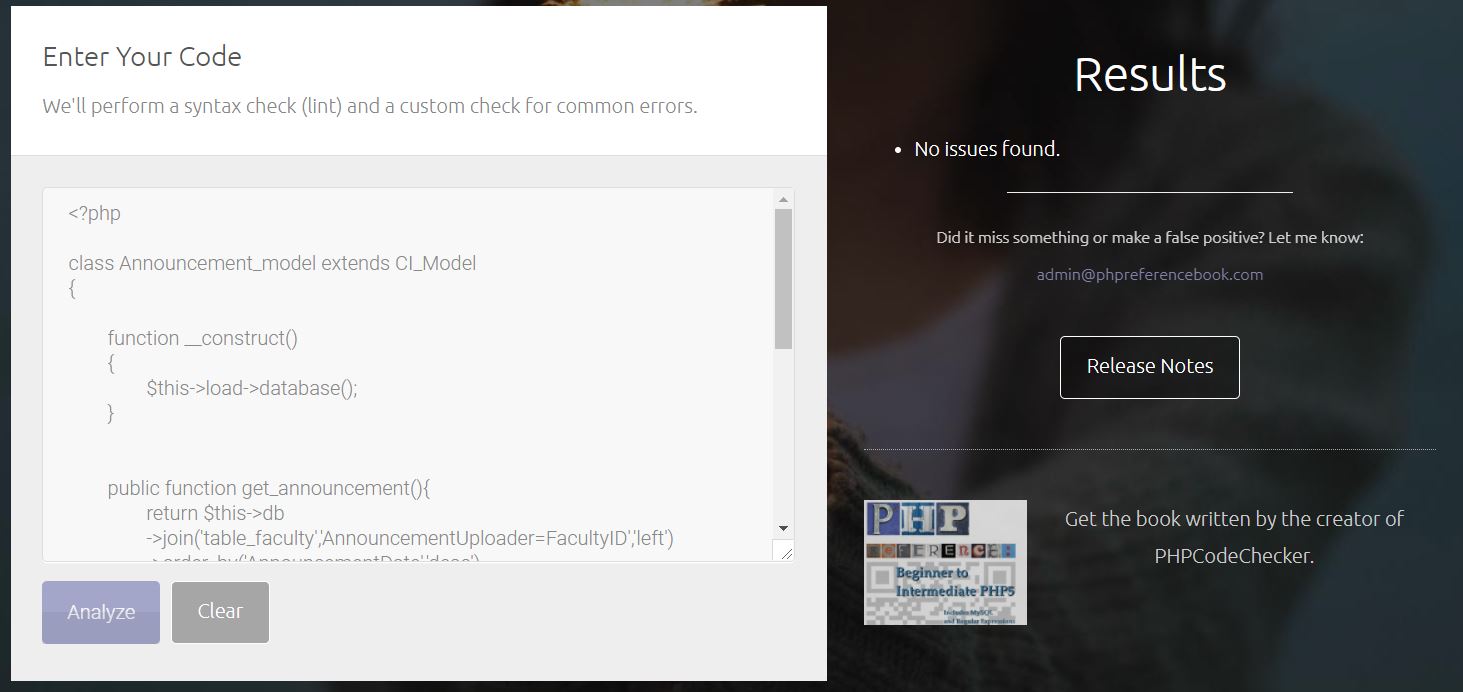
**Figure 8:View Uploaded School Requirements**

****

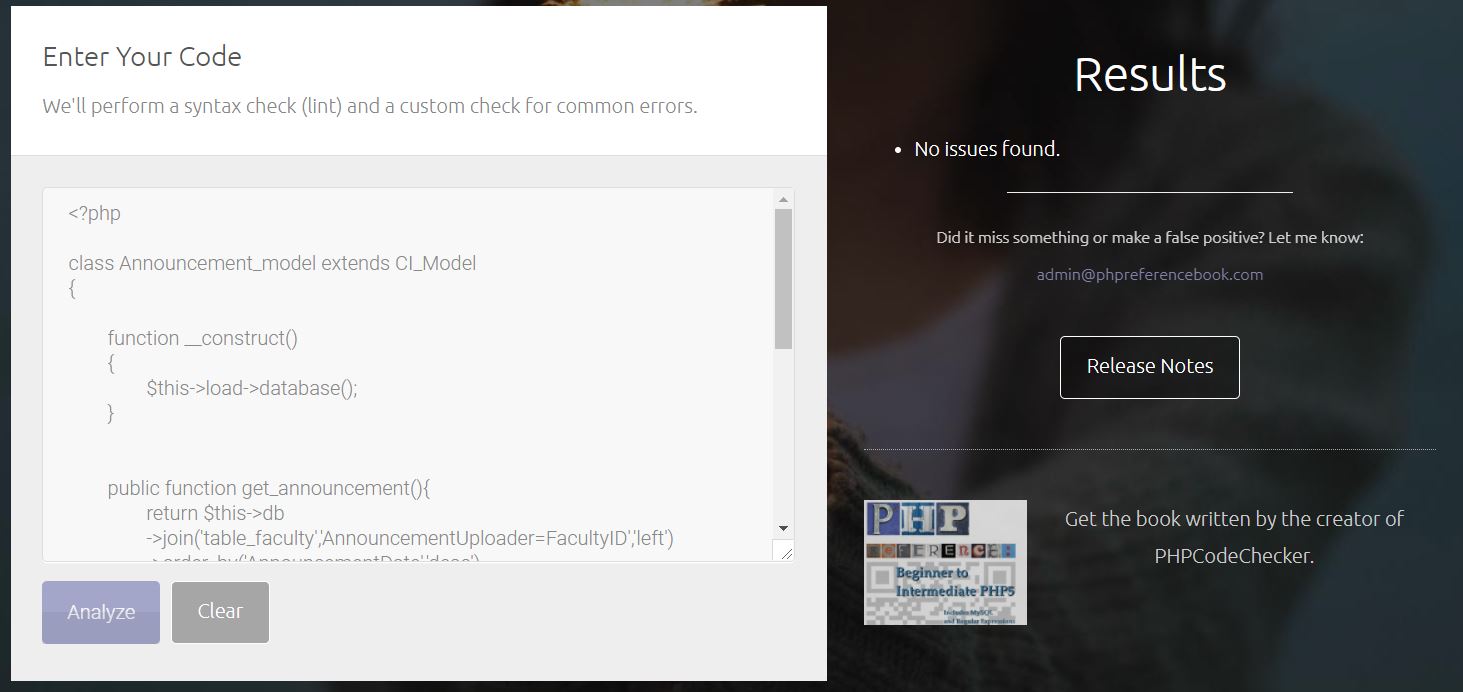
**Figure 9: Upload Answered School Requirements**

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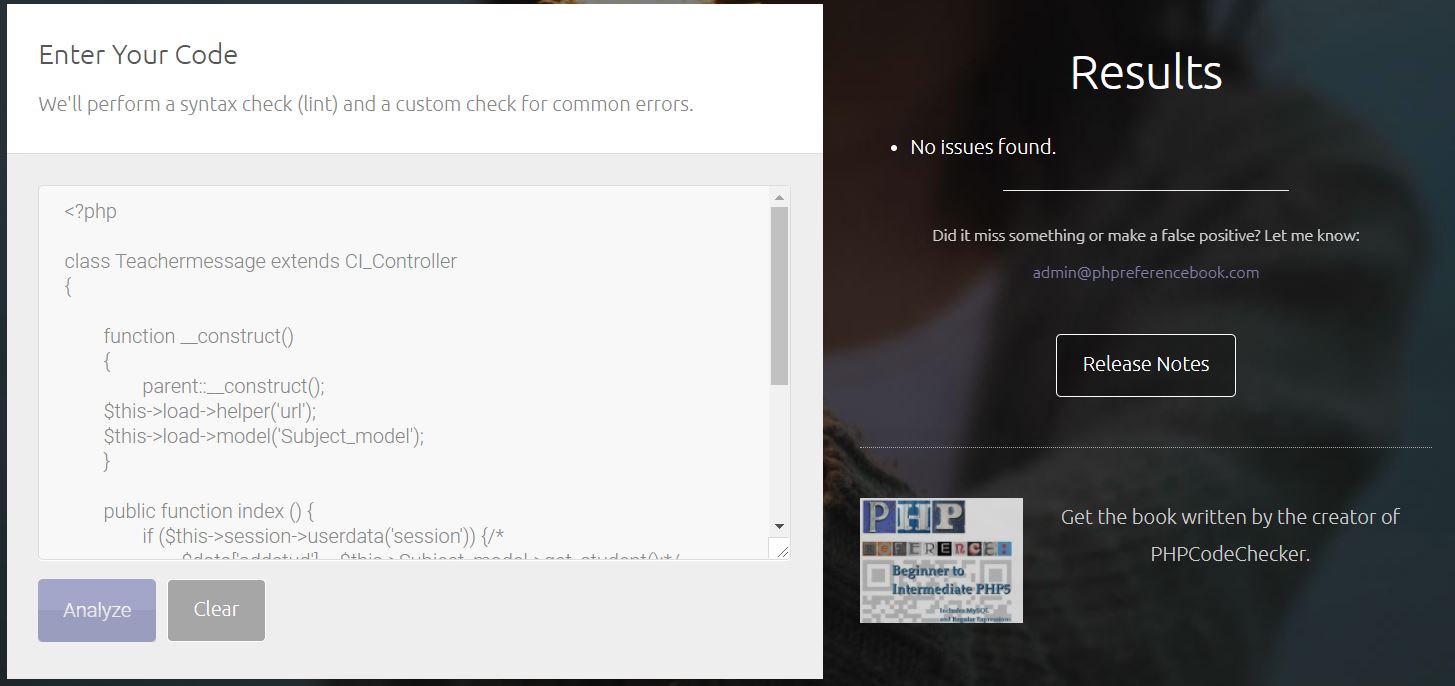
**Figure 10: Check Answered School Requirements**

****

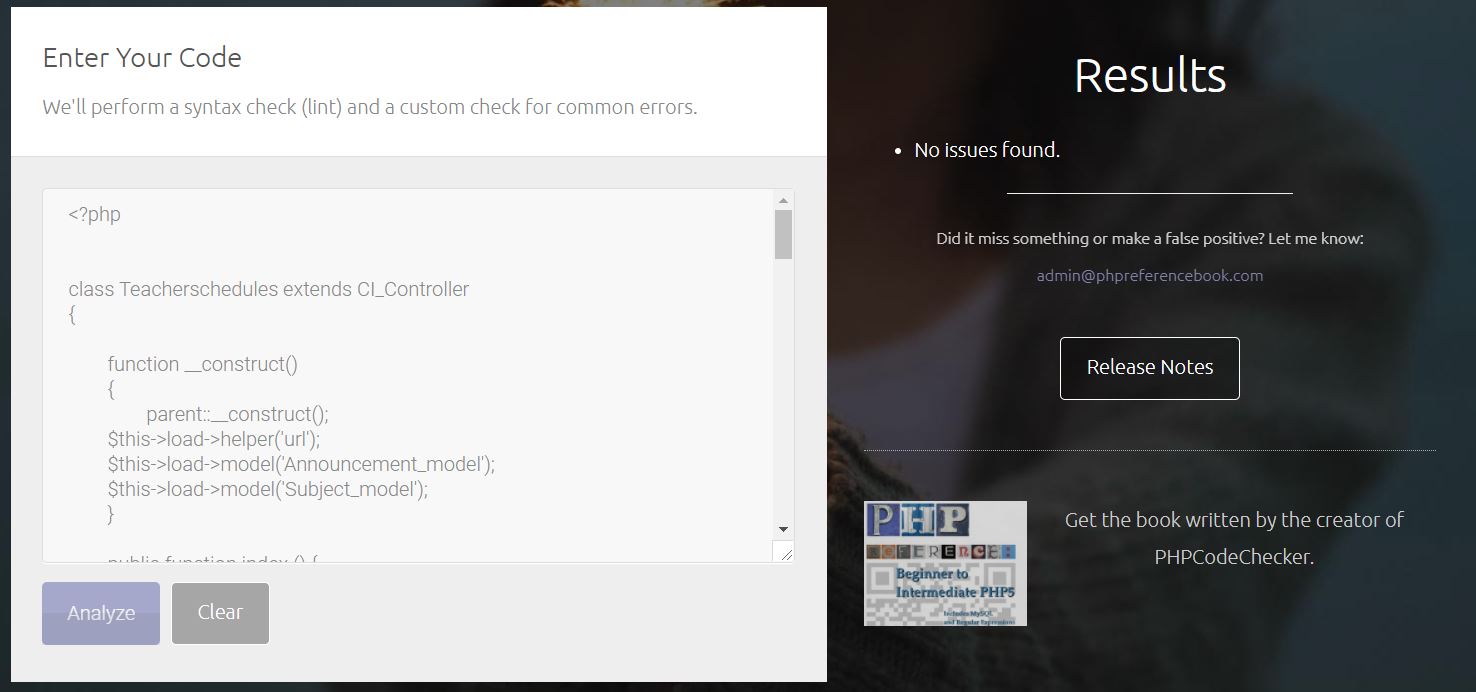
**Figure 11: Post Announcements**

****

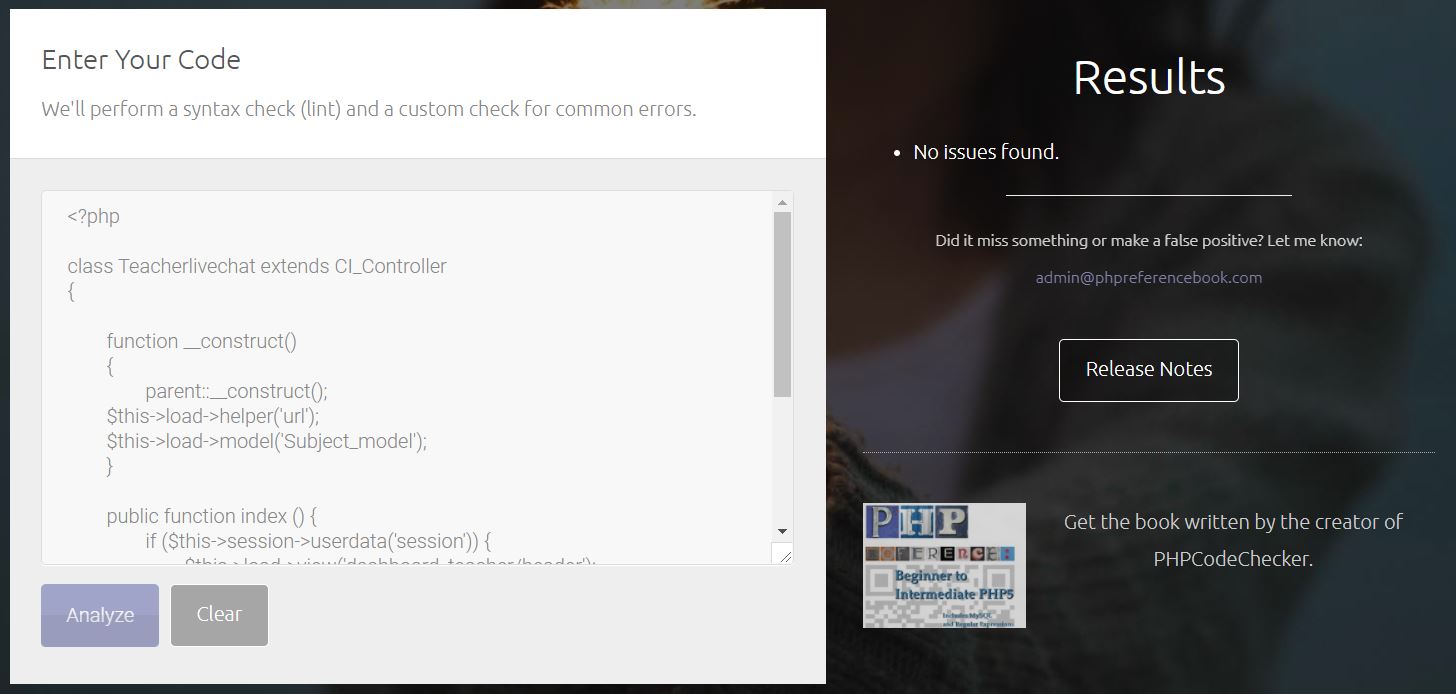
**Figure 12: View Announcements**

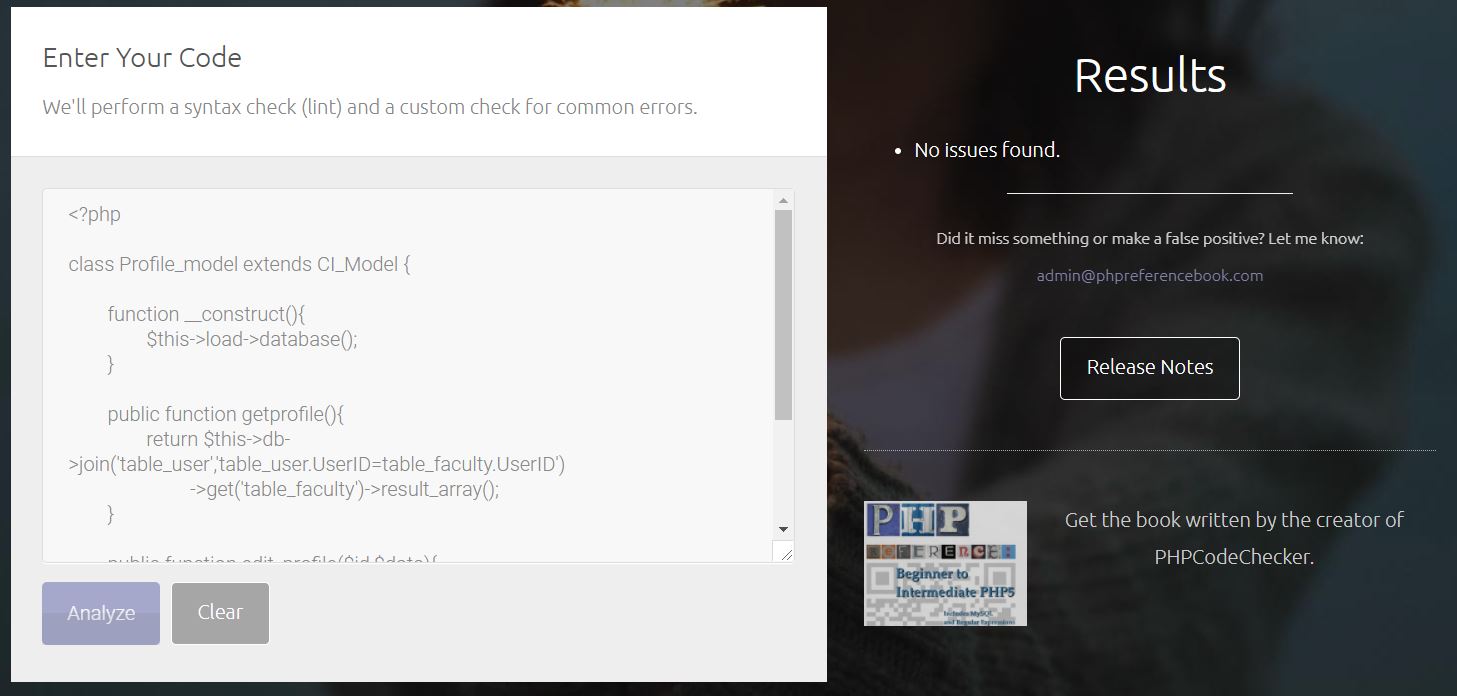
****

**Figure 13: Send Message**

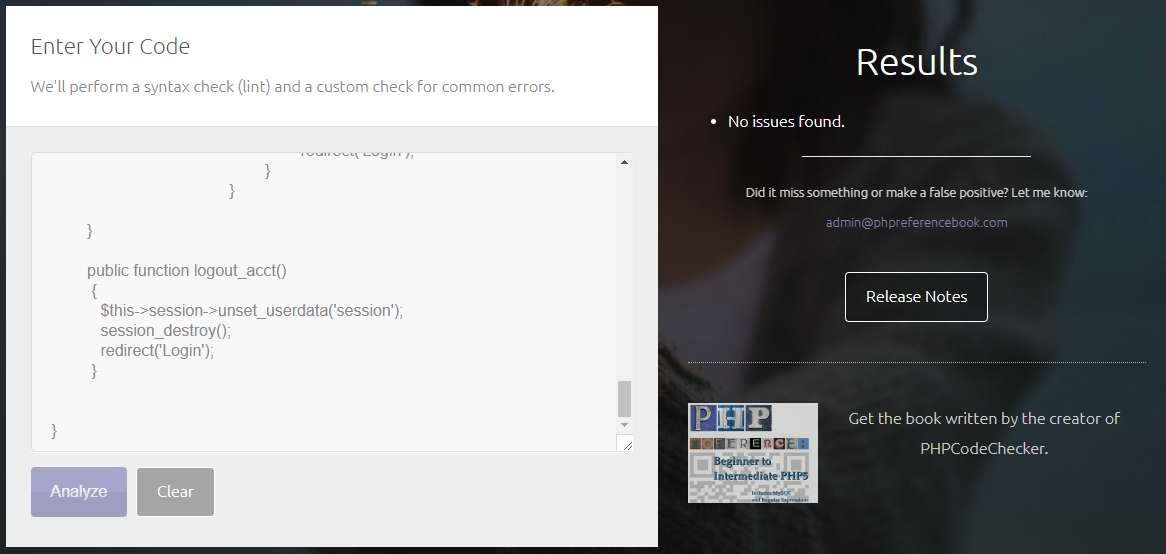
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**Figure 14: Set schedule for live chat session**

**Figure 15: Join Video Conference**

****

**Figure 16: Update Account Information**

**Figure 17: Logout Account**

**A.2 Integration Testing**

According to Hoven (2013) “Integration testing, also known as integration and testing (I&T), is a [software](http://searchsoa.techtarget.com/definition/software) development process which program units are combined and tested as groups in multiple ways. In this context, a unit is defined as the smallest testable part of an [application](http://searchsoftwarequality.techtarget.com/definition/application). Integration testing can expose problems with the [interface](http://searchcio-midmarket.techtarget.com/definition/interface)s between program components before trouble occurs in real-world program execution. Integration testing is a component of [Extreme Programming](http://searchsoftwarequality.techtarget.com/definition/Extreme-Programming) (XP), a pragmatic method of software development that takes a meticulous approach to building a product by means of continual testing and revision.”

The integration testing was conducted by the proponents to verify that all of the components of the system are properly developed according to the use cases identified in the USE CASE Diagram. The proponents have used as testing tool the PHP Code Checker as a testing tool in which it is a free testing tool provides checking the source code focusing on mistakes that wouldn’t already be found.

**A.2.1 Integration Testing Form**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Unit Name** | Account Module | | | |
| **Tool Used** | PHP code checker v2.83 | | | |
| **Tested by** | Lester John Pulanco | | | |
| **Test case Id** | **Test case Description** | **Expected Result** | **Actual Result** | **Remarks** |
|  | Register Account | Can register in the system | Pass | No issue or bug found |
|  | Log In | Can login on the system | Pass | No issue or bug found |
|  | Update Account | Can update account information | Pass | No issue or bug found |
|  | Log out Account | Can log out account | Pass | No issue or bug found |

**Table 16: Account Module**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Unit Name** | Subject Module | | | |
| **Tool Used** | PHP code checker v2.83 | | | |
| **Tested by** | Lester John Pulanco | | | |
| **Test case Id** | **Test case Description** | **Expected Result** | **Actual Result** | **Remarks** |
|  | Register Subject | Can register subjects | Pass | No issue or bug found |
|  | Add student | Can add students on a subject | Pass | No issue or bug found |

**Table 17: Account Module**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Unit Name** | Requirements Module | | | |
| **Tool Used** | PHP code checker v2.83 | | | |
| **Tested by** | Lester John Pulanco | | | |
| **Test case Id** | **Test case Description** | **Expected Result** | **Actual Result** | **Remarks** |
|  | Post | Can post requirements in the system | Pass | No issue or bug found |
|  | View | Can view requirements in the system | Pass | No issue or bug found |
|  | Upload | Can upload requirements in the system | Pass | No issue or bug found |
|  | Download | Can download requirements | Pass | No issue or bug found |

**Table 18: Requirements Module**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Unit Name** | Announcements Module | | | |
| **Tool Used** | PHP code checker v2.83 | | | |
| **Tested by** | Morena Jessa Adona | | | |
| **Test case Id** | **Test case Description** | **Expected Result** | **Actual Result** | **Remarks** |
|  | Post | Can post announcements | Pass | No issue or bug found |
|  | View | Can view announcements | Pass | No issue or bug found |
|  | Edit | Can edit announcements | Pass | No issue or bug found |

**Table 19: Announcements Module**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Unit Name** | Message Module | | | |
| **Tool Used** | PHP code checker v2.83 | | | |
| **Tested by** | Ken Samuel Evangelista | | | |
| **Test case Id** | **Test case Description** | **Expected Result** | **Actual Result** | **Remarks** |
|  | Send | Can send message | Pass | No issue or bug found |
|  | View | Can view message | Pass | No issue or bug found |

**Table 20: Message Module**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Unit Name** | Live Chat Module | | | |
| **Tool Used** | PHP code checker v2.83 | | | |
| **Tested by** | Michael Retorca | | | |
| **Test case Id** | **Test case Description** | **Expected Result** | **Actual Result** | **Remarks** |
|  | Set Schedule | Can post multiple  requirements | Pass | No issue or bug found |
|  | Join video conference | Can Join Video Conference | Pass | No issue or bug found |

**Table 21: Live Chat Module**

**A.3 User Acceptance Testing**

Bynum (2015) defines “User acceptance testing (UAT) is the last phase of the software testing process. During UAT, actual software users test the software to make sure it can handle the required tasks in real-world scenarios, according to specifications. UAT is one of the final and critical software project procedures that must occur before newly developed software is rolled out to the market. User acceptance testing (UAT), otherwise known as Beta, Application, or End-User Testing, is often considered the last phase in the web development process, the one before final installation of the software on the client site, or final distribution of it.”

The proponents have conducted the User Acceptance Testing (UAT) in Columban College, Inc, Graduate School, respectively the professors and students of the graduate school. The User Acceptance Testing started from January 5, 2016 until January 12, 2017. After a week, 10 professors and students from the graduate school were randomly selected to fill out the User Acceptance Testing form. The following tables present the results of the User Acceptance Testing.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **FUNCTIONALITY** | YES | NO | N/A | TOTAL |
| 1. The system functions according to the intended purpose. | 10 | 0 | 0 | 10 |
| 2. The system can produce the expected outputs in a given period of time. | 10 | 0 | 0 | 10 |
| 3. The system is easy to use and operate. | 10 | 0 | 0 | 10 |
| 4. The system gives convenience to the users every time they use it. | 10 | 0 | 0 | 10 |

**Table 22: Functionality of System**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **RELIABILITY** | YES | NO | N/A | TOTAL |
| 1. The system can withstand the intended operation. (Continuous or intermittent) | 10 | 0 | 0 | 10 |
| 1. The system is reliable in terms of strength, capacity and performance. | 10 | 0 | 0 | 10 |
| 1. High degree of security can be obtained when using the system. | 8 | 2 | 0 | 10 |
| 1. There is consistency on outputs. | 10 | 0 | 0 | 10 |
| 1. The system can satisfy the needed outputs of the user. | 9 | 0 | 1 | 10 |

**Table 23: Reliability of System**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **EFFICIENCY** | YES | NO | N/A | TOTAL |
| 1. The system meets the user’s objectives and requirements. | 10 | 0 | 0 | 10 |
| 1. The system can be used to its maximum design and capacity. | 10 | 0 | 0 | 10 |
| 1. The system can respond to the needs of the end user. | 10 | 0 | 0 | 10 |
| 1. The system can contribute for the development of the same model of technology. | 10 | 0 | 0 | 10 |
| 1. The system can enhance individual’s learning. | 10 | 0 | 0 | 10 |

**Table 24: Efficiency of System**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **MAINTANABILITY** | YES | NO | N/A | TOTAL |
| 1. The system can operate accurately with minimum maintenance. | 9 | 0 | 1 | 10 |
| 1. The system can be adapted to any changes in its working condition. | 8 | 0 | 2 | 10 |
| 1. Troubleshooting/repair can be done easily by the user. | 7 | 0 | 3 | 10 |

**Table 25: Maintainability of System**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **PORTABILITY** | YES | NO | N/A | TOTAL |
| 1. The software is machine independent. | 9 | 0 | 1 | 10 |
| 1. It is transferable to any other medium. | 9 | 1 | 0 | 10 |
| 1. The system is easy to install. | 9 | 0 | 1 | 10 |

**Table 26: Portability of System**

1. **Deployment**

**B.1 User’s Training**

The use of Virtual Classroom must be introduced to the members of institution initial training and the training of potential user must be set. The users of the system should have an orientation and training about the proposed system. It is important to conduct training, to ensure that they are familiarizing to the overall function of the system, especially for the teachers since they are the ones that will use the whole system developed. The students and professors of the graduate school should also have an orientation about the use of the system and the requirements in the mobile application. This is to attempt the learning being acquired during initial test. A series of schedule must be provided for training and actual hands-on practice.

**B.2 System Maintenance**

A system administrator is expected to do the maintenance of the system. In order to maintain the system, the following should be done:

* To update software used in the system to know if there are any changes that needs to fix by the developers immediately.
* To ensure if the system is working correctly.
* An update that can be performed throughout using the system by the Users.

**B.3 Policies and Procedures**

This user guide was created to assist the intended user what policies and procedures to ensure the effective and efficient management of the system. It is simply a guide and as such neither prescribes nor recommends any particular policy or procedure and any specific authorities or responsibilities.

* In case of lost password, students can change their password if forgotten using password reset confirmation through their email.
* The system function can only be accessed based on the user privilege given to the child user by the parent user which is the professor. The professor has authorized to use all the privileges on the system.
* Only the professor that created the quiz has the right to update, delete or view.
* Students can also update, delete, or view their uploaded requirements.
* Only the teacher can manage activity/quizzes. Editing them or re-uploading ad different files again.
* Only the teacher can view all scores of students, the teacher is allowed to print the e-class record and then upload it directly to the system so that users can be notified immediately in their performances to their respective subjects.
* On the subject side/tab of the system, the professor can choose or add the subjects listed on the system they are enrolled in with the students.
* After adding a particular subject, the professor can add multiple students at once to that subject.
* In the Live video portion, the professor will set a session where the students can join depending on the time and date set by the professor.
* All accounts are allowed to edit or change depending on the user including their information.

**CHAPTER VII**

**SUMMARY, CONCLUSION AND RECOMMENDATION**

This last chapter presents the summary, conclusion and recommendation.

**Summary**

The study will focus on the design and creation of “Virtual Classroom System of Graduate School, Columban College, Olongapo City”. This system will provide collaborative tools through an online based learning to the graduate school students. Teachers will also be aided in teaching their students through the use of virtual classroom system.

Specifically, it sought to answer the following questions:

1. What authoring tool will be used to allow the users to collect, manage, organize and publish content on the application?
2. How can the students access the application online?
3. What user interface will support the virtual learning of students to increase their knowledge, performance and skills?
4. What programming languages will be used to make the application responsive and appealing?
5. What are the software and hardware requirements needed to make the system accessible in different devices?

**Conclusions**

Based on the findings, the following conclusions are drawn:

1. In developing a Virtual Classroom System, the authoring tool that is needed to be used is Adobe Presenter 11. It is an eLearning plugin for Microsoft PowerPoint that allows to quickly and easily create interactive eLearning right inside of PowerPoint that enables to turn the presentations into resources that the teachers discussed to students online. With Smart Learning Interactions, Simulations and Quizzing support, Adobe Presenter 11 provides a simple solution for creating fast eLearning. The function of Adobe Presenter 11 turns out perfect for the system because of its drive in purposes. Other unique features include universal standards support file size control, navigational restrictions among others.
2. In order to access the system, students needed to be connected through an online network. With the use of browser the application will directly be opened right when the given site or link was released and inserted. In the registration, students have to register their account and input the required information. When it’s all set and done, students have to log-in their registered accounts to check each and every activities. Every updates, new announcement and activities posted by the professor will be viewed on the system.
3. In supporting the system into a friendly user interface, the Google Material Design is used to support the virtual learning of the students. A dynamic web page and a material design concept of an interface will be a great advantage. Google Material Design has the classic principle of a good design that a user can synthesize which is mostly used nowadays. It will help the students to increase their skills using online learning and it will improve their performance using virtual classroom system that has a friendly user interface. Also, it will improve the knowledge of the students to explore the different features of the system and for them to be able for the fast and reliable online discussion.
4. In developing a “Virtual Classroom System” the following tools needed for building the system were PHP to create dynamic web page content or dynamic images used on websites or elsewhere. It is used for the dashboard of the professor and student. JavaScript used for users side scripting. WebRTC for a collection of communications protocols and application programming interfaces that enable real-time communication over peer-to-peer connections. The WebRTC used to build the video conference in the system. Ajax for providing a simple and standard means for a web page to communicate with the server without a complete page refresh. The Web development tool are used to build the front-end and the back-end of the system are Atom and Sublime. MySQL and Xampp is used to build the database of the system. Lastly, jQuery is to make it much easier to use JavaScript on your website.
5. In determining the software requirements needed for the operating system are Windows 10 or Windows 7 for user friendly to the student and professor. The recommended web browsers are Google chrome and Mozila Firefox. It is the main browser that are usually used by the users. The hardware requirements needed are Hard disk 120GB or above, processor 2.13 GHz or above and RAM 4GB above for fast and smooth while using the system. For the one last thing, the internet connection for accessing the system.

**Recommendations**

In the light of the conclusions, the following recommendations are hereby presented:

1. The project can be improved by the organization, through promoting the system to the student and professor to save more time for doing their activities anytime and anywhere. The students will be monitored by the professor and can view real-time. It will help them to settle the issues experienced by the organization and enchancing the graduate school’s way of teaching.
2. The proponents recommend to improve the video conference. The video is automatically recorded during the the video conference. Also the video will able to view and download of the student. The video downloaded helps the student to review the previous lessons. For the better purposes, the proponents acquired a server that can handle heavy traffic as the number of user grows and database traffic to maintain the reliability, scalability and performance of the system and for a better user experience.
3. Upon implementation, the system should be made feasible evaluating its efficiency from time to time, with that it will help the future researchers to have more ideas for future development. The proposed solutions are not definite and they can change depending on the situation and the time of proposed system. Therefore the doors should stay open to welcome more ideas with similar aims.
4. The future researchers should create and add the different features that can be improved by the future researchers in developing the system. Annotation, this feature allows real time highlighting, drawing and marking on the shared document. Digital whiteboard for discussion, this feature allows the professor to write on the board using the digital pen or marker in the system while discussing the lesson. Direct notification, this feature will directly notify the student if the professor post new announcement or activity using SMS or email. The professor can easily inform the students even they are not online in the system. This feature allows the students to communicate with their professor by raising their hand or changing their status in the video conference and to notify the professor, the system will put up a status icon next to the student name.

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Sex : Female

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Father’s Name : Geronimo A. Adona

**EDUCATIONAL BACKGROUND**

2013- PRESENT Bachelor of Science in Information Technology

Columban College Inc.

Olongapo City, Philippines

2009-2013 St. Joseph College- High School

Olongapo City, Philippines

2003-2009 St. Joseph College- Elementary

Olongapo City, Philippines

**Special Skills**

* Popular software applications such as Microsoft Word, Microsoft Excel, Microsoft Power Point, Microsoft Access, Adobe Photoshop
* Doing works with timely manner
* Responsible for all the tasks assigned
* Strong leadership and organizational skills



**LESTER JOHN MACABULOS PULANCO**

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**PERSONAL INFORMATION**

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Height : 174cm.

Mother’s Name : Rowena Macabulos Pulanco

Father’s Name : Luisito R Pulanco

**EDUCATIONAL BACKGROUND**

2014- PRESENT Bachelor of Science in Information Technology

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2010-2014 Subic National High School

Subic, Zambales

2004-2010 Subic Central School

Subic Zambales

**Special Skills**

* Popular software applications such as Microsoft Office Applicatios, Adobe Photoshop
* Doing works with timely manner
* Responsible for all the tasks assigned
* Fast-learner and flexible



**Michael Nicholas Retorca**

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2010-2014 Magsaysay National High School

Magsaysay Dinalupihan Bataan.

2004-2010 Columban College Inc.

Olongapo City, Philippines

**Special Skills**

* Popular software applications such as Microsoft Office Applicatios, Adobe Photoshop
* Responsible for all the tasks assigned
* Fast-learner and flexible
* NCII Passer



**Ken Samuel** **D. Evangelista**

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**PERSONAL INFORMATION**

Birth Date : March 26 1998

Civil Status : Single

Religion : Catholic

Sex : Male

Citizenship : Filipino

Height : 174cm.

Mother’s Name : Gladys D. Evangelista

Father’s Name : Marlon A. Evangelista

**EDUCATIONAL BACKGROUND**

2014- PRESENT Bachelor of Science in Information Technology

Columban College Inc.

Olongapo City, Philippines

2010-2014 Immaculate Conception

2004-2010 Cabangan Elem. School

**Special Skills**

* Fluent in the English Language
* MS Office
* Adobe Photoshop
* Adobe Illustrator
* Network Administration
* Cisco
* Programming (HTML, PHP, CSS, JAVA, .NET)

**Survey Questionnaire**

**Profile of the Respondents**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| Name (Optional): |  | | | |
| Gender: | ( ) Male | | ( ) Female | |
| Civil Status: | ( ) Single | ( ) Married | ( ) Widow/er | ( ) Separated |
| Age: | ( ) 21-30 | ( ) 31-40 | ( ) 41-50 | ( ) 50-above |

I. Technology Approach

DIRECTION: Please check the number corresponding to your answer. Supply a complete answer whenever they are required.

Extremely Comfortable = 5

Fairly Comfortable = 4

Comfortable = 3

Somewhat Comfortable = 2

Not Comfortable = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Please rate which technology are you more comfortable with. | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| Discussion boards |  |  |  |  |  |
| Chat room |  |  |  |  |  |
| Video conferencing |  |  |  |  |  |
| Virtual reality |  |  |  |  |  |
| Use of Computer |  |  |  |  |  |
| Online tutorial learning |  |  |  |  |  |
| Please rate which class routine would you more comfortable | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| Curriculum and contents |  |  |  |  |  |
| Reading materials |  |  |  |  |  |
| Project activity |  |  |  |  |  |
| Communication exchange with classmates and instructor |  |  |  |  |  |
| Feedback from the instructor |  |  |  |  |  |
| Flexible learning schedule |  |  |  |  |  |
| Individual learning environment |  |  |  |  |  |
| Please rate which online services would you be more comfortable in using or learning | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| Lecture Capture - recording, storing, and distributing videos of classroom lectures. |  |  |  |  |  |
| Online live discussions |  |  |  |  |  |
| E-mail to, from, between students |  |  |  |  |  |
| Uploading activities, exams, and other course topic |  |  |  |  |  |
| Online submission activities |  |  |  |  |  |

II. PROBLEMS ENCOUNTERED

DIRECTION: Please check the number corresponding to your answer. Supply a complete answer whenever they are required.

Strongly Agree = 5

Agree = 4

Disagree = 3

Strongly Disagree = 2

Not a problem at all = 1

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Home Technology Services | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| Lack of Devices like Pc, Laptop and Tablet |  |  |  |  |  |
| Lack of Internet Connection |  |  |  |  |  |
|  |  |  |  |  |  |
| Student’s Skills towards computers | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| **Lack of Computer Literacy** |  |  |  |  |  |
| **Lack of Self-Motivation** |  |  |  |  |  |
| Lack of time in learning |  |  |  |  |  |
| Lack of Computer Experience |  |  |  |  |  |
| Classroom Problems towards technology | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| Smartphones and tablets distracts class sessions |  |  |  |  |  |
| Lack of internet and wifi connection in classrooms |  |  |  |  |  |
| Shortage of computer systems for students |  |  |  |  |  |
| Support instructors’ online distance courses | | | | | |
|  | **5** | **4** | **3** | **2** | **1** |
| Faculty’s lack of knowledge about technology |  |  |  |  |  |
| Faculty’s lack of confidence to use technology in teaching environment |  |  |  |  |  |
| Inconsistent technology: platforms, tool, software vary |  |  |  |  |  |
| Unreliable technology: Network/software crashes during teaching session |  |  |  |  |  |
| Keeping up with instructors’ demand to learn emerging/cutting edge technology |  |  |  |  |  |
| Instructors’ lack of knowledge about how to design courses utilizing technology to promote learning |  |  |  |  |  |

III. SUGGESTIONS/ RECOMMENDATIONS

DIRECTION: Below are the list of recommendations to improve the teaching of Graduate School in Columban College using Virtual Classroom System Check the corresponding box to the recommendation you are in favour of.

Digital white board for discussion.

Invest more computer systems for students.

Training for students that lack computer literacy.

Document Sharing. It supports the basic programs like Microsoft Office documents (Word, Excel, or PowerPoint), Portable Document Format (PDF) files, media files such as MP3s/MP4s and other files.

Chat Box. Messages can be public to everyone. Private chat allows direct communication with the presenter or with other users.

Annotation. Feature allows real-time highlighting, drawing and marking on a shared document.

Hand Raise and Status Change. This feature allows participants to communicate with their trainer by raising their hand or changing their status. The trainer will see a small status icon next to the participant’s name.

Breakout Groups.Dividing participants into smaller groups during an exercise, such as a brainstorming activity or skills practice, promotes an engaging and efficient learning.

Screen sharing. Allows trainers to share their screen, and the participants will see the trainer’s activity, including the mouse movements, all keyboard typing, and switching between programs.

COLUMBAN COLLGE, INC.

COLLEGE OF COMPUTER STUDIES

BSCS40/BSIT 35- THESIS/ CAPSTONE

**SOFTWARE EVALUATION FORM**

1. Software Information ( Please fill in PRINT)

|  |  |
| --- | --- |
| **INFORMATION ON THE SOFTWARE TO BE EVALUATED** | |
| Software Product/Created |  |
| Developer /s |  |
| Company for testing the software |  |
| SOFTWARE TYPE  System Software  Mobile Application    Application Software | |

1. Evaluation Criteria ( Please mark box with **🗸**)

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **\*CRITERIA** | **YES** | **NO** | **N/A** | **REMARKS** |
| **FUNCTIONALITY** | | | | |
| 1. The system functions according to the intended purpose. |  |  |  |  |
| 2. The system can produce the expected outputs in a given period of time. |  |  |  |  |
| 3. The system is easy to use and operate. |  |  |  |  |
| 4. The system gives convenience to the users every time they use it. |  |  |  |  |
| **RELIABILITY** | | | | |
| 1. The system can withstand the intended operation. (continuous or intermittent) |  |  |  |  |
| 2. The system is reliable in terms of strength, capacity and performance. |  |  |  |  |
| 3. High degree of security can be obtained when using the system. |  |  |  |  |
| 4. There is consistency on outputs. |  |  |  |  |
| 5. The system can satisfy the needed outputs of the user. |  |  |  |  |
| **EFFICIENCY** | | | | |
| 1. The system meets the user’s objectives and requirements. |  |  |  |  |
| 2. The system can be used to its maximum design and capacity. |  |  |  |  |
| 3. The system can respond to the needs of the end user. |  |  |  |  |
| 4. The system can contribute for the development of the same model of technology. |  |  |  |  |
| 5. The system can enhance individual’s learning. |  |  |  |  |
| **MAINTANABILITY** | | | | |
| 1. The system can operate accurately with minimum maintenance. |  |  |  |  |
| 2. The system can be adapted to any changes in its working condition. |  |  |  |  |
| 3. Troubleshooting/repair can be done easily by the user. |  |  |  |  |
| **PORTABILITY** | | | | |
| 1. The software is machine independent |  |  |  |  |
| 2. It is transferable to any other medium |  |  |  |  |
| 3.The system is easy to install |  |  |  |  |

\*Based on ISO 9126 Quality Model

1. Certification of Evaluation

|  |  |
| --- | --- |
| SOFTWARE EVALUATED FOR | CCS- COLUMBAN COLLEGE |

EVALUATED BY: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_\_

(Signature over Printed Name) DATE TIME

CERTIFIED BY:

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ \_\_\_\_\_\_\_ \_\_\_\_\_\_\_

(Signature over Printed Name) DATE TIME

**Letter of Interview**