

COLLABORATIVE TEACHING  
ENVIRONMENT SYSTEM USING  
THINK-PAIR-SHARE  
TECHNIQUE

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## ABSTRACT

There is a growing global interest in extending the field of study from stand-alone teaching environment to collaborative or cooperative teaching environment. In the light of the recent explosive growth of information technology, the platform for collaborative activities is focused more on producing the web-based platform. This research reflects on Think-Pair-Share technique used for collaborative communication in virtual classroom, where it can be applied among students during the teaching and learning process. ‘Think’ individually, discuss with a ‘pair’, then ‘share’ the ideas with the rest of class. CETLs for the short of Collaborative Environment for Teaching and Learning Science, is a web-based application which uses Active Server Pages (ASP) as the development backbone; allowing collaborative teaching and learning between teacher and students. Students can engage in group activities and also collaborate with teacher online. A built-in chat room supports collaborative dialogue. Students can work either individually or collaboratively with their partners as directed by the teacher to follow the think-pair-share technique. The teacher has the ability to articulate their choices and decisions about the content, assessment, coordination, and cooperation, as well as to engage in regular reflection about classroom performance; because all works will be evaluated by the teacher online, and the marks and feedback are given according to Think-Pair-Share activities. CETLs also provides few other elements for communications between teacher and students such as email, notes and assignment upload and download, in addition to bulletin board. This research also summarizes the three-tier client-server architecture as well as Rational Unified Process (RUP) used for CETLs development. Unit Testing and User Acceptance Testing (UAT) are conducted to identify the level of user acceptance towards the system, besides evaluating the CETLs’ perceive usefulness and perceive ease of use.

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# **CHAPTER 1**

## **INTRODUCTION**

### **1.1 INTRODUCTION**

Reaching this era of millennium, Internet and technology increasingly pervade every aspect of life. Since both Internet and technology are the preeminent tools for information processing, new generations need to become competent in their use, should acquire the necessary skills, and therefore must have access to computers and networks during their school life. Schools are the information- and knowledge-handling institutions. As a result, there has been wide interest in using Internet and web-based communication applications for educational purposes. The gradual shift from traditional way to the web-based style of teaching does not offer only advantages of time and place, but also of flexibility of information exchange and options for electronic communication. The online communication happens within a network society, or the so-called, community. Communication within communities of education like students, teachers or instructors can be facilitated by the use of online educational system which supports variety of communication styles such as e-mail, instant messaging, newsgroup, discussion forum and bulletin board. The educational system has the responsibility of preparing students for corresponding, co-operating, working and enjoying themselves when using it.

### **1.2 BACKGROUND OF RESEARCH**

Teaching and learning are interactive and iterative process in natural. Currently, most of the human life's aspects have been influencing by the new advanced information

and communication technology in variety of ways. The advent of innovative information and communication technologies has induced certain changes in the present educational system. These interactive technologies have affected the very nature of teaching and learning style, and in response to this situation, with today's wide use of the technology to assist people seeking and sharing knowledge, variety of courseware and web-based learning applications are currently available.

In order to improve education through technology, learning environment should not neglect the need of teachers or instructors to assist students. Bringing it the same way as the traditional teaching style, the virtual learning provides the working space and real-time communication between students and teachers, or among the students themselves, just like they were in physical class. Therefore, the online educational activities require all parties to be present, having coordination from teachers, and co-operation among students, lead to the creation of the integrated collaboration-oriented classroom.

The collaboration means 'working with others, a key theme in building partnerships for learning. Collaboration is essential library media specialists work with teachers to plan, conduct, and evaluate learning activities that incorporate information literacy' (Bruner, 1991). Having a collaborative work will increase the efficiency of the end result, which may not be gained by working alone. 'It is a process where each participant is seen as an equal partner. It is truly a non-hierarchical relationship' (Rhonda, 1998).

A teaching collaborative environment can be built through co-operation and support among students with the meddle of effective instructor. Where in this research for secondary school collaborative environment context, the instructor refers to the teacher. It

promotes the interaction between students and instructor which can be in either way; from instructor to student, or from student to instructor. The instructor plays an important role in constructing students' knowledge base, because 'learners must be encouraged to act as a group by developing learning activities...' (Karen, 2000). Therefore, the instructor will take the responsibility to organize or control the tasks besides acting like a facilitator, assist students to avoid them having confusion.

Apart from that, having a collaborative work may resolve conflict, increase the communication skills, as well as participation and commitment, which are relevant to the teaching conception. According to the findings of few researches, students are more likely to understand the virtue of learning by having convenient communication and discussion among peers with the help from tutors. Thus, by creating a virtual collaborative environment while keeping the students engage in the similar way of their current learning process may be a central to accomplish the goal of successful teaching process, and this can be supported by Computer-Supported Collaborative Learning (CSCL); which considers as one of the most promising innovations to improve teaching and learning with the help of modern information and communication technology. Gros *et al.* (2005) expressed that, CSCL is the idea of learning collaboratively in a group, which the learner need to interact with others via the use of computer as an element that intervenes this process.

Determining the focused subject for this collaborative teaching, Science is the most considered, since Science is one of the vital subjects taken by every secondary school students. Teaching and learning science involve critical thinking, and this subject supports open-ended type of questions to be asked to students during the learning process. Science is a subject that allows students to conclude ideas according to the lessons learned and

therefore, Science is well-suited to be learned collaboratively. Thus, this research chose Science subject for the implementation of the collaborative system in secondary school.

### **1.3 RESEARCH MOTIVATION**

The major focus of this research is to propose a collaborative teaching system that uses Think-Pair-Share technique to be adapted in secondary school which is meant for Science subject. The collaborative system is named as ‘CETLs’ which stands for ‘Collaborative Environment for Teaching and Learning Science’, and uses Rational Unified Process (RUP) methodology for the development processes.

#### **1.3.1 Why**

Recently, there is a rapid growth of computing technology, the applications and uses of computers have grown at a staggering rate. Software plays a central role in almost all aspects of daily life, whether in government, banking and finance, education, transportation, entertainment, medical, agriculture, and even law sector. The number, size, and application domains of computer programs have grown dramatically; as a result, hundreds of billions are being spent on software development, and the livelihood and lives of most people depend on the effectiveness of this development. It is undeniable that the software products have helped us to be more efficient and productive. They make us more effective in terms of problem solving, and they are able to provide us with an environment for work

and play that is often safer, more flexible, and less confining. Because of those reason, the educational technology is introduced to secondary school students.

The idea to develop this research with the development of a collaborative system arose for few reasons which are :

- **Lack of computer use in school**

There is limited usage of computers in school currently. Each school is provided with only a number of computers which are placed in the laboratory and the students are allowed to enter the laboratory during the specific hours. Since technology is the most excellent tools for information processing, new generations need to become competent in their use, therefore they should acquire the necessary skills, and this require access to computers during their school life. Therefore, with the development of online collaborative teaching system is intentionally to increase the use of computers in school.

- **To enhance learning with technology**

While some students enjoy playing games and do any clicks on the computer, however some of them still feel like a strange to hold a computer. Most of the teenagers seem the computer as a medium for communication and entertainment, but they do not really realize that it can also be as a teaching or education tool as well. Schools do not only play the role as the plain-learning institutions, but as a place to explore and discover new things. Therefore, by introducing the computer-based learning, it is hoped that the both teachers and students will have better exposure to the use of computers with frequent use.

- **Introducing students-centered approach**

The traditional process of teaching is more to teacher-oriented mode. The development of this collaborative system is to introduce and encourage the students-centered approach, where the students is given the priority to plan, solve, and communicate by themselves before asking for teacher's help. Teacher will be in the system as a facilitator, helping students with contents, ideas, assessment, and in final discussion. This online collaborative process will encourage group activity, thus allow students to be more courageous, since the system allow students to give opinions and ideas in an open discussion.

#### **1.4 RESEARCH OBJECTIVES**

In order to accomplish this thesis, few objectives are set which are :

- i) To identify existing collaborative teaching environment framework.
- ii) To develop a collaborative teaching system using Think-Pair-Share technique.
- iii) To evaluate the 'usefulness' and 'ease of use' of the collaborative system.

#### **1.5 RESEARCH SCOPE**

The scope of '*Collaborative Teaching Environment System Using Think-Pair-Share Technique*' research covers :

### **1.5.1 Collaborative Application (CETLs)**

In order to support the teaching process as well as collaboration, this research has come out with a web-based collaborative system named CETLs which is short for **C**ollaborative **E**nvironment for **T**eaching and **L**earning **S**cience. As its name shows, CETLs is purposely developed for collaborative teaching and learning, thus it allows both teacher and student to use it. However this dissertation focuses on how the teacher uses CETLs for teaching.

CETLs is mainly used for teaching Science subject in secondary schools. Since Science subject is widely teach in every school in Malaysia, plus its suitability to support group activities, therefore it is suitable for applying the collaborative process to this subject.

In order to realize the collaborative process, CETLs applies Think-Pair-Share technique for the teaching process.

### **1.5.2 Teacher**

The collaborative system (CETLs) is focusing on the teacher. The major role of the teacher in CETLs is to support collaborative activities, by providing contents and assigning Think-Pair-Share group as well as Think-Pair-Share activities to students. Teacher also responsible to evaluate student works during and after the Think-Pair-Share process. Teacher can also communicate with the students through the use of real-time messaging in the chatroom, bulletin board and e-mail.



## 1.6 RESEARCH CONTRIBUTION

The Internet and the World Wide Web (www) have provided a wide context for the Software Engineering field, which has already attracted a lot of attention. As defined by Meyer (2001), Software Engineering is the application of a systematic, disciplined, quantifiable approach to the development, operation, and maintenance of software. This research involves the system development, which is running on the network. In addition, this research also discusses the relevant topics in this field, including architecture, logical design, interface design, implementation strategies as well as testing. The discussion is based on the collaborative system, CETLs, which allow the user to work collaboratively for educational purposes. It provides many useful functions for students as well as teacher. CETLs has ran through various software engineering stages in order to function properly, besides working as a collaborative system for both teacher and students in order to introduce modern educational technology in secondary school.

In particular, CETLs is mainly designed for teachers and students. Both parties will use CETLs to collaborate among each other. CETLs is provided with the notes and assignment management in which the teacher may upload various kinds of files to students. The interaction might occur with the use of chat tool, instant messaging, e-mail, and announcement. CETLs is able to allow both parties to communicate in any way (as provided) they prefer, depending on the teaching situation. CETLs provide few communication methods, because communication will be more interactive with better facilities.

CETLs is applying the Think-Pair-Share technique; which is a collaborative technique, during the collaborative session between teacher and students. For the collaborative activity, students will be assigned a group (pair) by the teacher, and the tasks. Teacher will then assign timer in order to control students activities. All the students work will be evaluated by the teacher online. Teacher will assist students with the use of chat tool.

## **1.7 THESIS ORGANIZATION**

The first chapter of the dissertation inscribes the background of the research which covers the context of the study, as well as introducing the research objectives and scopes. It also highlights the contribution of this research towards Software Engineering field.

Chapter 2 starts by conferring about the Internet and World Wide Web, introducing the technology terms. It is followed by explaining different views and approaches about the teaching and learning process. It is then explore the traditional way of teaching before starts introducing the use of technology in educational environment. This chapter also highlights the current use of e-learning. Furthermore the chapter addresses the CSCL, in general, and particularly the collaborative teaching which includes its meanings, theory, features and processes. The interaction happens in the collaborative environment is discussed. One framework explaining the process of collaborative use in teaching and learning is introduced by explaining the framework elements. Before the chapter ends, one table is produced according to the comparison made on the five similar systems. The

similar systems are compared according to the collaborative learning features as well as the framework elements.

Chapter 3 explains the steps of doing research methodology by highlighting all the essential relevant works in order to achieve the aim to produce CETLs which applied Think-Pair-Share collaborative technique. The explanations are put in a diagram for better understanding. It is then followed by describing the system development methodology which is Rational Unified Process (RUP). The RUP phases and the core workflows are explained one by one.

The fourth chapter aimed at explaining the selected collaborative technique, Think-Pair-Share approach for collaborative teaching. The purpose, idea, and advantages of traditional Think-Pair-Share technique are studied. As a result, the automated Think-Pair-Share technique to be applied in CETLs is reported. One framework is also applied with slight adjustments (based on the study), with the purpose to suit the current collaborative technique which is Think-Pair-Share. The applied framework is proposed before ending the chapter with the summary of the findings made.

Chapter 5 discusses about the requirements for CETLs, which includes hardware and software, as well as functional requirement. All the software and hardware used during the system development are clarified, while the functional requirement has been related to the elements consist in the framework studied in chapter 2. A use case diagram is also produced to represent CETLs graphically. The chapter ends with a summary of the chapter and the main findings in the field.

Chapter 6 is initiated with the description of the system architecture which covers client server architecture, application and database servers. Next, the details design of CETLs is figured out with the use of class diagram while the database design is presented by using data dictionary. The major components of user interface design are discussed and some samples of the CETLs user interface are attached.

After completing the stage of designing, the seventh chapter is mainly focusing on implementation and testing in order to assure the system's quality and acceptability. The chapter is initiated with the discussion on the algorithm of the major modules which are Think, Pair, and Share. It is then followed with the testing part, where two different testing techniques are selected; Unit Testing which is done by the system developer, and User Acceptance Testing (UAT) which involves the end users by using the test cases and questionnaires. The chapter ends with the results from the test made throughout the system, where all the test records have been logged in test cases, and the discussion of the system's perceived usefulness and perceive ease of use results.

The thesis ends with chapter 8, in which the conclusion and recommendations are made. All the objectives are reviewed to see whether they have been achieved. Above all, the limitation of the system is also discussed.

## **CHAPTER 2**

### **LITERATURE REVIEW**

#### **2.1 INTRODUCTION**

This chapter gives an introduction to the Web-based Education before discussing about the types of the Web-based Education, which considered as a new and better environment for teaching. The definitions of a few terms are also provided. Collaborative teaching has been introduced by discussing about its theory, features, processes, and techniques as well as comparing it with the traditional way of teaching. In addition, a few collaborative techniques are enlightened to understand more about the interaction in collaborative environment. This chapter also involves a study about a related framework as a guideline before reviewing few similar existing systems.

#### **2.2 WEB-BASED EDUCATION**

Technological change, which not only permits new activities but makes those new activities superior in many important ways over the previous method of operation, which creates long lasting innovations in society. Web-based education is one of those innovations. Web-based education means that time and place are no longer barriers to either learners or instructors. Unlike Computer based training (CBT) which offers a presentation of courses most often on CD-ROM, web-based education offers a highly flexible access to many users simultaneously (Thomas and Cynthia, 2003).

## **2.2.1 Web-Based Education Approach**

In accordance to Hilt (1999), there are basically two types of web-based education approaches, which are synchronous and asynchronous.

### **2.2.1.1 Synchronous**

Literally, synchronous means ‘at the same time’ which involves interacting with an instructor or teacher via the Web in real time. Synchronous education is currently a less common form of training. It involves geographically dispersed students accessing the same Web site at the same time as an instructor. Typically this type of training involves the instructor broadcasting audio out to the students through either a teleconference phone call, or through web-based audio. The instructor typically ‘drives’ a slideshow presentation, which the students watch while connected to a conference web site. Students can ask questions or provide comments through the phone line, or through a chat window.

### **2.2.1.2 Asynchronous**

Asynchronous means ‘not at the same time’, which allows the student to complete the tasks on his own time and schedule, without live interaction with the instructor. Asynchronous learning is more common because it creates a just-in-time, on-demand student learning experience. Unlike synchronous training, students do not need to schedule their time around the predetermined plan of the instructor. William (2000) said that, facilitated asynchronous training involves an instructor and group of

students, but the interaction is not in real time. The instructor will post assignments on a Web page, which typically includes online reading or research conducted on various Web sites. Students communicate with each other through threaded discussions or online bulletin boards, and submit their homework to the instructor via e-mail. An advantage of this type of training is that students have a lot of peer interaction, and can receive personalized attention and guidance from the human facilitator. Additionally, even though the training is not completed live, students still have scheduling concerns because a human instructor is posting assignments and grading homework, some kind of schedule needs to be kept, where normally the instructor will assign the deadline for each assignment posted.

## **2.2.2 Types of Web-Based Education**

### **2.2.2.1 E-learning**

E-learning, in accordance with the description made by Kurtus (2004), is a vehicle that uses technology to enhance the traditional approach to learning.

As espoused by Chui and Manjit (2006), E-learning has grown rapidly in the past few years due to the demand for e-learning for various reasons; one of the main reasons is to reduce the cost of teaching or training. It is an education via the Internet, network, or standalone computer. E-learning is essentially the network-enabled transfer of skills and knowledge where it refers to using electronic applications and processes for learning

purpose. E-learning applications and processes include Web-based learning, computer-based learning, virtual classrooms and digital collaboration. Content is delivered via the Internet, intranet/extranet, audio or video tape, satellite TV, and CD-ROM.

#### **2.2.2.2 Collaborative Learning**

Collaborative Learning (CL) is an instruction method in which students work in groups toward a common academic goal. It is said as an umbrella term for a variety of approaches in education that involve joint intellectual effort by students or students and teachers. CL refers to methodologies and environments in which learners engage in a common task in which each individual depends on and is accountable to each other. Groups of students work together in searching for understanding, meaning or solutions or in creating an artifact of their learning such as a product. The approach is closely related to cooperative learning. Online collaborative learning activities should include communications tools among collaborators such as ‘chatroom’, ‘e-mail’, ‘forum’, and ‘video conferencing’. In order to support collaborative writing and group projects, there should be additional tools that allow the user to ‘share files’ or documents and ‘perform other activities’ (Totten *et al.*, 1991).



## **2.3 COLLABORATIVE TEACHING AND LEARNING**

### **2.3.1 Collaborative Definition**

Roberts (2004), quoted by Mahdizadeh (2007) defined collaborative as an adjective that implies working in a group of two or more to achieve a common goal, while respecting each individual's contribution to the whole. Collaborative learning is a learning method that uses social interaction as a means of knowledge building. While Williams (2002) defined collaborative as a virtual learning community that provides support and sharing among its members can be built through the integration of online communication tools and course activities and sustained through effective instructor. Collaborative activities are democratic by nature, which makes group members more flexible and eventually replaceable as the group as a learning community shares knowledge and experiences. As such, Lehtinen *et al.* (1999) explained that collaborative learning is a method that is in line with the new conceptions of learning and opposed to the traditional 'direct transmission' model, in which learners are assumed to be passive, receptive, isolated receivers of knowledge and skills. And therefore, collaborative learning tends to be more active by having co-operation among learners.

### **2.3.2 Variety Meanings of Collaborative**

As explained by Dillenbourg (1999), collaborative can be defined in a few ways which are :

- i) Situations characterized as “collaborative”*

Intuitively, a situation is termed “collaborative” if peers are more or less at the same level, can perform the same actions, have a common goal and work together.

*ii) Interactions characterized as “collaborative”*

Another way to define collaboration is to say that it is a situation in which learners interact in a collaborative way.

*iii) Processes characterized as “collaborative”*

The process of inductive, cognitive load, self-explanation, and conflict.

### **2.3.3 The Theory of Collaborative Learning**

Bruffee (1992) stated that a collaborative learning provides an environment to enliven and enrich the learning process. Introducing interactive partners into an educational system creates more realistic social contexts, thereby increasing the effectiveness of the system. Such an environment would help sustain the student's interests and would provide a more natural learning habitat. It is a coordinated, synchronous activity that is the result of a continued attempt to construct and maintain a shared conception of a problem.

By referring to Dillenbourg (1999), theories of collaborative learning concern these four items:

- There is a bi-directional link between the situation and the interactions. The situation defines the conditions in which some interactions are likely to occur during the collaborative situations. The situation happens during the collaborative activity has a close relationship with the interactions, where the interactions might happen between teacher and students, or among students themselves. It can be concluded that the interactions made by each party will lead to certain changes in collaborative situation.
  
- There is a bi-directional link between the interactions and the learning processes. The interaction between teacher and students, as well as between students and students has an impact towards the collaborative process, and vice-versa.
  
- There is a bi-directional link between the processes and the effects of collaborative learning. The effects are gained according to group processes, such as the ability to work in group. Any process performed during the collaborative process will affect the collaborative learning, whereby any group process will determine the collaborative learning level, whether or not the collaborative process is successful.
  
- Viewing the group as a unit; the ability of the group members to interact so well among each other. Eventhough each collaborative group consists of more than one person, but the team member as well as teacher need to assume that they are working and evaluating a single unit. The outcome from each unit is determined as a group work, and not as each member's

work. Each member should have and carry his own responsibility in order to get the work done. The interaction among them could happen in chat-basis for a discussion, having a question and answer, or studying and analyzing certain graph, map or figure. Any activity requires all group members to participate.

As concluded by Totten *et al.* (1991), the theory of collaborative teaching and learning refers to the active exchange of ideas within small groups that will not only increase interest among the participants but also promotes critical thinking. The cooperative teams achieve at higher levels of thought and retain information longer than students who work quietly as individuals. The shared learning gives students an opportunity to engage in discussion, take responsibility for their own learning, and thus become critical thinkers. Eventhough collaborative activities are labeled as democratic activity, but it requires a careful planning, monitoring and scaffolding by the teacher. As said by Dillenbourg (1999), Collaboration makes group members more flexible and eventually replaceable as the group as a learning community shares knowledge and experiences.

#### **2.3.4 Why Collaborative Teaching And Learning?**

Collaborative teaching and learning provides an environment to enliven and enrich the learning process. Introducing interactive partners into educational system will not only sustain the student's interest but increase the effectiveness of the system itself. The intention of collaborative teaching is to prepare students for a better and effective style of learning (Russell, 2001).

### **2.3.5 What Is Collaborative Environment in Teaching?**

Collaboration is a process to reach goals that cannot be reached as efficiently by acting alone (Bruner, 1991). It is a process where each participant is seen as an equal partner, a truly non-hierarchical relationship. Each partner understands the other's strengths and weaknesses and together they capitalize on their strengths and learn from each other.

In a collaborative teaching environment, the level of involvement of all the participants in a cooperative system is very strong and personal. It develops positive student-teacher attitudes. Teachers learn about student behaviors because students have many opportunities to explain their actions and thoughts to the teacher. Lines of communication are opened and actively encouraged. Teachers have more opportunities to observe on what their students are doing while offering help whilst the system allows students to have more input and having discussion with not only his peers but with the teacher as well. The interpersonal interactions can lead to a very positive effect to all parties involved.

Introducing technology into the learning environment has been shown to make learning more student-centered, to encourage cooperative learning, and to stimulate increased teacher/student interaction. Positive changes in the learning environment brought about by technology are more evolutionary than revolutionary. These changes occur over a period of years, as teachers become more experienced

with technology. Courses for which computer-based networks were use increased student-student and student-teacher interaction, increased student-teacher interaction with lower-performing students, and did not decrease the traditional forms of communication used. Many students who seldom participate in face-to-face class discussion become more active participants online. Greater student cooperation and sharing and helping behaviors occurred when students used computer-based learning that had students compete against the computer rather than against each other. Small group collaboration on computer is especially effective when student have received training in the collaborative process (Daniel *et al.*, 2000).

### **2.3.6 Computer-Supported Collaborative Learning (CSCL)**

Collaborative in education involve both teaching and learning. In order to teach and learn collaboratively, online collaborative learning should be supported by a specific tool. Thus it is closely related to Computer-Supported Collaborative Learning (CSCL).

Computer-Supported Collaborative Learning (CSCL) is considered as one of the most promising innovations to improve teaching and learning with the help of modern information and communication technology. As discussed earlier, collaborative learning refers to an instructional method whereby students are encouraged or required to work together on problem-solving or learning tasks. In its ideal form the collaboration involves the mutual engagement of learners in a

coordinated effort to solve a problem together or to acquire together new knowledge (Lehtinen et al., 1999). As explained by Vita (2006), CSCL needs both ‘working space’ and ‘learning space’ and for that reason, CSCL is mainly based on ‘groupware’ which is information technology that provides the higher levels of coordination and cooperation. The groupware must consist of ‘intentional group processes’ that make use of the software to support them.

Price *et al.* (2003) describes Computer Supported Collaborative Learning (CSCL) has primarily been centered on desktop computers, where learners share mice and screens, and where action and interaction is limited by the constraints of desktop computing. The models of collaboration for computer-supported learning are focusing on one dimension of potential collaborations, such as: peer-peer; child groups; adult-child; or computer-child interactions. In addition, Mahdizadeh (2007) explicated that CSCL is focused on how collaborative learning supported by technology can enhance peer interaction and group work, also, how collaboration and technology facilitate the sharing and distribution of knowledge and expertise among community members.

In accordance to Gros *et al.* (2005), computer-supported collaborative learning expresses two important ideas: first, the idea of learning collaboratively, with others, in a group. In this sense, the learner is not seen as an isolated person but rather in interaction with others. It is based on the idea that sharing goals and distributing responsibilities are desirable forms of learning. Furthermore, it emphasizes the role of the computer as an element that intervenes in this process. It is therefore a process where the individual learns to collaborate and collaborates in

order to learn. (Mahdizadeh, 2007) Furthermore computer-supported collaborative learning (CSCL) applications are powerful e-learning environments that facilitate interaction, negotiation, and collaboration amongst and between students and their teachers and external information sources in order to construct new knowledge.

Hence, it can be concluded that CSCL is a method for bringing the benefits of collaborative learning to users via networked computers. The purpose of CSCL is to scaffold or support students in learning together effectively. CSCL supports the communication of ideas and information among learners, collaborative accessing of information and documents, and instructor and peer feedback on learning activities. CSCL also supports and facilitates group processes.

### **2.3.7 Collaborative Learning Features**

Collaborative learning deals with instructional methods that seek to promote learning through collaborative efforts among students working on a given learning task. Hence, collaborative learning inspires students to work as a group and therefore they require a medium for communication. In a collaborative learning environment, where the goal is split into subtasks to be carried out by individual person in a group, it is often found that the persons are assigned roles. These persons however can be noticed as ‘peers’ where the peers can be either instructor (whom are teacher, tutor or facilitator) or learner (students, pupils). The advances in technology put an increased emphasis on teamwork within the workforce (Kumar, 1996).



As suggested by Kaplan (2002), when creating a community that supports collaborative learning approach, the community builders must consider variety of factors related to people, group processes and technology. In order to allow a proper communication and interaction among peers during the collaborative learning, the features of collaborative learning focus on four categories which are synchronous tools, asynchronous tools, content integration, and document management.

By referring to Section 2.2.1.1, *synchronous* means ‘at the same time’, which involves interaction in real time. The examples of synchronous tools are audio conferencing, Web conferencing, video conferencing, live chat, instant messaging and whiteboards.

Inversely, *asynchronous* (refer Section 2.2.1.2) brings the meaning of ‘not at the same time’. Asynchronous activity allows the user to complete the tasks on his own time and schedule, without real time interaction with anybody else. Asynchronous activities can be performed with the use of discussion boards, calendar, links, group announcements, e-mail, surveys and polls.

In order to make the collaborative activity successful, each learner needs to pay his own attention and therefore the use of *content integration* will be very useful. The content integration might be courseware, streaming media, narrated slideshows, or e-books.

Each instructor need to have proper *document management* to ease the learners where the instructors shall be provided with the resource library, version tracking and control, or the permission-based access. Some instructors might want to post specific materials to a specific group, and this document management is very

useful to manage their document online, where the instructors themselves will have the right to choose and arrange their own materials accordingly.

In accordance with the above discussion, the following table 2.1 outlines the features of collaborative learning:

Table 2.1 : Collaborative Learning Features (Kaplan, 2002)

<b>CL Features</b>	<b>Supporting Tools</b>
Synchronous Tools	<ul style="list-style-type: none"> <li>▪ Audio conferencing</li> <li>▪ Web conferencing</li> <li>▪ Video Conferencing</li> <li>▪ Chat</li> <li>▪ Instant Messaging</li> <li>▪ Whiteboards</li> </ul>
Asynchronous Tools	<ul style="list-style-type: none"> <li>▪ Discussion boards</li> <li>▪ Calendar</li> <li>▪ Links</li> <li>▪ Group Announcements</li> <li>▪ E-mail</li> <li>▪ Surveys and Polls</li> </ul>
Content Integration	<ul style="list-style-type: none"> <li>▪ Courseware</li> <li>▪ Streaming media</li> <li>▪ Narrated slideshows</li> <li>▪ E-books</li> </ul>
Document Management	<ul style="list-style-type: none"> <li>▪ Resource Library</li> <li>▪ Version Tracking and Control</li> <li>▪ Permission-based Access</li> </ul>

### 2.3.8 The Process of Collaborative Teaching and Learning

Supporting group learning activities requires an understanding of its process. Anuradha (1995), explicated that the processes of collaborative teaching and learning involve :

- *Subjects*

No matter whether the collaborative teaching is applied in university, primary or secondary schools, but there must be a subject that is being focused on. Subject will determine the objective and the approach that are going to be used during the teaching and learning session.

- *Treatment*

The treatment comprised of two parts: lecture and worksheet questions. Both parts are given and assigned by the teacher or instructor. Both lecture and worksheet questions can be applied independently; it does not require both parts to be applied in a single collaborative session.

- *Group Selection and Size*

Groups can be formed using self- selection, random assignment, or criterion-based selection. The process of selecting or assigning group members can be whether by the students make selection by themselves, or assigned by the teacher. The group can be smaller in size or larger, depending on the goals,

situation and amount of work. But according to Rau and Heyl (1990), smaller groups (of three) contain less diversity; and may lack divergent thinking styles and varied expertise that help to animate collective decision making. Conversely, in larger groups it is difficult to ensure that all members participate.

- *Individual Learning*

Eventhough it is a collaborative activity, but the individual learning is still needed at the initial stage. This is to ensure that each student is aware of the task that is going to be delivered before they start working with the peers. Normally the individual learning involve the explanation of the academic task by the teacher, and each student is tested with a simple question in specific time duration.

- *Collaborative Learning*

When implementing collaborative learning, the first step is to clearly specify the task. Next, the collaborative learning structure must be explained to the students. The instructor must then assign an instruction that pointed out the key elements of the collaborative process. During this time, students are encouraged to discuss the solution with peers, where they have to listen carefully to comments of each member of the group and be willing to reconsider their own judgments and opinions. This process minds about giving the opportunity to each member to contribute his or her ideas before the group will arrive at a solution.

This part will gain diverse skill levels and experience since each individual brings strengths to a group. Moreover, each member of the group is responsible to not only contribute his/her strengths, but also to help others understand the source of their strengths. Therefore the collaborative learning is increasing the options for problem solving.

- *Grading*

For effective collaborative learning, there must be "group goals" and "individual accountability". When the group's task is to ensure that every group member has learned something, it is in the interest of every group member to spend time explaining concepts to groupmates. The grading scheme and allocation of marks must be explained to students before they were assigned to start working collaboratively.

- *Instruments*

Instrument can be any reference or tools used during the collaborative teaching and learning processes. It can be the sources from an Internet, online notes, other software or application.

### **2.3.9 Comparing Traditional Teaching And Collaborative Learning**

Theroux (2004) describes that the traditional teaching is merely a teacher-centered approach, thus the responsibility and the power of handling class and making decision is held by the teacher. However the collaborative learning is factually a student-centered approach, where the students have their own

responsibility as well as act as decision makers. The traditional teaching is normally a competitive learning style, where each student try to compete among each other, and work individually, while the teacher work as an instructor. The collaborative learning encourage co-operative learning, where students work together to solve problems.

The difference between traditional teaching and the collaborative learning is presented in a table, which is taken from Theroux (2004). Refer Table 2.2 for the details.

Table 2.2 : The Comparison between Traditional Teaching and Collaborative Learning (Theroux, 2004)

<b>Comparing Traditional Teaching And Collaborative Learning</b>	
<b>Traditional Teaching</b>	<b>Collaborative Learning</b>
A teacher centered environment	A student centered environment
The teacher is in control.	Students are in control of their own learning.
Power and responsibility are primarily teacher centered.	Power and responsibility are primarily student centered.
The teacher is the instructor and decision maker.	The teacher is a facilitator and guide. The students are the decision makers.
The learning experience is often competitive in nature. The competition is usually between students. Students resent others using their ideas.	Learning may be co-operative, collaborative or independent. Students work together to reach a common goal. Students willingly help each other sharing/exchanging skills and ideas. Students compete with their own previous performance, not against peers.
Series of smaller teacher defined tasks organized within separate subject disciplines.	Authentic, interdisciplinary projects and problems.
Learning takes place in the classroom.	Learning extends beyond the classroom.
The content is most important.	The way information is processed and used is most important.
Students master knowledge through drill and practice.	Students evaluate, make decisions and are responsible for their own learning. Students master knowledge by constructing it.
Content is not necessarily learned in context.	Content is learned in a relevant context.

### **2.3.10 Collaborative Teaching Techniques**

There are many techniques available for collaboration. The first step before starting with the system design is to investigate well-known collaborative learning scenarios in order to transform them into web-based learning techniques. This might be useful for choosing the right technique after comparing few of them. Some common collaborative learning techniques are:

Collaborative groups refer to a variety of structured classroom management techniques and grading systems. These terms usually do not refer to loosely structured group work in which students are told simply to "work together" on a problem or assignment. In order to emphasize the difference between unstructured group work and collaborative group work, groups are usually referred to as teams. Because students often lack of collaborative group skills, it is essential to target interaction skills and team building within the class. Students need to learn how to listen to other students, and to analyze and interpret what they are saying. Students must learn, for example, how to encourage others in their group to participate, how to ask questions, how to manage dominant personalities, how to monitor and modify the group dynamic, and how to communicate effectively (Leonard *et al.*, 1999).

#### **2.3.10.1 Fishbowl**

The concept of this technique is: teams of three or four work on a problem or exercise. At the same time, other teams of three or four observe the first teams. In particular, the first teams work on seeking other points-of-view, listening to and paraphrasing ideas, and other communication skills

while solving the given problem. The second teams focus their attention on the team dynamic and make sure they are prepared to discuss how well or poorly the first teams worked together to solve the problem. After the given duration of time (even if every team has not finished the problem), the class discusses what had and had not happen during the activity. (Leonard, *et al.*, 1999).

#### **2.3.10.2 Jigsaw**

As stated by Gallardo *et al.* (2003), “Jigsaw is a method intended to provide collaborative learning environments. Hundreds of schools have JIGSAW in their classrooms with much success”.

The Jigsaw technique begins with pairs preparation. Each pair has a subject to study. The students must read and summarize their material. They must also plan how to teach it to the rest of their own initial group. Then, new pairs of students are formed. Their objective is to practice how to teach the assigned material. Typically one student listens the material presented by the other and suggests improvements. Then, the roles are interchanged. The cooperative goal is that all students know all parts of the educational material. The students must teach and learn. While students work, the teacher moves from group to group. Her job is to observe the work and assist the students in their processes. At the end of the session, students’ learning must be evaluated using an individual test on all lesson topics (Gallardo *et al.*, 2003).



### **2.3.10.3 Paired Annotations**

Students pair up to review or learn the same article, chapter or content area and exchange double-entry journals for reading and reflection. Students will then discuss key points and look for divergent and convergent thinking and ideas. The pair (group) discusses the key points of the reading and looks for areas of agreement and disagreement. Together students prepare a composite annotation that summarizes the article, chapter, or concept. Finally, the group prepares a composite annotation that summarizes the article, chapter, or concept (Brown, 2007).

### **2.3.10.4 Think-Pair-Share**

The tutor poses a question or a problem, then pairs of students work together to explore their ideas about some topic. They then separate and pair up with someone else to clarify, compare and justify ideas. The procedure can be repeated a number of times and students build on their knowledge and understanding as they progress (Bouras, *et al.*, 2002). Detail explanations about Think-Pair-Share technique will be discussed in Chapter 4.

## **2.3.11 Collaborative Helps Students Learn About the Group Processes**

Online environment often being the point to many people to build various kind of communities. For the most part, the community is developed in accordance to the face-to-face setting in terms of communication and spaces. Fisher *et al.*, (2000) examined that, based on the students reflections on their experiences as a

group learning online, the online collaborative activities help the students to understand about the group processes in the aspects of :

i. Developing group identity

- A small group may be defined as two or more individuals who:
  - a. interact with each other
  - b. are independent
  - c. define themselves and are defined by others belonging to the group
  - d. share norms concerning matters of common interest and participate in a system of interlocking roles
  - e. influence each other
  - f. find the group rewarding and
  - g. pursue common goals

ii. Participation and commitment

- For a group to function effectively and meet its goal, commitment and participation in the process and decision making are very important.

iii. Communication

- (disadvantage) lack of face-to-face cues
- differences were apparent between communicating synchronously (online) compared with asynchronously (face-to-face). With real time communication, there are more humour and informality, while with delayed communication the students tended to communicate more formally.

- (disadvantage) on certain circumstances, students unable to log on, loss their connection in the mid of conversation, or delay in receiving messages, which lead to receiving messages out of order.
- (disadvantage) misunderstanding of the post.

iv. Leadership and roles

- As having teacher / instructor
- “Any action that helps a group maintain effective working relationships among its members is a leadership action” (Fisher *et al.*, 2000).

v. Conflict

- A normal feature of most groups that meet over a period of time.
- Lack of visible body language means that anger or frustration may not be so readily communicated.
- Conflict because of absence of non-verbal, facial and body cues and the difficulty of expressing emotion through text.

vi. Group norms

- The stated rules and expectations about group member behaviour. Explicit norms in the online group were established by students early in the course and included :
  - a. to be without judgment
  - b. to be within the moment (focused)
  - c. to attend the group within that state
  - d. to be totally open to the learning experience
  - e. to respect the opinions of others

## **2.4 CONTROL OF COLLABORATIVE INTERACTIONS IN EDUCATION**

Interactivity is a crucial element in education. The interaction will not exist by itself but requires more than one party to be involved with. In order to realize the process of interaction in education, human will play the specific roles.

Cited in Anderson (2003), interaction serves a variety of functions in the educational transaction. It is inclusive of allowing learner's control, facilitating program adaptation based on learner input, allowing various forms of participation and communication, and as aiding the development of meaningful learning. In addition, interactivity is fundamental to creation of the learning communities.

### **2.4.1 The Importance of Teacher-Students Interaction in collaborative environment.**

Educational interactivity generally requires both teacher and students to be personally active and engaged in the interaction. (Lehtinen *et al.*, 2001), quoted by Mahdizadeh (2007), said that, in a collaborative learning environment the learner can learn through interaction, discussion, and explanation of a problem to others.

Based on Anderson (2003) study on the classroom delivery, the traditional lecture mode of delivery has medium levels of student-teacher interaction, and the level of interaction between students themselves is low. Recent efforts at enhancing the classroom through the use of multimedia equipment, and especially enabling access to net resources in "smart classrooms," will increase the quality of student-

content interaction, and thus the potential to increase levels of deep and meaningful learning. Efforts at enhancing teacher-student interaction through an increase in teacher immediacy, or through use of theatrical or multimedia presentation techniques, can also be expected to increase the quality of student-teacher interaction. Further efforts at enhancing student-student interaction in the classroom through case or problem based learning activities, have long been shown to increase not only student achievement, but also student completion and enjoyment rates. In these types of activities, increased student-student interaction is substituting for student-teacher interaction. When classroom delivery takes the form of a traditional seminar among relatively small numbers of students and a teacher, the levels of student-student and student-teacher interaction increase with generally increased the level of learning and satisfaction.

Espoused by Anderson (2003), a deep and meaningful formal learning is achieved as long as one of the three forms of interaction is at a high level (student-teacher; student-student; student-content), and extended the discussion to the other three types of interaction (teacher-teacher; teacher-content; content-content) as shown in figure 2.1. The other two may be offered at minimal levels, or even eliminated, without degrading the educational experience.

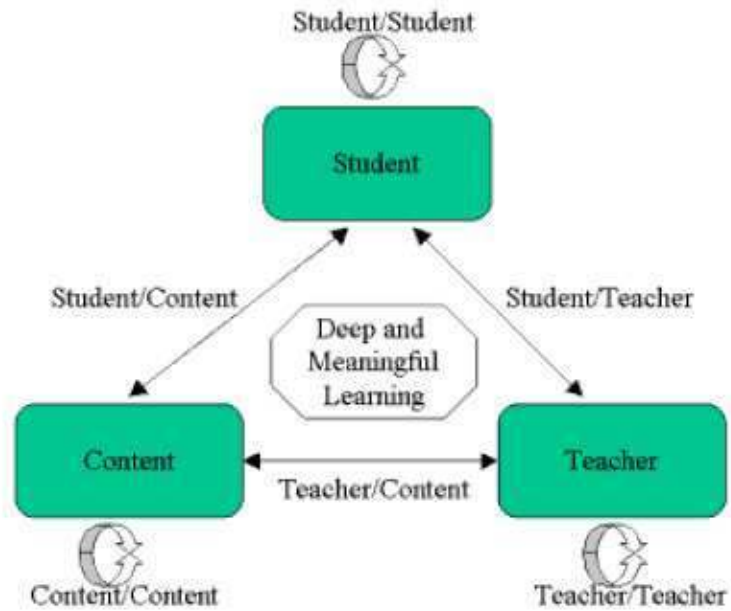


Figure 2.1 : Modes of Interaction in Distance Education (Anderson, 2003)

The above figure as suggested by Anderson (2003) shows the two-way communications among three components in education interaction which involves:

#### 2.4.2 Student Interaction

Learning process will never be called a 'learning process' without students' involvement. In a collaborative environment, besides solving problems alone, students will also interact among themselves to get better solution. They can discuss, as well as sharing ideas.

There will also be a student-teacher relationship, where both of them can communicate whether a teacher to assist students, or the students to seek help or getting order from the teacher.

Students need to access the content too, as they have to know what are being prepared for them, or what they need to solve.

### **2.4.3 Teacher Interaction**

Interaction with a teacher is often an important component of a formal learning experience. Teacher agents can perform many of the functions that currently consume teacher time, especially those of a bookkeeping, clerical, or organizational nature, thus migrating teacher-student and teacher-content interaction to content-student and content-content interaction. Some teacher interaction can be transformed into learning objects (videos, animations, assessment programs etc.), thus migrating student-teacher interaction to student-content interaction.

### **2.4.4 Content Interaction**

Provides an environment in which content can be formalized and manipulated, stored, searched, and computed automatically by teacher agent. The content will be very useful to students as they can use it for accessing multiple data or instructions. This will generate a direct relationship between teacher and students which can lead to a better interaction, resulting engagement and motivation.

## 2.5 COLLABORATIVE FRAMEWORK

Having a framework as a reference will improve the planning and management of the project. By providing a suitable framework, it will let people doing things right, following the right guideline. Therefore, people will have a thorough guide to refer to in order to produce the right product in a timely-manner. Here is the original framework of the system processes during the collaborative activity, which offer tools and functions to the involved human aspects, which is taken from Dimitracopoulou (2005).

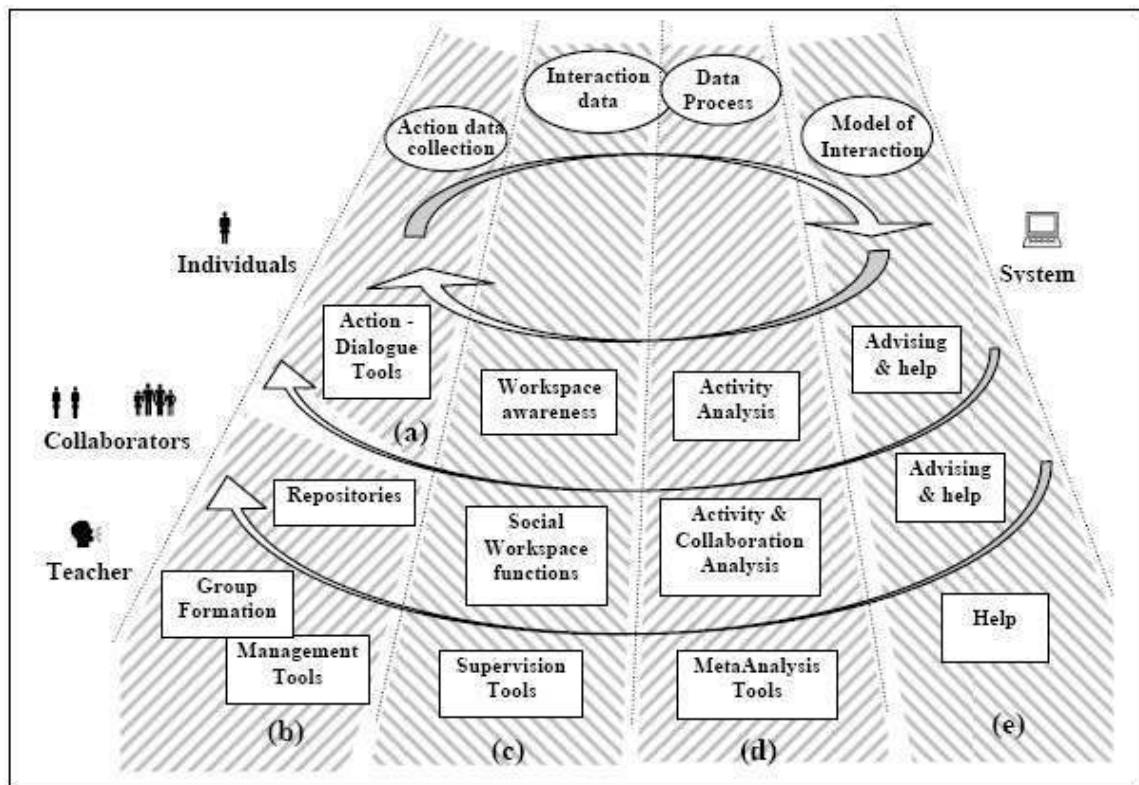


Figure 2.2 : System Processes During Collaborative Activity That Offer Tools And Functions to the Involved Human Aspects

(Dimitracopoulou, 2005)



According to the framework introduced by Dimitracopoulou (2005) which is addressed to primary and secondary education, it was derived from considerations of cognitive psychology, science education, and CSCL community search result. In particular, this framework consists of four fundamental considerations, which are:

*i) A vision of all agents and cognitive systems involved in collaborative learning settings.*

This collaborative process involves the pair of students, the collaborators or the whole learners, and the teacher. Both of individual student and the collaborative team play an important role during the collaboration process. On the other hand, the learning process particularly involves both learners and teachers. The whole community will equally take the responsibility and play their own role in order to let this collaborative environment meaningful and successful. Thus, we need to consider each actor: (i) the individual, (ii) each specific team, (iii) the whole learners' community that is formed and (iv) the teacher.

*ii) A complete view of the necessary tools and functions supporting collaborative learning.*

Ideally, each agent and each cognitive system needs some basic tools to fulfill five functions that allow and support collaboration for achieving learning progress. The functions involve :

a) Action and discussion, which refers to 'action data collection' and 'action dialogue tools'. These functions refer to the communication used by students during the learning processes. It may consist of instant or real-time messaging,

which will be used for collaborative purpose in order for the students to communicate with their peers (group) to get into solution.

- b) Course Management includes ‘repositories’, ‘group formation’, and ‘management tools’.
- ‘Repositories’ are the place where the students work will be stored in order for the teacher to have access to it.
  - While ‘Group Formation’ is referring to the collaborating group of students, which is either assigned by teacher or formed by the students themselves.
  - ‘Management Tools’ will be used by the teacher to manage academic works.
- c) Workspace awareness functions covered ‘workspace awareness’, ‘social workspace functions’, as well as ‘supervision tools’.
- ‘Workspace Awareness’ is the place or the work space that will be used by the students to perform activities. This is the place uses by student to finish their tasks.
  - ‘Social Workspace Functions’ is the place where student or pair of students can perform their work, finishing assignments or tasks, and having discussion with their pairs. They can use it for communication purpose.
  - ‘Supervision Tools’ is used by the teacher to assist students during the collaborative teaching and learning processes. It may be supported by the use of chat application, instant messaging, video or audio conferencing.

- d) Analysis Tools is referring to ‘meta analysis tools’ and ‘activity and collaboration activities’.
- ‘Meta Analysis Tools’ is meant for the teacher to analyze the students’ work in order to evaluate their performance.
  - ‘Activity and Collaboration Activities’ means for collaborative activity and can be supported by the use of chat tools.
- e) Help and Advising functions involve ‘Advising and Help’ and ‘Help’ which lead to simple help systems or more advanced advising systems for students and teachers.

iii) *A vision of a mixed category of collaborative learning systems.*

There are two dominant systems’ categories which are problem-solving or exchanging ideas which can be seen from (ii) ‘*A complete view of the necessary tools and functions supporting collaborative learning*’.

iv) *A vision of the control of the collaborative process as distributed to all the agents.*

How a system processes the whole interaction, what functions it assures and to whom it is addressed. The individual user has available the tools for action and dialogue in order to function in a private workspace or interact and collaborate through a shared workspace. In order to manage production, users have also access to specific tools (e.g. repositories). The collaborative learning system internally collects the data of each user’s actions as well as that of the interactions among all participants and then processes this data, eventually constructing a model of actions

and interactions. This system assures the continuation of the five main functions that are necessary to support collaboration.

## **2.6 RESEARCH THE SIMILAR EXISTING SYSTEM**

Research has been done on several existing systems to examine the features inside each of the collaborative system. The advantages and disadvantages of the systems are highlighted and some relevant ideas to improve the existing system are suggested. On the other hand, a few good features found in the existing software will be adapted to this project.

The research on the similar existing system involves five other systems, as discuss in the following paragraph :

- Web-Based Collaborative Learning System (WebICL)
- Learning through Collaborative Visualization (CoVis) Project
- Virtual Learning Environment (VLE)
- CoMMIT - Collaborative Multi-Media Instructional Toolkit
- GREWPtool

### **2.6.1 Web-Based Collaborative Learning (WebICL)**

The explanation of the WebICL system was given by Jianhua *et al.*, (2000) who mentioned that WebICL describes about the modeling and system design. It includes systematic necessary, tutor's necessary, and peer's necessary which are :

- *Systematic necessary*

Systematic necessary focus on development, implementation, operation, and interaction, which they will impact flexibility and adaptability of WebICL.

- *Tutor's Necessary*

Within WebICL environments, the role of the tutor is in most respects no different to their role in face-to-face cooperative learning situation. Tutor's necessary includes how to facilitate teaching effect, how to organize instructional approach, and how to realize the teacher's role of leader, designer, facilitator, guider, assistant, evaluator and assessor.

- *Peer's Necessary*

Student's necessary includes learning content (curriculum knowledge), learning resource, interaction approach, learning tools, learning environment, and systematic interface.

In WebICL, organizing the learning group process includes the data of learning group structure that will be fetched from *group structures interface* module (peer and tutor), database module, curriculum knowledge module, evaluation module, tutor module, and CL tools module. The working mechanism and processes of each module is described as follows. In order for a student to use WebICL, student need to register first. And when the student login through *student interface*, WebICL system will search his register account number in *student records database*. Then the data of student model was acquired and sent them to *student grouping module*. That is the general flow of WebICL.

From the modeling and system design, we can see the strengths and weaknesses.

Advantages:

- Provides the member login function.
- Consist variety functions that fulfill the collaborative teaching processes and activities.
- The databases are well-arranged.

Disadvantages:

- WebICL seems to be too complicated for the level of users.

### **2.6.2 Learning through Collaborative Visualization (CoVis) Project**

Basically, CoVis is a software that focuses on how to use applications of high performance computing and communications technologies to support Science education reform. CoVis is learning through Collaborative Visualizations and it is function as a “collaborative learning environment” for the Science education.

The CoVis Project provides students with a range of collaboration and communication tools. These include desktop video conferencing, shared software environments for remote, real time collaboration, access to the resources of the Internet, a multimedia scientist’s notebook and scientific visualization software. The CoVis Project is specifically designed for learning ability and usability by

students, teachers, and new groupware environments to support collaborative learning and work by students and educators (Gomez, 1998).

Advantages:

- It provides graphics and visualizations which are pretty good and very suitable for its purpose to display the weather conditions.
- The result is accurate.
- Consists functions of collaborative.

Disadvantages:

- Lack of normal functions like user guide, member login. There is no user manual to refer to.

### **2.6.3 Virtual Learning Environment (VLE)**

As described by O'Leary (2007), VLE is used for teaching and learning purpose. In order to increase the effectiveness of its purpose, VLE provides online courses and online activities such as chat room. This system is categorized into four major sections which are known as 'Study Room', 'General Office', 'Meeting Room' and 'Work Room'.

Below are some commonly perceived advantages and disadvantages of using VLE.

### Advantages:

- Easy online delivery of materials.
- Easy to use for both students and lecturers.
- Widens student access on and off campus to learning materials and resources.
- Offers flexible support for educators who do not need to be in a fixed time or place to support and communicate with students.
- Has the potential for new ways of learning and teaching such as active and independent learning which make use of online communication, online assessment and collaborative learning.

### Disadvantages:

- Can become a 'dumping ground' for materials not designed to be delivered online.
- Copyright of materials need to be considered.
- Off campus access to hardware and networks can be problematic for both students and educators and raises issues of equality. Disability legislation and accessibility to online materials also need to be considered.
- Need to plan online support carefully
- Such independent learning still needs to be guided and supported. Appropriate training and ongoing support is still needed for both students and educators.



#### **2.6.4 CoMMIT - Collaborative Multi-Media Instructional Toolkit**

Lautenbacher (1996) explained that CoMMIT is a system which provides computer support for a variety of educational models including cooperative, distance, and problem-based learning. CoMMIT also provides a comprehensive and collaborative environment. The students could work together in a group, or do independent work that was later shared with the group. The students were instructed to record their findings in an individual paper-based journal.

Using CoMMIT, notes can be generated by the individual group member, after that, every member can response to each individual notes. This is called a collaboration sequences among members. Notes can further be discussed among group using the asynchronous activity sessions before they reach to a conclusion. At the end of the session, two reviewers will perform a scoring evaluation of the entries from both the electronic and paper base work.

Advantages:

- CoMMIT is supported with multiple graphics which help students understand its concept easily.
- Since CoMMIT use both electronic and paper bases, it can be seen that the notes on materials are more organized in the electronic base.
- The concepts to be learned in the electronic base are better documented, and the coherence of thought chains is higher in the electronic base.
- More interaction is documented between team members in the electronic case.

- There is better coherence, accuracy and use of scientific facts in the electronic base.

Disadvantages:

- The interface design is not really suitable for the students' level since it looks very complicated.
- The system is lack of real-time communication tools for student to collaborate among each other.

### **2.6.5 GREWPtool**

GrewpTool is an online collaborative system that allows students to experiencing the collaborative learning environment. GrewpTool provides few communication tools among students where it has a chat window which let the students communicate using an instant messaging. This is a collaborative editor that allows one or more students to simultaneously edit code, and a pair of browser windows where students can navigate through the assignment and a manual. All user interaction with the tool is logged and there is a playback mechanism, which allows one to analyze the learning session in great detail. Student will be given time frame to complete a test (Taneva, 2005).

Advantages:

- Provides a communication space which is known as 'chatting window', and the students may interact with one another in real-time.
- Consists an editor that allows one or more than one students to edit same document at the same time.

- Consists a pair of browser windows where the students are able to navigate through help pages and watch the other students' webpage views.
- It records a precise history of every key stroke of the students, including the delete key, the number of key strokes each user has typed, the number of chat messages each user has sent, and the detailed activity of each user.
- The history file can then be played back.

Disadvantages:

- The length of talk between students cannot determine the students' correctness of answer. Students might talk frequently but for the wrong answer.
- The amount of time spent talking can determine the closeness of the students but not the depth of collaboration.
- Lack of features to support collaborative learning.

#### **2.6.6 Comparisons of the Five Similar Systems Based on CL Features and Framework Elements**

After all the collaborative systems; WebICL, CoVis, VLE, CoMMIT, and GREWPtool have been studied and investigated, the comparisons have been made in accordance with the Collaborative Learning (CL) features discussed earlier in Section 2.3.7 plus the elements consists in framework (from Section 2.5). Therefore a comparison table, which is Table 2.3 has been produced to represent the details.

Table 2.3: Comparing the Five Existing Systems with Collaborative Learning Features and Framework Elements

CL Features and Framework Elements	System Functionality	WebICL	CoVis	VLE	CoMMIT	GREWP tool
<i>Agent</i> <i>(Student)</i> <i>(Teacher)</i>	<i>Member Login</i>	√	√		√	√
	<i>Group formations</i>	√	√	√	√	√
	<i>Group Joining</i>	√	√	√		
	<i>Group Activity</i>		√	√	√	√
<i>Synchronous tools that support communications</i>	<i>Audio Conferencing</i>					
	<i>Video conferencing</i>		√			
	<i>Chat</i>	√				√
	<i>Instant Messaging</i>					
	<i>Whiteboards / Editor</i>		√			√
<i>Asynchronous tools to support communications</i>	<i>Discussion Boards / Forums</i>	√	√		√	
	<i>Calendar</i>					
	<i>Links / Search Engine</i>	√	√	√		
	<i>Group Announcements (Bulletin Boards)</i>		√			
	<i>E-mail</i>		√	√		
	<i>Surveys/Polls</i>					
<i>Content Integration</i>	<i>Courseware</i>		√			
	<i>Streaming Media / Visualizer</i>		√	√		√
	<i>Narrated Slideshows</i>					
	<i>e-books</i>					
<i>Document Management</i>	<i>Resource Library</i>		√			
	<i>Upload / Download</i>		√	√	√	
	<i>Permission- based Access</i>		√	√		
<i>Workspace Awareness</i>	<i>Working Space</i>	√	√	√	√	√
<i>MetaAnalysis Tools</i>	<i>Online Assessment</i>	√		√	√	√
<i>Supervision Tools</i>	<i>Online Supervision</i>	√	√	√		
<i>Collaborative Technique</i>	-	N/A	N/A	N/A	N/A	Paired Annotations

*N /A= Cannot be determined.*

Table 2.3 place the Collaborative Learning (CL) Features on the leftmost column, where the first five rows are the features of CL, while the rest of the rows are the elements of the framework. The ‘System Functionality’ column lists all the functions which are supposed to be in the collaborative system, categorize into the specific sections accordingly. The rest of the column heading labeled as WebICL, CoVis, VLE, CoMMIT, and GREWPtool are the five similar systems use for comparison.

From Table 2.3, it can be concluded that none of the systems fulfill all the CL features and framework elements. However, the best system is CoVis since it fulfills all the *Agent* features, where CoVis is provided with the member login function, group formation by teacher, group joining by students, as well as group activity. The *synchronous* communication is done through the use of video conferencing as well as a shared editor, while *asynchronous* communication is supported with the use of four tools which are forums, search engine, bulletin boards, and e-mail. The courseware and visualizer are used for the *content integration*. The *document management* is handled with the use of upload and download tool, as well as the resource library, where all the documents are accessed with the *permission-base*; only the appointed members can access specific documents. Having a *supervision tool* for the teacher/instructor, CoVis also provides a *working space* for all the learners. However, the collaborative technique used for CoVis cannot be determined.

From the study, it can be seen that the least complete system is CoMMIT, where it applies only seven out of sixteen CL features / framework elements. For the *Agent* features, it provides only the login and group formation function. It is provided with only *asynchronous tool* which is forum, and not the *synchronous tool* to support communication. CoMMIT is lack of *content integration* function, however it is provided with the upload

and download function for the *document management*. The *work space* is provided for the learners while the instructor has the ability to do an *online assessment*. The collaborative technique used for CoVis, however, cannot be determined.

Other three systems which are WebICL, VLE, as well as GREWPtool fulfill nine, eleven, and eight CL features and framework elements accordingly. Thus, they are considered as average collaborative tools, which are not too good nor too poor. The most important thing is they are able to fulfill the least CL necessity.

Analyzing the table horizontally, it can be seen that a few features are not supported by any of the compared systems which are audio conferencing, instant messaging, calendar, surveys/polls, narrated slideshows, and e-books. On the other hand, the features that are supported by all the systems are group formation and working space. The only one system that can be determined its collaborative technique is GREWPtool.

Therefore, it can be concluded that all the systems have their own strengths and weaknesses. A collaborative system shall fulfill the minimum of one function for each feature, even though they will work better with more functions.

Most of the reviewed systems do not mention the name of the collaborative technique applied in their system. However, based on the study and analysis made, it is obvious that none of the reviewed system uses Think-Pair-Share technique for the collaborative activity. However, the researcher finds that Think-Pair-Share is useful to be as an alternative to the collaborative teaching due to its several advantages.

Think-Pair-Share has advantages over the other collaborative techniques. The 'think', 'pair' and 'share' concept incorporate the important activities among students

during their learning process. It allows all and every student to develop answers. With think-pair-share technique, students are more willing to suggest ideas because they have already discussed it with their partner. Thus, it helps students to be more active in class. Also, the Think-Pair-Share technique enhances the student's oral communication skills as they discuss their ideas with the rest of the class before the collaborative session ends.

## **2.7 CONCLUSION**

In sum, the researcher was able to understand the teaching theory and types. In order to make a gradual shift from traditional to modern teaching technique, it requires support from technology. Therefore a study regarding educational technology has been made to see how does technology change teaching and learning. When introducing the new technology to be adapted in traditional teaching, the new roles of teacher is highlighted, to see how this new technology can improve education, which provides a better teaching environment to both teachers and students. From the study we can see that the role of virtual teacher in technology-infused classroom often shift to a facilitator or coach rather than just a teacher who is giving lecture. The literature found that using new technology in teaching and learning yields positive results. In order to use it most effectively, teachers should possess skills that include the language of imagery as well as techniques of teaching virtually.

Different type of web-based education was compared. The discussion also touches about the Computer-Supported Collaborative Learning (CSCL) before making a comparison between 'traditional and collaborative learning'. After understanding the

collaborative teaching and learning in terms of its theory, the ‘why’ and ‘what’ it is, plus its processes and techniques, it can be concluded that this new teaching method gained more achievement among students since it allows group discussion and let the students solve a problem among themselves; and therefore students are more independent. Furthermore, collaborative processes are able to help students learn about the interaction and the group processes. The use of a figure explained this issue very well.

The discussion continues with the explanation on the ‘System Processes During Collaborative Activity’ framework taken from Dimitracopoulou (2005). After the framework has been studied, it can be seen that each element appears in this framework convey to the collaborative process, and it is clear that the existence and interaction of both teacher and student will inclusively increase the successful of the collaborative activity.

After all, few similar existing systems have been reviewed by making several comparisons. They were then compared in accordance to the Collaborative Learning features as well as the Framework elements studied earlier in this chapter. The comparisons are arranged in a table for a better understanding besides keeping a tidy look. The results from the comparison enable the researcher to get some ideas on how to organize and set up a new collaborative teaching system.



## CHAPTER 3

### RESEARCH METHODOLOGY

#### 3.1 INTRODUCTION

The research methodology is directly connected to the problem statement and the goal of research because the research goal and problem may vary different methods of research can be utilized. This chapter will explain about the methodology used to carry out this research. A diagram is produced to illustrate the steps to research methodology.

#### 3.2 RESEARCH METHODOLOGY

In order to accomplish this research, a few steps have been approached and the discussion on each steps are as follows :

Studies have been conducted in a few ways. The research has been done on several printed materials which involve library research in order to find related books and journals. Various books, dictionaries and journals that are related to *Software Engineering* and *Collaborative Teaching* are studied. Internet becomes as another important sources since it contains a lot of information from various researches and journalists. Moreover, it also acts as a learning source for knowing and understanding the new growth technology. This study also involves study the online journals and articles. The researcher has gone through various online libraries and communities with the intention to find related online journals and articles; which not only provide ideas and solution about this topic, but also on how to work on research.

The Literature Review (LR) involves conducive study on several areas which are Internet education that explains about the teaching pedagogy, theory and types. It is then focused on the technology adaptation in teaching to understand the educational technology; how does technology change teaching. Study was extended to the collaborative teaching and learning which covers the collaborative definition, theory, the what and why, and its process before comparing it with the traditional teaching. This research also touches on the Computer-Supported Collaborative Learning (CSCL) and comparing various collaborative techniques.

With the intention to understand more about web-based collaborative system, the similar existing systems are reviewed. A few existing systems that have been selected for reviewing are CoVis, WebICL, CoMMIT, VLE, and GREWPtool. Comparisons have been made in terms of collaborative teaching and learning characteristics found in the studied framework. Besides that, their contents and functionality are also been reviewed in the mean to find some ideas which can be applied in CETLs.

The researcher has conducted a study on the collaborative framework where the existing framework was analyzed, and applied. Before the framework was studied, the control of collaborative interactions in education was examined.

After few collaborative techniques have been revised, a specific collaborative teaching technique which is Think-Pair-Share has been selected. The researcher has made a further study to understand its structure and its traditional concept. Based on these ideas,

the computerized Think-Pair-Share technique is proposed to be applied in collaborative system.

This research also involves a collaborative system development. The system has been developed by using Rational Unified Process (RUP) methodology which involves Requirements, Analysis, Design, Implementation and Testing core workflows. In the testing part, besides performing Unit Testing, the testing was also conducted along with the user in secondary school using User Acceptance Test (UAT). UAT was conducted to evaluate the users' perception and acceptance towards the collaborative system. Here, the questionnaires that engross the 'usefulness' and 'ease of use' of the system were distributed to the target users which are secondary school students and teachers.

Finally, after all the steps and methodologies have been approached, the proposed collaborative system named as CETLs was produced.

These research methodologies are represented graphically for better viewing in the following Figure 3.1.

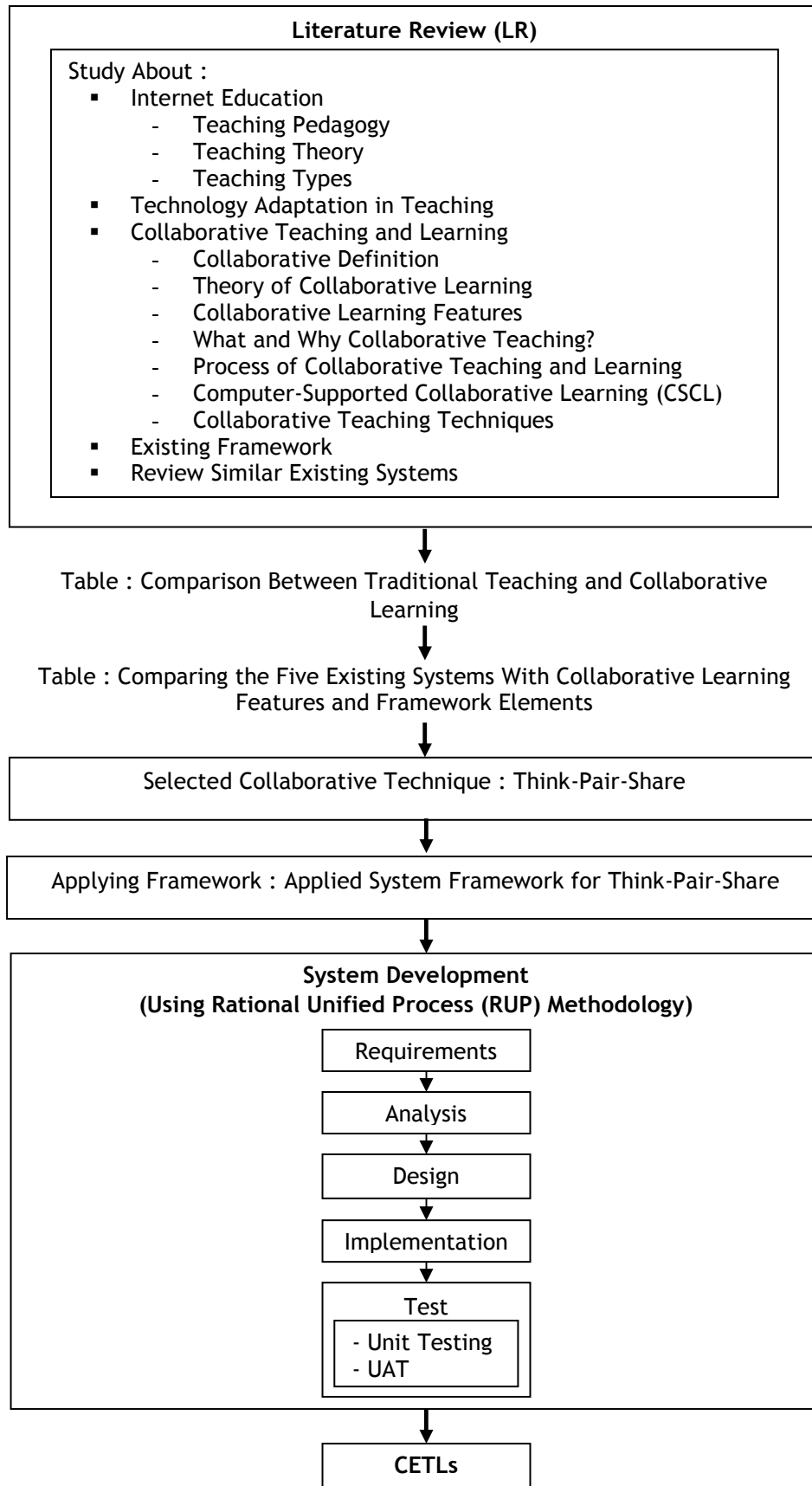


Figure 3.1 : The Steps to Research Methodology

### **3.3 SYSTEM DEVELOPMENT METHODOLOGY**

As mentioned and described in Section 3.1 and Figure 3.1, the development of the new collaborative teaching application; CETLs that uses Think-Pair-Share technique will be based on Rational Unified Process (RUP).

#### **3.3.1 Rational Unified Process (RUP)**

A methodology in the domain of information system must cover a number of aspects of the project, although coverage varies from one to another. Avison and Fitzgerald (1998) describe a methodology as a collection of many components. Typically, each methodology has procedures, techniques, tools and documentation aids that are intended to help the system developer in his or her efforts to develop an information system.

This CETLs project will use Rational Unified Process (RUP) methodology to guide the system development process and thus reduce the impact of many problems during development.

The Rational Unified Process is a software engineering process, which provides a powerful framework for application development. RUP defines disciplines, workflows, activities, roles and artifacts that control the software development, aiming to produce software with quality, on budget and within schedule. It is designed to model an object-oriented process which allows the team to gain the full benefits of the industry-standard Unified Modeling Language

(UML). Thus the process is likely enhances the team productivity since it identifies necessary activities and helps team layout a formal plan for the software development process (Cole, et al, 2004).

The Unified Process has three distinguishing characteristics. These characteristics are (Meloche, 2002) :

- Use-Case Driven

The process employs Use Cases to drive the development process from inception to deployment.

Use case modeling is a method of capturing the functional requirements of the system. A use case captures requirements as a sequence of actions that the system will perform to yield an observable result to a particular actor.

- Architecture-Centric

The process seeks to understand the most significant static and dynamic aspects in terms of software architecture. The architecture is a function of the needs of the users and is captured in the core Use Cases.

The architecture of a system is the blueprint for the application. It defines the overall structure of an application and determines how the functional requirements of the system will be satisfied.

- Iterative and Incremental

The process recognizes that it is practical to divide large projects into smaller projects or mini-projects. Each miniproject comprises an iteration that results in an increment. An iteration may encompass all of the workflows in the process. The iterations are planned using Use Cases. RUP based projects are developed in a series of controlled iterations.

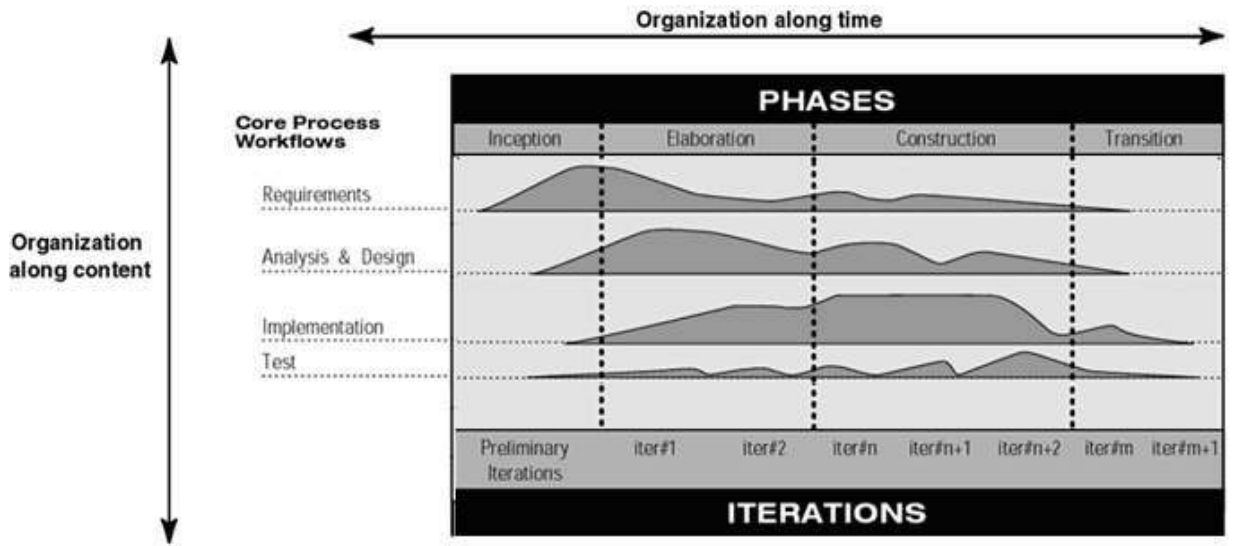


Figure 3.2 : Rational Unified Process (RUP) (Norlund, 2005)

**3.3.1.1 Four Processes Phases**

According to Meloche (2002), The Unified Process consists of cycles that may repeat over the long-term life of a system. A cycle consists of four phases: Inception, Elaboration, Construction and Transition. Each cycle is concluded with a release, and therefore key goals must have been achieved after critical decisions have been made in each phase.

#### **3.3.1.1.1 Inception Phase**

(A Rational Software Corporation White Paper, 1998) describes that, during the inception phase, the business case for the system should be established and the limit of the project scope is set up. This phase involves understanding the core business drivers in order to understand the business case for why the project should be attempted. The inception phase establishes the product feasibility and delimits the project scope.

In order to accomplish this, all external entities with which the system will interact (actors) will be identified. This involves identifying all use cases and describing a few significant ones. The business case includes success criteria, risk assessment, and estimate of the resources needed, and a rough schedule on project.

#### **3.3.1.1.2 Elaboration Phase**

The purpose of the elaboration phase is to analyze the problem domain, establish a sound architectural foundation, develop the project plan, and eliminate the highest risk elements of the project. During the elaboration phase the majority of the Use Cases are specified in detail and the system architecture is designed.

After gathering information, it requires to document and analyse the system requirements. This CETLs project will model the requirement in use cases. “Use cases specify the functionality that



the system will offer from the user's perspective. They are used to document the scope of the system and the developer understands of what it is that the users require" (Simon, *et al.*, 2002).

In the elaboration phase, an executable architecture prototype is built in one or more iterations, depending on the scope, size, risk, and novelty of the project. This effort should at least address the critical use cases identified in the inception phase, which typically expose the major technical risks of the project.

#### **3.3.1.1.3 Construction Phase**

During the construction phase the product is moved from the architectural baseline to a system complete enough to transition to the user community. The architectural baseline grows to become the completed system as the design is refined into code.

During the construction phase, all remaining components and application features are developed and integrated into the product, and all features are thoroughly tested. The construction phase is, in one sense, is to produce a product that is ready to put in hands of its end-users. At minimum, it consists of :

- The software product integrated on the adequate platforms.
- The user manuals.
- A description of the current release.

#### **3.3.1.1.4 Transition Phase**

In the transition phase the goal is to ensure that the requirements have been met to the satisfaction of the stakeholders. This phase is often initiated with a beta release of the application. Other activities include site preparation, manual completion, and defect identification and correction. The transition phase ends with a postmortem devoted to learning and recording lessons for future cycles.

The transition phase focuses on the activities required to place the software into the hands of the users. Once the product has been given to the end user, issues usually arise that require developing new releases, correcting some problems, or finishing the features that were postponed.

The transition phase is, in one sense, primarily confine with user feedback, product tuning, configuring, installation, and usability issues.

#### **3.3.1.2 Core Workflows**

The Rational Unified Process provides each team member with the guidelines, templates and tool mentors necessary for the entire team to take full advantage of it. It consists of the total of nine workflows, with 5 engineering workflows and three supporting workflows (A Rational Software Corporation White Paper, 1998). The workflows are not sequential and likely will be worked on during all of the four phases. The workflows

are described separately in the process for clarity but they do in fact run concurrently, interacting and using each other's artifacts (Meloche, 2002).

The 5 engineering workflows are (A Rational Software Corporation White Paper, 1998) :

#### **i. Requirements**

- The second major RUP workflow that requires the capture of business rules is the Requirements workflow. The purpose of the requirements workflow includes :

- Establishing what the system is to do.
- Establishing the boundaries of what the system is to do.
- Communicating the requirements of the system to the developers.

- There are two major categories of requirements for any system. These are :

- Functional requirements – the business functions and features the system must provide. The functional requirement for CETLs has a relation with the applied framework, where the functional requirements are determined according to the applied framework.
- Non-functional requirements – attributes of the system that are not functional but affect how the system is to be developed. These include quality attributes, such as performance and scalability, and other technical, regulatory or legal constraints. CETLs has been determined according to its performance which focus on its system load factor, safety and security requirements.

## **ii. Analysis**

- This workflow concern with the analysis of the functional and non-functional requirements of the system and the subsequent design of an architecture and software components that will satisfy the requirements.
- Use case models capture the requirements as a series of use cases and use case diagrams, which depict the relationships between the various use cases and the actors who interact with them. One use case diagram to represent the system (CETLs) has been produced, having all the actor's and use case description. In addition, the detail analysis of CETLs has been interpreted in few diagrams such as Component and deployment diagrams.

## **iii. Design**

- CETLs has been logically and physically designed. The logical design involves interface, form and database design which then be transferred to physical design.

## **iv. Implementation**

- Subsequent to the Analysis and Design workflow is the Implementation workflow. The primary activities of this workflow are the construction and integration of the software components. In theory, this workflow does not require any explicit knowledge of the business rules other than how to implement them, as specified in the

component design. In practice, there is generally a significant amount of refinement of business rules performed during this workflow. The construction of CETLs begins in this workflow.

#### **v. Test**

- The major activities of the test workflow are the design, implementation and execution of tests to ensure the constructed software meets its requirements. The various requirements documents and models, including the business rules document, are used as inputs to the design of the tests. The functional tests have been made towards the collaborative system, CETLs. Few test cases have been provided to log the error report.

### **3.4 CONCLUSION**

This chapter has emphasized the methodology used to carry out the research. In the mean to support the additional research to develop an educational collaborative system, further study was focused on the Rational Unified Process (RUP) methodology, before choosing it as a platform to develop the proposed system. The explanation is highlighted on the RUP phases and workflows; where the explanation is highlighted according to the carried tasks.

**CHAPTER 4**  
**THINK-PAIR-SHARE TECHNIQUE FOR COLLABORATIVE**  
**TEACHING APPLICATION**

**4.1 INTRODUCTION**

In general, collaborative teaching and learning is a complex activity. Research about it has many methodological and theoretical perspectives. Collaborative learning, in brief, is small groups of students work together to maximize their own and their classmates' learning. This type of activities fit into the constructivist learning strategies. Collaborative activities mean a paradigmatic change with respect to traditional or conductist educational approach. There are changes in roles and responsibilities for students and teachers involved during the teaching and learning processes.

On the other hand, technology may provide tools to improve communication and information management and this could have a positive impact on educational processes. This should change people attitudes about knowledge and way of thinking.

‘Software methodology is as set of activities and associated results which lead to the production of a software product. These may involve the development of software from scratch although it is increasingly the case that new software is developed by extending and modifying existing systems. These activities are mostly carried out by software engineers’ (Sommerville, 2001).

This chapter will first explain about the selected technique that will be applied in the collaborative teaching environment. The further explanation will then focus on the

framework, as well as the development methodology that will be as a practical guideline during the system development.

## **4.2 SELECTED TECHNIQUE**

Some techniques are more compatible with certain activities or instructional goals than others. For instance, Fishbowl is good for developing skills; Pairs Check and Jigsaw are good for learning new material; and Word Webbing and Two-Box Induction are good for relating concepts. (Leonard, *et al.*, 1999).

### **4.2.1 Think-Pair-Share**

Think, Pair, Share is a technique first developed by Professor Frank Lyman at the University of Maryland in 1981 and adopted by many writers in the field of co-operative learning since then. It introduces into the peer interaction element of co-operative learning the idea of ‘wait or think’ time, which has been demonstrated to be a powerful factor in improving student responses to questions. It is a simple strategy, effective from early childhood through all subsequent phases of education to tertiary and beyond. It is a very versatile technique, which has been adapted and used, in an endless number of ways. This is one of the foundation stones for the development of the ‘co-operative classroom’ (Bell, 1998).

Think-pair-share is a relatively low-risk and short collaborative learning technique, and is ideally suited for instructors and students who are new to collaborative learning (Wisc, 2006). Defined by Ledlow (2001), “Think-Pair-Share is a low-risk strategy to get many students actively involved in classes of any size”.

Ledlow (2001) also declared that think-pair-share technique in education is also about :

- **Think** about your answer individually.
- **Pair** with a partner and discuss your answers.
- **Share** your or your partner's answer, when called upon.

#### **4.2.1.1 The Purpose of Think-Pair-Share**

Obviously the purposes of this technique are to process information, having a communication and develop thinking among students.

#### **4.2.1.2 The Idea of Traditional Think-Pair-Share**

The following table 4.1 explains about the Think-Pair-Share technique in detail; description of what, why and how to apply this technique in the collaborative teaching environment (Nsw, 2006).



Table 4.1 : What, Why, and How the Traditional Think-Pair Share is (Nsw, 2006)

What	Think Pair Share
Why	<ul style="list-style-type: none"> <li>▪ A cooperative learning strategy where students interact with a partner, and then partners, to share information.</li> <li>▪ This strategy is a structured process to share information efficiently. It can be used as a reflective tool at any stage throughout the learning process. The process can lead to other learning situations that build on background knowledge and understanding.</li> </ul>
How	<p>1. <b>Think</b> - As individuals</p> <p>Outline a particular task or discussion point. Each student thinks about the task or topic, taking notes or jotting down ideas. This stage gives students a chance to write down their answer before discussing it with their pair. The teacher may collect written responses from each student before allowing them to continue to the ‘Pair’ stage.</p> <p>2. <b>Pair</b> - In pairs</p> <p>Ask students to form pairs. The pairs of students then discuss their thoughts and ideas about the task or the notes taken, before come out with a conclusion from the pair discussion. The pair will then create a new answer that incorporates the best of the ideas.</p> <p>3. <b>Share</b> - Pair Share To The Whole Group</p> <p>Ask pairs to share their thought with the rest of the class. The pairs then discuss their group thoughts and ideas about the task or discussion point.</p> <ul style="list-style-type: none"> <li>▪ <b>Timing</b> It is important for the teacher to state the time allowed for each activity and stick to it. Depending on the complexity of the task, the time for each activity may vary. Normally the ‘think’ stage require less duration compared to other two stages. This is due to the less complex task assigned for individual during the ‘think’ stage.</li> </ul>

As illustrated by Nsw (2006), the idea of the traditional think-pair-share is having the students independently think or solve a problem quietly, then pair up and share their thoughts or solution with someone nearby. Each pair should be prepared to share their thoughts or solution with the class. In another words, it is meant to let the team learns from each other.

While applying this technique, the teacher creates a challenging or open-ended question and gives time to students to think about it. Students will first start formulates answers by him/herself before he/she pairs with a collaborative group member to discuss their ideas about the question for several minutes. This technique gives all students the opportunity to discuss their ideas. At this knowledge construction stage, the students will find out what they do and do not know which is very valuable for them. Normally this active process is not widely practice during traditional lectures.

“After several minutes the instructor solicits student comments or takes a classroom ‘vote’. Students are much more willing to respond after they have had a chance to discuss their ideas with a classmate because if the answer is wrong, the embarrassment is shared. Also, the responses received are often more intellectually concise since students have had a chance to reflect on their ideas. The Think-Pair-Share technique also enhances the student's oral communication skills as they discuss their ideas with the one another” (Wisc, 2006).

Think-Pair-Share has many advantages over the traditional questioning structure. The ‘think’, ‘pair’ and ‘share’ concept incorporate the

important activities need to be developed among students during their learning process. It allows all and every student to develop answers; not necessarily a short answer but longer and more elaborate answers as well. Normally, students will feel very shy to shoot out their ideas or answers in traditional way of teaching, for fear that they will be criticized, or the answers might be wrong. They do not have enough courage to express themselves as they are trained to think alone. However, with think-pair-share technique, students are more willing to take risks and suggest ideas because they have already discussed it with their partner. Therefore, it helps students to be more active in class by presenting their ideas with no fear.

#### **4.2.1.3 Advantages of The Think-Pair-Share Technique**

Concluded from (Bell, 1998), the benefits gained from Think-Pair-Share technique are:

- It is quick since it does not take much preparation time.
- The personal interaction motivates many students with little intrinsic interest in the subject taken.
- Multiple kinds and levels of questions can be asked.
- It engages the entire class and allows quiet students to answer questions without having to stand out from their classmates.
- Teacher can assess student understanding by listening in on several groups during the activity, and by collecting responses at the end.
- Teacher can do think-pair-share activities once or several times during a given class period.

#### **4.2.2 Applying Think-Pair-Share Technique In CETLs**

Based on the previous study made, it can be concluded that the collaborative teaching technique; Think-Pair-Share is suitable to be automated; a revolution from traditional to computerize Think-Pair-Share. Therefore this research proposes a collaborative system named CETLs that will use Think-Pair-Share technique for the teaching process.

According to the previous study, it is also noticed that Think-Pair-Share is seen as a technique that well-suited to be applied to teaching Science. This is due to its implementation style, which let the student taking his/her time to think by themselves first, before they can discuss it with his/her pair. Science is a subject that requires students to solving and planning together. For that reason, Think-Pair-Share will help students solve Science problems by conferring it with their partner. During the pair discussion, they will gain and generate more ideas, which lead to a better planning, yet a better solution.

After examining the processes of collaborative teaching and learning in Chapter 2, under Section 2.3.8 specifically, plus the concept and structure of traditional Think-Pair-Share (refer Section 4.2.1.2); a collaborative teaching technique, it is discovered that the computerized / automated Think-Pair-Share (CETLs) must consists of the following aspects in order to successfully implement the collaborative teaching:

- ***Subjects***

CETLs will focus on Science subject. The suitability of this subject is because of its suitability to be applied for a group process. Science require analytical thinking among learners, since it require learners to make a conclusion and find solution according to the experiment or lessons learned. Thus, working in a group to learn Science will not only encourage students to be more active, but to gain more ideas and knowledge sharing. “Science is useful in stimulating critical thinking and helps students to clarify ideas through discussion and debate” (Richard, 1994).

- ***Treatment***

Both notes and tutorial questions are available online, which means the teacher need to upload the notes while the students will download it. The assignment will also be uploaded online; which require students to upload their solution and answer back to the teacher.

- ***Group Selection and Size***

CETLs will allow the teacher to assign group. The selection of the ‘pair’ will be determined by the teacher before the collaborative session begins. Each group must consist of only two students, since Think-Pair-Share allow only two students to work as a group during the ‘pair’ stage.

- ***Individual Learning***

The 'think' stage requires student to work alone. Each student needs to write down their answer in his/her private window in the given time duration. This happen before he/she starts pairing with his/her partner. The individual answer need to be submitted to the teacher for evaluation purpose.

- ***Collaborative Learning***

The collaborative learning involves two stages which are 'pair' and 'share'. After the students have been assigned a group by the teacher, they will start the collaborative activity (after the 'think' stage) with his/her partner during the 'pair' stage. During this time, students need to discuss their ideas with peers in their communication window, where they have to find the best solution to the given question, which also can be called as problem solving. Then each group need to submit their work to the teacher.

The 'share' stage will give the opportunity for each group to share their thought with everybody in the learning environment, including the teacher. Here, the teacher can take the opportunity to consult students on the given task. A special discussion area will be provided in CETLs.

- ***Grading***

The purpose of assigning task to each student and each pair is to evaluate their understanding on the subject matter. It is also to ensure that every group member has learned something from the discussion. Each assignment

and task will be assessed by teacher online. The individual and group marks will be allocated accordingly.

- ***Instruments***

Since CETLs is mainly focus on teaching Science subject, therefore students may refer to the models, graphs, text book or any other resources to help them find the right solution during the collaborative process. Students may also refer to the lecture notes which are downloadable from CETLs.

### **4.3 APPLIED FRAMEWORK**

After doing the analysis on the collaborative teaching environment plus the existing framework in Chapter 2, this chapter comes out with a framework, which applied the existing framework with slight adjustments.

#### **4.3.1 Applying Think-Pair-Share in Framework**

Since the available framework from the current study (refer Section 2.5) was meant for many-to-many communication and does not suit Think-Pair-Share; which require student to interact in pair-basis, therefore it is adjusted to make it suitable to support the whole collaborative environment process that uses Think-Pair-Share technique. Figure 4.1 illustrates the applied framework :

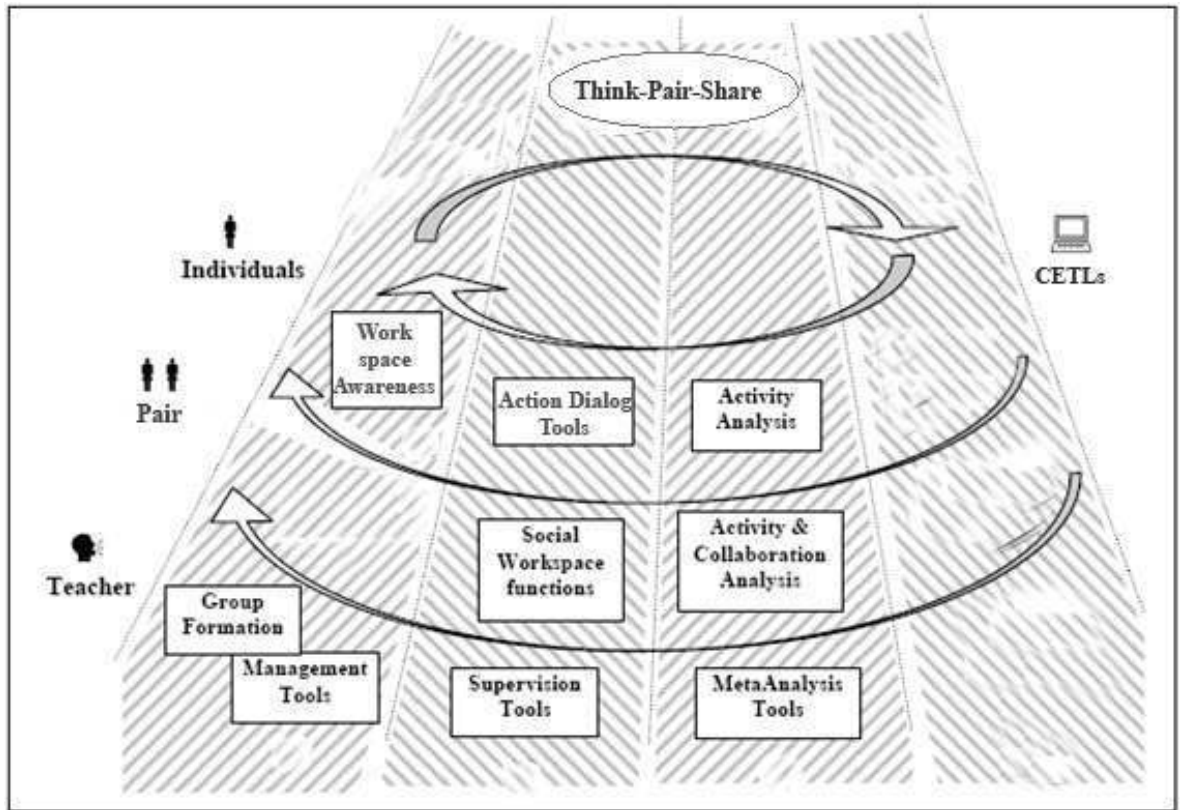


Figure 4.1 : Applied System Framework for Think-Pair-Share

(Adapted from Dimitracopoulou (2005))

By referring to the applied framework of the collaboration process (refer figure 4.1), it is noticeable that the collaborative learning process requires both students and teacher to get involve. This framework particularly focuses on the process happen in the collaboration activity and interaction happens between users and the system; CETLs, where the users can be either students or teacher. The collaborative activities might happen between teacher and students, or between a pair of students. Students, who act as collaborator in pair-basis, will perform specific tasks and actions by having a teacher as an observer or supervisor. The attention of this framework is given to the ‘teacher’, ‘pair collaborator’, and the ‘system’ itself.



Concerning about the existence of the teacher as an instructor to students in this collaborative environment, this framework highlight the usefulness of the collaborative system to the teacher, as well as the students. Specifically, the interaction between the system and user are classified according to the user level, focusing on the necessary functions supporting collaborative teaching and learning activities :

All users, both **teacher** and **students**, can involve in :

i) Think-Pair-Share

Think-Pair-Share technique is applied to the whole processes of CETLs. Think-Pair-Share activities involve individual students, the pair of students which also known as collaborators, and the teacher. Both of individual and pair of students play an important role during the collaborative process. The whole community will equally take the responsibility and play their own role in order to let this collaborative environment meaningful and successful. Thus, CETLs take into account each actor which are: (i) the individual, (ii) pair of students (group), (iii) the whole learners' community that is formed and (iv) the teacher.

**Teacher** can use the system to do:

i) Group Formation

For every collaborative class, teacher needs to assign an activity for the students in think-pair-share manner. The teacher will give a chance for the students to work alone first; which we call it as a '**think**' stage. Then they will be grouped into two for '**pair**' stage. After the submission of both tasks has

been made, they need to be in the 'share' stage where the teacher will also involve for a discussion.

Teacher can use the system to form a group of collaborators, and to know each group, whom they are paired with, and which group or class is the teacher conducting. The list of online students will be printed on the screen, so that the teacher will have an idea on how many pairs of students is he/she dealing with.

## ii) Management Tools

Teacher will use this tool to manage his/her work. Here the teacher can use the announcement (bulletin board) module in both ways, whether to post it or to read it. An announcement can be posted to variety type of users, whether for all users, for only teachers, for all students, or a specific group of students. Old announcement can be deleted accordingly.

Besides that, teacher can also upload new assignment for a particular class and determine the due date of the assignment. Students must upload their answer back to the teacher before the final date in order for them to get marks. The assignment will automatically be closed once it reaches the due date.

Whenever the teacher wants to start a collaborative class, he needs to open the collaborative session first. Each session is only valid on the date created and specific period given. When the time is over, the students are no longer can have the pair or class discussion. Therefore they have to be in the class during the assigned time.

### iii) Supervision Tools

Acting as a supervisor, the teacher will use this specific function to assist and offer help to students during the ‘**share**’ stage of collaborative teaching and learning processes. Both parties can interact by sending text message to each other, using a chat application. The teacher must be there in the system to help the students learn.

### iv) MetaAnalysis Tools

Processing the data involves analyzing the students’ work. Teacher need to assess and evaluate the students in order to grade them, and the analysis is done based on the students answer and their performance. Also involve the activity of giving comment on the written answer. The analysis of students’ work is done according to :

- **Think**

During the ‘think’ stage, the student is accessed individually. The teacher will first distribute questions to each students and set the appropriate timer. Once the timer ends, every student need to submit their work to the teacher. The teacher is able to access and evaluate the individual’s work online by giving marks and comments. If there is no submission made by the students during this stage, the student will get no marks.

- **Pair**

In this ‘Pair’ stage, the student needs to work with their partner assigned by the teacher earlier before the collaborative session begins. All the students work will be accessed in pair-basis.

- **Share**

The evaluation is made according to open discussion which allows all users to take part.

Ideally, the **students** will have specific function to interact which are :

- i) **Workspace Awareness**

This workspace is reserved for '**think**' activity. This is the place or space uses by each student to finish their first task individually. Each student will receive questions from the teacher and he/she needs to work on it before the time is up. Once the time ends, everyone needs to submit the answer to the teacher in order to get marks.

- ii) **Action Dialog Tools**

This function refers to the communication tool used by each student during the learning processes. It consists of instant or real-time messaging, which will be used by individual student for collaborative purpose in order for the students to communicate with their '**pair**' (group) to get into solution.

- iii) **Activity Analysis**

The students are allowed to perform their own sides-activity which supports collaborative process. E-mail and notes downloading can be the examples.

iv) Social Workspace Functions

This is the place where student or pair of students can perform their work, finishing assignments or tasks, and having discussion with their pairs. They can use it for communication, plotting and typing their ideas while discussing with peers or collaborators.

v) Activity and Collaboration Activities

The ‘**share**’ activities will take place, having a place for everybody to make a real-time communication and conversation.

#### **4.3.1.1 Think-Pair-Share and Framework Summary**

After studying and understanding this framework, it is clear that the need of every collaborative class involve having both teacher and students as the agent, as well as the discussed framework elements which involve the collaborative activities and workplace. In addition, by referring to Section 4.2.2, the conclusion can be made that the processes of collaborative teaching and learning that applies Think-Pair-Share technique should consist all of the aspects discussed within the stated section, which are *Subjects, Treatment, Group Selection & Size, Individual Learning, Collaborative Learning, Grading*, as well as *Instruments*. This is due to the similarity which match the elements consist in the applied framework. Therefore, all the aspects from Section 4.2.2 will be kept as it is, without any

addition. After knowing the content needs, the development methodology of the proposed system is determined.

#### **4.4 CONCLUSION**

Like it or not, technology keeps on evolving in all aspects of our life including education. The result from this study shows that technology can be used creatively and cooperatively to enhance educational sector, both in teaching and learning activities.

As mentioned previously, cooperative learning and technology are natural partners. Results of the studied made on the collaborative teaching technique which is Think-Pair-Share and the applied framework showed that the need of both teacher and students to be appeared during the teaching process is essential. Both parties play different roles which lead to better outcomes. Each element in the applied framework are discussed by highlighting its use; both about users and activities that support collaborative by applying the Think-Pair-Share technique.

In addition, the Think-Pair-Share technique has been determined as suitable to be automated, thus to be applied in the proposed system.

## **CHAPTER 5**

### **ANALYSIS OF CETLs**

#### **5.1 INTRODUCTION**

‘System analysis is a systematic investigation of user requirement to arrive at a definition of a system’ (McDaniel, 1994). Hence, this chapter will discuss about the requirements needed by the system, or CETLs in specific.

#### **5.2 THE REQUIREMENTS FOR CETLs**

The requirements of CETLs are based on the outcomes from the previous study in Chapter 2, 3 and 4. The requirements that are going to be highlighted are the requirements of the software and hardware, functional and non-functional requirements, plus a use case diagram.

#### **5.3 SOFTWARE REQUIREMENTS**

Choosing the right software is one of the most important criterion for CETLs system development since it will determine the quality and performance of the final system. This section comes with the details of every software used for the development of CETLs.

### **5.3.1 Operating System For Web Server**

#### **5.3.1.1 Windows XP Professional (Service Pack 2)**

Windows XP Professional (Service Pack 2) offers enhancement and better protection against hackers, viruses, and worms since Microsoft has made security a top priority, and helping users take a proactive approach to protecting a computer, information, and privacy.

To install Windows XP Professional (Service Pack 2), a personal computer with the minimum requirement of a CD-ROM drive, a 233-Mhz processor, 64 MB RAM, and 900 MB of available disk space during installation is needed.

### **5.3.2 Web Server Software**

#### **5.3.2.1 Internet Information Services (IIS)**

In general, Microsoft Internet Information Services (IIS) comes as a package with current version of Microsoft Windows Server operating system. IIS, as a Microsoft product, was originally designed to run only on Windows NT and Windows 2000 operating system. It has been released for Microsoft Windows 2003 Server and runs on the Windows XP operating system. However, it is not included as standard part of the Windows XP. IIS also includes the Microsoft FrontPage website development tool and other reporting tools.

IIS's inclusion of ASP provides an application environment in which HTML pages and scripts can be combined to produce dynamic web pages. For this CETLs project, IIS will be used as the web server.



### **5.3.3 Server Side Scripting**

#### **5.3.3.1 Active Server Pages (ASP)**

Microsoft has developed a technology called Active Server Pages (ASP) which capable to add interactivity to web pages, including server-side task running databases, without CGI scripting. However, using ASP requires web server to run the Microsoft's Internet Information Services (IIS), which only runs on Windows NT, 2000 and XP. Since ASP code runs on the web server, it can refer to the information stored on the server, including text files and database. By the use of Open-source Database Connection (ODBC), it is easy to use commands to write or read from the database. Those commands, however, are yet another language, namely Structured Query Language (SQL).

Although the basics of ASP scripting are simple, ASP scripts can be long and complicated, to create entire applications implemented in a web server. This CETLs project will make use of this server-side scripting since it allows web pages to be dynamic with Java script support.

#### **5.3.3.2 Java Script**

Java script is known as scripting language and most often used for client side web development. JavaScript is a dynamic and prototype based scripting C language. The code are been written into an HTML page and the HTML page will convert the page for easily to used. For example a new window can be opening or popping up with programmatic control over the

size, position and also can make the menu toolbars is visible or not. JavaScript is supported by Mozilla, Explorer and Opera and it is suit with the system requirements.

### **5.3.4 Database**

#### **5.3.4.1 Microsoft Access**

Microsoft Access contains significant security enhancements, in addition to stability and performance improvements. Microsoft Access also suitable for business database or database tools. Since the CETLs is developed for only one school, and will be used by only secondary students from age 14 to 15 (form 2 and form 3), therefore the size of the database is not too large and can definitely be supported by Microsoft Access.

### **5.3.5 Tools**

#### **5.3.5.1 Adobe Photoshop CS**

Adobe Photoshop is a graphical editor or a tool that has been specifically designed to edit images, media, animation, and authoring. This tool can provide a non-linear editing and special effects services, such as backgrounds, textures, and web design. Adobe Photoshop CS is a professional image-editing standard which will allow the professional designers and graphics producers to create sophisticated images for print, the Web, wireless devices, and other media. It supports a lot of model color such as RGB, CMYK, grayscale and bitmap and has the ability to read and write in different image formats such as .EPS, .PNG, .GIF, .JPEG, Fireworks, etc.

### 5.3.5.2 Macromedia Dreamweaver MX 2004

Macromedia Dreamweaver is a web authoring tool that can give the ability to create impressive web pages. Dreamweaver can design tools to produce better-looking websites. The features inside such as new layout and graphics tools will make it easier to design. It supports not only the HTML language, but the ASP, PHP, ASP.NET and any other language as well. The use of Javascript is supported by this tool as well. The interface and layout is very user friendly, which can support a fast system development.

### 5.3.6 Summary of the Software Requirements

After a lot of researches and studies had been carried out, summarization of selected software for CETLs development is presented in the following table.

Table 5.1 Software Requirements

<b>Tool</b>	<b>Software</b>
Operating System	Microsoft Windows XP
Web Server Host	Internet Information Services
Database Management System	Microsoft Access 2003
Server Side Scripting Language	Active Server Pages (ASP)
Scripting Language	JavaScript
Image Editor	Adobe Photoshop CS
Web Development	Macromedia Dreamweaver MX 2004
Web Browser	Microsoft Internet Explorer 6.0

## 5.4 HARDWARE REQUIREMENTS

CETLs will be developed within the best-suited hardware environment to ensure that it will support the development process to be smoothly running. In addition, this will prevent external errors from hindering the projects, or from slowing down the system. The proposed development hardware requirements are shown in the table below.

Table 5.2 Hardware Requirements

<b>Description</b>	<b>Hardware</b>
Type and speed of processor	Intel Pentium 4 processor 2.6GHZ
Amount of memory	256MB DDR SDRAM
Size of hard disk	40GB Hard Disk Drive
Operating System	Windows XP

## 5.5 FUNCTIONAL REQUIREMENTS

The functional requirements for a system describe the functionality or services that the CETLs is expected to provide. Here, the functional requirements for CETLs are derived from the discussions made within Section 2.5 and the elements found in the applied framework under Section 4.3. It is then presented in the tables below :

### 5.5.1 Functional Requirements According to Elements Consist in Framework

Table 5.3 : General Requirements

Framework Elements	Requirements	CETLs Functions
Management Tools	R1	<ul style="list-style-type: none"> <li>▪ The system shall provide a working space for ‘coordinator’ which includes:               <ol style="list-style-type: none"> <li>1. System Administration</li> <li>2. Class Management</li> <li>3. Announcement Management</li> <li>4. Messaging System</li> <li>5. My Profile</li> </ol> </li> </ul>
	R1.1	<ul style="list-style-type: none"> <li>▪ Coordinator can view the list of teachers and students registered with the system. They are listed according to the registration date; in the sequential order.</li> <li>▪ Coordinator has the right to either block or unblock the user depending on the case.</li> <li>▪ Those who are blocked from accessing the system will be indicating with the red tag line.</li> <li>▪ Coordinator can also add another new coordinator by turning on the user’s icon in the particular user’s profile.</li> </ul>
	R1.2	<ul style="list-style-type: none"> <li>▪ All new classes must be registered with the system, and coordinator is the only one who needs to do it.</li> <li>▪ Once the new class is opened/created, it will be listed in the existing active class.</li> <li>▪ The coordinator must assign at least one teacher for every new class opened.</li> <li>▪ This is to prevent from creating fake class.</li> <li>▪ During assigning class to a teacher, coordinator is provided with a table which displays the name of the teacher together with their assigned class/es.</li> </ul>

**Table 5.3, continued**

		<ul style="list-style-type: none"> <li>▪ For any class that needs to be shutting down, the coordinator need to ‘retire’ it.</li> </ul>
	R1.3	<ul style="list-style-type: none"> <li>▪ All users can access; whether to read it (coordinator, teacher, and students) or to post a notice (coordinator and teacher).</li> <li>▪ Coordinator and teacher can type an announcement in advance, because it will only be published after the status is turned to ‘active’.</li> <li>▪ Coordinator and teacher are able to post a notice to a specific class.</li> </ul>
	R1.4	<ul style="list-style-type: none"> <li>▪ An alternative to an email, which can only be used internally. Meaning the email is specifically designed to be used by the registered user only.</li> <li>▪ The functions allow the user to compose, reply or receive a new email and optionally attach a file.</li> </ul>
	R1.5	<ul style="list-style-type: none"> <li>▪ Coordinator is allowed to update his profile, whether to change a name, password, or email.</li> </ul>
	<b>R2</b>	<p>The system shall provide the working space for ‘teacher’ to perform the following tasks:</p> <ol style="list-style-type: none"> <li>1. Announcement Management</li> <li>2. Assignment Management</li> <li>3. Notes Management</li> </ol>
	R2.1	<ul style="list-style-type: none"> <li>▪ Teacher can use the announcement (bulletin board) module in both ways, whether to post it or to read it.</li> <li>▪ An announcement can be posted to variety type of users, whether for all users, for only teachers, for all students, or a specific group of students.</li> <li>▪ Old announcement can be deleted accordingly.</li> </ul>
	R2.2	<ul style="list-style-type: none"> <li>▪ Teacher can upload new assignment for a particular class and determine the due date of the assignment.</li> </ul>

		<ul style="list-style-type: none"> <li>▪ The assignment will automatically be closed once it reaches the due date.</li> <li>▪ For the existing assignment, teacher is able to view the progress of the students.</li> <li>▪ For each work submitted by the students can be seen and rated by the teacher.</li> <li>▪ Teacher can assign marks together with the comments.</li> <li>▪ The marks will be visible in each student’s window.</li> </ul>
	R2.3	<ul style="list-style-type: none"> <li>▪ Teacher is provided with the ‘upload notes’ function.</li> <li>▪ This function supports various kinds of files to be uploaded.</li> <li>▪ Notes can optionally be uploaded to specific group of students only.</li> </ul>
Group Formation	<b>R3</b>	<p>The system shall allow the ‘teacher’ to assign collaborative group (pair) to students.</p> <p>1. Class Management</p>
	R3.1	<ul style="list-style-type: none"> <li>▪ After the students registered with the system, they need to select class. During this time, teacher may either accept or reject the student’s request.</li> <li>▪ For every collaborative class, teacher needs to priory assign partner for each group.</li> <li>▪ Then the teacher will assign an activity for the students in Think-Pair-Share manner.</li> <li>▪ The teacher can view all the classes that were assigned under him.</li> <li>▪ For each class, the teacher might also view the list of students registered, plus the number of think-pair-share group available in the class.</li> </ul>

Activity Analysis	<b>R4</b>	The system shall allow the ‘students’ to perform the following activities :  <ol style="list-style-type: none"> <li>1. Active Assignment</li> <li>2. Uploaded Notes</li> <li>3. Messaging System (e-mail)</li> </ol>
	R4.1	<ul style="list-style-type: none"> <li>▪ Student can view and download all the assignments uploaded by the teacher. Students can also upload their solution of assignments back to the teacher.</li> </ul>
	R4.2	<ul style="list-style-type: none"> <li>▪ Students are able to download all available notes.</li> </ul>
	R4.3	<ul style="list-style-type: none"> <li>▪ Read and compose mail messages to all registered users. Also able to attach any files.</li> </ul>

Table 5.4 : ‘Think’ Stage Requirements

Framework Elements	Requirements	CETLs Functions
Workspace Awareness	<b>R5</b>	The system shall provide the work space for each ‘student’ in order for them to accomplish the tasks given by the teacher:  <ol style="list-style-type: none"> <li>1. Think</li> <li>2. Timer</li> </ol>
	R5.1	<ul style="list-style-type: none"> <li>▪ Each student receive task from the teacher.</li> <li>▪ Student need to answer the questions individually.</li> </ul>
	R5.2	<ul style="list-style-type: none"> <li>▪ Once the time is up, every student needs to stop answering and submit the work to the teacher.</li> <li>▪ After the ‘think’ answer has been submitted and evaluated by the teacher, each pair is able to view the results and marks.</li> </ul>



MetaAnalysis Tools	<b>R6</b>	<p>The system shall provide the working space for the ‘teacher’ to analyse students’ work. For every collaborative class, teacher needs to assign an activity for the students in ‘Think-Pair-Share’ manner. Students are given a chance to work alone first; which we call a ‘think’ stage. Therefore at this stage, the evaluation towards students’ work is done according to :</p> <ol style="list-style-type: none"> <li>1. Think</li> <li>2. Timer</li> </ol>
	R6.1	<ul style="list-style-type: none"> <li>▪ During the ‘think’ stage, the student is accessed individually.</li> <li>▪ All answers from each student need to be submitted to the teacher during the initial collaborative activities.</li> <li>▪ The teacher is able to access and evaluate the individual’s work online by giving marks and comments.</li> </ul>
	R6.2	<ul style="list-style-type: none"> <li>▪ The ‘think’ activity will run successfully with a timer set by the teacher.</li> <li>▪ For each assignment given by the teacher, should be completed in a given period of time. Each student need to submit it once the time is up.</li> </ul>

Table 5.5 : ‘Pair’ Stage Requirements

Framework Elements	Requirements	CETLs Functions
Action Dialog Tools	<b>R7</b>	The system shall provide a real-time or instant messaging system for every ‘pair’ of ‘students’:
Social Workspace Functions	<b>R8</b>	<p>Here the interaction between pair of ‘students’ should take place.</p> <ol style="list-style-type: none"> <li>1. Pair</li> <li>2. Timer</li> </ol>

**Table 5.5, continued**

	R8.1	<ul style="list-style-type: none"> <li>▪ In this ‘pair’ stage, the student will form a group of two.</li> <li>▪ The solution from each pair needs to submit to the teacher online.</li> <li>▪ The student and his/her partner (pair) discuss and answer questions posted by the teacher.</li> <li>▪ Both pair of students communicates with each other using instant messaging.</li> <li>▪ After the ‘pair’ answer have been submitted and evaluated by the teacher, each pair is able to view the results and marks.</li> </ul>
	R8.2	<ul style="list-style-type: none"> <li>▪ The outcome from the pair discussion will be submitted to the teacher online after the time elapse.</li> </ul>
MetaAnalysis Tools	<b>R9</b>	<p>The system shall provide the working space for the ‘teacher’ to analyse students’ work. Therefore at this stage, the evaluation towards students’ work is done according to :</p> <ol style="list-style-type: none"> <li>1. Pair</li> <li>2. Timer</li> </ol>
	R9.1	<ul style="list-style-type: none"> <li>▪ From the submission of each pair on the given task, the teacher will make an evaluation by giving comments to each question, together with the marks.</li> </ul>
	R9.2	<ul style="list-style-type: none"> <li>▪ Similar to the think stage, the ‘pair’ activity also use the timer to control the time taken by the pair of students to finish their collaborative work.</li> <li>▪ Each group need to submit only one final solution in a given time.</li> </ul>

Table 5.6 : ‘Share’ Stage Requirements

Framework Elements	Requirements	CETLs Functions
Activity and Collaboration Analysis	<b>R10</b>	The system shall provide chatroom which is mean for : 1. Share
	R10.1	<ul style="list-style-type: none"> <li>▪ All students can interact among them in a chatroom. Everybody can type and send message to others.</li> <li>▪ Further discussion (from every ‘pair’) regarding the current task can be made.</li> </ul>
Supervision Tools	<b>R11</b>	The system shall provide the place of interaction for the ‘teacher’ to supervise students. <ul style="list-style-type: none"> <li>▪ Share</li> </ul>
	R11.1	<ul style="list-style-type: none"> <li>▪ During this final or ‘share’ stage, the system provides the user a special interaction place which is chatroom, in which every member in the collaborative class can involve.</li> <li>▪ The role of the teacher is to give solution and answer to any questions from students regarding the current collaborative activities.</li> <li>▪ The interaction happens in chat-basis, where each student is identified by their names.</li> </ul>

### 5.5.2 Use Case Diagram for CETLs

Use cases are scenario-based technique for requirement elicitation, it is description of the functionality of the system from user's perspective. Use case diagrams are used to show the functionality that system will provide and to show which users will communicate with the system in some way to use that functionality (Simon, *et al.*, 2002). With this approach, use case diagram is applied as a functional model to describe the functionality of the system from the user's point of view.

Use case is particularly specifying the functionality that the system will offer from the user's perspective. They are used to document the scope of the system and the developer understands of what it is that the users require (Simon, *et al.*, 2002). Each use case is analyzed separately to identify the objects that are required to support it. The use case is also analyzed to determine how these objects interact and what responsibilities each of these objects have in order to support the use case.

The whole functional requirements discussed in Table 5.3 – Table 5.6 are represented using the following Use Case Diagram (refer figure 5.1).



Figure 5.1 explains that CETLs is specially composed for three categories of users which are teacher, student, and coordinator. Coordinator is responsible for administrative part such as handling and approving teachers' and students' registration, as well as managing the teachers and students list.

As a normal user, teacher needs to register himself and wait until the registration is approved by the coordinator before he can continue using the CETLs. The teacher is the one who holds the responsibility to manage his respective class where the teacher needs to make approval for the class and students assigned under him. The teacher will also manage the collaborative class by creating a new class, assigning collaborative partner, and get engage in the collaborative class to get involve with the 'Think', 'Pair' and 'Share' activities. Other activities that can be performed by the teacher in CETLs are managing announcement, uploading assignment and notes which are meant for students. Besides the chatroom which is available in the 'Share' activity, the teacher may use the messaging system to communicate with the students.

Another user is student, who needs to register to the system too. After getting the approval from the coordinator, then the student is able to choose the active class to join in. This process however needs approval from the class teacher. It was mentioned above that the teacher will use CETLs for uploading assignments and notes. Therefore all those materials will be downloaded by the students. Once the collaborative class has been created or opened by the teacher, students may join the class in order to get engage in 'Think', 'Pair' and 'Share' activities. Teacher can be contacted by the students using messaging system.

### 5.5.2.1 Actors and Use Cases

Table 5.7 : Actors Description for CETLs Use Case Diagram

<b>Actor</b>	<b>Description</b>
Coordinator	Staff within the school whose role is to provide administrative support that enables the work of all system's user to take place.
Teacher	Staff who teaches on a particular class.
Student	Any student in the school which registered with the system.

### 5.5.2.2 Use Case Description

Table 5.8 : Use Case Description for CETLs Use Case Diagram

<b>Use Case</b>	<b>Description</b>
Register	When a new user (both teacher and student) enter the system for the first time, they need to register themselves.
Approve Registration	When the new users register themselves, coordinator needs to approve their registration by assigning the 'active/inactive' status.
Manage System Admin	This includes manage the list of teacher and students.
Manage Class	Whether to create new class or to produce the class list according to the registration made by students.
View Active Class	All the classes opened will be displayed to students, to let them make selection.
Approve Class	Teacher will determine whether or not to approve students' selection according to the given list.
Assign Collab Partner	This is the inclusion of 'approval of class'. Te collaborative partner will be assigned by the teacher once he/she approve the students' selection.
Join Collab Class	Students will join the collaborative class opened by the specific teacher.

**Table 5.8, continued**

Manage Announcement	New announcement can be posted while the existing announcement can be updated or removed.
Upload Assignment	Teacher uploads the notes online. Each note uploaded will be labeled with the name, and the date uploaded.
Download Assignment	Students can download notes that have been uploaded by the teacher.
Use Messaging System	All parties may enjoy using the messaging system, compose and reply mail to each other.
Manage Collab Class	Everytime the teacher wants to start the collaborative activity, he/she needs to open the session first.
Engage in Collab Class	After the collaborative session is opened, the students are allowed to start the collaborative activity. This includes think, pair, and share activities.
Engage in 'Think' stage	The 'think' activity require student to work alone in his own private window.
Engage in 'Pair' stage	'Pair' activity requires students to work with partner in a social workspace.
Engage in 'Share' stage	The 'Share' activity is provided with a chat room for discussion.

### 5.5.2.3 Detail Use Case Description

Described in Table 5.5.2.2 are the brief descriptions of each use cases for Figure 5.1. Table 5.9 – Table 5.12 provide detail descriptions for few use cases, mainly focus on the collaborative class management and the teacher-student interaction. The detail description for the rest of the use cases can be obtained in Appendix E.



Table 5.9 : Detail Use Case Description for 'Assign Collaborative Partner'

<i>Name</i>	Assign Collaborative Partner
<i>Participating actors</i>	Initiated by Teacher Communicates with Student
<i>Flow of events</i>	<ol style="list-style-type: none"> <li>1. The Teacher opens any of his active classes.</li> <li>2. CETLs will list all the registered students for the class together with their registration date.</li> <li>3. To assign the collaborative partner for collaborative activities, teacher needs to select two students (to assign as one pair), by clicking on the checkbox. Teacher will assign the group name (indicated as A1, A2, A3, and so on) for each of the pair.</li> <li>4. CETLs displays the list of the collaborative group (pair).</li> </ol>
<i>Entry condition</i>	<ul style="list-style-type: none"> <li>▪ The Teacher is logged into CETLs.</li> </ul>
<i>Exit condition</i>	<ul style="list-style-type: none"> <li>▪ The lists of collaborative partner (pair) are generated.</li> </ul>

Table 5.10 : Detail Use Case Description for 'Manage Collaborative Class'

<i>Name</i>	Manage Collaborative Class
<i>Participating actors</i>	Initiated by Teacher Communicates with Student
<i>Flow of events</i>	<ol style="list-style-type: none"> <li>1. The Teacher activates the "Manage Collaborative Class" function.</li> <li>2. Teacher create new collaborative class by generating the 'Think', 'Pair', and 'Share' session.</li> <li>3. The Teacher specifies a class name, description, start and end dates.</li> <li>4. Teacher sets the timer for Think and Pair activity (the timer is in minute basis).</li> <li>5. Teacher assigns Think question(s) for every student, Pair question(s) for each group of two, and Share question(s) for all students.</li> <li>6. The Teacher selects which group to notify (only the selected group can join the specified collaborative session).</li> <li>7. CETLs creates a collaborative environment for the session consist of Think, Pair and Share working place.</li> <li>8. On the application start date and time, CETLs allow the specified students to get engage in the collaborative class until the timer ends (extends use case Engage in Collaborative Class)</li> </ol>
<i>Entry condition</i>	<ul style="list-style-type: none"> <li>▪ The Teacher is logged into CETLs.</li> </ul>
<i>Exit condition</i>	<ul style="list-style-type: none"> <li>▪ The Teacher confirmed the generation of the new collaborative class and completed assign tasks.</li> </ul>

Table 5.11 : Detail Use Case Description for 'Engage in Collaborative Class'

<i>Name</i>	Engage in Collaborative Class
<i>Participating actors</i>	Initiated by Student Communicates with Teacher
<i>Flow of events</i>	<ol style="list-style-type: none"> <li>1. Student joins the collaborative class which consists of 'Think', 'Pair', and 'Share' activities.</li> <li>2. Student get engage in the collaborative class (include use case engage in 'Think' activity).</li> <li>3. Student will accomplish individual task during Think stage and submit it to the Teacher. The Teacher will then evaluate the task.</li> <li>4. Students get engage in Pair session (include use case Engage in 'Pair' Activity). Student starts collaborate with his/her partner (pair) to solve the given task(s) before submitting it to the Teacher for evaluation.</li> <li>5. Students join the Share session (include use case Engage in 'Share' Activity) where all the Students will collaborate together with the intervention and collaboration from the Teacher.</li> </ol>
<i>Entry condition</i>	<ul style="list-style-type: none"> <li>▪ The Student is logged into CETLs and joins the collaborative class.</li> </ul>
<i>Exit condition</i>	<ul style="list-style-type: none"> <li>▪ Each Think, Pair and Share session ends accordingly.</li> </ul>

Table 5.12 : Detail Use Case Description for 'Upload Assignment'

<i>Name</i>	Upload Assignment
<i>Participating actors</i>	Initiated by Teacher Communicates with Student
<i>Flow of events</i>	<ol style="list-style-type: none"> <li>1. The Teacher activates the "Upload Assignment" function.</li> <li>2. CETLs will display the uploading assignment environment, where the Teacher can browse for the file (to upload). Only one file can be uploaded at a time.</li> <li>3. Once the file is chosen, Teacher clicks on the 'Upload File' button which later brings the Teacher to a new page.</li> <li>4. Teacher fills in the details of the uploaded Notes such as <ul style="list-style-type: none"> <li>- Notes description</li> <li>- Status of the Notes (Active or Inactive)</li> <li>- Close Date (due date)</li> </ul> </li> <li>5. CETLs lists all the group (class) under the Teacher's supervision.</li> <li>6. Teacher selects the group of Students (class), which he wants to upload the file to (only the selected group can access the file).</li> <li>7. Once the 'Save' button is clicked, the uploaded file will be listed in the 'My Uploaded Assignment' field.</li> <li>8. Teacher can view/edit/delete the uploaded notes.</li> <li>9. The uploaded assignment can be viewed and downloaded by the Students (include use case Download Assignment).</li> <li>10. Teacher is able to view the Students' progress on each assignment. <ol style="list-style-type: none"> <li>11. To view the progress of each Student on a particular assignment, Teacher clicks on the 'Progress' icon next to the assignment name.</li> <li>12. CETLs displays the list of all students involve with the particular assignment.</li> <li>13. Those who have submit the assignment solution back to the Teacher will be marked as 'Send', where the submission date is also stated.</li> <li>14. Teacher can simply view the student's answer by clicking on the 'View Doc' icon. CETLs will display the document submitted by the Student.</li> </ol> </li> </ol>
<i>Entry condition</i>	<ul style="list-style-type: none"> <li>▪ The Teacher is logged into CETLs.</li> </ul>
<i>Exit condition</i>	<ul style="list-style-type: none"> <li>▪ The Teacher selects the file he wishes to upload.</li> <li>▪ List of uploaded files is generated.</li> <li>▪ Student submitted the answer to Teacher (upload solution).</li> </ul>

## 5.6 NON-FUNCTIONAL REQUIREMENTS

Non-functional requirements are those requirements which are not directly concerned with the specific functions delivered by the system. They may relate to emergent system properties such as performance, safety and security requirements.

### 5.6.1 Performance Requirements

#### - System Load Factor

Response time is considered in this part. The response time may increase due to the increment of the data in database. This system will be a web-based system designed to operate on any terminal on the networked PC service. The program will have to access only one shared file, which will be the Microsoft Access database. It is assumed that this database will be stored over a network on the server.

#### - Database Factor

The database is a file that will be shared across a network. The database is assumed to be able to handle limited simultaneous request on a table. This number of transaction will only be reached when there are multiple instances of the program running on separate terminals all accessing the database at the same time. Thus, the database must be in the well design to make sure the performance of the application is good enough.

### **5.6.2 Safety Requirements**

No data shall be lost when a power failure occurs as well as damage to the records stored in the database, it is because the data is protected from software and hardware faults. Backups are the last line of defense against hardware failure, floods or fires, catastrophic virus or spyware infections, the damage caused by a security breach or just accidental deletion of data.

### **5.6.3 Security Requirements**

Some functions are protected by the username and password. This authorization is needed to prevent the unauthorized users from accessing the system. CETLs allow three level access to the system which are 'Coordinator', 'Teacher' and 'Student'. Different user has different level of access.

## **5.7 ASSUMPTIONS**

There are few things that need to be considered during the development of CETLs since it involve the teacher and secondary school students. In order for them to use this system, they are assumed to have the basic knowledge of the Science subject. The most important factor is to assume that they the basic knowledge on how to use the computer. The users are also assumed to have their own personal computer at home with the internet connection.

## **5.8 CONSTRAINTS**

CETLs also has its limitation which we called it as constraints. Before the user can use this sytem, they must have an internet connection since this system can only run with the support of internet. It will be best viewed in Microsoft Internet Explorer 6.0 and above.

There is limited database storage for CETLs since the system is using Microsoft Access. This is due to the capacity availability of Microsoft Access it self. Besides that, the system can only be accessed by the registered students, teachers and coordinator. Therefore all of the functions including email can only be used internally.

## **5.9 CONCLUSION**

After studying and analyzing the concepts of collaborative technique; Think-Pair-Share from Section 4.2, and the collaborative framework in Section 4.3, this chapter came out with the identification of various aspects of requirements. The functional requirements for CETLs have been identified according to the elements consist in the framework. The identification of the requirements are extended to analyzing the software, hardware, functional and non-functional requirements. Since use case diagram specifies the functionality offered by the system from the user's perspective, it is often used to understand the scope of the system. Hence a use case diagram plus its description is produced.

As the result from the analysis of CETLs functional requirements, it is able to show the interactivity happen from two different users which are student and teacher during the collaborative process. All the analysis made according to framework and collaborative technique; Think-Pair-Share which comes from the previous study in previous chapter.

## **CHAPTER 6**

### **DESIGN OF CETLs**

#### **6.1 INTRODUCTION**

Tracing back the history of the web creation was merely to assist scientist in exchanging information. It is apparent that the web is invented not to compete with the stylish design of lustrous magazine or television. Up until today, scheming and managing a page layout remains one of the web greatest issues. As been discussed in chapter 2, the Web users are becoming more sophisticated and this has more or less increased their expectations in terms of user interface and functionality. In this chapter, the discussion will go in deep of the system architecture, database design which is presented in data dictionary, the Class diagram to model the details of design, major components of user interface design plus some samples of the CETLs user interface.

#### **6.2 ARCHITECTURE OF THE SYSTEM**

##### **6.2.1 Client server architecture**

Client server is the network server which separates a client from a server. Each instance of client software can send requests to a server. Specific types of server include application servers, file servers, and mail servers. Users send the requests to the web server and the web server finds all the information through the database server. The web server will send the information back to web browser to let user look at it. One of the types of client sever architecture is three – tier client server architecture. The three-tier client server architecture has been chosen for

CETLs development. The system concept is suitable with the client server concepts where by CETLs is a web-based system that needs to be accessed through the internet. The architecture is suitable and provide the scalable architecture. The three-tier client server architecture is divided by three phases which are:

#### **6.2.1.1 Client Tier**

The client is managing the user interface where the processes of the user take place. The client for CETLs is the computer used by coordinator, teacher and students.

#### **6.2.1.2 Application Servers/Tier**

The application server is to process all the business and data processing logic for the clients where a server computer dedicated to running certain software applications. Here the systems will performs query/update processing and transmits response to client. CETLs will process all the collaborative and administrative activities performed by all parties. This application supports file uploading and downloading, real-time message transfers, online editing, as well as e-mailing.

#### **6.2.1.3 Database Servers Tier**

The database server will generate data validation and database request for transmitting to the server. The database provides the database



services to other computer programs or computers. Here, the server will accept and process the database request from clients and check the authorization. Database management systems use in CETLs is Microsoft Access which frequently provides database server functionality. The database keeps all the students, teachers, and coordinators' record, and transactions made by them.

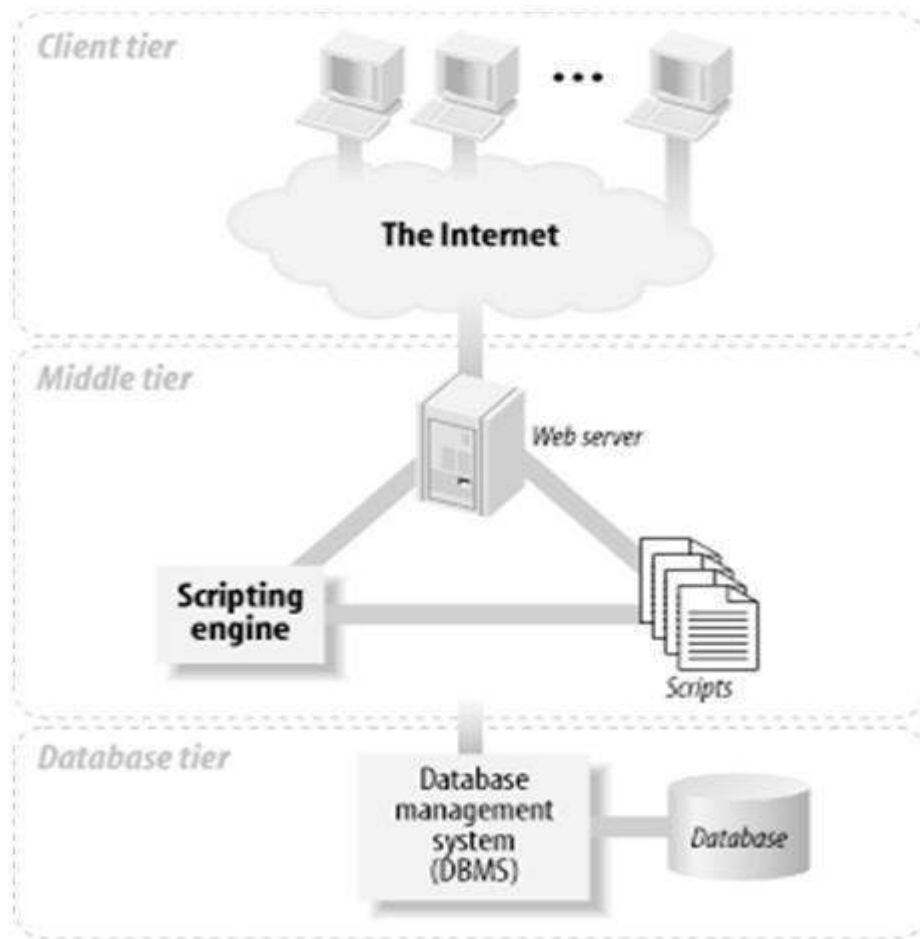


Figure 6.1: Three-tier Architecture Model (Juel, *et al.*, 2005)

## 6.3 DATABASE DESIGN

The database design is explained in details with the use of Data Dictionary under Section 6.3.1 below.

### 6.3.1 Data Dictionary

There are fifteen tables used to compose a database for CETLs development. The tables are named as *Administrator*, *Teacher*, *Student*, *Group Formation (Student collection)*, *Student Homework*, *Collaborative class (Student)*, *Notes*, *Assignment*, *Collaborative Class (Teacher)*, *Message (Pair)*, *Homework (Think)*, *Sending E-mail*, *E-mail*, *Collection*, and *Collection Message (Share)*. The details of each table are represented in data dictionary as shown in Table 6.1 – Table 6.15.

Table 6.1: Table for Administrator

Field Name	Type	Size	Description
ID	AutoNumber	8	Administrator's ID
Name	Text	30	Administrator's name
IC_No	Text	50	Administrator's username for sign in.
pwd	Varchar	20	Administrator's username for sign in.
Email	Text	10	Administrator's phone number
Last_login	Text	6	Administrator's gender

Table 6.2: Table for Teacher

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Teacher's ID
Name	Text	250	Teacher's name
IC_No	Text	50	Teacher's username for sign in.
Email	Text	20	Teacher's email
Last_login	Text	6	Teacher's last login
Dt_Register	Text	100	Teacher's date register
Rank	Text	long Int	Teacher's Rank
Status	Number	long Int	Teacher's Status
Pwd	Text	15	Teacher's username for sign in.
New	Number	long Int	New teacher
Date	Date/Time	Date/Time	Teacher's login date

Table 6.3: Table for Student

Field Name	Type	Size	Description
ID	AutoNumber	8	Student's ID
Name	Text	250	Student's name
IC_No	Text	50	Student's username for sign in.
Email	Text	20	Student's email
Last login	Text	6	Student's last login
Dt_Register	Text	100	Student's date register
Status	Number	long Int	Student's Status
New	Number	long Int	New student
Pwd	Text	15	Student's username for sign in.
Date	Date/Time	Date/Time	Student's login date

Table 6.4: Table for Group Formation (Student collection)

Field Name	Type	Size	Description
ID	AutoNumber	-	Auto increment id.
Day	Number	long Int	Day
Month	Number	long Int	Months
Year	Number	long Int	Year
Collection	Text	250	Class
Name	Text	20	Class Name
IC_No	Text	50	Identification number
Status	Number	long Int	Class status
Grouping	Text	50	Class group

Table 6.5: Table for Student Homework

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id.
ICNo	Text	50	IC number
Eday	Number	longInt	Date for student submission
Emonth			
Eyear			
Time	Text	250	Current system time
Mark	Number	longInt	Marks to the student
Comment	Memo	-	Comment to the student

Table 6.6: Table for Collaborative class (Student)

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Id Number
Collection	Text	250	Class
Std_Group	Text	250	Student group (pair)
StartTime	Date/Time	Date/Time	Start time
A1-A50	Memo	-	Answer 1 -50
C1-C50	Memo	-	Comment for student 1 -50
M1-M50	Number	longInt	Marks for student 1-50
Marks	Number	longInt	Marks for students

Table 6.7: Table for Notes

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id
Day	Number	long Int	Date to show when the notes upload
Month			
Year			
Desc	Text	250	Description of the notes
Doc_upload	Text	250	Upload document
Teacher	Text	250	Name of the teacher
Collection	Text	250	Collection

Table 6.8: Table for Assignment

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id
Day	Number	long Int	Current system date
Month			
Year			
Desc	Text	250	Description of the notes
Doc_upload	Text	250	Upload document
Teacher	Text	250	Name of the teacher
Collection	Text	250	Class
Eday	Number	longInt	Date of assigning task
Emonth			
Eyear			
Active	Number	longInt	Activate the task

Table 6.9: Table for Collaborative Class (Teacher)

Field Name	Type	Size	Description
ID	AutoNumber	150	Auto increment id
Title	Memo	-	Title of the class
Minutes	Number	longInt	Time frame
Teacher	Text	250	Name of the teacher
Collection	Text	150	Class
Date	Text	250	Current system date
Active	Number	longInt	Active collaborative class
Total	Number	longInt	Total number of questions
Q1-50	Memo	-	Number of questions

Table 6.10: Table for Message (Pair)

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id.
Day	Number	long Int	Current system date
Month			
Year			
Active	Number	longInt	Active collaborative class
Text	Memo	-	Instant Message from student
For	Text	250	Receiver
Eday	Number	longInt	Date of collaborative session
Emonth			
Eyear			
Writer	Text	50	Sender

Table 6.11: Table for Homework (Think)

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id
Day	Number	long Int	Current system date
Month			
Year			
Desc	Text	250	Description of the notes
Doc_upload	Text	250	Upload document
Teacher	Text	250	Name of the teacher
Collection	Text	250	Class
Eday	Number	longInt	Date of assigning task
Emonth			
Eyear			
Active	Number	longInt	Activate the task

Table 6.12: Table for Sending E-mail

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id
MessageID	Text	250	Message Id
DateRecieved	Date/Time	-	Date of receiving e-mail
Title	Memo	-	Title of the email
Message	Memo	-	Description of the email
Attachment	Text	250	Files or document
From	Memo	-	Sender
To	Memo	-	Receiver
Status	Number	longInt	Status

Table 6.13: Table for E-mail

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Auto increment id
MessageID	Text	250	Message Id
DateRecieved	Date/Time	-	Date received the email
Title	Memo	-	Title of the email
Message	Memo	-	Description of the email
Attachment	Text	250	Files or document
From	Memo	-	Sender
To	Memo	-	Receiver
Status	Number	longInt	Status

Table 6.14: Table for Collection

Field Name	Type	Size	Description
C_ID	AutoNumber	longInt	Class id
Col_name	Text	250	Class name
Col_rand	Text	250	Class random
Col_day	Number	longInt	Date of class creation
Col_month			
Col_year			
Active	Number	longInt	Active class

Table 6.15: Table for Collection Message (Share)

Field Name	Type	Size	Description
ID	AutoNumber	longInt	Identification
Time	Date/Time	-	Time
Group_id	Text	250	Group identification
User_id	Text	250	User identification
Message	Memo	-	Message

## 6.4 DETAILS OF DESIGN

### 6.4.1 Class Diagram

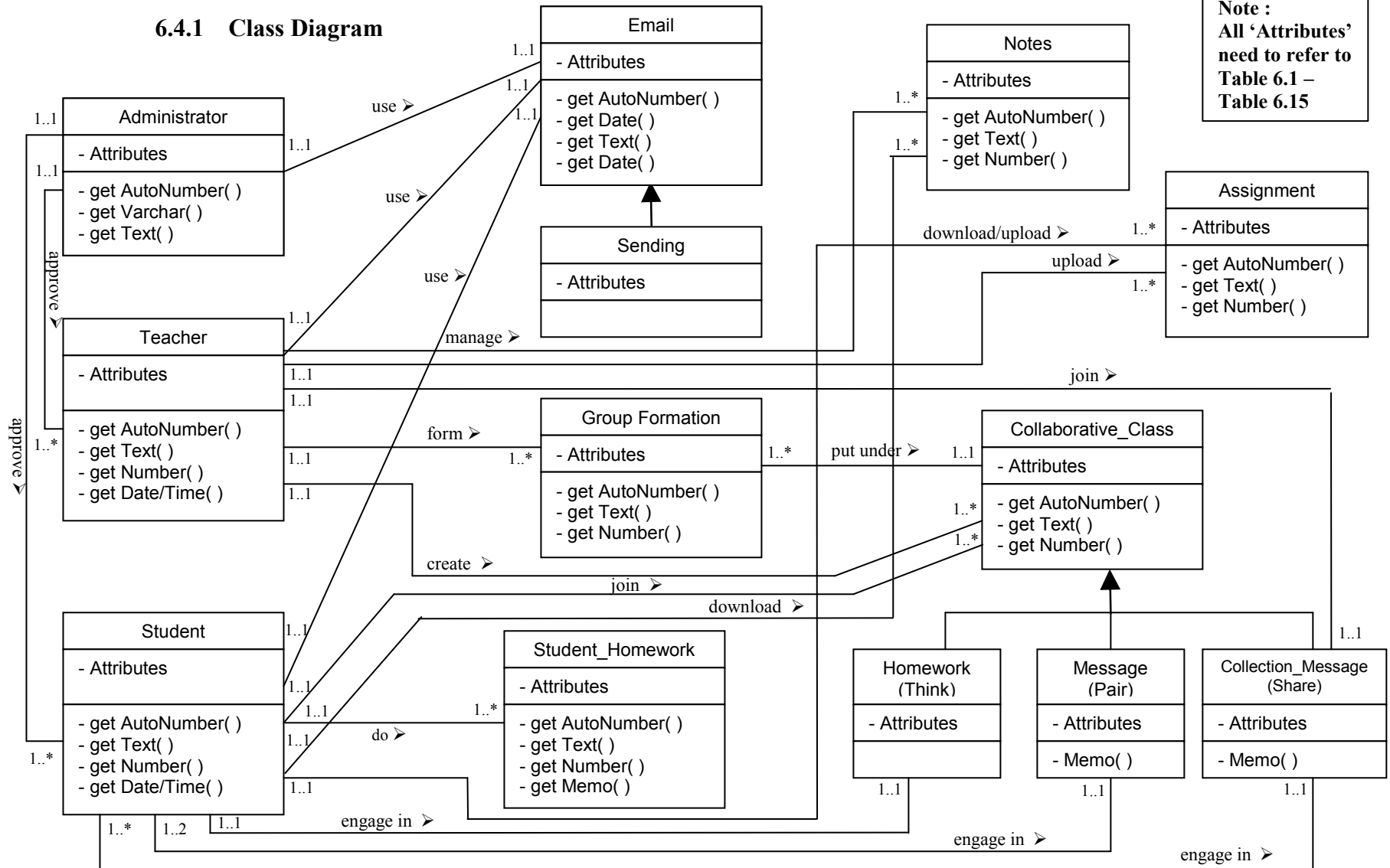
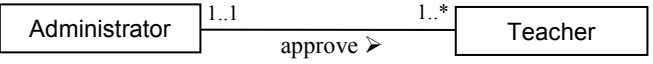
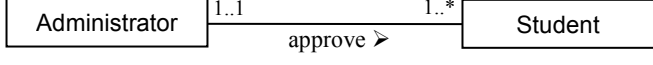
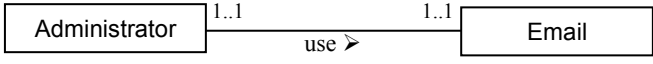
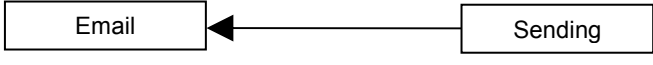
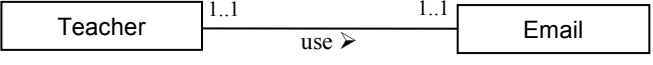
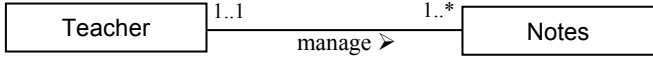
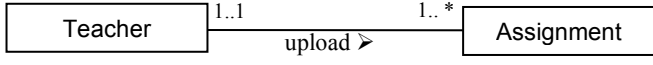
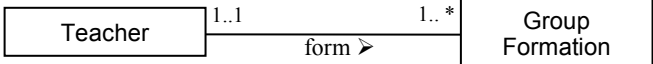
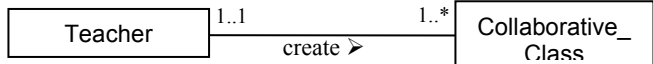
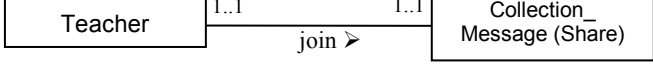


Figure 6.2 : Class Diagram for CETLs

The description of the Class Diagram from Figure 6.2 is presented in the following Table 6.16 by explaining the relationships one-by-one.

Table 6.16 Class Diagram Description

Relationship	Description
	An Administrator approves one or more Teacher while each Teacher is approved by exactly one Administrator
	Administrator approves one or more Student while each Student is approved by exactly one Administrator
	Administrator use only one Email account, and one Email account can be used by only one Administrator
	Email class is inherited by Sending class. Thus all attributes and Operations belongs to Email is inherited by Sending.
	Every Teacher uses only one Email account and each Email account can be used by only one Teacher
	A teacher is able to manage many Notes while each Note can be managed by only one Teacher
	A Teacher is able to upload one or many assignments and one assignment can be uploaded by only one Teacher
	Each Teacher forms one or more GroupFormation, and each GroupFormation can only be formed by one Teacher
	Each Teacher creates at least one Collaborative_Class, each Collaborative_Class is created by only one Teacher
	One Teacher can join one Collection_Message(Share) at a time



**Table 6.16, cont'**

	<p>Every Student uses only one Email account and each Email account can be used by only one Teacher</p>
	<p>A student does at least one Student_Homework, and each Student_Homework is done by one Student</p>
	<p>One student is able to download many Notes while each Note can be downloaded by only one Student</p>
	<p>Every Student is able to download/upload one or many assignments and each assignment can be uploaded by only one Student</p>
	<p>A student is able to join one or more Collaborative_Class</p>
	<p>Only one student can get engage in each Homework(Think) activity and each Homework(Think) is done by only one student</p>
	<p>One student is able to get engage in one Message(Pair) activity at a time</p>
	<p>A student can get engage in one Collection_Message(Share) per session</p>
	<p>Each GroupFormation is put under one Collaborative_Class and each Collaborative_Class can contain one or more GroupFormation</p>
	<p>A Collaborative_Class is inherited by Homework(Think), all Operations belong to Collaborative_Class are inherited by Homework(Think)</p>
	<p>A Collaborative_Class is inherited by Message(Pair) by inheriting all the Operations, however the Message(Pair) also has its own Operations</p>
	<p>A Collection_Message(Share) inherits the Collaborative_Class, having all its Operations. Collection_Message(Share) also has its own Operations</p>

## 6.4.2 Component Diagram

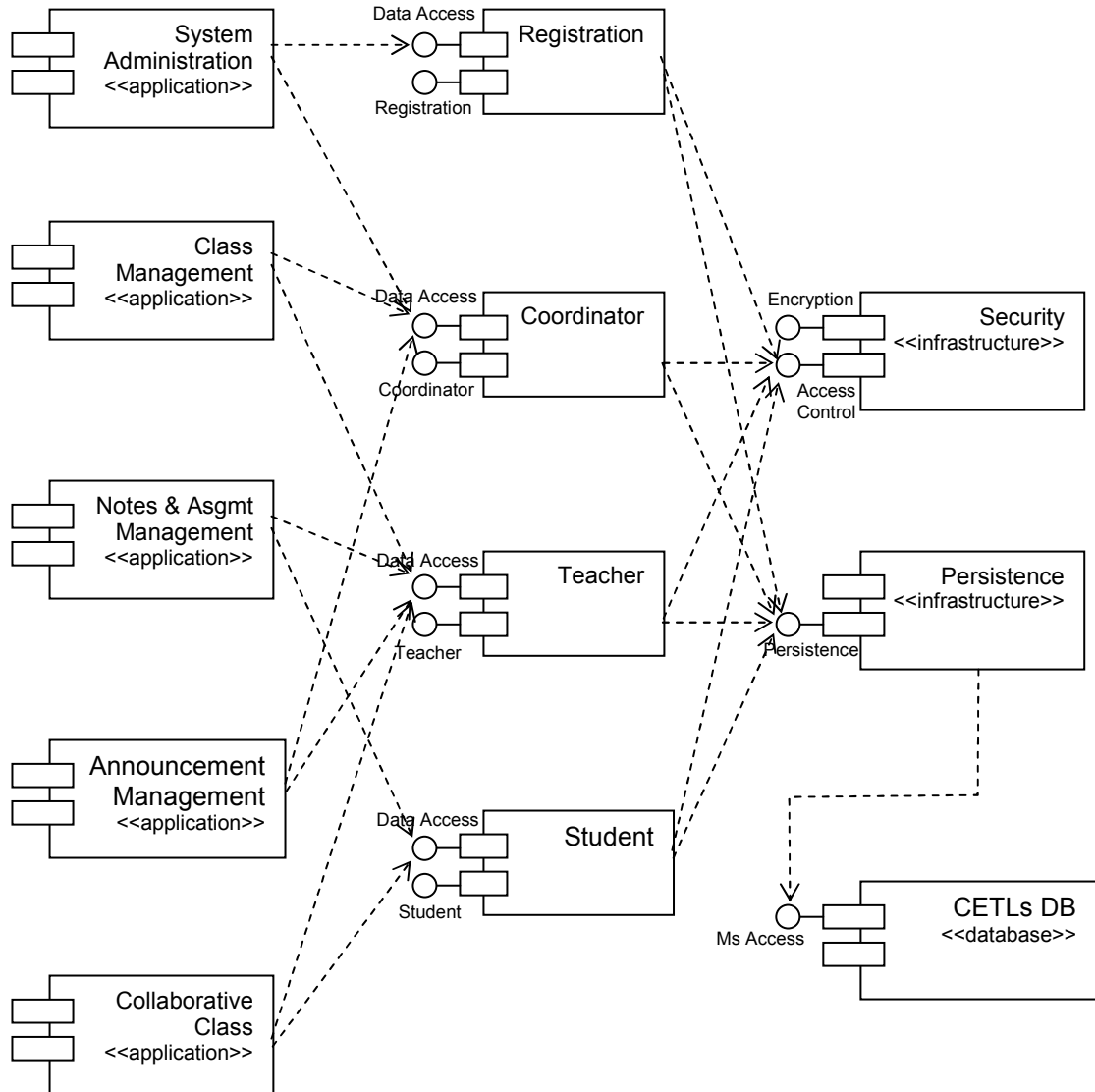


Figure 6.3 : Component Diagram For CETLs

In a software development project, there will be many files that make up the system. These files will have dependencies on one another. Component diagram as is one of the two types of implementation diagram in Unified Modeling Language (UML) (Bennet, *et al.*, 2002). As illustrated by Figure 6.3, this component diagram

represents the dependencies of the components with some applications, with and without the use of the interface. CETLs has few major interfaces that consist of data access to different type of components which are registration, coordinator, teacher, and student. Each of them is meant for different purpose even though some of them may be used for the same activities. The 'registration' component is used for administration while the 'coordinator' will manage the class and announcement application. Both 'teacher' and 'student' components have the data access to notes and assignment management as well as announcement applications. These two components will also get engage in the collaborative application.

However, each of these components is protected with the security access control whereby the encryption is used for login purpose. In another word, all are protected by the security infrastructure to ensure the security and access level of the system. The persistence infrastructure is used for system's determination, where the system can determine the appropriate response according to the components input by itself.

Principally, CETLs is provided with a database that uses Microsoft Access to handle all the components, applications and infrastructures in terms of data storage and retrieval.

### 6.4.3 Deployment Diagram

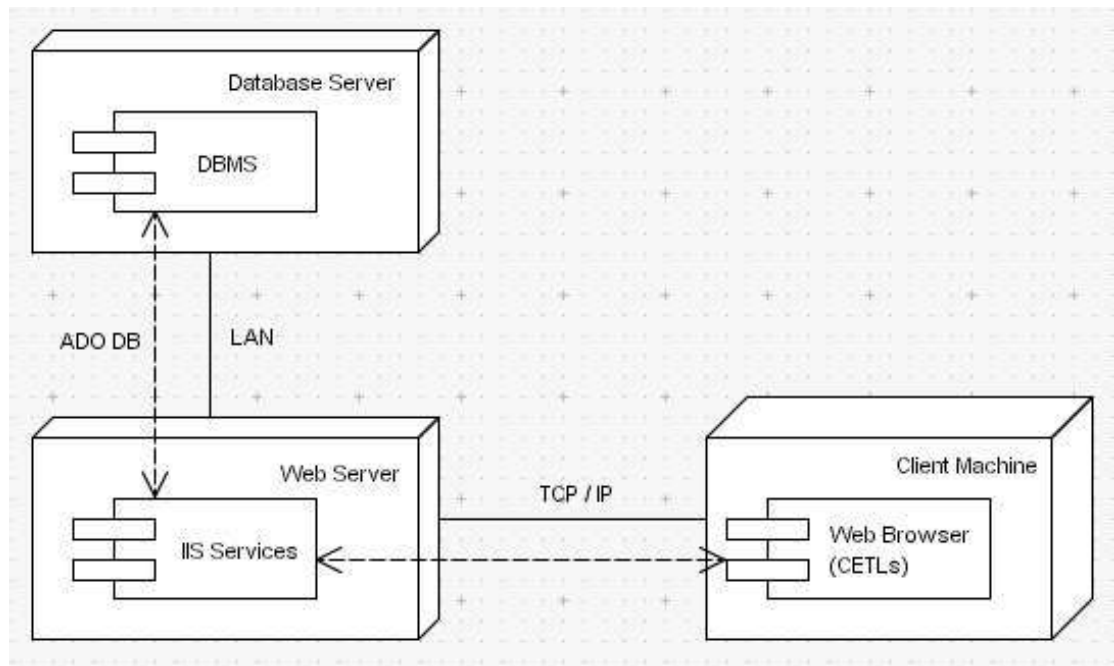


Figure 6.4 : Deployment Diagram For CETLs

Figure 6.4 displays the deployment diagram for CETLs. Each node in this diagram represents machine used for CETLs development and execution. Each of the machines is installed with appropriate software or component.

The client machine which runs the system (CETLs) through a web browser will initiate the activity by requesting data or files from the Web server, which is IIS; acronym for Internet Information Services. All the user's operations are done through the use of Web browser. After transmitting the data to the Web server by using an Internet protocol named TCP/IP; the short for Transmission Control Protocol / Internet Protocol, all the requests will be processed. Any request to retrieve the stored data will go through the database server, the place where DBMS (Database Management System) is placed. This process will go through ADO DB

which stands for Active Data Objects Database; a set of database abstraction classes which supports Microsoft Access. ADO is used to access a secure Access database and for SQL performance monitoring.

## **6.5 INTERFACE DESIGN**

### **6.5.1 Design Priorities**

Careful thoughts came into the designing of CETLs. This is especially true in the case of designing the collaborative part of the system, which to entice the students, not only with discussion, upload and download function, but also with the high-level design of user interface for each entities so that it would appear functional to a great number of users. The most important part that needs to be looked into, before attempting to develop this web system is to deal with the anonymity of monitor resolutions. It is in the nature of the window's browser to be resized to any dimension, according to the size of the monitor. Therefore it is extremely difficult to design a web page for an indefinite amount of user. Due to this shortcoming, the question of which monitors resolution to design for, should be based on the understanding and informed knowledge of the target audience and the main purpose of the site.

It is essential to decide the possible size of the web page by understanding the maximum amount of space offered by the computer monitor. Typically, monitors come in variety of standard sizes, ranging from 14 to 21 inches. In this project, the most important measurement is made by identifying the total number of pixels available on the screen, given that, the higher the pixel is, the higher details

can be delivered on the screen. It is essential to measure the availability of the pixels so that the page elements and the graphic design can be done smoothly and accordingly.

To overcome the problems regarding the anonymity of monitor resolution, the concept layouts are applied in the interface design of CETLs. Layouts are being used by and large to position tables and layers in this web system. It is the most important element to synchronize the interface in terms of on-screen text organization, icons, and white spaces. The approach of flexible design is also used extensively throughout this process. Since that the web's innate characteristics are flexible by default, the text and elements created by HTML file allows it to stream into the browser window by filling all the available spaces, despite of the monitor size. To ensure the flexibility of the design, the page layouts are formatted without using relative measurement so that the elements may be resized in one proportion consecutively. Tables are also used so that the page would have a more flexible structure, in terms of the table width.

The advantages of using flexible design approach in this project are, the pages can be displayed on a variety of monitor resolutions and can be customized for all displays. Again, as been stated earlier in this chapter, the natural characteristic of the web is flexible by default, therefore, any move towards a flexible page design that takes into account the nature of the medium would appear practical and serviceable to a great number of users. In addition, by using this approach of flexible page design, the entire window will not be packed by the possible empty spaces surpluses by most flat width designs.

## **6.5.2 Major components of interface design**

According to Dennis and Wixom (2003), the goal of interface design is to create a pleasant appearance of a system so that it would make easy for the user to interact with the system in a clear manner. For this CETLs project, the interface design is focused on five categories, which are, the navigation mechanism, input mechanism, output mechanism, and user interface design. The navigation mechanism includes buttons and menus used by the user to maneuver from one page to another and to give command to the system about the task or actions that need to be executed. The input mechanism deals with the method used by the system to capture information. While the output mechanism is the way the system provides information to users. User interface on the other hand, deals with the graphic icons and menus. These components will be discussed in detail, later in this chapter.

Here some interface design ideology as introduced by the authors can be applied with the previous four interface design components as discussed above. The ideologies are :

### **6.5.2.1 Layout**

One of the recommendations in some books on screen design is to keep the screen uncluttered and not to make it too busy (Kevin and David, 2000). Therefore the layout of CETLs are divided into four main areas, namely, the system navigation, section navigation, page navigation and status bar as presented in Figure 6.5. It is believed that layout concept

introduced in this project will minimize users' effort in terms of movement from one page to another and all areas will remain consistent in terms of size, shape, placement for entering data and result. It is deemed that the page will be self-contained, for instance, the user is able to retrieve information from a single link. In addition, the page will have an intuitive flow; from left to right and general to specific.

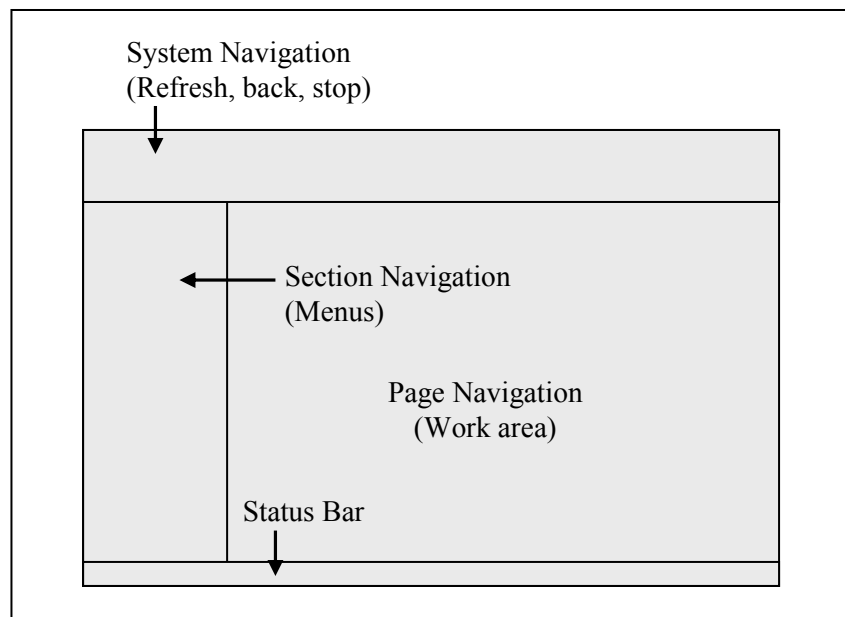


Figure 6.5 : CETLs layout design

### 6.5.2.2 Consistency

Consistency in user interfaces seems a self-evidence virtue. On the surface it appears that consistency will make it easier for users to move from one application to another (Kevin and David, 99). It is proven that the users will become familiar with something similar. Thus, keeping the similar looks of the interface and appearance will ease them understanding the system faster. The consistency in each page will make the system looks nice and uncluttered.



### **6.5.2.3 Content Awareness**

To avoid confusion, all interfaces will have its own titles so that it would be clear for the user to know which page they are working on. The system will specifically divide the content for different user, which are coordinator, teacher, and student. Different level access is marked on the system, and the user will be notified about their status as well. It is important in this CETLs system to be clear and precise as the users are mainly at very young ages, and most of them are not excellent PC users. They need guide and a descriptive system. Therefore, by adapting the content awareness in CETLs will help the users a lot, and the users will find themselves at ease of learning the web system.

### **6.5.2.4 User Experience**

The basis of the user interface design for CETLs is to support the infrequent users; both novice and expert users who involve with the use of this system. Since it involves variety level of users (teachers and students), CETLs is provided with images to speed up the learning process.

### **6.5.2.5 User Control**

CETLs provide simplicity and flexibility where the user takes the control, rather than the user being controlled. This can clearly be seen during the chat session, and they have the right to assign timer of their own. Users have different ways of operating, they have different tasks from those thought of during design, and they will want to do things in different ways from the way envisaged. Forcing people into a straightjacket of responses

causes them to become frustrated and annoyed. When the users experience the flexibility during the system navigation, they will feel comfortable and freer, thus they will think that it is not a tedious work.

### **6.5.3 Navigation design**

In order to ease and decrease the tediousness of user navigation throughout the system, the design of CETLs is carefully determined. CETLs is provided with a drop down menu on the left pane, which appear all the time. Therefore the users are free to change from one module to another at anytime without the needs to turn back to the previous page to find the main menu. Simple English language is used to help the user understand the tasks and instructions easily. This factor is considered since the scope of user comes from secondary school teachers and students.

### **6.5.4 Input design**

The input design is meant for the end users which are teachers and students. CETLs is presented to the end users with a list of available alternative that relevant to the task performed. CETLs use a single menu and hierarchical menu approach. Using single menu, the user can input the data in the text based options and performed by different command. It will display a text based options that can be individually selected by the end user. The user will select the option from menu, and the command will execute and any necessary output will be generated. It is the simplest design and easy to navigate. CETLs also used the hierarchical menu approach where the main menu consists of few submenus. This will ease the navigation process. The hyperlinks are created in order to provide alternatives or

additional decisions for the users to choose from. The figure below shows the input design interface for the registration of a new student and a hierarchical menu.

Wednesday, September 05, 2007  
**COLLABORATIVE ENVIRONMENT  
 FOR TEACHING & LEARNING  
 SCIENCE (SYSTEM)**

Student's Page  
**CETLs**

**New Registration For Student**

- Please look at the timer at the bottom of this page while filling the form
- This page will be refreshed every 7 minutes to allow generation of new random ID (Timer at the bottom left)
- If your record highlighted in **RED**, you're denied from using the system. Please contact Coordinator for further info

Full Name :

IC Number :

Current Email Address :

Insert your password (1) :  \* Insert password of your choice

Insert your password (2) :  \* Confirmation of your password

Insert the string displayed again :  **72BFC**

**Waiting List**

No	Name	IC No	Date/Time Registered
No Record Found			

[Back to Login Page](#)

Figure 6.6 : Input Design Interface

Figure 6.6 displays one example of input design interface. The page displays above is a registration page for a new user. There are few types of inputs used for the registration. One of them is by using the text box, which accepts letters and numbers. The use of special characters '@' is allowed for the e-mail address field.

Another input type used for the registration page is button. Both 'Reset' and 'Submit' buttons accept mouse click and key stroke. The relevant action will be performed after the button receives a mouse click or when having the key stroke (pressing the 'Enter' key).

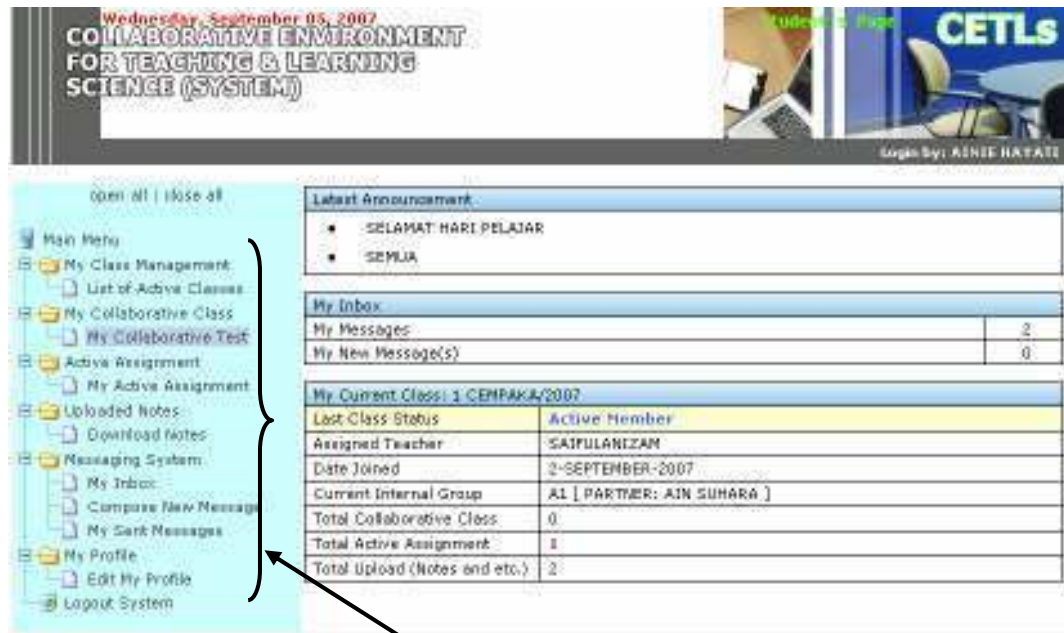


Figure 6.7 : Hierarchical Menu Approach

Figure 6.7 displays the hierarchical menu used in CETLs. The hierarchical menu is put on the left side of the page for easy navigation and to keep the page looks uncluttered. The '+' symbol beside each menu can be clicked on, in order to view the submenus. This hierarchical menu accept only mouse click.

#### 6.5.4.1 Types of Input

In this project, three types of input are being used through the design of the Web systems forms. These inputs are the text box, drop down list box and check box. These text boxes will be used by the user to enter both text and numbers. The text box has the GUI capability which permits such action like cut, copy and paste. Another input are drop down list box, which allow

the users to choose the value that ought to be entered rather than having type it. This concept is suit for the novice user whom has no experience in dealing with the system. This also will speed up and simplified the input process. The CETLs system is also use other input type which is the check box. It is a graphical user interfaces element that permits the user to make multiple selections from a number of options.

### **6.5.5 Output Design**

The output design of the CETLs will be focused specifically in designing the layout of the result for the assessment students as this component is very important for both end user who are teacher and students. The output design will be represents the desired information to the end user in an understandable and a usable manner. In the CETLs system, the teacher will give the results test, assignment or exercise to the students. The students will log in to the system and must be able to see their results. The output is designed in such way that the students can only view it but cannot edit it. This is important so that the integrity of the marks and result is safely kept.

### **6.5.6 Sample of User Interface Design**

The following figures 6.8 – 6.13 are the samples of the CETLs' User Interface Design. Each of the sample is labeled with brief explanation on the input types and the Graphical User Interface elements.

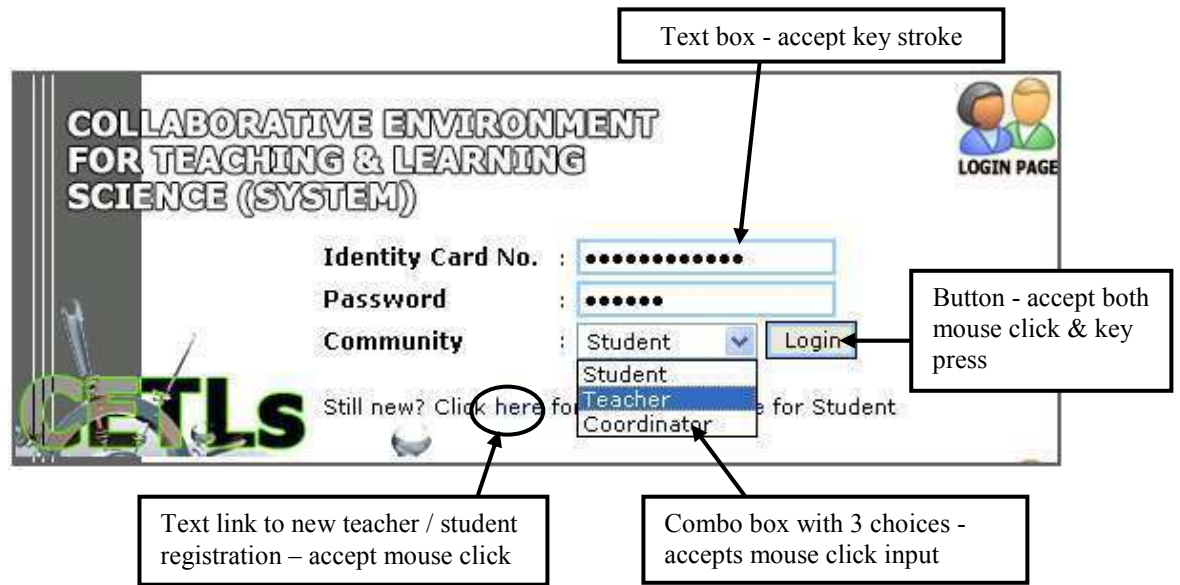


Figure 6.8 : The Login Page User Interface

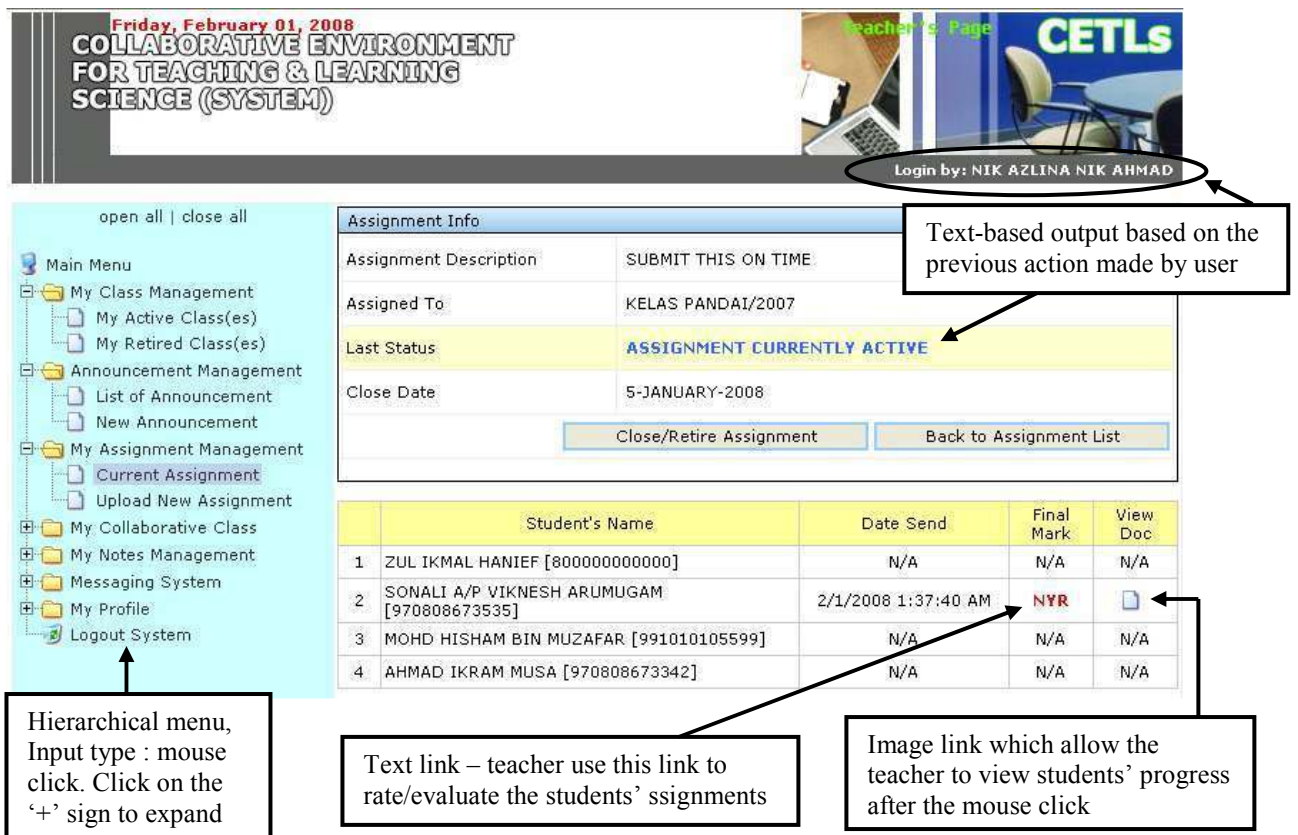


Figure 6.9 : 'Check Students' Progress on Assignment' User Interface

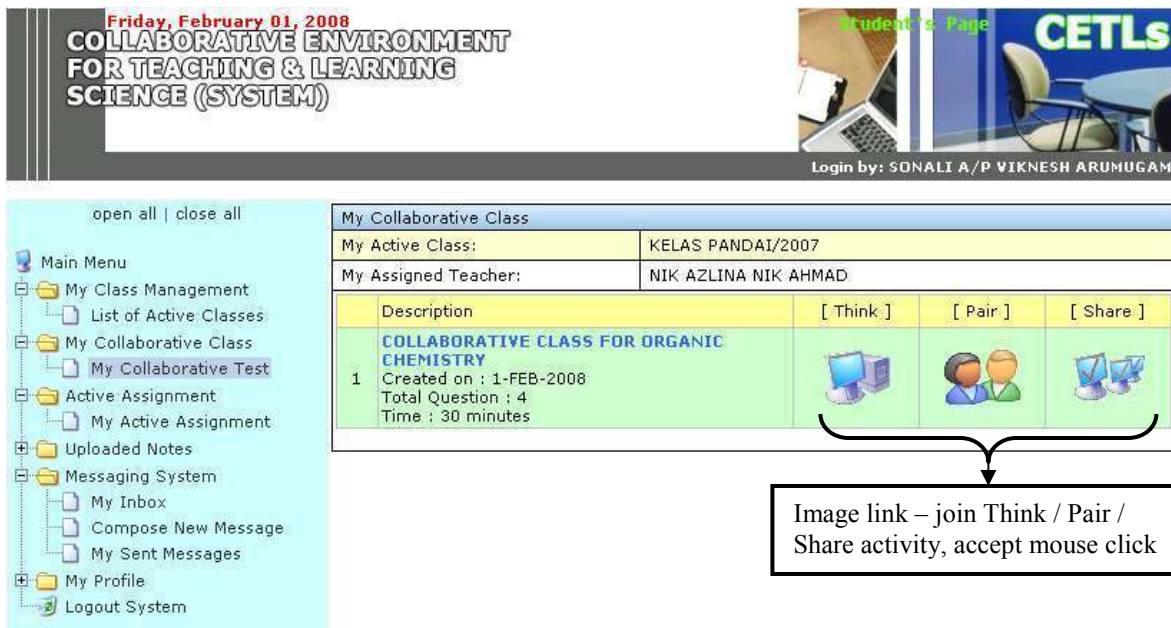


Figure 6.10 : The ‘Think-Pair-Share’ User Interface

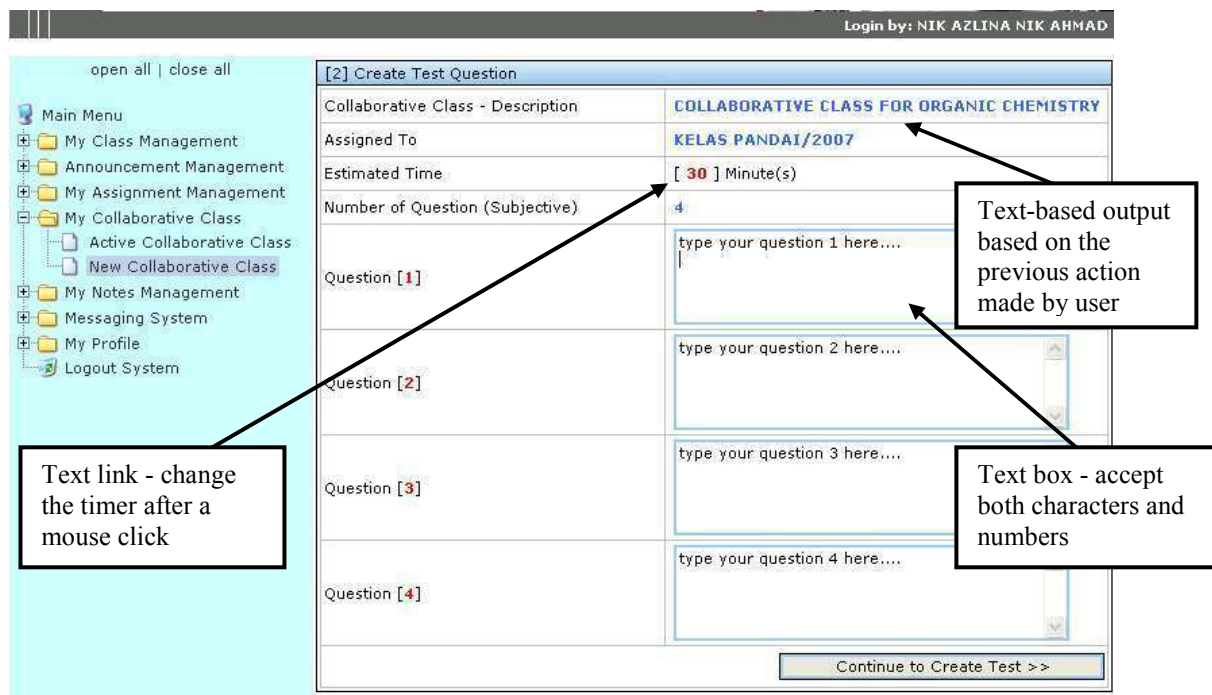


Figure 6.11 : ‘Think: Assign Questions and Timer’ User Interface

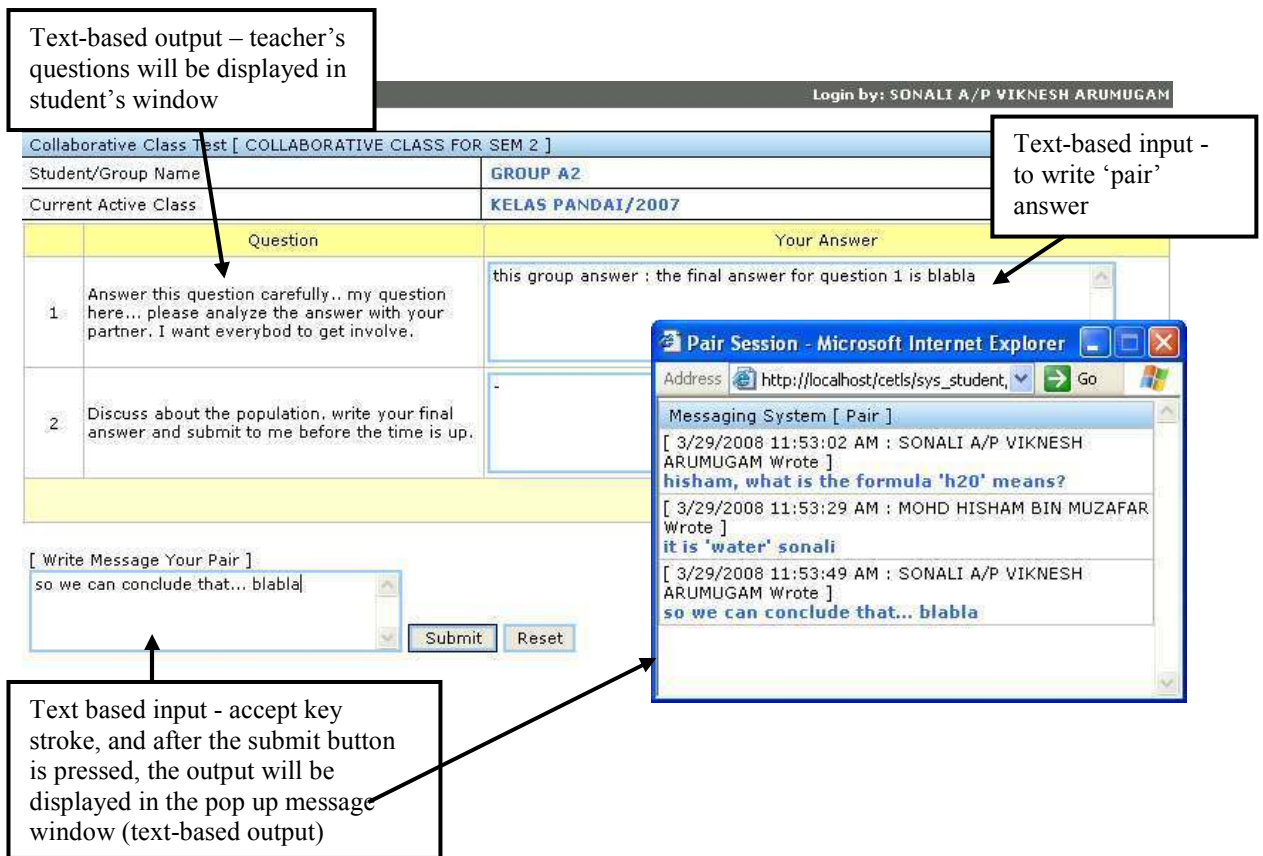


Figure 6.12 : ‘Pair: Instant Messaging Window’ User Interface

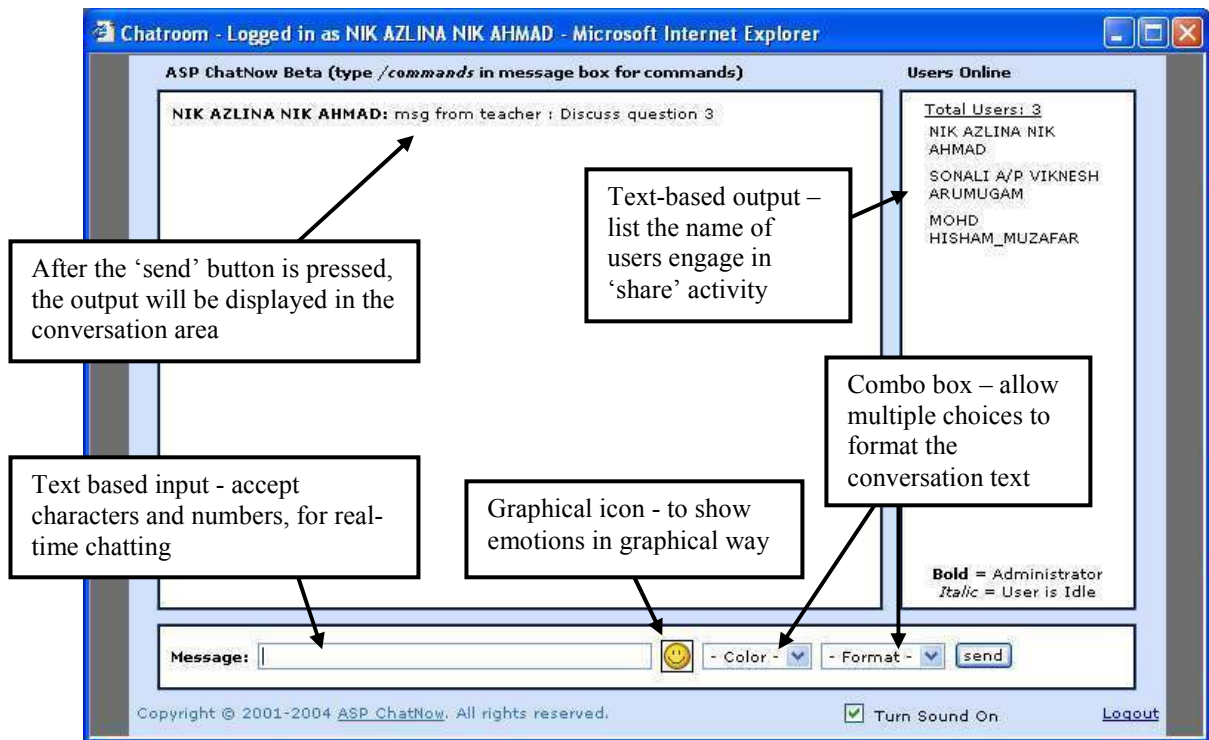


Figure 6.13 : ‘Share: Chat Window’ User Interface



## 6.6 CONCLUSION

After all the diagrams and tables have been produced, three-tier architecture has been selected for the database. Then the database design is represented with Data Dictionaries. The database design is explained in details with the use of Class diagram that capture all the classes and objects involved in CETLs.

Further discussion on this chapter emphasized on the Components Diagram, where all the applications and interface within the system are presented. The Deployment diagram clearly shows the use of the Database server, Web Server as well as the computer to be placed on the client's side. Each of these node is installed with a specific software to enable the processes.

Before placing the samples of CETLs interface design, the major components of interface design are also discussed. From the discussion, it is clear that the good interface design may reduce tediousness and able to attract users. Not only the inputs and outputs type, but considering the placement of the inputs and outputs will help the users understand the system well.

## **CHAPTER 7**

### **IMPLEMENTATION AND TESTING**

#### **7.1 INTRODUCTION**

The first step in implementation is system construction, during which the system is built and tested to ensure it performs as designed (Dennis, 2002). The deliverables of this step is the program itself, therefore some highlighted algorithms for the essential parts of the system are placed. After the design and implementation of the collaborative system; CETLs, have been done, the system need to be tested in order to ensure its quality. The testing part starts by describing its meaning and purpose. CETLs was first being tested using Unit Testing and followed by User Acceptance Testing. The purpose and scopes of both tests are explained, and the further explanation and result of each test is recorded in the test cases.

#### **7.2 ALGORITHM**

This section highlights the algorithms for the major modules of CETLs, which are Think, Pair, and Share.

The following code is used to create a main interface for Think, Pair, and Share; the place where users' initiate the Think-Pair-Share activities.

```

<div align="center">
<table border="0" cellpadding="2" cellspacing="1"
width="100%" bgcolor="#C0C0C0" id="table4">
<tr bgcolor="#FFFF99" height=22>
    <td width="5%">&nbsp;</td>
    <td width="50%">Description</td>
    <td width="15%" align=center>[ Think ]</td>
    <td width="15%" align=center>[ Pair ]</td>
    <td width="15%" align=center>[ Share ]</td>
</tr>

```

### 7.2.1 Think

The Think activity involves working individually with the use of timer.

Below is the code use for this part.

```

Sub HandleTime
if hr2=0 and min2=0 and sec2=0 then
    endtime
elseif min2>=0 and sec2>0 then
    sec2=sec2-1
    status=hr2 & ":" & min2 & ":" & sec2
    intTimerID=setTimeout("HandleTime",950, "VBScript")
elseif min2>0 and sec2=0 then
    min2=min2-1
    sec2=59
    status=hr2 & ":" & min2 & ":" & sec2
    intTimerID=setTimeout("HandleTime",950, "VBScript")
elseif hr>=0 and min=0 then
    hr2=hr2-1
    min2=59
    sec2=59
    status=hr2 & ":" & min2 & ":" & sec2
    intTimerID=setTimeout("HandleTime",950, "VBScript")
end if
End Sub

```

### 7.2.2 Pair

The Pair activity involves communication between two parties using an instant messaging. Here is the code that will trigger the action :

```
Sub starttime
    cleartimeout intTimerID
    window.navigate("pair_chat.asp?y=<%=x%>&pid=<%=y%>")
end sub
```

During this pair activity, teacher will assign marks to student based on students' work. Below is the code for the module :

```
SQY = "Select * From Std_Homework Where HMWK_ID = '" & nHw &
"' And NOKP = '" & Session("NOKP") & "'"
RS.Open SQY,db
If Not RS.Bof Then
    komen = RS("Komen")
    markah = "<font class=M>" & RS("Markah") & "</font>"
End If
RS.Close
```

### 7.2.3 Share

A chat window is used for communication among teacher and students. The communication involve both receive (get message) and send message (post message). The code which trigger the get message and post message are written below :

## GET MESSAGE

```
If IsArray(Application(ApplicationMsg)) Then
    saryMessages = Application(ApplicationMsg)
Else
    ReDim saryMessages(6, 0)

    Application.Lock
    Application(ApplicationMsg) = saryMessages
    Application.Unlock
End If

.
.
.

If blnRecordstoShow Then
    Response.Write(vbCrLf & "var chatBoxHTML =
    document.getElementById(""chatBox"");")
    Response.Write(vbCrLf & "chatBoxHTML.innerHTML += addHTML;")
    Response.Write(vbCrLf & "toBottom()")
End If
```

## POST MESSAGE

```
If IsArray(Application(ApplicationMsg)) Then
    saryMessages = Application(ApplicationMsg)
Else
    ReDim saryMessages(5, 0)
    Application(ApplicationMsg) = saryMessages
End If

.
.
.

function insertText(strText) {
    var txtarea =
    parent.frames["postmessage"].document.frmMessage.message;

    txtarea.value = strText;
    txtarea.focus();
}
```

## 7.3 MAIN MODULE FROM USER POINT OF VIEW

### 7.3.1 Activity Diagram for Registration

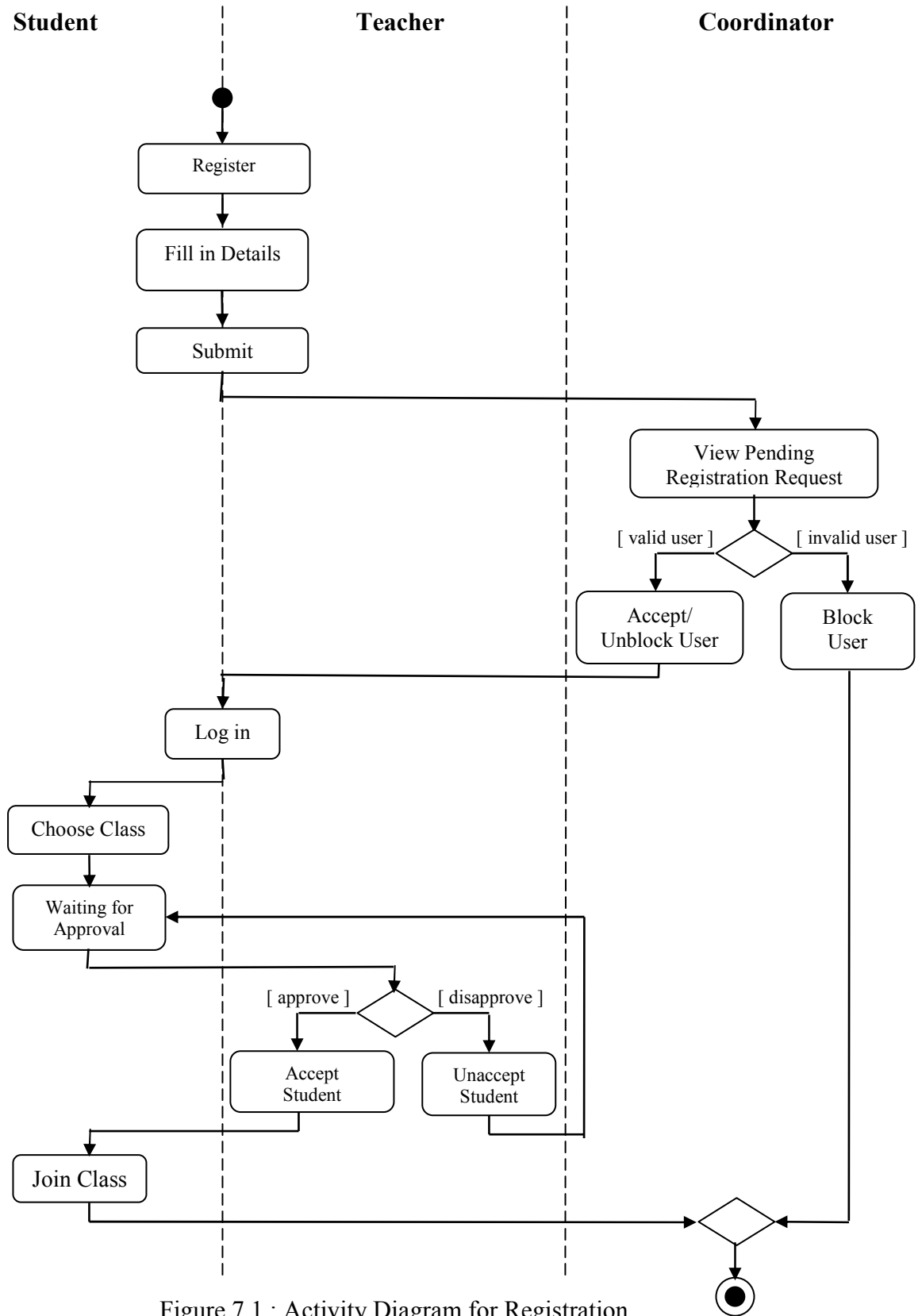


Figure 7.1 : Activity Diagram for Registration

The above Figure 6.1 explains about the activities happen during registration process in CETLs. The presence of the 'swimlanes' or sometimes is called as 'partitions' in this activity diagram is to group the states of an activity model, and it clearly shows the activities performed by which actor. The swimlanes are labeled with the named of the actor on top of it which are student, teacher and coordinator. The activities are arranged in the swimlanes according to the responsible actors.

As can be seen, teacher and student share few same activities and therefore, the shared activities are presented in a single state crossing the teacher and student swimlane. Other activities that are self-performed are presented in the respective swimlane accordingly.

The registration process starts with either a teacher or student filling in their personal details in the registration form. After the form has been submitted, the coordinator will view the list of all the pending registration request. Here, the approval from the coordinator is needed before the user (teacher or student) can continue using the system. The coordinator will accept the user if the registration is made by a valid user, otherwise the coordinator has the right to block the user if he found that the registration is made by invalid user.

Once the user is accepted or unblocked, he/she might log in to the system. If the user is a student, he needs to choose the class for him to join in. the student will not be able to enroll in his selected class until he gets approval from the teacher. The teacher has the right whether or not to accept the student's choice. The registration part ends with the enrollment of student in the class.

### 7.3.2 Activity Diagram for Coordinator

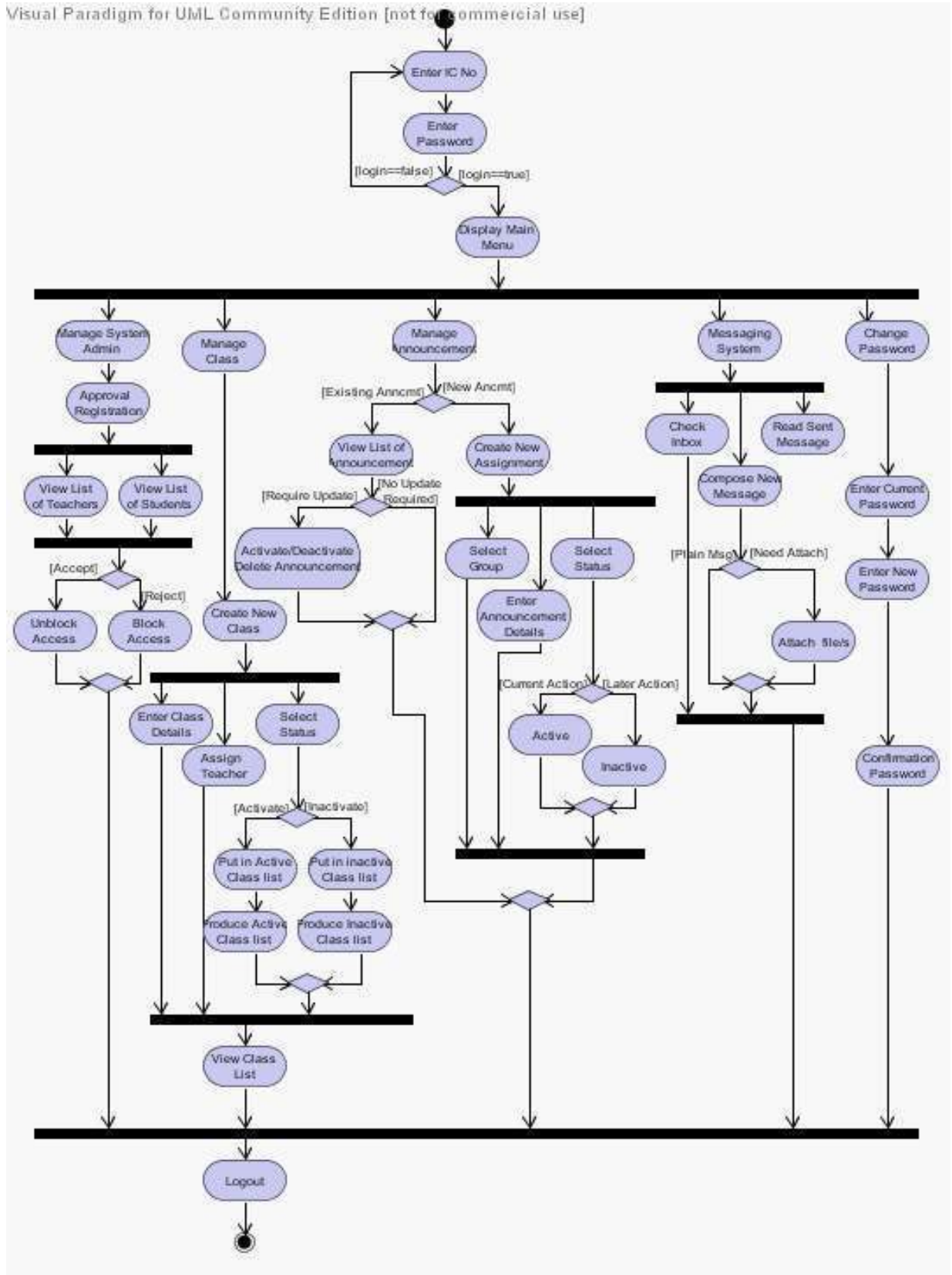


Figure 7.2 : Activity Diagram for Coordinator



Figure 7.2 explains the activities handled by coordinator in detail. In order to ensure the security of the system, the coordinator needs to log in using his Identity Card (IC) number as username together with his password. CETLs will display the main menu after the password is verified as correct. Otherwise, the user will be brought to the login page again.

Coordinator is responsible for five major activities which are managing system admin, class, announcement, messaging system, as well as changing password.

Managing system admin activity requires coordinator to approve users' registration. Coordinator will view the list of teachers or students who have registered with the system first, then he needs to make a decision whether to accept or reject those teachers or students.

Manage class means the coordinator is able to create new class and this activity involves entering the class' details, assigning class teacher and set the class' status. The status can be either active or inactive. Whichever the status is set, the system will then produce the list of both active and inactive class.

Coordinator is also responsible in managing announcement. He may create a new announcement or update the existing one. Announcement can be posted to the entire users or to the specific group. If the announcement is meant for only selected users or classes, the coordinator needs to select the group and enter the details of the announcement. CETLs is created to be flexible, therefore the coordinator may use the function 'active' or 'inactive'

to indicate whether the announcement is ready to be posted or not. Coordinator is allowed to type the announcement in advance, and later post the announcement.

The messaging system is similar to the e-mail. Coordinator is able to read all the mail in his inbox, compose a new mail message, reply to a specific sender, and read all the sent mail. A new mail can be composed with or without attachments.

Password which is used for login purpose can be changed whenever needed. The process needs the current password to be filled in before entering the new password. After the confirmation is made, the new password will be saved, replacing the previous password.

### 7.3.3 Activity Diagram for Teacher

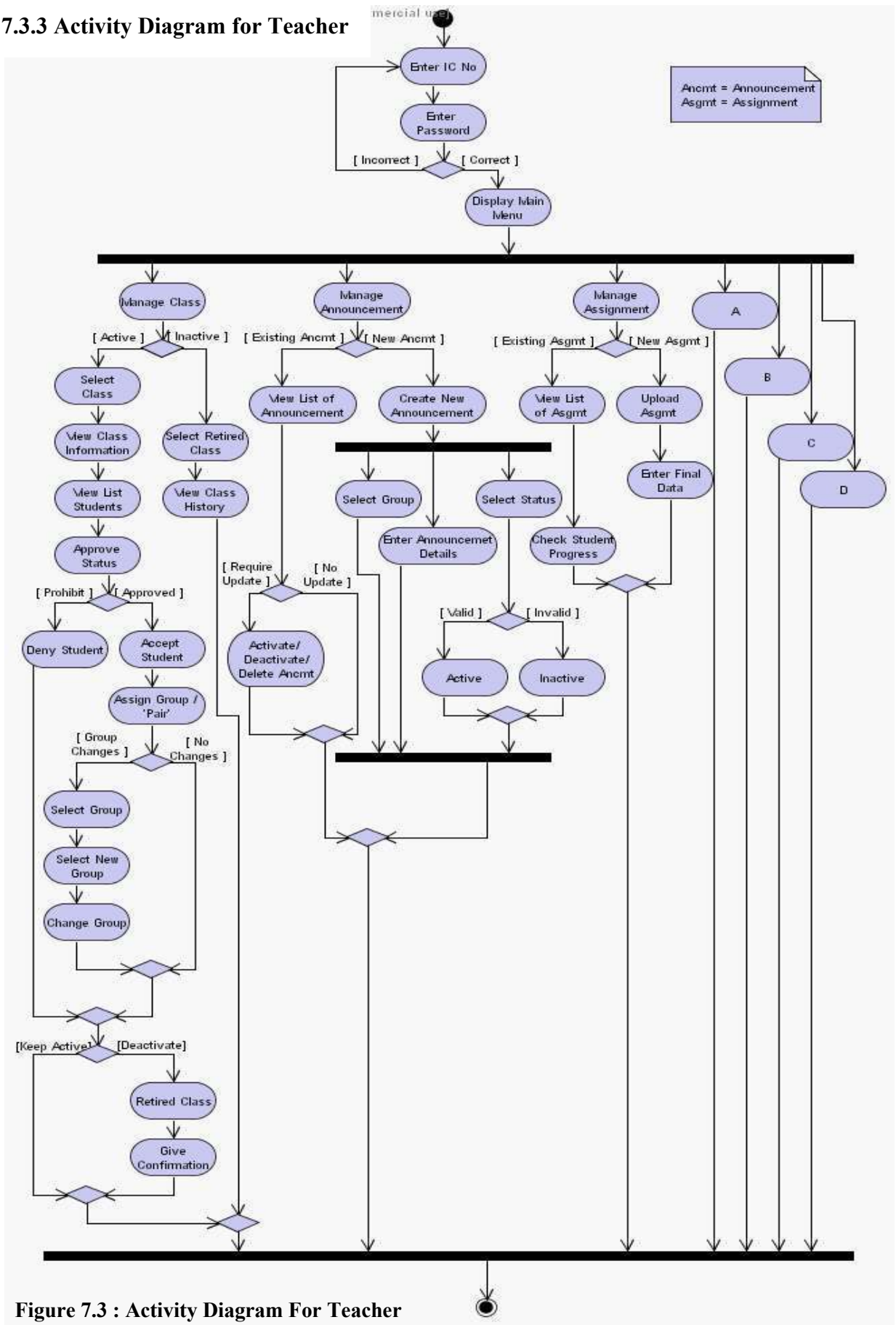


Figure 7.3 : Activity Diagram For Teacher

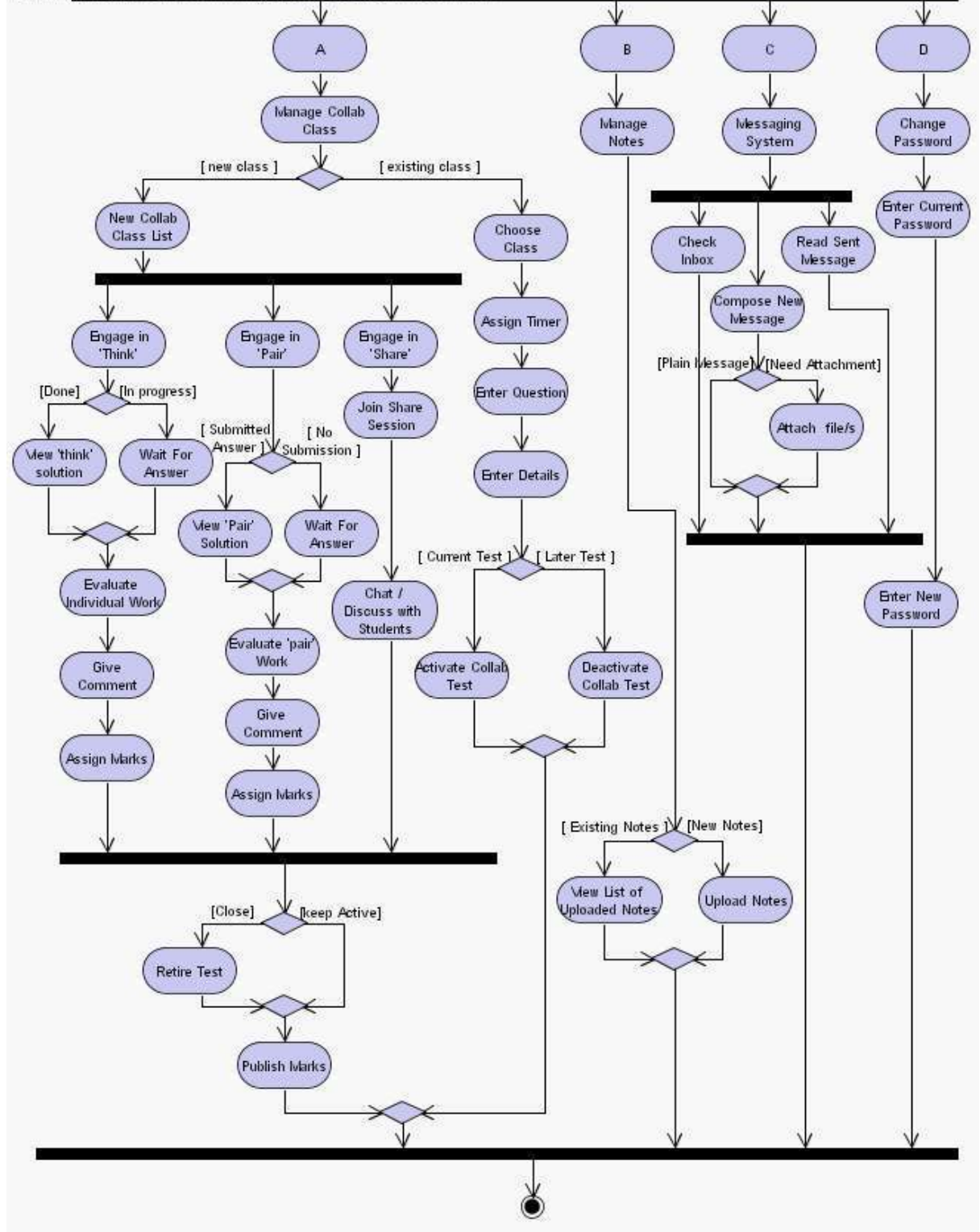


Figure 7.4 : Activity Diagram For Teacher (continued)

Figure 7.3 and 7.4 illustrate the Activity Diagram for Teacher. Both figures explaining the same part; all activities performed by the teacher in CETLs. As a normal user, teacher needs to log in to the system by entering his Identity Card (IC) number as a username together with his password. Unlike the correct login which will be brought to the main menu, the incorrect login requires re-login, where the teacher will be brought to the login page to fill the login details again.

The teacher is responsible to manage a few activities which are managing class, announcement, assignment, collaborative class, and notes. However the teacher is also provided with a messaging system, and changing password menu.

Managing class involves few steps since the class listed in CETLs might be in either active or inactive status. If the class is still active, the teacher may select any classes in the active list to view its class information as well as the list of students registered with the class. This registered students need to get teacher's approval. If the students are accepted by the teacher, they will be assigned a 'pair' (group). In the future, the teacher is able to change the students' group. Once the class is inactive, teacher has the right to close/retire it.

Figure 7.3 is explaining about the announcement management too. The teacher is able to create new announcement, update or delete the existing announcement. Creating new announcement involves selecting the dedicated group, writing the announcement details, and assigning announcement status; whether to let it active or inactive, and the status can be changed at anytime.

Another task performed by the teacher in CETLs is managing assignment. Teacher is able to upload new assignment for students, and the expiry date can be set. Once the assignment reaches its end date, it will automatically be deactivated and no longer can be downloaded by students. After the students download the assignment and finish their task, they are able to upload back their assignment to teacher. The teacher is able to view the students' progress, whether or not they have submitted their work. Once the work is submitted, teacher will mark and evaluate the students' work online.

Figure 7.4 is the continuity from Figure 7.3 and connected through the 'A', 'B', 'C', and 'D' states. This figure continues explaining about the teachers' activities in CETLs. From the above activity diagram, it can be seen that teacher is responsible to manage the collaborative class, where he is allowed to create new collaborative class, and get engaged in all the 'Think', 'Pair', and 'Share' activities. The details of this collaborative process will be explained in Figure 7.5.

Teacher is also hold the responsibility to manage the notes, where he may upload the notes, to make it accessible to students. The list of all the uploaded notes can be viewed.

Messaging system can be used by the teacher to read, reply and compose mail message to any CETLs members. The file(s) can also be attached to the message.

Teacher is also able to change his password should he wish to. Using the 'change password' module, the teacher needs to enter his old password before entering his new password.

All the above discussion regarding Figure 7.3 and Figure 7.4 are for the user 'Teacher'; what he is able to do when using CETLs.

### 7.3.4 Activity Diagram for Think-Pair-Share

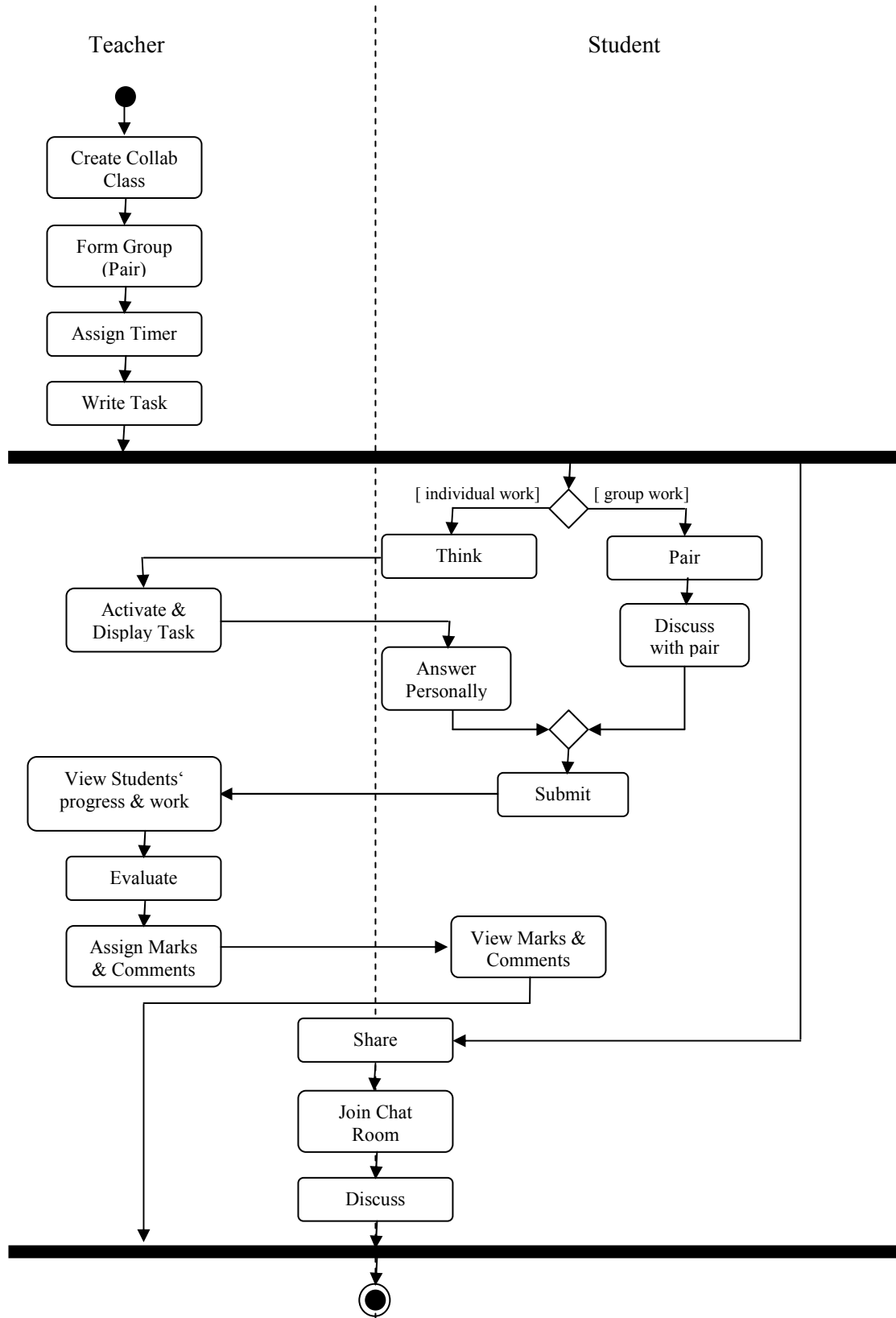


Figure 7.5. Activity Diagram for Think-Pair-Share



Figure 7.5 above is mainly about the main module exist in CETLs which is the Think-Pair-Share. The activity diagram is divided into two partitions by using the swimlanes in order to categorize the task of two different users; teacher and student. All the task listed under the teacher partition is belongs and performed by only teacher, and vice versa. However, the tasks that are listed under both partitions are the shared tasks, which are performed by both actors.

The collaborative activities are initiated by the teacher, creating a collaborative class, before forming students group. Each group consists of only two students, and therefore it is called as 'pair'. Teacher will then assign timer and task. The tasks are divided into three stages which are 'Think', 'Pair', and 'Share'.

The **Think** stage will start first. When the teacher activates the task, the student is able to start thinking about it individually and answer it. Student will then submit the answer to the teacher for evaluation purpose.

Unlike the Think stage which allow the student to work individually, the **Pair** stage requires the student to work in group (pair), assigned by the teacher earlier. The answer will be submitted to the teacher as well. Teacher will view the students' work, and starts to evaluate it. Teacher will give comments and assign marks for the student's work. Once the marks are assigned, student is able to view it.

The **Share** stage requires both parties (teacher and student) to get involve. In order to start the communication, both teacher and students need to join the Chatroom. The discussion happens in real-time.

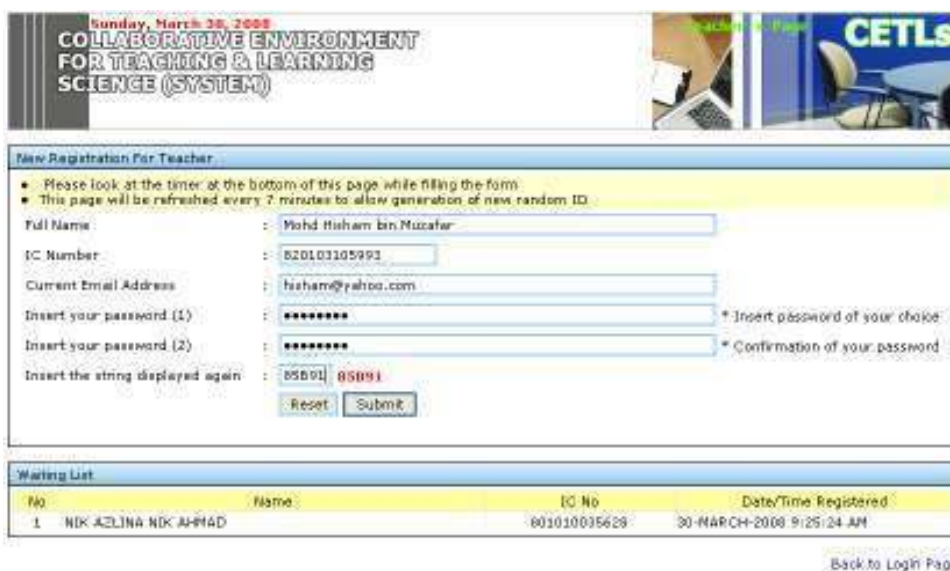
## 7.4 EXECUTION OF CETLs FROM USER POINT OF VIEW

The following figures are the interfaces of main modules and functions exist in CETLs.



Figure 7.6: Login Page for CETLs

Figure 7.6 shows the main interface of CETLs, the place where coordinator, teacher or students log in. The registration of the new user also starts here. When the new teacher or student uses CETLs for the first time, he needs to click on the 'here' link in order to register himself. Once the link is clicked, the registration page as shown in the following Figure 7.7 will appear.



No	Name	IC No	Date/Time Registered
1	NIK AZLIINA NIK AHMAD	601010035628	30-MARCH-2008 9:25:24 AM

Figure 7.7 : The Registration Page For Teacher

Every new registration should begin with the form filling as shown in Figure 7.7. The new user need to enter all the blank fields including the ‘authorization code’ displayed in red. This is to ensure the integrity of the system, and to ensure that the system does not create the new user by itself. The ‘waiting list’ space is to list all the registered members that have not been approved.

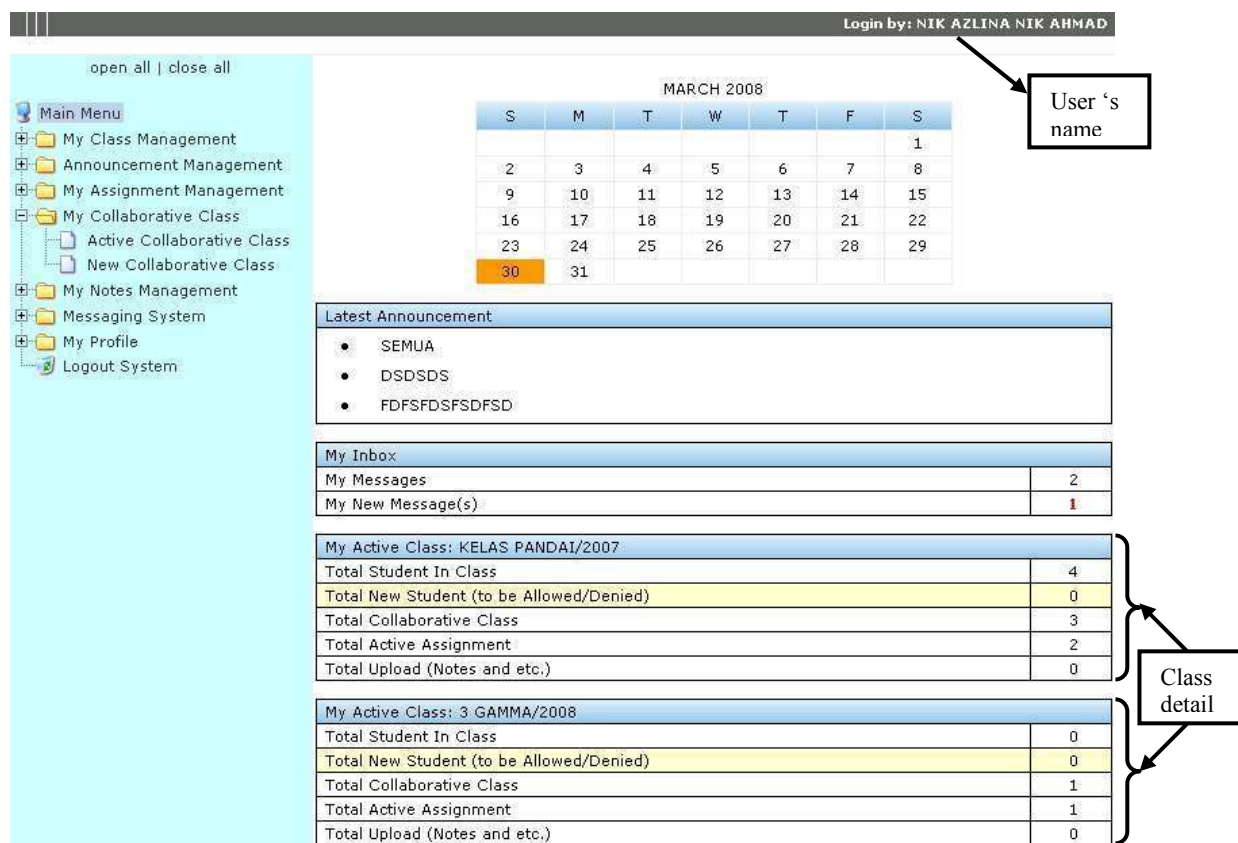


Figure 7.8 : Teacher Main Interface

Once the teacher’s registration has been approved by the coordinator, he may login to the system and navigate through the CETLs. Figure 7.8 shows the teacher’s main interface. For confidentiality, the user’s name will be displayed on top of the right corner of the system. On the left side is the hierarchical menu which can be clicked on. Teacher may click the “+” symbol in order to expand the menus. If the teacher teaches two classes, the system will display the details of both classes, as shown in Figure 7.8.



Figure 7.9 : View The List of Active Class Belongs to The Teacher

If the teacher clicks on the ‘My Class Management’ menu (which can be seen from the left side of Figure 7.9), he is able to view the active or inactive (retired) classes. Once the ‘My Active Class (es)’ is clicked, the system will display the list of all the active classes belongs to the teacher. Teacher may select any class to view its details. Once the class is selected, the new page will be displayed as shown in Figure 7.10.

Login by: NIK AZLINA NIK AHMAD

open all | close all

Main Menu

- My Class Management
  - My Active Class(es)
  - My Retired Class(es)
- Announcement Management
- My Assignment Management
- My Collaborative Class
  - Active Collaborative Class
  - New Collaborative Class
- My Notes Management
- Messaging System
- My Profile
- Logout System

**Class(es) Assigned to Me**

**\* Only ACTIVE classes assigned to you will appear in this list**

Select an Active Class: KELAS PANDAI/2007

**Active Class Information**

Class Name	KELAS PANDAI/2007
Creation Date	12-NOVEMBER-2007

**\* Please noted that you can't longer do anything with this class once deactivated.**

Retire This Class

**List of Student for KELAS PANDAI/2007**

Student's Name	IC No	Group	Date Registered
<input type="checkbox"/> AHMAD IKRAM MUSA	970808673342	A1	1-FEB-2008
<input type="checkbox"/> MOHD HISHAM BIN MUZAFAR	991010105599	A2	1-FEB-2008
<input type="checkbox"/> SONALI A/P VIKNESH ARUMUGAM	970808673535	A2	1-FEB-2008
<input type="checkbox"/> ZUL IKMAL HANIEF	800000000000	A1	12-NOV-2007

Allow Student
Deny Student
Delete Student

**Legend**

	To be Accept/Deny
	Already a Member
	Membership Denied

Figure 7.10 : Teacher's Active Class

Figure 7.10 displays the details of active class belongs to the logged in teacher. All the students registered with the class are listed here. Teacher is allowed to whether 'Allow' or 'Deny' students depending on the case. The details explanation on the 'Group' which is indicated as 'A1' and 'A2' will be discussed in Figure 7.19 – 7.21.

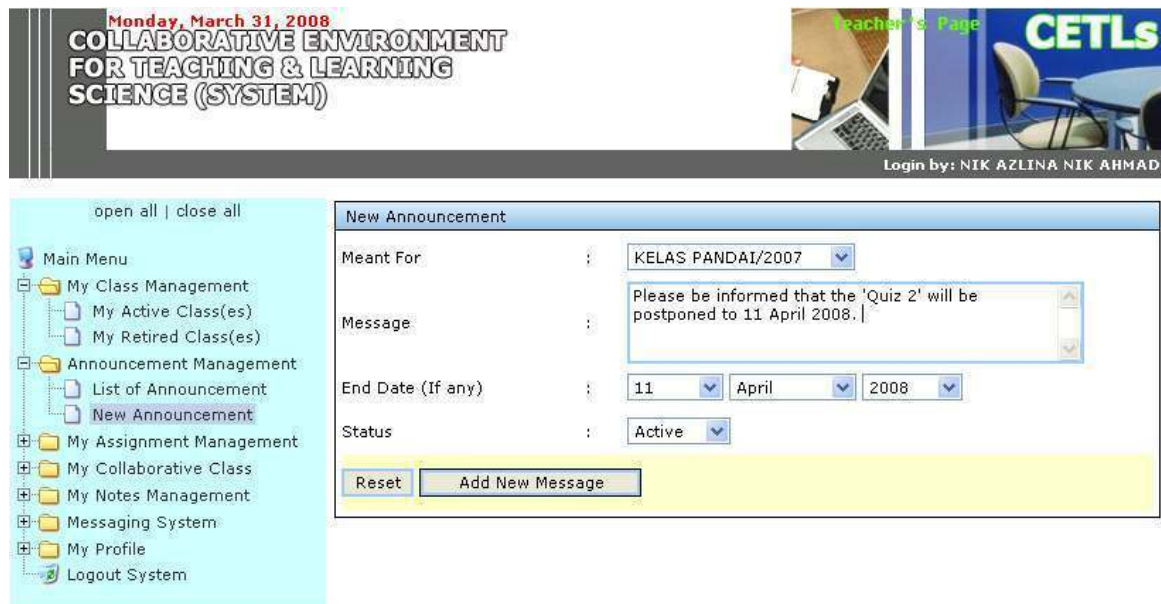


Figure 7.11 : The Announcement Page

Under the ‘Announcement Management’ menu, the teacher may either view the lists of the existing announcements or creating a new one. The announcement can be posted to all users or only specific class as can be seen from Figure 7.11. The ‘Select Entity’ combo box will list all the classes assigned under the teacher, to allow the teacher making selection (to whom he wants to post the announcement) instead of typing the name of every class. To create a new announcement, teacher also needs to enter any other details such as text message (announcement), end date (once the announcement reaches its end date, CETLS will automatically deactivate it), and status (whether to activate or inactivate the announcement). Only announcement with the active status will be displayed to the users.

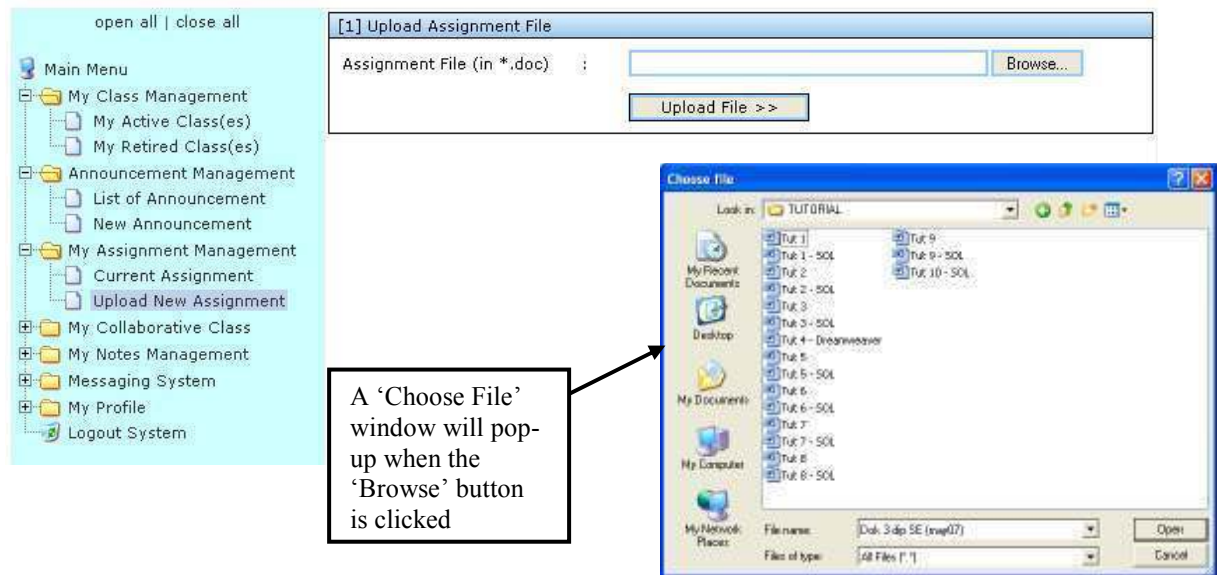


Figure 7.12 : Upload Assignment By Teacher

Figure 7.12 shows how to upload an assignment. There is a text field for a teacher to write the path of the file to be uploaded. Another alternative is by using the 'Browse' button, which will pop-up the 'Choose File' window, to allow the teacher select the file to be uploaded. Once the 'Upload File' button is clicked, the uploaded file will be displayed in the students' page and ready to be uploaded by them. The process of 'Uploading Notes' also follow the same procedures.



Figure 7.13 : Upload Assignment Details

The uploaded assignment can be assigned to only one class, or many classes under the teacher's coordination. In order to specify the class, the checkbox need to be checked. The assignment can only be accessed by the checked classes. Any other details such as the assignment description, activation status, as well as date need to be filled in accordingly.



Friday, February 01, 2008  
**COLLABORATIVE ENVIRONMENT  
 FOR TEACHING & LEARNING  
 SCIENCE (SYSTEM)**

Teacher's Page  
**CETLs**

Login by: NIK AZLINA NIK AHMAD

open all | close all

Main Menu

- My Class Management
  - My Active Class(es)
  - My Retired Class(es)
- Announcement Management
  - List of Announcement
  - New Announcement
- My Assignment Management
  - Current Assignment
  - Upload New Assignment
- My Collaborative Class
- My Notes Management
- Messaging System
- My Profile
- Logout System

My Upload Assignment

Title	Class Assigned	Final Date	Progress
<input type="checkbox"/> A POWER POINT FILE - PLEASE DOWNLOAD AND PRINT IT [VIEW ]	3 GAMMA/2008	1-JAN-2008	
<input type="checkbox"/> THIS IS FOR YOUR ADDITIONAL HOMEWORK [VIEW ]	KELAS PANDAI/2007	1-JAN-2008	
<input type="checkbox"/> SUBMIT THIS ON TIME [VIEW ]	KELAS PANDAI/2007	5-JAN-2008	

Activate Assignment    Deactivate Assignment    Delete Assignment

Legend

	Active Assignment
	Inactive Assignment
	Assignment Closed/Retired

Click 'VIEW' to view the uploaded assignment question

Click this icon to view students' progress

Figure 7.14 : List of Uploaded Assignments

Figure 7.14 displays the list of assignments that have been uploaded by the teacher. Here, the teacher is able to view the students' progress by clicking on the image link (icon). Once the icon is clicked, the following page (as shown in Figure 7.15) will be displayed. The teacher can still view the assignment questions by clicking on the 'VIEW' text link.

Friday, February 01, 2008  
**COLLABORATIVE ENVIRONMENT  
 FOR TEACHING & LEARNING  
 SCIENCE (SYSTEM)**


Teacher's Page  
**CETLs**

Login by: NIK AZLINA NIK AHMAD

open all | close all

- Main Menu
  - My Class Management
    - My Active Class(es)
    - My Retired Class(es)
  - Announcement Management
    - List of Announcement
    - New Announcement
  - My Assignment Management
    - Current Assignment
    - Upload New Assignment
  - My Collaborative Class
  - My Notes Management
  - Messaging System
  - My Profile
  - Logout System

Assignment Info	
Assignment Description	SUBMIT THIS ON TIME
Assigned To	KELAS PANDAI/2007
Last Status	<b>ASSIGNMENT CURRENTLY ACTIVE</b>
Close Date	5-JANUARY-2008
<input type="button" value="Close/Retire Assignment"/> <input type="button" value="Back to Assignment List"/>	

	Student's Name	Date Send	Final Mark	View Doc
1	ZUL IKMAL HANIEF [8000000000000]	N/A	N/A	N/A
2	SONALI A/P VIKNESH ARUMUGAM [970808673535]	2/1/2008 1:37:40 AM	<b>NYR</b>	
3	MOHD HISHAM BIN MUZAFAR [991010105599]	N/A	N/A	N/A
4	AHMAD IKRAM MUSA [970808673342]	N/A	N/A	N/A

NYR = Not Yet Rated

Figure 7.15 : Check Students' Progress on Assignment

Under this section (refer Figure 7.15), teacher is able to view the students' progress. All the students registered with this class will be listed and their progress is determined accordingly. Those who have submitted/uploaded their work to the teacher will be indicated by showing the date and time of submission made. The submitted work can be viewed by the teacher by clicking on the 'View Doc' icon. The word "NYR" under the 'Final Mark' section means "Not Yet Rated". Once the teacher rate the assignment and assign marks to students, the "NYR" will be replaced with the student's final mark (as shown in Figure 7.17). The process of assigning marks is shown in Figure 7.15 below.

open all | close all

- Main Menu
  - My Class Management
    - My Active Class(es)
    - My Retired Class(es)
  - Announcement Management
    - List of Announcement
    - New Announcement
  - My Assignment Management
    - Current Assignment
    - Upload New Assignment
  - My Collaborative Class
  - My Notes Management
  - Messaging System
  - My Profile
  - Logout System

Assignment Info	
Assignment Description	SUBMIT THIS ON TIME
Assigned To	KELAS PANDAI/2007
Last Status	<b>ASSIGNMENT CURRENTLY ACTIVE</b>
Close Date	5-JANUARY-2008
<input type="button" value="Close/Retire Assignment"/> <input type="button" value="Back to Assignment List"/>	

Marked Assignment by Student	
Student's Name	SONALI A/P VIKNESH ARUMUGAM [970808673535]
Date/Time Send	2/1/2008 1:37:40 AM
Related Collection	KELAS PANDAI/2007
Related Assignment	SUBMIT THIS ON TIME
View Student's Assignment	WORKSHOP LABSHEET4.doc
Marks (/100)	<input type="text" value="15"/>
Comment	<input type="text" value="You should produce two tables for question 4."/>
<input type="button" value="Marked Student's Assignment"/>	

Figure 7.16 : Assigning Marks To Students

Once the teacher opens the uploaded document by the students, the teacher is able to evaluate the student's work. The teacher may write necessary comments in the provided area, and assign the total marks inside the field marked as 'Marks'.

Friday, February 01, 2008  
**COLLABORATIVE ENVIRONMENT FOR TEACHING & LEARNING SCIENCE (SYSTEM)**

Teacher's Page  
**CETLS**

Login by: NIK AZLINA NIK AHMAD

open all | close all

- Main Menu
  - My Class Management
    - My Active Class(es)
    - My Retired Class(es)
  - Announcement Management
    - List of Announcement
    - New Announcement
  - My Assignment Management
    - Current Assignment
    - Upload New Assignment
  - My Collaborative Class
  - My Notes Management
  - Messaging System
  - My Profile
  - Logout System

**Assignment Info**

Assignment Description: SUBMIT THIS ON TIME

Assigned To: KELAS PANDAI/2007

Last Status: **ASSIGNMENT CURRENTLY ACTIVE**

Close Date: 5-JANUARY-2008

Close/Retire Assignment    Back to Assignment List

	Student's Name	Date Send	Final Mark	View Doc.
1.	ZUL IKMAL HANIEF [800000000000]	N/A	N/A	N/A
2.	SONALI A/P VIKNESH ARUMUGAM [970808673535]	2/1/2008 1:37:40 AM	<b>15</b>	
3.	MOHD HISHAM BIN MUZAFAR [991010105599]	N/A	N/A	N/A
4.	AHMAD IKRAM MUSA [970808673342]	N/A	N/A	N/A

Figure 7.17 : Marks Assigned To Student

Student's mark

Once the marks is assigned by the teacher, the 'Final Mark' field will change from 'NYR' (refer Figure 7.15) to the student's final which is indicated by numbers.

Friday, February 01, 2008  
**COLLABORATIVE ENVIRONMENT FOR TEACHING & LEARNING SCIENCE (SYSTEM)**

Teacher's Page  
**CETLS**

Login by: NIK AZLINA NIK AHMAD

open all | close all

- Main Menu
  - My Class Management
  - Announcement Management
  - My Assignment Management
  - My Collaborative Class
    - Active Collaborative Class
    - New Collaborative Class
  - My Notes Management
  - Messaging System
  - My Profile
  - Logout System

**[1] Create New Collaborative Class**

Collaborative Class - Description: Collaborative Class For Organic Chemistry

Assigned To: KELAS PANDAI/2007

Estimated Time (in Minutes): 30

Number of Question (Subjective): 4

Continue to Create Question >>

Assign Timer

Assign Number of Questions

Figure 7.18 : Teacher Create Collaborative Class

Before teacher and students can get engage in a collaborative class, the teacher need to create the collaborative class first. Teacher needs to write the description of the collaborative class, and select the group/class to assign the collaborative class to. The timer and number of questions will be assigned here too (as shown in Figure 7.18).

Class(es) Assigned to Me

\* Only ACTIVE classes assigned to you will appear in this list

Select an Active Class: KELAS PANDAI/2007

Active Class Information

Class Name	KELAS PANDAI/2007
Creation Date	12-NOVEMBER-2007

\* Please noted that you can't longer do anything with this class once deactivated.

Retire This Class

List of Student for KELAS PANDAI/2007

Student's Name	IC No	Group	Date Registered
<input type="checkbox"/> AHMAD IKRAM MUSA	970808673342	A2	1-FEB-2008
<input type="checkbox"/> MOHD HISHAM BIN MUZAFAR	991010105599	A2	1-FEB-2008
<input type="checkbox"/> SONALI A/P VIKNESH ARUMUGAM	970808673535	A1	1-FEB-2008
<input type="checkbox"/> ZUL IKMAL HANIEF	800000000000	A1	12-NOV-2007

Allow Student Deny Student Delete Student

Legend

Green	To be Accept/Deny
Yellow	Already a Member
Red	Membership Denied

Group formation

Figure 7.19 : Teacher Assign 'Pair'

Once the teacher has created a collaborative class, he needs to assign the group members (Pair) for the students. Figure 7.19 displays the details of active class belongs to the logged in teacher. All the students registered with the class are listed here. In certain cases, teacher needs to deny the student's access to the class, and it can be done by selecting (check / tick) the checkbox and click on the 'Deny Student' button. All the denied students can join the class if the teacher changes the status by clicking the 'Allow Student' button.

By default, CETLs will automatically assign a pair of students for the collaborative class. The pair is marked as 'A1', 'A2', 'A3' ..., 'An'. The teacher can easily use the combo box to assign the group to students. Once the group (pair) is assigned to all students, the page will be like Figure 7.20.

The screenshot shows a web interface for managing classes. On the left is a navigation menu with options like 'My Class Management', 'My Assignment Management', and 'My Collaborative Class'. The main content area is titled 'Class(es) Assigned to Me' and shows the active class 'KELAS PANDAI/2007'. Below this, there's a table of student information with columns for name, IC No, group, and date registered. A callout box points to the 'Group' column with the text 'Click to change 'Pair''.

Student's Name	IC No	Group	Date Registered
AHMAD IKRAM MUSA	970808673342	A1	1-FEB-2008
MOHD HISHAM BIN MUZAFAR	991010105599	A2	1-FEB-2008
SONALI A/P VIKNESH ARUMUGAM	970808673535	A2	1-FEB-2008
ZUL IKMAL HANIEF	800000000000	A1	12-NOV-2007

Figure 7.20 : Teacher's Active Class

Figure 7.20 shows all the registered students for 'KELAS PANDAI' with their group name and partners according to the previous 'group formation' activity made by teacher. However the teacher is allowed to change the group members later, by clicking on the group name. Once the group name is clicked, the Figure 7.21 will be displayed and the teacher can easily use the combo box to assign the new group to students.

Change Student's Group	
Student's Name	AHMAD IKRAM MUSA
IC No	970808673342
Current Group	A1 <input type="button" value="Change Group"/> <input type="button" value="Close"/>

Figure 7.21 : Change Group (Pair)

Login by: SONALI A/P VIKNESH ARUMUGAM

open all | close all

- Main Menu
  - My Class Management
    - List of Active Classes
  - My Collaborative Class
    - My Collaborative Test
  - Active Assignment
    - My Active Assignment
  - Uploaded Notes
  - Messaging System
    - My Inbox
    - Compose New Message
    - My Sent Messages
  - My Profile
  - Logout System

FEBRUARY 2008

S	M	T	W	T	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	

Student's Name

Latest Announcement

- SELAMAT HARI PELAJAR
- SEMUA
- FDSDSDFSDSDFSD

My Inbox

My Messages	1
My New Message(s)	1

My Current Class: KELAS PANDAI/2007

Last Class Status	In Process
Assigned Teacher	NIK AZLINA NIK AHMAD
Date Joined	1-FEBRUARY-2008
Current Internal Group	- [ PARTNER: MOHD HISHAM BIN MUZAFAR ]
Total Collaborative Class	1
Total Active Assignment	2
Total Upload (Notes and etc.)	0

Collaborative Partner Name (Pair)

Collaborative class, click to join

Figure 7.22 : Student's List of Partner (Pair) for Collaborative Class

Once the process of creating collaborative class (refer Figure 7.18) and assigning group (pair) members to students (refer Figure 7.19 – 7.21) are done, the students page will automatically be updated. By referring to Figure 7.22, as usual, the logged in user name will appear on the top, right side of the page to indicate which user is currently using the system. From this page which is logged in by the student, the student 'Sonali' has a collaborative partner (Pair) which is 'Mohd Hisham'. Both of them will work together as a

'Pair' during the collaborative class. The student now has one new collaborative class. If the link (collaborative class) is clicked, the 'collaborative class' will be displayed as shown in Figure 7.23.

Friday, February 01, 2008  
**COLLABORATIVE ENVIRONMENT FOR TEACHING & LEARNING SCIENCE (SYSTEM)**

Student's Page **CETLS**  
 Login by: SONALI A/P VIKNESH ARUMUGAM

open all | close all

- Main Menu
  - My Class Management
    - List of Active Classes
  - My Collaborative Class
    - My Collaborative Test
  - Active Assignment
    - My Active Assignment
  - Uploaded Notes
  - Messaging System
    - My Inbox
    - Compose New Message
    - My Sent Messages
  - My Profile
  - Logout System

My Collaborative Class			
My Active Class:	KELAS PANDAI/2007		
My Assigned Teacher:	NIK AZLINA NIK AHMAD		
Description	[ Think ]	[ Pair ]	[ Share ]
1 <b>COLLABORATIVE CLASS FOR ORGANIC CHEMISTRY</b> Created on : 1-FEB-2008 Total Question : 4 Time : 30 minutes			

Details of the question

Think-Pair-Share activities. Click on the icon to join

Figure 7.23 : The 'Think-Pair-Share' Main Interface

Figure 7.23 displays the collaborative class main interface. The students need to get engage in all three 'Think-Pair-Share' activities. Once the icon is activated or clicked, the Think, Pair, or Share page will be displayed accordingly.



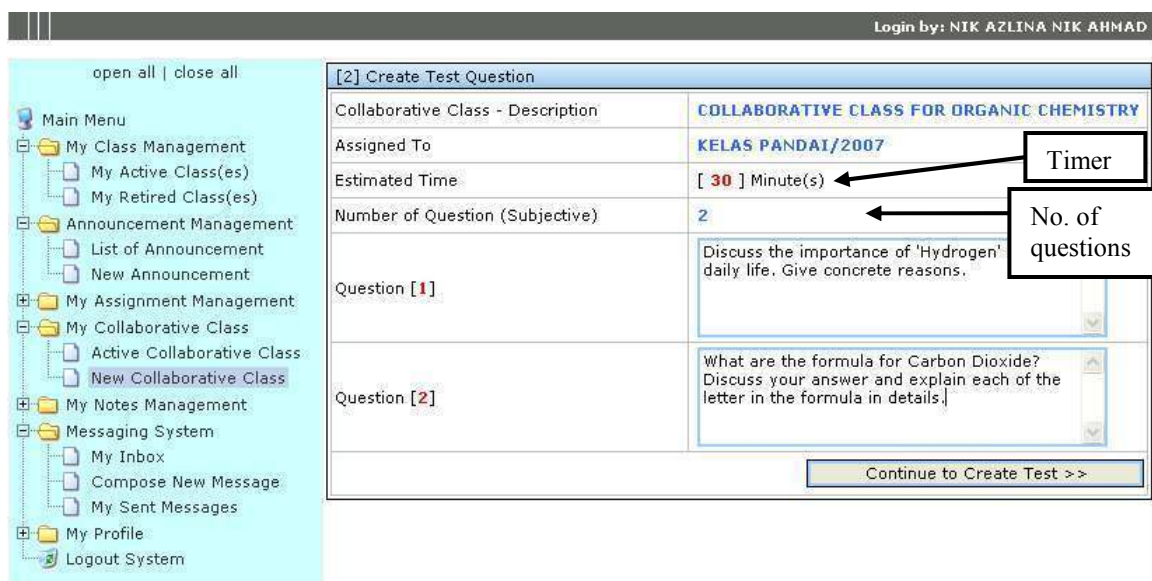


Figure 7.24 : Assign Questions and Timer

When assigning questions and tasks to students, the teacher may assign any number of tasks, depending on the topic and type of assessment. The teacher may write the question in the provided space. If the teacher assigns only two questions, CETLs will provide the space for only two questions to be typed in. Both 'Timer' and 'the number of questions' which are set up earlier (refer Figure 7.18) are displayed in this page.

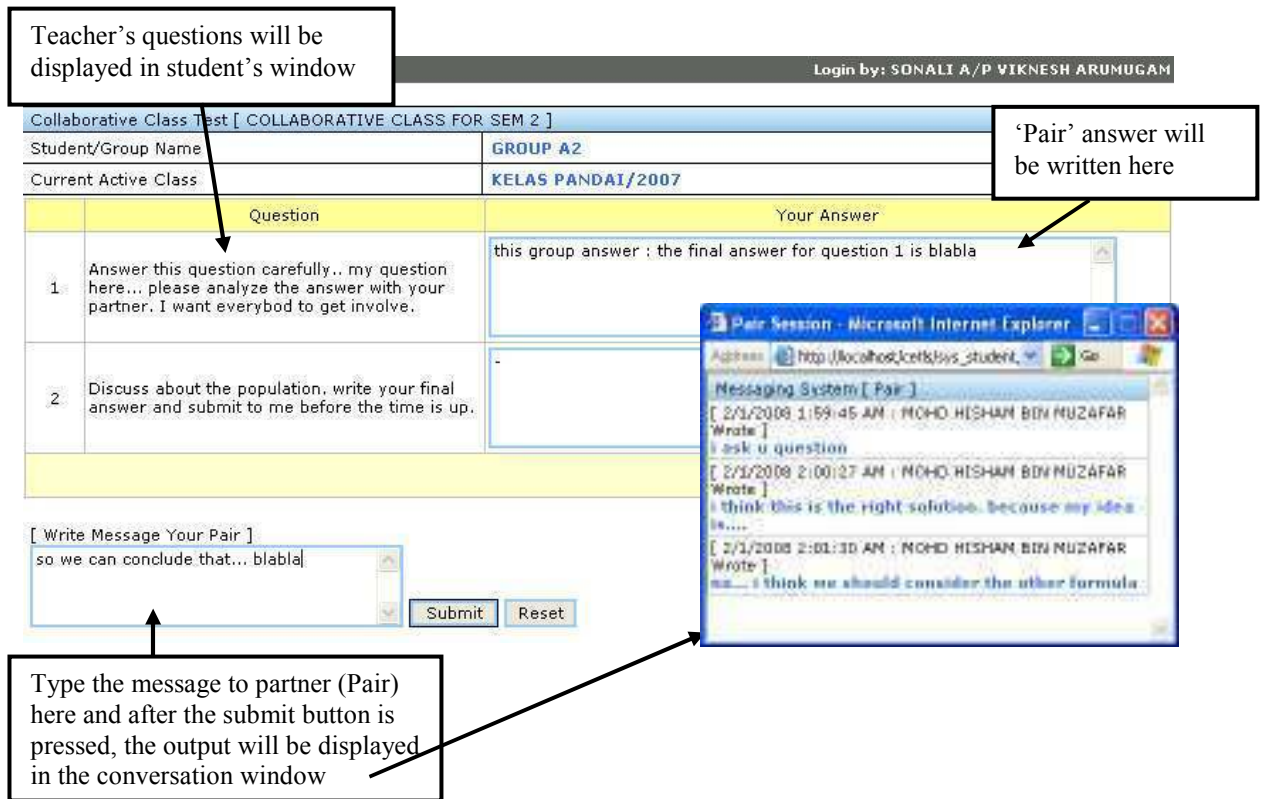


Figure 7.25 : Instant Messaging Window between 'Pair'

Figure 7.25 shows the activities happen during the 'Pair' session. Each student is provided with his own window, and one shared Instant Messaging window. During the discussion, student will type the message in the provided space and the message will be displayed in the pop-up window (shared Instant Messaging window).

Login by: NIK AZLINA NIK AHMAD

open all | close all

- Main Menu
- My Class Management
- Announcement Management
- My Assignment Management
- My Collaborative Class
  - Active Collaborative Class
  - New Collaborative Class
- My Notes Management
  - Current Notes
  - Upload New Note(s)
- Messaging System
- My Profile
- Logout System

**Collaborative Class - Info**

Test Description	COLLABORATIVE CLASS FOR ORGANIC CHEMISTRY
Assigned To	KELAS PANDAI/2007
Join Share Session	
Last Status	<b>THIS TEST CURRENTLY ACTIVE</b>

**Test Status [ Student ]**

	Student's Name	Date/Time	Final Mark (%)
1	ZUL IKMAL HANIEF [800000000000]	N/A	N/A
2	SONALI A/P VIKNESH ARUMUGAM [970808673535]	2/1/2008 1:49:38 AM	NYR
3	MOHD HISHAM BIN MUZAFAR [991010105599]	2/1/2008 1:51:40 AM	NYR
4	AHMAD IKRAM MUSA [970808673342]	N/A	N/A

**Test Status [ Group ]**

	Student's Name	Date/Time	Final Mark (%)
1	A1	N/A	N/A
2	A2	2/1/2008 1:49:50 AM	0

Think progress

Pair progress

Figure 7.26 : View 'Think and Pair' Progress

Teacher can view the progress of the students in Think and Pair activities. The Think activities will be evaluated individually since the student is work individually to solve his own task. Those who have submitted their work to the teacher be indicated with the “NYR” which stands for “Not Yet Rated”, together with its submission date and time. Those who have not submitted their work will be indicated as “N/A” which stands for “Not Available”. Once the submission is made, the N/A status will be changed accordingly.

For the 'Pair' activity, students will be evaluated in pair-basis. As can be seen from Figure 7.26, only two pairs available, since this class “KELAS PANDAI” has only four students. Therefore, when the teacher form a group for 'Pair' (2 persons in a group), two groups are formed. Each group (pair) need to submit only one answer or solution based on their discussion. In order for the teacher to evaluate the Think and Pair activities, teacher

needs to click on the submitted document (marked as NYR) and the following page (shown in Figure 7.27) will be displayed.

Marked Test by Student/Group	
Student's Name(s)	MOHD HISHAM BIN MUZAFAR [991010105599]
Date/Time Send	2/1/2008 1:51:40 AM
Final Mark	10%
Q1. type your question 1 here....	My answer here
Q2. type your question 2 here....	My second answer
Q3. type your question 3 here....	here is the an
Q4. type your question 4 here....	i tried my best to answer this question

Teacher's comments for Q1: This question is wrong... change to blabla

Teacher's comments for Q2: you use the wrong formula. the right one is blabla

Teacher's comments for Q3: <Your Comment Here>

Teacher's comments for Q4: <Your Comment Here>

Buttons: Edit Final Mark, Marked Test >>

Figure 7.27 : Evaluation on 'Think' Activity

Teacher is able to view all the students' answer and evaluate them by giving relevant comments before assigning the final marks to students (refer Figure 7.27).

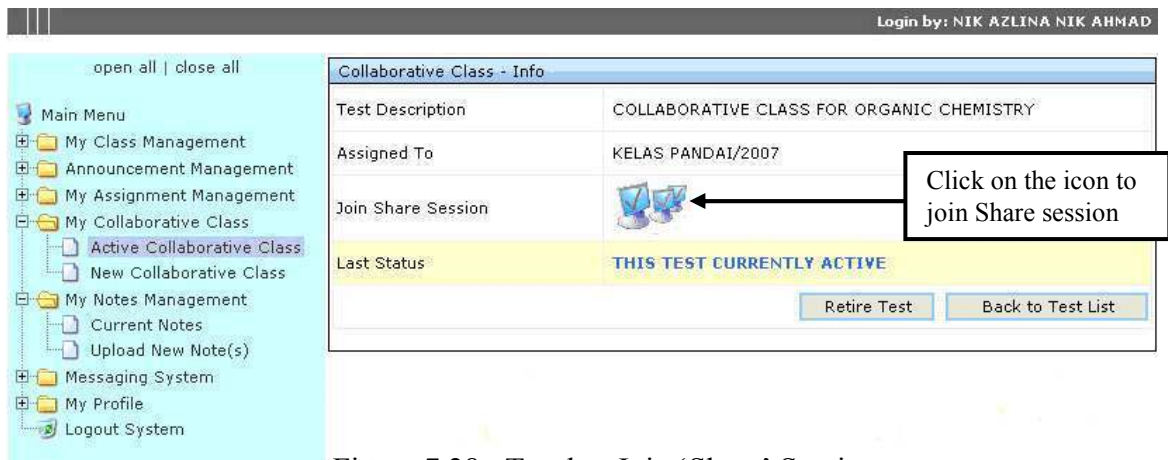


Figure 7.28 : Teacher Join 'Share' Session

In order for the teacher to join the Share session, which is joining the live chat with all students to discuss on the specific subject matter, teacher needs to click on the small computer icon as shown in Figure 7.28. The teacher will be brought to the chat room as shown in Figure 7.29.

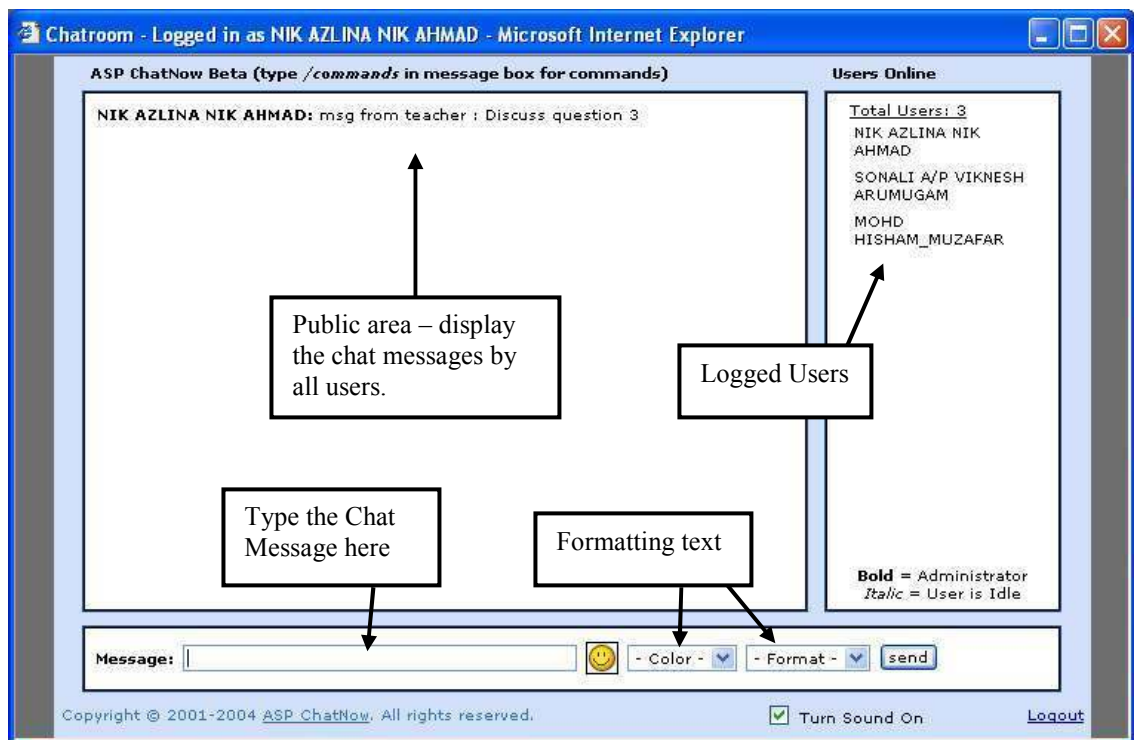


Figure 7.29 : 'Share' Stage

The Share stage involves open discussion among all the collaborators which are teacher, pair of students, and all students. The chat application will log the users who have join or leave the session. The logged users are displayed under the ‘Users Online’ area (refer Figure 7.29). The chat message can be typed using the provided text box, and can be formatted using the ‘Color’ and ‘Format’ function. Additional smiley (emotion icons) can be added (this may attract students). All the chat messages typed by any logged users will be displayed in the public area.



Figure 7.30 : Messaging System Inbox

Figure 7.30 displays the user’s Inbox for ‘Messaging System’. The inbox displays the sender’s name, subject and the date received. In order to view the message (which is similar to e-mail), the user needs to click on the sender’s name, and the message will appear. The green-highlighted messages indicate that the message has not been read.

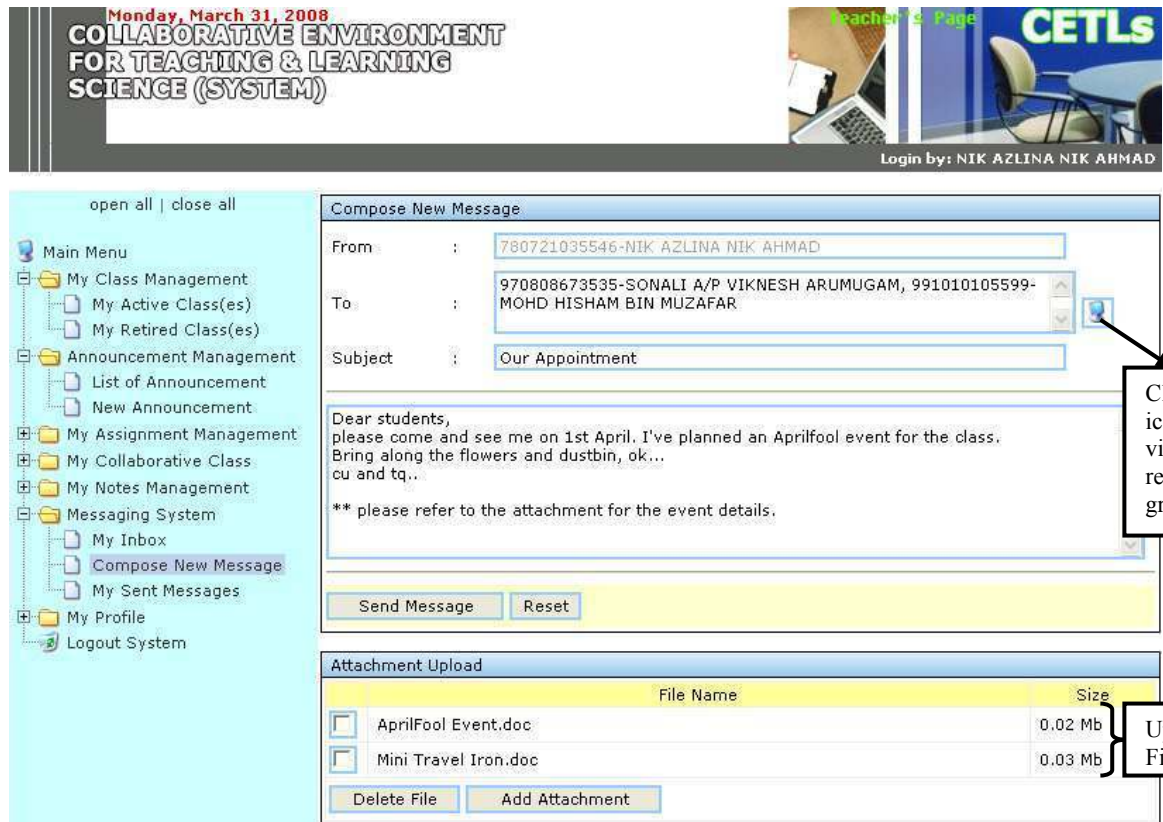


Figure 7.31 : Messaging System : Compose and Attaching Files

CETLS' user is also allowed to compose new email / message to any registered users. The 'From' field is disabled, because CETLS does not allow the user to change his username. However, the sender's name can be accessed by clicking on the 'small computer icon' on the right side of the 'To' field. Once the icon is clicked, the following Figure 7.32 will appear.



Figure 7.32 : Select Group to Send Message

Once the Figure 7.32 appear, the user may select which group/entity to send the message (e-mail) to. If the teacher selects the 'TEACHER' entity, CETLs will list all the teachers' name to allow selection. In this example, the teacher select the 'KELAS PANDAI/2007' entity, therefore all the students registered under this class will be listed out as shown in Figure 7.33.



Figure 7.33 : Select the Receiver Name

Since the teacher has selected the 'KELAS PANDAI/2007' entity, therefore, only the students registered under this class are displayed (as shown in Figure 7.33). The teacher may select any students from this class to send the email to. CETLs allow multiple selections with the use of checkboxes.

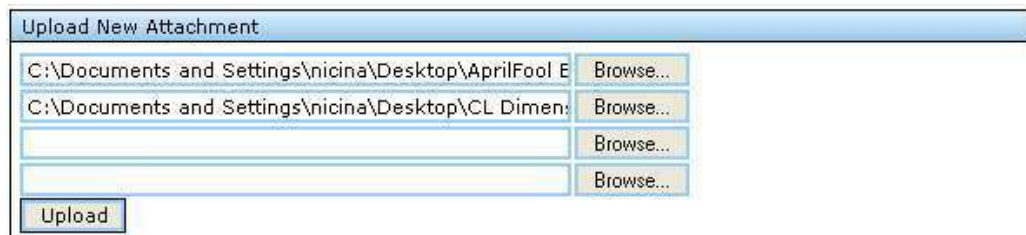


Figure 7.34 : Attaching Files to Message



As seen on Figure 7.31 , the uploaded files are listed accordingly. The process of uploading files is shown in Figure 6.34, where the user may either type the path of the files, or use the ‘Browse’ button to get the files. CETLs allows multiple attachment to be uploaded at a time.

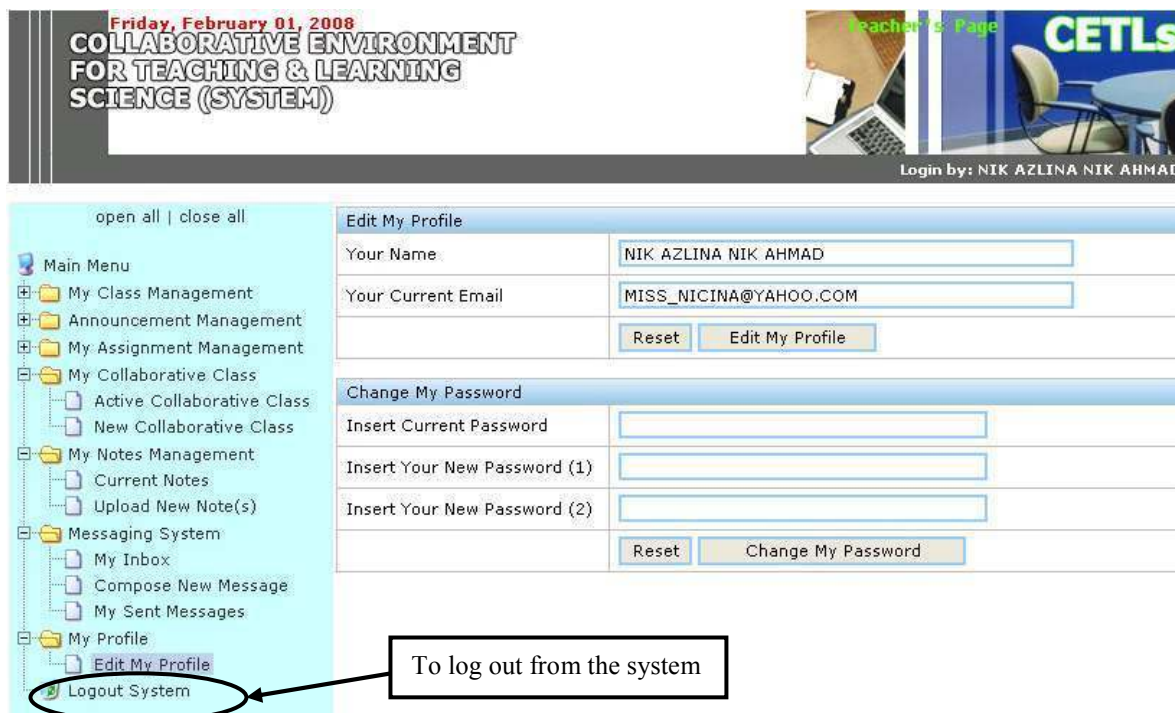


Figure 7.35 : Edit Profile Page and System Log Out

CETLs allows its users to edit their profile. Editing profile involves the users’ name, e-mail address, and password. However, in order for the users to change their password, they are required to enter the old password before replacing it with the new one. The confirmation of the new password is required, where the users need to enter the new password twice. Once the ‘Change My Password’ button is clicked, the users may logout from the system and start using their new password.

In order for the user to log out from the system, the user can simply click on the ‘Logout System’ link as shown in Figure 7.35.

## **7.5 TESTING AND EVALUATION**

After coding, a programmer must test each program to make sure it functions correctly (Shelly, 2006). In order to identify and eliminate execution and logic errors, CETLs has been tested using both ‘Unit Testing’ and ‘User Acceptance Testing.

### **7.5.1 Unit Testing**

Unit Test focuses on one unit which is a program module that performs specific functions that can be tested. This Unit Testing is performed only after the programmer believes the unit to be error free. CETLs is tested with both correct data and erroneous data to ensure that the system accept only correct test data, and reject the erroneous data.

#### **7.5.1.1 Purpose**

The purpose of Unit Testing is to ensure that the module or program performs its functions as defined in the program specification. This is to ensure whether the unit meets the requirements stated in the program specifications.

#### **7.5.1.2 Test Scope**

Unit testing focuses on the performance of specific part of the application system. The scope is to test the major functions of CETLs in accordance with ‘functional requirements’ discussed earlier in Chapter 5 (Section 5.5). This is to ensure that the functional requirements within the units are working properly with no error, and able to receive the valid input

and reject the invalid one. This Unit Testing is also performed in order to identify whether the specific functions or criteria provided by CETLs passed as it should be (the actual results parallel with the expected results).

### **7.5.1.3 Test Cases**

The following Table 7.1 – Table 7.6 are the series of test cases which stressed on the functional requirements and the status of the results, whether it has passed the test successfully (when there is no error). Each of the Graphical User Interface elements are tested by using the valid and invalid values. If the actual results match the expected results, then the status of the case will be marked as ‘passed’. Otherwise, it is considered as ‘need improvement’. The summary of the Unit Test results are discussed in Section 7.5.1.4.

Table 7.1 Unit Test Case 001

<b>TEST CASE</b>		
<b>Tester :</b> Nik Azlina Nik Ahmad		
<b>Date :</b> 31/08/07		
<b>Results :</b> <input checked="" type="checkbox"/> Passed <input type="checkbox"/> Need Improvement		
<hr/>		
<b>Test Case No. :</b> 001 <b>Required Addressed :</b> View List of Active Class		
<b>Objectives :</b>		
To ensure that only the active class assigned under the teacher can be viewed. To ensure the list of active class will appear after the selection made.		
<hr/>		
<b>Test Cases</b>		
<b>Functional Requirement</b>	<b>Elements of GUI</b>	<b>Value Entered</b>
1. R1.2 : Class Management (Active Class)	Combo Box	Select Blank
2. R1.2 : Class Management (Active Class)	Combo Box	Select 2 BETA
3. R1.2 : Class Management (Retired Class)	Combo Box	Select 2 BETA
<hr/>		
<b>Expected Results / Notes</b>		
Test 2 and 3 are a valid selection of the combo box. All others should be rejected.		
<hr/>		
<b>Actual Results / Notes</b>		
Test 2 and 3 are accepted. Test 1 should be rejected.		

Table 7.2 Unit Test Case 002

<b>TEST CASE</b>		
<b>Tester :</b> Nik Azlina Nik Ahmad		
<b>Date :</b> 31/08/07		
<b>Results :</b> <input checked="" type="checkbox"/> Passed <input type="checkbox"/> Need Improvement		
<hr/>		
<b>Test Case No. :</b> 002	<b>Required Addressed :</b> Create New Announcement	
<b>Objective :</b>		
Ensure that the selection made by the Teacher on the ‘new announcement form’ is valid.		
<hr/>		
<b>Test Cases</b>		
<b>Functional Requirement</b>	<b>Elements of GUI</b>	<b>Value Entered</b>
1. R1.3 : Announcement Group	Combo Box	Select Blank
2. R1.3 : Announcement Group	Combo Box	Select All Users
3. R1.3 : Announcement Group	Combo Box	Select Teacher
4. R1.3 : Announcement Group	Combo Box	Select Student
5. R1.3 : Announcement Message	Text Box	text123_@#\$\$%
6. R1.3 : Announcement Date	Combo Box	Select 7, Feb, 2007
7. R1.3 : Announcement Status	Combo Box	Select Active
8. R1.3 : Announcement Status	Combo Box	Select Inactive
<hr/>		
<b>Expected Results / Notes</b>		
Test 2, 3, 4, 6, 7, 8 are valid selection of the combo box. All others should be rejected. Test 5 is a valid announcement message since this text box accepts all data types. Test 1 is rejected		
<hr/>		
<b>Actual Results / Notes</b>		
Test 2, 3, 4, 5, 6, 7 & 8 are accepted.		

Table 7.3 Unit Test Case 003

<b>TEST CASE</b>		Page 1 of 2
<b>Tester :</b> Nik Azlina Nik Ahmad Ainie Hayati Noruzman		
<b>Date :</b> 31/08/07		
<b>Results :</b> <input checked="" type="checkbox"/> Passed <input type="checkbox"/> Need Improvement		
<hr/>		
<b>Test Case No. :</b> 003	<b>Required Addressed :</b> Assignment Management	
<b>Objective :</b>		
Ensure that the notes uploaded by the teacher can be downloaded by the students.		
<hr/>		
<b>Test Cases</b>		
<b>Functional Requirement</b>	<b>Elements of GUI</b>	<b>Value Entered</b>
1. R2.3 : Upload New Assignment	Text Box	C:\UM\notes.doc
2. R2.3 : Upload New Assignment	Browse Button	Click Button
3. R2.3 : Assignment Description	Text Box	Blank
4. R2.3 : Assignment Description	Text Box	Notes Chapter 1
5. R2.3 : Group Assigned	Check Box	Uncheck
6. R2.3 : Group Assigned	Check Box	Check
7. R2.3 : Assignment Activation	Combo Box	No
8. R2.3 : Assignment Activation	Combo Box	Yes
9. R2.3 : Assignment Close Date	Combo Box	Select 7, Feb, 2007
10. R4.2 : Download Assignment	Image Link	Click
11. R4.2 : Upload Assignment (student)	Browse Button	Click Button
12. R4.2 : Upload Assignment (student)	Text Box	Answer for Asgmt
13. R2.3 : Assignment Progress	Image Link	Click
14. R2.3 : Assignment Assessment	Text Link	Click
15. R2.3 : Assignment Assessment	Text Box	abcxyz
16. R2.3 : Assignment Assessment	Text Box	45

**Expected Results / Notes**

Test 1,4, 12 &16 are valid input for the text boxes.  
Test 10, 13 & 14 is a valid mouse click for links.  
Test 6 is a valid input for check box.  
Test 2 & 11 are valid mouse click for a button.  
Test 7,8 & 9 are valid selection.

---

**Actual Results / Notes**

1, 2, 4, 6, 7, 8, 9, 10, 11, 12, 13, 14 & 16 are accepted.  
Test 3, 5 & 15 should be rejected.

Table 7.4 Unit Test Case 004

<b>TEST CASE</b>		
<b>Tester :</b> Nik Azlina Nik Ahmad Ainie Hayati Noruzman		
<b>Date :</b> 31/08/07		
<b>Results :</b> <input checked="" type="checkbox"/> Passed <input type="checkbox"/> Need Improvement		
<hr/>		
<b>Test Case No. :</b> 004 <b>Required Addressed :</b> Notes Management		
<b>Objective :</b>		
Ensure that the notes uploaded by the teacher can be download by the students.		
<hr/>		
<b>Test Cases</b>		
<b>Functional Requirement</b>	<b>Elements of GUI</b>	<b>Value Entered</b>
1. R2.3 : Upload New Notes	Text Box	C:\UM\notes.doc
2. R2.3 : Upload New Notes	Browse Button	Click Button
3. R2.3 : Note Description	Text Box	Blank
4. R2.3 : Note Description	Text Box	Notes Chapter 1
5. R2.3 : Group Assigned	Check Box	Uncheck
6. R2.3 : Group Assigned	Check Box	Check
7. R4.2 : Download Notes	Image Link	Click
<hr/>		
<b>Expected Results / Notes</b>		
Test 1 & 4 are valid input for the text boxes. Test 2 & 7 are a valid mouse click as an input. Test 6 is a valid input.		
Test 3 & 5 should be rejected.		
<hr/>		
<b>Actual Results / Notes</b>		
Test 1,2,4,6,7 are accepted. Test 3, 5 were rejected with correct error message.		



Table 7.5 Unit Test Case 005

<b>TEST CASE</b>		
<b>Tester :</b> Nik Azlina Nik Ahmad Ainie Hayati Noruzman		
<b>Date :</b> 31/08/07		
<b>Results :</b> <input checked="" type="checkbox"/> Passed <input checked="" type="checkbox"/> Need Improvement (Test Case 7)		
<hr/>		
<b>Test Case No. :</b> 005	<b>Required Addressed :</b> Collaborative Class	
<b>Objective :</b>		
Ensure that all the collaborative activities are working properly.		
<hr/>		
<b>Test Cases</b>		
<b>Functional Requirement</b>	<b>Elements of GUI</b>	<b>Value Entered</b>
1. R3.1 : Create Collaborative Class	Text Box	blank
2. R3.1 : Create Collaborative Class	Text Box	text123_#\$\$%^*
3. R3.1 : Choose Group	Combo Box	Select Blank
4. R3.1 : Class Management	Combo Box	Select 2 BETA
5. R3.1 : Assign Timer	Combo Box	Select 5 mins
6. R3.1 : Number of Questions	Combo Box	3
7. R3.1 : Questions Details	Text Box	Blank
8. R3.1 : Questions Details	Text Box	text123_#\$\$%^*
9. R3.1 : Collaborative Class Activation	Check Box	Uncheck
10. R3.1 : Collaborative Class Activation	Check Box	Check
11. R3.1 : Collaborative Activity Progress	Image Link	Click
12. R5.1 : Join 'Think' Stage	Image Link	Click
13. R5.1 : 'Think' Answer Question	Text Box	blank
14. R5.1 : 'Think' Answer Question	Text Box	abc123_#\$\$%^&*
15. R6.1: 'Think' Evaluation	Text Link	Click
16. R6.1: 'Think' Evaluation	Text Link	abcxyz
17. R6.1: 'Think' Evaluation	Text Link	45
18. R9.1: 'Pair' Stage	Instant Messaging	blank

Table 7.5, continued

20. R9.1: 'Pair' Evaluation	Text Link	Click
21. R9.1: 'Pair' Evaluation	Text Link	abcxyz
22. R9.1: 'Pair' Evaluation	Text Link	45
23. R10.1 & R11.1 : 'Share' Stage	Chat Box	blank
24. R10.1 & R11.1 : 'Share' Stage	Chat Box	abc123_#\$\$%^&*
25. R10.1 & R11.1 : 'Share' Stage	Button	Click
26. R10.1 & R11.1 : 'Share' Stage	Check Box	Uncheck
27. R10.1 & R11.1 : 'Share' Stage	Check Box	Check

### Expected Results / Notes

Test 2, 8, 14 are valid input for the text boxes.  
 Test 10, 26 & 27 are valid inputs for check box.  
 Test are a valid mouse click as an input.  
 Test 4, 5, 6 are valid selections for combo box.  
 Test 11, 17, 20, 21, 22 is a valid mouse click input for the links.  
 Test 15, 16, 19 are valid input for the Instant Messaging.  
 Test 23 & 24 are valid input for chat box.  
 Test 25 is valid mouse click for button.

Test 1, 3, 7, 9, 13 & 18 should be rejected.

### Actual Results / Notes

Test 2, 4, 5, 6, 8, 10, 11, 12, 14, 15, 16, 17, 19, 20, 21, 22, 23, 24, 25, 26 & 27 are accepted.

Test 1, 3, 9, 13, 18 were rejected with correct error message.  
 Test 7 needs improvement.

Table 7.6 Unit Test Case 006

<b>TEST CASE</b>		
<b>Tester :</b> Nik Azlina Nik Ahmad Ainie Hayati Noruzman		
<b>Date :</b> 31/08/07		
<b>Results :</b> <input checked="" type="checkbox"/> Passed <input type="checkbox"/> Need Improvement		
<hr/>		
<b>Test Case No. :</b> 006	<b>Required Addressed :</b> Messaging System	
<b>Objective :</b>		
To ensure that the e-mail is well-functioning.		
<hr/>		
<b>Test Cases</b>		
<b>Functional Requirement</b>	<b>Elements of GUI</b>	<b>Value Entered</b>
1. R1.4 : Inbox,Compose	Text Link	Click
2. R1.4 : Inbox, Compose	Button	Click
3. R1.4 : Add Recipient	Image Link	Click
4. R1.4 : Add Recipient	Combo Box	Select 'Teacher'
5. R1.4 : Add Recipient	Combo Box	Select 'Student'
6. R1.4 : File Attachment	Button	Click
7. R1.4 : File Attachment	Text Box	C:\UM\file.doc
8. R1.4 : File Attachment	Browse Button	Click
9. R1.4 : Sent Messages	Text Link	Click
<hr/>		
<b>Expected Results / Notes</b>		
Test 1, 3 & 9 are valid inputs for the link.		
Test 2, 6, 8 are valid mouse click for the button.		
Test 7 is a valid input for text box.		
Test 4 & 5 are valid input for combo box.		
<hr/>		
<b>Actual Results / Notes</b>		
Test 1, 2, 3, 4, 5, 6, 7, 8 & 9 are accepted.		

#### **7.5.1.4 Unit Testing Results**

The Unit Testing was performed by the CETLs developer and the results for the tested units are recorded. According to the Unit Test Case 001 – Test Case 006 which can be obtained from Table 7.1 – Table 7.6, which log the results and activities on each unit, it can be concluded that all the units are working properly. The expected results tally with the actual results. Each GUI element such as combo box, check box, buttons, and text or image links accept only valid values and reject the invalid one.

#### **7.5.2 User Acceptance Test (UAT)**

Acceptance Tests are done primarily by the users with support from the project team. The goal is to confirm that system is complete, meets the business needs that prompted the system to be developed, and it is acceptable to the users.

##### **7.5.2.1 Purpose**

Since the User Acceptance Test (UAT) requires the involvement of the users to evaluate the proposed system, whether or not it is acceptable, therefore the users need to evaluate CETLs by themselves. The results are recorded according to the testing session made between the developer and users. The users will get involved in two different ways of testing, with two different purposes, as discussed below:

- **UAT Test Case (During the Lab Session)**

The purpose of this UAT lab session is to allow the users to experience the system by themselves, so that they will be able to evaluate the system, and identify whether to accept it or not by marking their level of acceptability on the test case series provided. The intention of using the Test Cases (which wrap up the system's functional requirements) is to ensure that the functional requirements provided in CETLs meet the users' satisfaction, whether or not the functions are working properly and suitable to be used for teaching and learning.

- **Questionnaire (After the Lab Session)**

The questionnaire is distributed with the purpose to get each user's view point in terms of the system's 'perceived usefulness', 'perceived ease of use', and 'behavioral intention'. However, since the research objective from Section 1.4 is to evaluate the system's usefulness and ease of use, therefore the main focus of this dissertation is to identify the level of users' agreement towards the system in terms of its :

- **Perceived Usefulness**

The intention of this part is to examine the usefulness of CETLs, whether it can help reduce teachers' and students' work, improve their time management, improve their computer skills and knowledge, and improve the communication among teachers and students.

- **Perceived Ease of Use**

This 'Perceived Ease of Use' is to analyze whether CETLs is easy to be used by its users, whether or not it is easy to be used for uploading and downloading notes, assignment, and tasks, as well as handling marks distribution and join the 'collaborative activities'.

### **7.5.2.2 Test Scope**

Since UAT is handled with two purposes, therefore the scope of this UAT is also categorized into two which are :

- To test the major functions of CETLs in accordance with 'functional requirements' discussed earlier in Section 5.5. This is to ensure that the functional requirements meet the users' satisfaction. This is done through the use of a series of test cases during the UAT lab session.
- Distribution of questionnaire to the users after the lab session ends, with the intention to evaluate the system's usefulness and ease of use.

### **7.5.2.3 Test Process**

Unit Acceptance Test involves meeting the users at a specific place with some processes at hand. UAT involves two major processes which are UAT Lab Session and the distribution of questionnaires to uses. The details for each process are :

#### ▪ **UAT Lab Session (Using Test Cases)**

Since CETLs is specifically designed to support collaborative teaching and used by three categories of users which are Coordinator, Teacher and Student, therefore UAT was handled at one secondary school named as Sekolah Menengah Tengku Panglima Raja with the involvement of the researcher as coordinator, four Science teachers and eight form two students. All of the users were gathered in a well-equipped computer laboratory, with an Internet connection.

Both teachers and students were asked to experience the system by themselves. The evaluation session starts with users' registration before the students were grouped in a pair-basis. A complete training manual were given to each user as a guide, which can be found in Appendix D.

During this evaluation time, the users were given a series of test cases, which allow the users to give either positive or negative comments. The users are given the freedom to mark the status of the system's acceptability based on their experience with the system during the testing session. Each case is determined by the three acceptance status provided in every test cases which are 'Yes', 'No', or 'N/I' which stands for 'Need Improvement', where the cases are determined according to the functional requirements found in Chapter 5, under Section 5.5. One sample of the test cases is provided in Table 7.7. The results of this UAT Lab Session are discussed under Section 7.5.2.4.

### ▪ **Questionnaire Distribution**

In order to record the users' feedback in terms of the three perspectives mentioned in Section 7.5.2.1, two sets of questionnaires (which are available in Appendix B) were distributed to teachers and students accordingly. This questionnaire were divided by three sections in order to examine the CETLs' perceive usefulness, perceive ease of use, as well as the behavioral intention. The questionnaire used five-point Likert scale to identify the level of users' agreement, where the range is from 1 – 5 as a symbol of 'Strongly Disagree', 'Disagree', 'Neutral', 'Agree', and 'Strongly Agree'. The results are discussed in Section 7.5.2.5.

#### **7.5.2.3.1 Test Case**

Table 7.7 presents a sample of the UAT test case, however the details of the test case series are available in Appendix A. As mentioned earlier, UAT test cases are meant to test the major functions of CETLs in accordance with 'functional requirements' discussed in Section 5.5. By referring to Table 5.5 under Section 5.5.1, the functional requirement R9.1 represents the 'MetaAnalysis Tools' during the 'Pair stage'. The following test case was used by the teacher in order to evaluate the function of 'MetaAnalysis Tools', whether or not the teacher is successful to do analysis and evaluation towards her students during the 'Pair' stage. The comment was written by the teacher herself, and she was given positive comments on this function.



Table 7.7 Sample of UAT Test Case

<b>Tester</b> : Nik Azlina Nik Ahmad			
<b>User</b> : Nik Azida Nik Mahmood (Teacher)			
<b>Date</b> : 11/01/08			
<b>Test Case No.:</b>	<b>013</b>	<b>Test Method :</b>	<b>User Acceptance Testing</b>
<b>Functional Requirement</b>	R9.1: 'Pair' Stage		
<b>Developer Notes</b>	Completed		
<b>User Comments</b>	<ul style="list-style-type: none"> <li>- Able to make an evaluation according to the submission made by each group.</li> <li>- Able to give comments to each question, together with the marks.</li> <li>- Difficult to control students' activities since it is lack of face-to-face communication.</li> </ul>		
<b>User Acceptance</b>	Yes	No	N/I
	√		

#### 7.5.2.4 UAT Lab Session (Using Test Cases) Results

User Acceptance Test (UAT) is recorded using the test cases, which are available in Appendix A. The test case series were distributed to the four teachers and eight students involved during the testing process. The results from the teachers and students are discussed accordingly in order to determine their acceptability towards the CETLs' functional requirements; whether or not the CETLs provides the functional requirements that are able to meet the users' satisfaction. The following discussions highlight the results from teachers and students point of view.

- **Results From the Teachers**

According to the feedback given by the teachers in the UAT Test Case 001 – 015 which can be obtained from Appendix A, only one case is marked as ‘Need Improvement (N/I)’, which is UAT Test Case 009 - “*R3.1: Class Management*”, the rest are marked as ‘Accepted’. The users comment that this ‘*Class Management*’ case enables them to view all the classes assigned for them and to view the list of students registered with their class. They are also able to form group (pair) of students as well as to view the number of Think-Pair-Share group available in the class. However, they complaint that, even though the system assign the automatic pair of students by default, but it also allow the teacher to form more than two students in one group which is not suitable for ‘Think-Pair-Share’ method.

Teachers mentioned that they like the features of accessing the online module where they can upload and download notes and assignments. The Think-Pair-Share part received good response since both students and teachers like this part except for a comment from a teacher that she could not control the ‘Pair’ communication between students, and she afraid that the students will use the ‘Instant Messaging’ to talk about something unrelated to the subject. However, she said that that the communication part really helped them improving their typing skills.

Other cases which are *Announcement Management*, *Notes Management*, *Assignment Management*, as well as *Messaging System* cases receive positive comments and accepted by the teachers.

According to the results discussed, it can be concluded that the functional requirements provided by CETLs met the teachers' satisfaction.

- **Results From the Students**

When distributing the test case series to the students, the feedback are positive and this can be seen from the recorded UAT Test Case 016 – 023 available in Appendix A. The users enjoy using the system especially for the 'pair' and 'share' part because it involves online communication (instant messaging for 'Pair' and live chat for 'Share').

However some students face a timeframe problem during the UAT session. They claimed that they do not have enough time to finish their task because the time set by the teacher during the Think-Pair-Share stage is not suitable with the number of questions assigned. It is different from the normal manual practice, where the students may ask for extra time from the teacher, but, when dealing with the system, CETLs will automatically take action when the session expires. This problem, however, can be solved by the teachers; by assigning less number of questions, or by setting extra time, since CETLs provides

flexibility to the teachers to choose the number of questions and set the timer of their own.

All the *Active Assignments*, *Uploaded Notes*, *Messaging System*, and *Think-pair-Share* cases receive positive comments and accepted by the students.

Thus, it can be said that functional requirements provided by CETLs are working properly and meet the students' satisfaction.

#### **7.5.2.5 Questionnaire Results**

As mentioned earlier in Section 7.5.2.1, the questionnaire was divided by three sections in order to examine the *perceived usefulness*, *perceived ease of use*, as well as the *behavioral intention*. The questionnaire was purposely designed in two sets, where one set is distributed to four Science teachers and another set was distributed to eight students at Sekolah Menengah Tengku Panglima Raja. It was distributed after the users finish with the system evaluation (UAT). The purpose of this questionnaire distribution is to examine the technology acceptance of collaborative teaching and learning using CETLs among teachers and students. The questionnaire results analysis is done by using the SPSS (Statistical Package for the Social Sciences) software. Since the questionnaire uses the five-point Likert scale, therefore the results log the percentage of users' acceptance towards CETLs in accordance to each scale. The set of questionnaire can be

obtained from Appendix B while the details of each section are discussed below :

#### 7.5.2.5.1 Perceived Usefulness

As mentioned in Section 7.5.2.1, the intention of this part is to examine the usefulness of CETLs, whether it can help reduce teachers' and students' work, improve their time management, improve their computer skills and knowledge, and improve the communication among teachers and students. The analysis of this part is done by using the SPSS (Statistical Package for the Social Sciences) software. The analysis of this part is presented in Table 7.8 – 7.15 for the teacher, while Table 7.16 – 7.24 represent the Students feedback.

### TEACHER : PERCEIVED USEFULNESS

Table 7.8 Teacher's Perceived Usefulness Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Respondent for B1	4	100.0%	0	.0%	4	100.0%
Respondent for B2	4	100.0%	0	.0%	4	100.0%
Respondent for B3	4	100.0%	0	.0%	4	100.0%
Respondent for B4	4	100.0%	0	.0%	4	100.0%
Respondent for B5	4	100.0%	0	.0%	4	100.0%
Respondent for B6	4	100.0%	0	.0%	4	100.0%
Respondent for B7	4	100.0%	0	.0%	4	100.0%

**N = No. of Respondents**

Table 7.8 is the case processing summary for the teacher’s perceived usefulness towards the technology acceptance of collaborative teaching using CETLs. There are four respondents involved with this evaluation and it is represented with an ‘N’ symbol. The ‘B1’ until ‘B7’ represent the cases (questions) appeared in the questionnaire (refer Appendix B). From the analysis, it was determined that all the B1 – B7 cases are 100% valid, and none of the cases are missing (invalid).

Table 7.9 Teacher’s Perceived Usefulness Respond for B1

		B1					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (25%)	3 (75%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (25%)	3 (75%)	4 (100.0%)

Based on the analysis made on the perceived usefulness part of the questionnaire, Table 7.9 represents the response from the four teachers for “*B1: I think that using CETLs would improve my time management*”. Three of the respondents with the percentage of 75% strongly agreed with the statement while another one (25%) agreed. None of them disagreed, therefore, it can be concluded that all teachers agreed that the respondents think that CETLs will improve their time management.

Table 7.10 Teacher’s Perceived Usefulness Respond for B2

		B2					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (50%)	2 (50%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	2 (50%)	2 (50%)	4 (100.0%)

Table 7.10 represents the result for B2 which is “B2: *I feel that using CETLs would improve my skills & knowledge about using computer & internet*”. Two respondents agreed while another two are strongly agreed with the statement. Zero respondents gave the negative results. The result shows that both Agree and Strongly Agree have equal weighting which is 50%.

Table 7.11 Teacher’s Perceived Usefulness Respond for B3

		B3					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)	0 (0.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)	0 (0.0%)	4 (100.0%)

Question B3 from Table 6.11 is “B3: *I find that ‘Notes Management’ & ‘Assignment Management’ modules are very useful*”. All the four respondents give the same feedback, which are agreed that lead to a 100% score. Therefore, it can be concluded that the teachers think that both modules are very useful to them.

Table 7.12 Teacher’s Perceived Usefulness Respond for B4

		B4					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)	2 (50.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	1 (25.0%)	1 (25.0%)	2 (50.0%)	4 (100.0%)

According to the response given by the teachers towards question B4 which is “B4: *(Think-Pair-Share) I find that the communication part (Chat room) is effective for teaching*”, one of them stayed neutral which is 25% of the overall, another 25% agreed, and the rest 50% are strongly agreed, as found in Table 7.12.

Table 7.13 Teacher's Perceived Usefulness Respond for B5

		B5					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	4 (100.0%)

The B5 question is to determine the respondents feedback on this “B5: I think that the online assessment & evaluation are practicable” statement. All four respondents gave the positive feedback with 25% strongly agreed and the rest 75% were agreed with the evaluation statement.

Table 6.14 Teacher's Perceived Usefulness Respond for B6

		B6					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	0 (0.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	0 (0.0%)	4 (100.0%)

Table 7.14 analyzes the respond for “B6: Overall, I find that CETLs is useful in completing my job (Notes, Assignment, Marks and Discussion)”. 25% of the respondents gave the neutral feedback while the 75% marked it as agreed.

Table 7.15 Teacher's Perceived Usefulness Respond for B7

		B7					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	1 (25.0%)	2 (50.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)
Total		1 (25.0%)	2 (50.0%)	1 (25.0%)	0 (0.0%)	0 (0.0%)	4 (100.0%)

Response for B7 recorded that 25% of the respondents strongly disagreed and 50% disagreed with the question “B7: CETLs is lack of face-to-face communication. Do you think this will influence your effectiveness of your work?” Another 25% gave a neutral response.



## STUDENT : PERCEIVED USEFULNESS

Table 7.16 Student’s Perceived Usefulness Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Respondent for B1	8	100.0%	0	.0%	8	100.0%
Respondent for B2	8	100.0%	0	.0%	8	100.0%
Respondent for B3	8	100.0%	0	.0%	8	100.0%
Respondent for B4	8	100.0%	0	.0%	8	100.0%
Respondent for B5	8	100.0%	0	.0%	8	100.0%
Respondent for B6	8	100.0%	0	.0%	8	100.0%
Respondent for B7	8	100.0%	0	.0%	8	100.0%
Respondent for B8	8	100.0%	0	.0%	8	100.0%

**N = No. of Respondents**

Table 7.16 is the case processing summary for the student’s perceives usefulness. There are eight respondents involved with this evaluation and it is represented with an ‘N’ symbol. ‘B1’ until ‘B8’ represent the cases (questions) appeared in the questionnaire (refer Appendix B). All the B1 – B8 cases are 100% valid, and none of the cases are missing (invalid).

Table 7.17 Student’s Perceived Usefulness Respond for B1

		B1					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	1 (12.5%)	3 (37.5%)	3 (37.5%)	1 (12.5%)	8 (100.0%)
Total		0 (0.0%)	1 (12.5%)	3 (37.5%)	3 (37.5%)	1 (12.5%)	8 (100.0%)

Based on the analysis made on the perceived usefulness part of the questionnaire, Table 7.9 represents the response from the eight students for “B1: I think that using CETLs would improve my time management”. 12.5% of the respondent strongly agreed with the statement while another 37.5% agreed. 37.5% disagreed, and none of them strongly disagreed. Therefore, it can be concluded that all students agreed that the respondents think that CETLs will improve their time management.

Table 7.18 Student's Perceived Usefulness Respond for B2

		B2					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (75.0%)	2 (25.0%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	6 (75.0%)	2 (25.0%)	8 (100.0%)

Table 7.18 represents the result for B2 which is “B2: I feel that using CETLs would improve my skills & knowledge about using computer & internet”. Six respondents agreed while another two are strongly agreed with the statement. Zero respondents gave the negative results. The result shows that both Agree and Strongly Agree have the weighting of 75.0% and 25.0% accordingly.

Table 7.19 Student's Perceived Usefulness Respond for B3

		B3					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (50.0%)	4 (50.0%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	4 (50.0%)	4 (50.0%)	8 (100.0%)

Question B3 is “B3: I find that ‘Download Notes’ and ‘Download & Upload Assignment’ are very useful”. There are 50% respondents agreed and another 50% strongly agreed with the statement. Therefore, it can be concluded that the students think that both modules are very useful to them.

Table 7.20 Student's Perceived Usefulness Respond for B4

		B4					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	1 (12.5%)	4 (50.0%)	2 (25.0%)	1 (12.5%)	8 (100.0%)
Total		0 (0.0%)	1 (12.5%)	4 (50.0%)	2 (25.0%)	1 (12.5%)	8 (100.0%)

According to the response given by the students towards question B4 which is “*B4: I find that the ‘instant messaging’ part is very interesting*”, 12.5% of them marked it as disagree, 50% stayed neutral, 25% agreed, while another 12.5% are strongly agreed, as found in Table 7.20.

Table 7.21 Student’s Perceived Usefulness Respond for B5

		B5					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (37.5%)	5 (62.5%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (37.5%)	5 (62.5%)	8 (100.0%)

The B5 question is to determine the respondents feedback on this “*B5: (Think-Pair-Share) I think that the chatroom module is interesting*” statement. All eight respondents gave the positive feedback with 62.5% strongly agreed and the rest were agreed with the evaluation statement.

Table 7.22 Student’s Perceived Usefulness Respond for B6

		B6					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	3 (37.5%)	5 (62.5%)	0 (0.0%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	3 (37.5%)	5 (62.5%)	0 (0.0%)	8 (100.0%)

Table 7.22 analyzes the respond for “*B6: I think that getting the marks online is very exciting*”. 37.5% of the respondents gave the neutral feedback while the 62.5% marked it as agreed.

Table 7.23 Student's Perceived Usefulness Respond for B7

		B7					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	2 (25.0%)	5 (62.5%)	1 (12.5%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	2 (25.0%)	5 (62.5%)	1 (12.5%)	8 (100.0%)

Response for B7 recorded that 12.5% of the respondents strongly disagreed with the question “B7: Overall, I find that CETLs is useful in learning activity (Notes, Assignment, Marks, Discussion)”, 62.5% disagreed and another 25% gave a neutral response.

Table 7.24 Student's Perceived Usefulness Respond for B8

		B8					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	2 (25.0%)	3 (37.5%)	3 (37.5%)	0 (0.0%)	0 (0.0%)	8 (100.0%)
Total		2 (25.0%)	3 (37.5%)	3 (37.5%)	0 (0.0%)	0 (0.0%)	8 (100.0%)

Response for B8 recorded that 25% of the respondents strongly disagreed with the question “B8: CETLs is lack of face-to-face communication. Do you think this will reduce your attention during learning session?” 37.5% disagreed and another 37.5% gave a neutral response.

### 7.5.2.5.2 Perceived Ease of Use

As stated in Section 7.5.2.1, this ‘Perceived Ease of Use’ is to analyze whether CETLs is easy to be used by its users, whether or not it is easy to be used for uploading and downloading notes, assignment, and tasks, as well as handling marks distribution and join the ‘collaborative activities’. The details of the Perceive Ease of Use results are recorded in Table 6.25 – 7.28 (Teacher) and Table 7.29 – 7.31 (Students).

#### TEACHER : PERCEIVED EASE OF USE

Table 7.25 Teacher’s ‘Perceived Ease of Use’ Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Respondent for C1	4	100.0%	0	.0%	4	100.0%
Respondent for C2	4	100.0%	0	.0%	4	100.0%
Respondent for C3	4	100.0%	0	.0%	4	100.0%

**N = No. of Respondents**

Table 7.25 is the case processing summary for the teacher’s perceives ease of use. The ‘N’ symbol represents the number of respondents, which are four teachers, while ‘C1’ until ‘C3’ represent the cases (questions) appeared in the questionnaire (refer Appendix B). All the C1 – C3 cases are 100% valid, and none of the cases are missing (invalid).

Table 7.26 Teacher's 'Perceived Ease of Use' Respond for C1

		C1					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	0 (0.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	0 (0.0%)	4 (100.0%)

According to the response given by the teacher towards question C1 which is “C1: CETLs would make my job easier because I can do my work virtually (Notes, Assignment, Marks, Discussion)”, 25% of them marked it as agree, 37.5% stayed neutral, while 75% agreed, as found in Table 7.20.

Table 7.27 Teacher's 'Perceived Ease of Use' Respond for C2

		C2					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	4 (100.0%)

Response for C2 recorded that 25% of the respondents strongly agreed with the statement “C2: CETLs is simple to use in terms of uploading and downloading notes, assignment, and handling marks distribution and join ‘collaborative activities’ (chat)”, while 75% of them disagreed.

Table 7.28 Teacher's 'Perceived Ease of Use' Respond for C3

		C3					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	2 (50.0%)	2 (50.0%)	0 (0.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	2 (50.0%)	2 (50.0%)	0 (0.0%)	4 (100.0%)

The C3 question is to determine the respondents feedback on this “C3: CETLs can reduce the tension & stress in completing my job (Notes, Assignment, Marks, Discussion)” statement. Half of the respondents gave the neutral feedback and another half agreed with the evaluation statement.

### STUDENT : PERCEIVE EASE OF USE

Table 7.29 Student’s ‘Perceived Ease of Use’ Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Respondent for C1	8	100.0%	0	.0%	8	100.0%
Respondent for C2	8	100.0%	0	.0%	8	100.0%

**N = No. of Respondents**

The case processing summary for the teacher’s perceives ease of use is represented using Table 7.29. The ‘N’ symbol represents the number of respondents, which are eight students. The cases (questions) are represented using the symbol ‘C1’ until ‘C2’, and both cases are determined as 100% valid, and none of the cases are missing (invalid).

Table 7.30 Student’s ‘Perceived Ease of Use’ Respond for C1

	Student	C1				Total	
		Strongly Disagree	Disagree	Neutral	Agree		Strongly Agree
Respondent		0 (0.0%)	0 (0.0%)	2 (25.0%)	5 (62.5%)	1 (12.5%)	8
Total		0 (0.0%)	0 (0.0%)	2 (25.0%)	5 (62.5%)	1 (12.5%)	8

According to the response given by the students towards question C1 which is “C1: CETLs would make my learning activities easier because I can do my work virtually (Notes, Assignment, Marks, Discussion)”, 12.5% of them marked it as strongly agree, 62.5% agreed, and the rest 25% stayed neutral with their answer.

Table 7.31 Student’s ‘Perceived Ease of Use’ Respond for C2

		C2					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	3 (37.5%)	3 (37.5%)	2 (25.0%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	3 (37.5%)	3 (37.5%)	2 (25.0%)	8 (100.0%)

Based on Table 7.31 which considered the students’ feedback on “C2: CETLs is simple to use in terms of uploading and downloading notes, assignment, and handling marks distribution and join ‘collaborative activities’ (chat)”, 25% of the respondents strongly agreed with the statement, while another 37.5% agreed, and another 37.5% keep neutral with their answers.

### 7.5.2.5.3 Behavioral Intention

This part will determine the users’ intention of using CETLs, whether they are willing to use the system under certain conditions; if the school provides the system or because the system makes their jobs easier. The researcher also investigates whether or not the users have the intention to use the system frequently. The teachers’ feedbacks are shown in Table 7.32 – 7.35 while the students’ feedbacks are represented in Table 7.36 – 7.39.



## TEACHER : BEHAVIORAL INTENTION

Table 7.32 Teacher’s ‘Behavioral Intention’ Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Respondent for D1	4	100.0%	0	.0%	4	100.0%
Respondent for D2	4	100.0%	0	.0%	4	100.0%
Respondent for D3	4	100.0%	0	.0%	4	100.0%

**N = No. of Respondents**

Table 7.32 is the case processing summary for the teacher’s behavioral intention towards using CETLs. Four respondents were involved in this evaluation and they are represented with an ‘N’ symbol. ‘D1’ – ‘D3’ cases represent the questions appeared in the questionnaire (refer Appendix B), and all of the cases are 100% valid, with zero missing (invalid) cases.

Table 7.33 Teacher’s ‘Behavioral Intention’ Respond for D1

		D1					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (25.0%)	3 (75.0%)	4 (100.0%)

Based on the analysis made on the behavioral intention part of the questionnaire, Table 7.33 represents the response from the four teachers for “D1: *If the school provides CETLs, I intend to use it to do my work (Notes, Assignment, Marks, Discussion)*”. Three of the respondents with the percentage of 75% strongly agreed with the statement while another one (25%) agreed. None of them disagreed, therefore, it can be concluded that all teachers accepted CETLs and willing to use it if they were provided with it.

Table 7.34 Teacher's 'Behavioral Intention' Respond for D2

		D2					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (75.0%)	1 (25.0%)	4 (100.0%)

Table 7.34 represents the result for D2 which is “D2: I intend to use CETLs because it makes my job easier”. All the respondents gave positive results, where the analysis recorded that 75% of the respondent agreed and 25% strongly agreed with the statement. It is shown that teachers intend to use CETLs since it is able to ease their work.

Table 7.35 Teacher's 'Behavioral Intention' Respond for D3

		D3					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Teacher	0 (0.0%)	0 (0.0%)	1 (25.0%)	2 (50.0%)	1 (25.0%)	4 (100.0%)
Total		0 (0.0%)	0 (0.0%)	1 (25.0%)	2 (50.0%)	1 (25.0%)	4 (100.0%)

According to the response given by the students towards question D3 which is “D3: I intend to use CETLs frequently”, 25% of them marked it as strongly agree, 50% agreed, and the rest 25% stayed neutral with their answer.

### STUDENT : BEHAVIORAL INTENTION

Table 7.36 Student's 'Behavioral Intention' Case Processing Summary

	Cases					
	Valid		Missing		Total	
	N	Percent	N	Percent	N	Percent
Respondent for D1	8	100.0%	0	.0%	8	100.0%
Respondent for D2	8	100.0%	0	.0%	8	100.0%
Respondent for D3	8	100.0%	0	.0%	8	100.0%

**N = No. of Respondents**

The student’s behavioral intention of using CETLs was recorded, and its case processing summary is represented in Table 7.36. Eight respondents were involved with this evaluation and it is represented with an ‘N’ symbol. The symbols ‘D1’ until ‘D5’ are used to represent the cases (questions appeared in the questionnaire). All the D1 – D3 cases are 100% valid, and none missing (invalid) case found.

Table 7.37 Student’s ‘Behavioral Intention’ Respond for D1

		D1					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	1 (12.5%)	4 (50.0%)	3 (37.5%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	1 (12.5%)	4 (50.0%)	3 (37.5%)	8 (100.0%)

Based on the Table 7.37 which analyzes the result for D1 which is “*D1: If the school provides CETLs, I intend to use it to do my work (Notes, Assignment, Marks, Discussion)*”, 37.5% respondents strongly agreed, another 50% agreed, and 12.5% neutral with the statement. Zero respondents gave the negative results.

Table 7.38 Student’s ‘Behavioral Intention’ Respond for D2

		D2					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	0 (0.0%)	5 (62.5%)	3 (37.5%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	0 (0.0%)	5 (62.5%)	3 (37.5%)	8 (100.0%)

The D2 question from Table 7.38 is to determine the respondents’ feedback on “*D2: I intend to use CETLs because it is very interesting to use*”. All eight respondents gave the positive feedback with 62.5% agreed and the rest 37.5% were strongly agreed with the evaluation statement.

Table 7.39 Student's 'Behavioral Intention' Respond for D3

		D3					Total
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree	
Respondent	Student	0 (0.0%)	0 (0.0%)	3 (37.5%)	3 (37.5%)	2 (25.0%)	8 (100.0%)
Total		0 (0.0%)	0 (0.0%)	3 (37.5%)	3 (37.5%)	2 (25.0%)	8 (100.0%)

Table 7.39 analyzes the respond for “D3: *I intend to use CETLs frequently*”. 37.5% of the respondents gave the neutral feedback while the 62.5% marked it as agreed.

### 7.5.2.6 Questionnaire Results Discussion

As described previously under Section 7.5.2.5, the results of questionnaire which have been logged in Table 7.8 – 7.39 recorded the response from both teachers and students. The analysis of the questionnaire (refer Appendix B for the questionnaire) was made according to the feedback received from both teachers and students towards the ‘perceived usefulness’, perceived ease of use’, and ‘behavioral intention’ categories. Each question (which is presented as B1, B2, C1, D2, etc) is evaluated using the five-point Likert scale, with a range from ‘1’ – ‘5’, where 1 represents ‘Strongly Disagree’, 2 for ‘Disagree’, 3 is the symbol of ‘Neutral’, 4 indicates ‘Agree’ while 5 symbolize the ‘Strongly Agree’ feedback. The results, however, are grouped into three categories, which are *negative* (to group both ‘Strongly Disagree’ and ‘Disagree’), *neutral* (consider only ‘Neutral’ answer) and *positive* (to group both ‘Agree’ and ‘Strongly Agree’ feedback), which better be illustrated as :

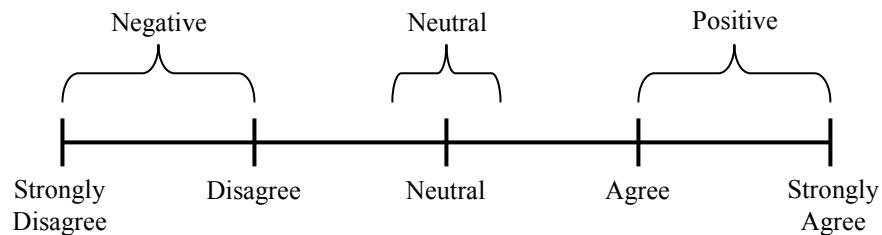


Figure 7.36 : Grouping the Five-point Likert Scales Used in Questionnaire

Table 7.40 : Perceived Usefulness Results Overview

Category	Case	Teacher			Student		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Perceived Usefulness	B1	100%	0%	0%	50%	37.5%	12.5%
	B2	100%	0%	0%	100%	0%	0%
	B3	100%	0%	0%	100%	0%	0%
	B4	75%	25%	0%	37.5%	50%	12.5%
	B5	100%	0%	0%	100%	100%	0%
	B6	75%	25%	0%	62.5%	37.5%	0%
	B7	0%	25%	75%	75%	25%	0%
	B8	-	-	-	0%	37.5%	62.5%

As mentioned in Section 7.5.2.5.2, the intention of ‘Perceived Usefulness’ category is to examine the usefulness of CETLs, whether it can help reduce teachers’ and students’ work, improve their time management, improve their computer skills and knowledge, and improve the communication among teachers and students.

B7 (Teacher) : B8 (Student)

According to the questionnaire result analysis logged in Table 7.40, it can be concluded that teachers accept CETLs as a useful teaching medium, since there is no negative feedback given with the exception for ‘B7’ case. B7 receives 0% positive but 75% negative feedback since the question was asked in the contrary way; *‘whether the lack of face-to-face communication used in CETLs will influence their effectiveness of work’*. Therefore receiving a 75% negative feedback for B7 is fine and shows that face-to-face communication does not affect the effectiveness of teachers’ work. On the students’ point of view, the same question was asked in ‘B8’ case. The feedback shows that none of the students agreed with the statement,

however, not 100% of them disagreed, since some of them, 62.5%, are neutral with the answer.

#### B1 (Teacher) : B1 (Student)

Looking at the 'B1', it can be seen that there is a contradiction between teachers' and students' feedback. The teachers were 100% agree with the statement that *'CETLs is able to improve their time management'* while half part of the students were agreed. The teachers felt that their time will be more manageable since they can prepare and upload the teaching materials earlier before the class starts. The students' feedbacks were influenced by the computer facilities; because some of them do not have any Internet connection at home.

#### B2 (Teacher) : B2 (Student)

'B2' case which concerned about *'using CETLs will improve users' (teachers and students) skills and knowledge about using computer and Internet'* receive 100% positive feedback. Thus, we can conclude that both teachers and students' seemed to agree that CETLs not only teach them about the focused subject, but getting familiar with the technology as well.

#### B3 (Teacher) : B3 (Student)

Concerning the *'Notes Management as well as Assignment Management modules which allow the users to upload and download notes or assignments'* for the case 'B3', both teachers and students gave 100% positive results. It shows that the users think that these modules are very useful.

#### B4 (Only Student)

‘Instant Messaging’ is used by only students, therefore the evaluation of this module is raised to only students under case ‘B4’. Only 37.5% students agreed that *‘the use of Instant Messaging is very interesting’* while 12.5% disagreed and the rest are neutral with their answers. This is due to the timer used; where the conversation between two students can only happen within the preset time. Once the time elapsed, the students were no longer being able to communicate with their pair/partner. Some students commented that the use of the timer did not appropriate with the number of questions assign to them. However the number of questions was determined by their own teacher and this problem can be overcome by assigning less number of questions to students. Thus, teachers need to be more alert with the use of appropriate timer.

#### B4 (Teacher) : B5 (Student)

The case ‘B4’ for teacher is equal to the case ‘B5’ for the students; to identify whether *‘the use of chat module to support Think-Pair-Share is interesting’*. 75% of the teachers agreed, while another 25% felt indifferent with the reason that they could not control the students’ communication because some of the students use the chatroom to discuss unrelated matters. Apparently, it can be concluded that all of the students think that the chat module is very interesting since 100% of their feedback are positive.



B5 (Teacher) : B6 (Student)

Both 'B5' under the teachers' part and 'B6' under the students' part are concerning about the online assessment, '*whether the online assessment and evaluation are practicable to teachers and students*'. Based on the response, 100% teachers agreed while the students agreed with the percentage of 62.5%. All the teachers felt that online assessment is useful, because they can view and mark the students' work anytime and anywhere, without carrying the students' books. From the students' perspective, however, eventhough they seemed to agree with the statement, but there are still few students who were uncertain (neutral) with their answers. Nevertheless, since the cases recorded zero negative feedback, therefore, it can be said that both parties think that online assessment module is useful.

B6 (Teacher) : B7 (Student)

The overall opinion about CETLs was asked to both parties (teachers and students) under the case 'B6' and 'B7' accordingly. All respondents (teachers and students) agreed with the percentage of 75% with the statement '*overall, CETLs is useful for completing jobs / for learning (which involve Notes, Assignment, Marks and Discussion)*'. Depending on the response, only 25% of the respondents felt neutral about this statement while the rest agreed. It shows that most of them felt that CETLs is useful to perform academic jobs better and CETLs is also a useful learning medium.

- **Summary of the ‘Perceived Usefulness’ Discussion**

Overall, there is no negative feedback received from the teachers. Thus, it can be concluded that the teachers accept CETLs as a useful medium for teaching. Hence, the *perceived usefulness* criteria are fulfilled.

Meanwhile, most of the students accept CETLs with convenient feedback, except for the case ‘B4’ which highlighted that instant messaging system is very interesting. Minimal amount of students disagreed with the case. However, the rest of the respondents gave positive feedback, thus, it is concluded that students accept CETLs as a useful medium for learning. Therefore, the *perceived usefulness* criteria are fulfilled satisfactorily.

Table 7.41 : Perceived Ease of Use Results Overview

Category	Case	Teacher			Student		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Perceived Ease of Use	C1	75%	25%	0%	75%	25%	0%
	C2	100%	0%	0%	62.5%	37.5%	0%
	C3	50%	50%	0%	-	-	-

By referring to Section 7.5.2.5.2 which analyze the results of CETLs’ ‘Perceived Ease of Use’, the purpose of this category is to analyze whether CETLs is easy to be used by its users, whether or not it is easy to be used for uploading and downloading notes, managing assignments and tasks, as well as handling marks distribution. The detail discussions on Table 7.41 are written below.

### C1 (Teacher) : C1 (Student)

'C1' case which concerned about *'using CETLs will make the teachers' job and learning activities easier since users can do their work virtually'* receive 75% positive feedback from both parties. The rest 25% were neutral with their answers. Thus, we can conclude that most of the respondents agreed that CETLs is able to ease their work as well as the learning activities since there is no negative feedback received.

### C2 (Teacher) : C2 (Student)

The use of case 'C2' is to identify whether *'CETLs is easy to use in terms of uploading and downloading notes, assignment, handling marks distribution, and join collaborative activities'*. The percentage of agree received 100% and 62.5% from the teachers and students accordingly. 37.5% of the students felt indifferent (neutral) with the possible reason that some of them felt hard to familiarize themselves with computer, which lead to a slower navigation, thus late in finishing tasks. Students also require more guidance on certain part such as uploading their assignments to teacher. In contrast, the teachers appreciated this collaborative system and felt those modules were easy to use.

### C3 (Only Teacher)

The case 'C3' was asked to only teachers since it involved the evaluation of *'CETLs can reduce their tense and stress in completing their job (Notes, Assignments, Marks, Discussion)'*. Half of the respondents agreed with the case while another half was neutral with their answers. It shows that some teachers think that CETLs is not the solution of being tense, since they still have to prepare the teaching contents and materials.

- **Summary of the ‘Perceived Ease of Use’ Discussion**

Overall results found that there is no negative feedback given by both teachers and students. It shows that both parties agreed that CETLs is easy to use.

Table 7.42 : Behavioral Intention Results Overview

Category	Case	Teacher			Student		
		Positive	Neutral	Negative	Positive	Neutral	Negative
Behavioral Intention	D1	100%	0%	0%	87.5%	12.5%	0%
	D2	100%	0%	0%	100%	0%	0%
	D3	75%	25%	0%	62.5%	37.5%	0%

This ‘Behavioral Intention’ part (shown in Table 7.42) will determine the users’ intention of using CETLs, whether they are willing to use the system under certain conditions (refer Section 7.5.2.5.3).

D1 (Teacher) : D1 (Student)

Concerning the ‘*intention of respondents to use CETLs if the school provides it*’ which is under case D1, received 100% positive response from teachers. The students, however, recorded as 87.5% accepted it positively. There are few students with the minimal percentage (12.5%) felt neutral about this case. Apparently all the teachers and most of the students have the intention to use CETLs if they were provided with it, and this conclusion was made in accordance to zero negative feedback given by the respondents.

D2 (Teacher) : D2 (Student)

‘D2’ was asked in order to identify the respondents’ feedback on *‘their intention to use CETLs for the reason that CETLs is very interesting’*. Both teachers and students gave 100% positive results. It shows that all the respondents think that using CETLs as a medium of teaching/learning is very interesting.

D3 (Teacher) : D3 (Student)

Based on the result of the case ‘D3’ which stress on *‘the respondents’ intention to use CETLs frequently’* received 75% and 62.5% positive feedback from teachers and students accordingly. The rest 25% of the teachers and 37.5% of the students marked it as neutral about this case, where their answers were influenced by the facilities at home, since some of them do not own computer nor Internet connection. Since there is zero negative feedback received, it can be concluded that most of the respondents have the intention to use CETLs frequently.

▪ **Summary of the ‘Behavioral Intention’ Discussion**

Based on the results of the users’ behavioral intention recorded in Table 7.42, it can be seen that almost all respondents have the intention to use CETLs if they were provided with such facilities.

### **7.5.2.7 Lessons Learned**

Overall, it is clear that most of the respondents respond positively, with a very least amount of negative results. Thus, it can be said that respondents accept CETLs as a useful and easy-to-use teaching/learning medium, which shows that CETLs has fulfilled the '*perceived usefulness*' and '*perceived ease of use*' criteria and satisfied the users with the functions provided. The results reflect the users' (teachers and students) feelings of accepting the enhancement of the teaching and learning process with the use of technology. Apparently, respondents accept and willing to apply the technology-wise education.

## **7.6 CONCLUSION**

The implementation part is presented with the algorithms for the main part of the CETLs which is the Think-Pair-Share module. After that, the overall system's flow is displayed using Activity Diagrams. The diagrams are produced according to the Think-Pair-Share module, as well as the module of registration, coordinator and the teacher. Here we can conclude that the coordinator is responsible for handling the registration part, while teacher and students involve in collaborative activity by using the Think-Pair-Share technique. The execution of CETLs from user point of view is discussed with the use of the screen shots. Each screen is explained for better understanding.

The testing part starts by discussing the Unit Testing. All the Unit Test Cases are pasted within the chapter. From the test cases, it is noted that the Unit Test which use the black box testing technique does not have much problem. Almost all the units passed with the expected and actual results running in parallel.

The second testing technique used to evaluate CETLs is User Acceptance Test (UAT). The UAT results show that all users which are coordinator, teacher as well as students accept the system with good feedback and response. All of them satisfy with the functions and ideas provided in CETLs. Therefore it can be concluded that the new technology that is trying to be introduced into secondary school level can be accepted and both teacher and students do not face much problem in using CETLs as a medium of collaborative teaching and learning. One of the factors that affect the user acceptance on CETLs is the power of the new computer technologies to make learning more humanly interactive by adding well-designed communication elements such as chatting space and instant messaging.

The distribution of questionnaires also receives positive response from both parties which are teacher and students. CETLs was evaluated on its perceived usefulness, perceived ease of use, as well as its behavioral intention. Some analysis on the users' response and feedback are recorded, and the result shows that the feedbacks are positive. Therefore it can be concluded that the users accepted CETLs and the User Acceptance Test is successful with positive results, which shows that the school teachers and students accept the educational technology.

## **CHAPTER 8**

### **CONCLUSION AND RECOMMENDATION**

#### **8.1 CONCLUSION**

As online education grows in popularity, the need to monitor both group interaction and individual work will increase. This ‘*Collaborative Environment System Using Think-Pair-Share Technique*’ study about elaboration and uses of technology in education has revealed the importance of interaction in teaching. Understanding teaching theory involves knowing the ‘teacher’ himself, the students, as well as the ‘stuff’ or materials used for teaching. Teaching Science subject can be well-achieved by acquiring students’ to work in group since they can share opinions and thoughts.

The process of collaborative teaching and learning involve few steps that stress on the ‘group selection and its size’, the ‘individual’ and ‘collaborative learning’, as well as ‘grading’. However to merely use the collaborative approach requires a specific technique. The Think-Pair-Share technique chose for this project applies all the collaborative teaching and learning processes discussed in Section 2.3.8.

##### **8.1.1 Review Objectives**

This thesis was written with the intention to fulfill the three objectives which can be obtained from Section 1.4 in Chapter 1. Below are the outcomes of the achievement for each objective :



- ***Objective 1 : To identify a collaborative teaching environment framework***

A ‘System Processes During Collaborative Activity That Offer Tools And Functions To The Involved Human Aspects’ framework taken from Dimitracopoulou (2005), under Section 2.5, has been studied. The study involves human aspect as well as the collaborative processes. It can be concluded that the collaborative process must not only encompass human intervention but the support from the appropriate tool as well. Each element consist in the framework have been examined. This study also involves analyzing the activity performed by each user and the response from the system. Educational collaborative environment involve only two types of users which are teacher and students. However the interaction between these two parties may lead to a collaborative activity.

The studied framework was purposely designed for many-to-many communication (among collaborators). Therefore, this research applied the existing framework with slight adjustments (from Section 4.3) to suit the ‘pair’ communication. This is due to the selection of collaborative technique, ‘Think-Pair-Share’ that allows ‘pair’ communication in a collaborative group.

- ***Objective 2 : To develop a collaborative teaching system using Think-Pair-Share technique.***

This objective 2 has been achieved in which a collaborative system named as CETLs; acronym for Collaborative Environment for Teaching and Learning Science, has been developed by using Rational Unified Process (RUP) methodology. CETLs supports interaction between teacher and students, as well as access to the academic contents besides allowing the users to perform various kinds of online activities.

As mentioned in Objective 1, CETLs is supported by a collaborative technique known as ***Think-Pair-Share***. This technique, which can be obtained in detail from Section 4.2 allows users; which are teachers and students, to interact to each other in pair- and share-basis.

CETLs benefits its users by providing a collaborative support where each user is able to perform collaborative tasks and activities on the provided workspace. All the modules and functions provided in CETLs is according to the Think-Pair-Share structure, plus the applied framework discussed in Objective 1. The '***Think***' stage allows the student to work independently in a given time frame, and this is to prepare students for the next 'Pair' and 'Share' stage that require discussion.

The collaborative activities mean the user can interact to one or more person to discuss specific academic matter. The second stage, '***Pair***' requires two persons

in a group to interact. Therefore CETLs supports 'Pair' communication that uses instant messaging as a medium. Teacher will act as an assessor by giving marks to each 'Pair' work.

The '*Share*' stage accommodates students with the help from teacher. The share workplace is provided with chat facility to allow real-time communication between teacher and students to discuss academic matters. This is also called as supervision tool.

Besides that, all elements supported in the framework are applied in order to support activities for teaching and to be as a medium for communication and interaction. In addition to Think-Pair-Share technique, CETLs is also provided with 'content awareness' where both teacher and students can share the same content. The teacher will responsible to upload notes and assignments and make it accessible for students to download them.

CETLs also provides another tools to support communication such as the use of e-mail and bulletin board for the teacher to post announcements. This is to promote more interactions during the collaborative processes.

- ***Objective 3 : To evaluate the ‘usefulness’ and ‘ease of use’ of the collaborative system.***

After CETLs has been developed, it was tested and evaluated by the target users which are secondary school teachers and students. As discussed in Section 7.5.2, the User Acceptance Test (UAT) has been conducted in one secondary school where the users experienced using the system themselves. Two sets of questionnaire (which can be obtained from Appendix B) were distributed to them in order to examine the users’ acceptance, and each of the question was measured using the five-point Likert scale. The questions were focused on the system’s *usefulness*, to find out whether CETLs help the users to improve their work and whether or not CETLs provide the functions that are useful to the users. It is also to examine whether CETLs is a useful teaching/learning medium. Another important aspect highlighted in the questionnaire was the system’s *ease of use*, to observe whether CETLs is easy to use by both parties (teachers and students).

The questionnaire result analysis is available in Section 7.5.2.5. All answers given by the users were analyzed and represented in a table, where the feedback is analyzed using a statistical software. The results of the CETLs’ *perceived usefulness* and *perceived ease of use* are then overviewed with regards to the reflection between teachers’ and students’ feedback (refer Section 7.5.2.6). The analysis showed that all teachers and most of the students agreed that CETLs is a useful teaching/learning medium, and easy to be used, by giving positive feedbacks. Thus, it can be concluded that CETLs’ has satisfied and fulfilled the *perceived usefulness* and *perceived ease of use* aspects.

In sum, this research has reported on a collaborative approach used to teach secondary school level students for Science subject on the Web. Approaches to collaborative teaching include positioning the teacher as supervisor, joint class discussion by supervisor and students, and the use of a group project. User Acceptance Test results on teacher as well as students' opinion of their teaching and learning process were, in general, positive and these approaches appear to have been successful. In addition, ad hoc users' feedback indicates both parties enjoyed the teaching and learning experience, which indicates their acceptance of applying the use of technology in education.

## **8.2 LIMITATIONS**

While the collaborative teaching approaches used in CETLs had a positive outcome for both teacher and students, experiences gained have resulted in several observations on the potential problems inherent in the process.

First, CETLs is lack of face-to-face communication. Therefore it is difficult for the teacher to control the class interaction. Since the 'Pair' discussion is allowed for only group members (2 students) to interact, therefore the teacher cannot identify the content of the students' conversation, whether they really talk on the subject matter or something else.

Another potential drawback is for the school itself. Since CETLs is a Web-based system, therefore one of the major requirements is to have an Internet connection before the

school can use it. The computer laboratory should be provided with well-configured network in order for every students and teacher to be facilitated properly.

Lastly, it should be noted that CETLs can only be accessed by the registered students, teachers and coordinator. Therefore all of the functions including e-mail can only be used internally.

### **8.3 FUTURE WORKS AND RECOMMENDATIONS**

Further work includes the improvement of the system for better scope and performance.

Future research possibilities include using the system for a non-science class to emphasize that collaborative activities do not only support Science subject, but any other subjects as well.

The 'Pair' of students which is formed by the teacher should be in pair-basis. By default, CETLs will automatically assign two students to each group after the students have registered. However, the teacher still can change the number of group members by himself. This is not a major problem, but still can be improved to prevent any changes.

Since CETLs support e-mail to be used internally, by the registered user only, therefore the future work may expand the use of email externally. The e-mail may be send or receive to/from another e-mail provider.



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