AUTHORING ACTIVITIES ENVIRONMENT THROUGH GRID PORTAL TECHNOLOGY

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ABSTRACT

Individual work is significant in any learning course but, student should also learn the collaborative behavior. Students' involvements are required in group attempt. Group works in designing and authoring a courseware is not an easy task. The purpose of this study is to identify student's difficulties in completing their authoring activity or collaborative work in conventional environment. This study was conducted to design and develop an online collaborative tool through grid portal technology. UTM Grid Portal is developed for students of Faculty of Education to accomplish their courseware development project. Students engaged in collaborative learning might use blog as a medium to discuss with group members in order to gather information sharing ideas and distributing task. The evaluation process was conducted to obtain students engagement and involvement in collaborative environment activity. The study sample consisted of 36 undergraduate students enrolled in SPM 2332 (Authoring Language) course. Data was gathered using qualitative approach which was through blog discussion as a link in UTM Grid Portal. Result from the analysis shows that student's activity in group work can be divided into three main categories which are cooperative and collaborative, support as well as task distribution. Cooperative and collaborative in students activity involves sharing ideas, sharing information, sharing problem as well as opinion and suggestion. Besides that, students support other group members by giving motivation, updating progress and show respect to others.

(Keywords: Keywords-grid portal; collaborative authoring activities; e-learning; education; content sharing; quantitative and qualitative research methodology)

ABSTRAK IN MALAY LANGUAGE

Kerja individu adalah sangat penting dalam setiap program pembelajaran namun, pelajar juga harus mempelajari cara bekerjasama dalam kumpulan. Penglibatan pelajar adalah perlu dalam usaha berkumpulan. Kerja berkumpulan dalam merekabentuk dan memantau sesuatu perisian bukan tugas yang mudah. Tujuan kajian ini dijalankan adalah untuk mengenalpasti kesulitan pelajar dalam menyiapkan tugasan rekabentuk atau kerja berkumpulan secara tradisional. Selain itu, kajian ini dijalankan untuk merekabentuk dan membina suatu alat kerjasama atas talian menerusi teknologi grid portal. UTM Grid Portal dibina untuk pelajar

Fakulti Pendidikan untuk menyiapkan tugasan membina perisian. Pelajar yang terlibat dalam kerja kumpulan mungkin menggunaan blog sebagai medium perbincangan bersama ahli kumpulan dalam mengumpul informasi, kongsi idea dan pembahagian tugas. Proses penilaian dijalankan untuk memperoleh penglibatan pelajar dalam aktiviti berkumpulan. Sampel kajian ini terdiri daripada 36 orang pelajar sarjana muda yang mendaftar dalam kursus SPM 2322 (Bahasa Gubahan). Data dikumpul menggunakan pendekatan kualitatif menerusi perbincangan di blog yang merupakan pautan dalam UTM Grid Portal. Hasil daripada analisis menunjukkan aktiviti pelajar dalam kumpulan boleh dibahagi kepada tiga kategori utama iaitu kerjasama, sokongan dan pembahagian tugas. Kerjasama dalam kumpulan merangkumi kongsi idea, kongsi informasi, kongsi masalah serta memberi pendapat. Selain itu, pelajar menyokong ahli kumpulan dengan member motivasi, melapor perkembangan dan menghormati antara satu sama lain.

(Keywords: ***Keywords-grid portal; collaborative authoring activities; e-learning; education; content sharing quantitative and qualitative research methodology)***

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CHAPTER 1

INTRODUCTION

1.19 Introduction

The rapid developments of Information and Communication Technology (ICT) give a very high impact in almost aspect to human life including the educational field. The rapid developments of multimedia interactive give impact to teaching and learning aspect whereas it gives facilities to the students to search for information and

knowledge. Over the past few decades, Computer Based Training (CBT) solutions evolve from standalone to web-based package (Web Based Training – WBT) with rich multimedia element content. Today, most of the web-based solutions influence on various load-balancing techniques to increase their performance, availability and reliability.

Learning process can classified as synchronous and asynchronous. Asynchronous learning process means a process which interaction between instructors and students occurs discontinuously with time delay. Examples of asynchronous

learning are online discussion group and email. While synchronous learning process is a process where instructor lead real-time event in which all participants are logged on at the same time and communicate directly with each other. Interaction also may occur via video conferencing or audio. Most of conventional web-based education practices the synchronous learning process due to limited space of memory as well as slow performance.

Collaborative learning is one of the teaching method practices in the teaching and learning process. The collaborative learning can be in small or large group of people with different ability or level of intelligence. This teaching method allows students to give and share their idea among the group members. It also encourages pleasant interaction among the group members for a more comfortable learning situation.

A large body of research has shown that collaborative approaches to learning can be effective in producing achievement gains, promoting critical thinking and enhancing problem solving in both face-to-face learning contexts (Cobb,1988; King, 1989; Webb, 1989; Webb & Palincsar, 1996) and more recently in computer-supported learning environments (Weinberger, Fischer & Mandl, 2002).

The introduction of the internet into the educational arena has rapidly changed the way individuals learn and paved the way to widespread collaborative and cooperative learning that was not perceived possible until recent years (Dabbagh & Bannan-Ritland, 2005). Web and interactive multimedia form can also support the

collaborative learning in order to create an attractive environment during the teaching and learning process.

Online collaborative tool and collaborative authoring environment will support online collaborative effort of students. Some of the activities involves in authoring environments are interactive educational multimedia example Authorware and HyperCard, multimedia formats in various form (bitmap graphic, vector graphic, etc.), e-learning content editors and many more. The grid portal technology enhance the authoring support web based collaborative group works by improving speed up in term of searching, supporting the huge memory, high quality of visualization and increasing the computational performance.

1.20 Background of Study

Individual work is significant in any learning course but, student should also learn the collaborative behavior. Students' involvements are required in group attempt. Stunkel (1998) identified an increasing use of teams and groups as one of the predominant trends in higher education. Teams have proven to be an excellent vehicle for accomplishing interactive, cooperative instruction (Lengnick-Hall & Sanders, 1997). Besides that, research has shown that students learn most effectively when working in groups, where they can verbalize their thoughts, challenge the ideas of others and collaborate to achieve group solutions to problems (Deutsch, 1962; Johnson & Johnson, 1989, 1994).

Group works in designing and authoring a courseware is not an easy task. One of the major problems in collaborative work is time constraint for the group members and unequal distribution of task among the group members. In order to overcome this problem, it is essential to provide the collaborative tools and collaborative authoring environment online. On the other hand, the conventional web-based education support on only one server result in very slow operation of searching, uploading, visualizing output and file saving (Dayang, 2010).

Currently, the web-based education used in the Universiti Teknologi Malaysia (UTM) is e-learning through Moodle open-source. Unfortunately, the e-learning by Moodle has some limitation especially for synchronous learning activity where the traffic or database was overloaded (Marliah, 2007). Besides that, students only can interactively use the application to download the notes, discussion in the forum and send message to their peers. Students can also submit their assignment through uploading the files but only for small size of file because it cannot support the huge memory. In other words, e-learning is an asynchronous learning process which interaction between instructors or lecturers and students occurs intermittently with time delay.

Therefore, the design and authoring activities in group on-line requires efficient and powerful web server in parallel fashion, which will support collaborative efforts among students on-line. Grid portal technology with high performance computing platform in supporting Web Based Education (WBE) is very high speed in terms of searching, supporting the huge memory, high quality of visualization and increasing the

computational performance. Therefore, grid portal technology with high performance can be a potential in enhancing the authoring support for courseware design.

1.21 Problem Statement

Students are encouraged to learn collaborative behavior besides individual work. This is because collaborative work could practice the students to give and share their ideas with other group members. These will lead to producing a better product as well as enhancement in their performance. It has been shown that by having collaborative learning with peers, they may come to externalize their knowledge, monitor each others' learning and jointly negotiate meaning. These activities may trigger significant individual cognitive processes that ultimately lead to individual knowledge construction (Webb & Palincsar, 1996).

Designing and authoring a courseware in a group work is not as easy as we think. Many problems could occur during the development of the courseware. As mention before, one of the major problems in collaborative work is unequal distribution of task among the group members. Some of the group member might give ideas and do the works while some of them might just sit back and wait for the other members to

complete the work. On the other hand, the lecturer has difficulty to evaluate the work group based on the contribution of the group members. With the introduction of collaborative technologies, there are opportunities for collaborative to take place across barriers of time and space.

The conventional web-based education may not essential to be the collaborative tools and online collaborative authoring environment in future educational technology. This is because the conventional web-based education results slow operation of searching, uploading, visualizing output and file sharing. Therefore, a new strategy or alternative is needed to overcome as well as upgraded the conventional web-based education in order to perform high speed up in terms of searching, supporting huge memory, high quality of visualization and so on especially in courseware design.

1.22 Objective

The objectives are to:

1. Identify students' difficulties in completing their authoring activity or collaborative work in a conventional environment.
2. Design and develop an online collaborative tool through grid portal technology.
3. Identify the effectiveness of the grid portal in courseware development project.

1.23 Research Question

The research questions are:

1. What difficulties did the students encounter in completing authoring activity or collaborative work in a conventional environment?
2. How could online collaborative tool through grid portal technology help students overcome some problems in group work?

1.24 Scope of Project

The target group of the research would specially consist of undergraduate students of Faculty of Education in Universiti Teknologi Malaysia that take multimedia subjects. Multimedia subject offered in Faculty of Education including graphic, animation and video digital which covers the video usage, audio, text animation as well as graphic digital. Moreover, some of the activities involves in authoring environments are interactive educational multimedia for example Authorware and HyperCard, multimedia formats in various form (bitmap graphic, vector graphic, etc.), e-learning content editors and many more. This portal will be put forward to a number of groups, which will consist of the undergraduate students attend course SPM2322 (Authoring Language).

1.25 Significance of Research

The purpose of the research is to develop an online collaborative tool through grid portal technology to overcome some problems in group work as well as allows the lecturer a new easier approach to monitor the students. The research is proposed after taking into consideration the present e-learning has some weakness need to be overcome or upgraded.

This particular research would be significant to the following parties, on the basis of the reasons stated by student, lecturers and Universiti Teknologi Malaysia.

1.25.1 Students

The development of the online collaborative tool through grid portal technology will create an interesting teaching and learning process by the students. It also will overcome some problems such as time constraint as well as transportation because students could use this application at any time and anywhere. Students could make their task online and discuss problems occurs during completing the task or learning process with their peers in the forum. The successful application of authoring activities environment through grid technology provides enhancements in work group performance, helps to lower cost, and encourages innovation.

1.25.2 Lecturers

The online collaborative tool through grid portal technology will give benefit to the lecturers as well. The lecturers could monitor the progress of the task given to the students through online time by time without need to see face to face. Besides that, one of the advantages of virtual teams, from the assessment point of view is the ability to have an accurate record of the discussions that have occurred within the team (Ferris & Goddar, 2005). Therefore, this portal will help the lecturer evaluate the group work easier as the lecturer could see the contribution of each student. In addition, it also helps lecturers to facilitate and support work group students in their design and developing a courseware.

1.25.3 University

The grid portal technology will help the member universities build a network of facilitators to support e-learners such as forum with advanced Information and Communication Technology (ICT), i.e., with the use of massive parallel processors of globally distributed and yet interconnected mini-supercomputers through global neural computer network.

1.26 Terminology

1.26.1 Implementation

Implementation is to put into effect (The Oxford Study Dictionary, 1994). In this study, we want to know the effect of this authoring environments tool which is the portal to the students in their collaborative learning.

1.26.2 Online

From the Oxford Dictionary, online means activity or service available on or performed using the Internet or other computer. In this study, the portal is available through online.

1.26.3 Collaborative Learning

Collaborative is produced by or involving two or more parties working together (The Oxford Study Dictionary, 1994). Collaborative learning is two or more students learning and working together for example in group work.

1.26.4 Grid Portal Technology

The term Grid is chosen as an analogy to a power Grid that provides consistent, pervasive, dependable, transparent access to electricity irrespective of its source. These technology opportunities have led to the possibility of using distributed computers as a

single, unified computing resource, leading to what is popularly known as Grid computing. Grids enable the sharing, selection, and aggregation of a wide variety of resources including supercomputers, storage systems, data sources, and specialized devices that are geographically distributed and owned by different organizations for solving large-scale computational and data intensive problems in science, engineering, and commerce (Mark Baker *et. al*, 2002).

1.27 Conclusion

For the conclusion, the development of online collaborative tool through grid portal technology is right at the time since the need of this technology for teaching and learning is increasing. This technology is one of the alternatives for interesting and effective in learning activities to the students accordance with the present development of technology. Besides that, the grid portal technology gives the lecturer facilities in facilitating and monitoring the group work activities by the students. Therefore, the development of the online collaborative tool through grid portal technology is hopefully will be used wisely and accomplish the objective.

CHAPTER 2

LITERATURE REVIEW

2.19 Introduction

This chapter discusses in details the literature review related to this research. The literature review involves the systematic identification, location and analysis of documents containing information related to the research problem (L.R. Gay, 2009). The main purpose of literature review is to determine what have been done by other researcher related to the research topic. Besides that, literature review will give the researcher understanding and insight about the topic he or she conducted.

Some of the aspects that will be covered in this chapter are virtual learning environment and online collaborative learning. Besides that, this literature review will discuss on the instructional design model as well as the grid portal technology that going to be used in this research. The review of literature on the instrument used to collect data in this study will also be discussed in this chapter.

2.20 **Web-based Education Environment**

Online education is an approach to teaching and learning that utilizes Internet technologies to communicate and collaborate in an educational context. This includes technology that supplements traditional classroom training with web-based components and learning environments where the educational process is experienced online (Blackboard Inc., 2000).

As we can see, changes currently taking place globally in education. From chalk and talk environment, education has move forward to virtual learning environment along with the rapid developments of information and communication technology (ICT). Therefore, the government has put a lot of effort to give awareness of technology to the people. Some of the government's efforts are to allocate the money to provide computer labs in schools in order to foster students' interest towards using technology in learning process.

Web-based education tools provide many ways to increase communication between class members and lecturer, including discussion boards, chats, and e-mails. Lecturer and students will cooperate to optimize the use of these facilities in teaching and learning. Besides that, students will be more motivate and participate actively in class discussion and projects. Students are "more willing to participate [due to] a measure of anonymity, which serves as a motivator… people feel more empowered. They are daring and confrontational regarding the expression of ideas," (Kubala, 1998 as cited in Blackboard Inc., 2000).

Furthermore, by using web-based education tools students will reinforce sense of equality. Each individual has the same opportunity to "speak up" by posting messages without typical distractions such as seating arrangements, volume of student voices, and gender biases. Sometimes, students feel shy and anxious to speak up giving their opinion in class because they afraid their opinion were wrong or unacceptable. Thus, this is a good medium for these students to feel more comfortable expressing ideas and backing up facts when posting online instead of speaking in a lecture room. Studies prove that online discussions provoke more confrontational and direct communication between students.

In addition, online communication also benefits students to communicate with the lecturer. Students in courses no longer have to worry if they cannot meet face-to-face with the lecturer when they have problems with the assignments or projects. This is particularly helpful when a student’s schedule conflicts with office. This is good for the lecturer too, as they can respond at his or her convenience instead of being tied to a desk or office.

Some students work best in different time, some in the morning and some in the evening. Some students commute to campus and others commit with extracurricular activities. Scheduling time for homework and group projects can be difficult depending on each student's course, job, and personal responsibilities. When course content and activities are provided online, students no longer need to worry about accessing course materials. Students can complete assignments during their most productive times.

2.21 **Collaborative Learning**

Cooperation is associated with tasks that are fairly structured and this makes it relatively easy for group members to divide up the work and to work on sections separately (Alexander, 2004 as cited in Strijbos, Martens, & Jochems, 2004). Besides that, Alexander (2004 as cited in Moran, 2000; Strijbos et al., 2004) stated that collaboration is a conversational, relatively unstructured, iterative, but nevertheless, active process during which the participants work together to achieve a goal, reach a decision or a solution. Online learner participation is a process of learning by taking part and maintaining relations with others. It is a complex process comprising doing, communicating, thinking, feeling and belonging, which occurs both online and offline (Hrastinski, 2008).

Collaborative learning is based on the idea that learning is a naturally occurring social act in which the participants talk among themselves (Gerlach 1994). Noriah *et al* (2002) stated as suggested by Smith and MacGregor (1992:9) that the idea of collaborative learning is based on several premises. First, that learning is an active and constructive process in which students integrate new materials with prior knowledge to create new ideas and new meanings. Second, that learning depends on rich contexts that ask students to collaborate with peers to identify and solve problems by engaging in higher-order reasoning and problem solving skills. Third, learners are diverse and have different background and experiences. Fourth, that learning is a social act in which students talk to learn. This social interaction often improves the participants' understanding of the topic under consideration. Fifth, that learning has effective and subjective dimensions. Collaborative activities are both socially and emotionally

demanding and most often require students not only to articulate their own points of view but also to listen to the views of others.

When students have the opportunity to work in small groups, they can contribute to a common understanding, as well as developing verbal and social abilities (Nussbaum *et al*, 2009). Recipients get the opportunity to experience new approaches to thinking from peer supported learning. On the other hand, helpers benefit because when they explain their ideas to others, they have to verbalize their understanding, making explicit the difference in what is in his/her mind and his/her utterance, and by doing so obtain a clearer perspective of the topic (Gillies, 2006 as cited in Nussbaum *et al*, 2009).

The following are possible steps to be taken in developing collaborative classroom with computer technology inclusion by Noriah *et al* (2002):

i. Students work in small groups and confer about a project that they can develop together based on one research design.
ii. To save time, students will be asked to share their ideas in an electronic discussion group. The lecturer or the group leader will make an initial posting for their pre-appointed topic and all the other group members are asked to contribute their ideas about the topic.
iii. The students will also be asked to read a hypertext research book and build a class reading by annotating and then passing it to others via the discussion group. Students will be asked to use a special font to highlight their contributions.
iv. Students will compare the annotated reading materials with the original to understand the research design.

v. The lecturer will then ask the students to share knowledge on research design in real time and to discuss in-depth about each design method.
vi. These discussions can be archived for others to read and comment asynchronously.

There is a lot of flexibility in collaborative learning. It enables the lecturers as well as students to optimize their full potential in interacting with others. The strategy also enhances critical thinking at a much higher level where students are able to synthesize, and evaluate the accuracy of information and understand how the information have an impact on their learning process. Concomitantly, students will also develop group management and conflict resolution skills.

Table 2.1: Taxonomy of Collaborative Skills

Skills Category	**Collaborative Skills**
Interpersonal Skill	Congenial, friendly, make clear statement, listening skills, positive communication (no name calling, put-downs) and eye contact.
Group Building/Management	Organize work, keep group on task, run a meeting, participate in group self analysis, show empathy
Inquiry Skill	Clarification, critique, probe assumptions and evidence, probe implication and consequences, elicit view points and perspectives
Conflict	Prevention, resolution and mediation
Presentation	Summarize, synthesize, speaking in front of a

	group, creating presentation materials, report writing.

(Source: Miller, Trimber and Wilkes, 1994 as cited in Noriah *et al*, 2002)

2.22 **Online Collaborative Learning**

The introduction of the internet into the educational arena has rapidly changed the way individuals learn and paved the way to widespread collaborative and cooperative learning that was not perceived possible until recent years (Dabbagh & Bannan-Ritland, 2005 as cited in Ferris & Godar, 2005).

Many educational institutions use Internet for collaborative learning in a distributed educational process. It has been known that traditional communications media can be replaced by electronic communication for the whole educational process and in particular, to assess the role of collaborative learning in a distributed education environment. It has been found that a distributed educational process naturally supports collaborative learning environments in which students and tutors interact and provide essential support for students studying at a distance (Soekartawi, 2006).

Collaborative learning is widely regarded as an effective instructional approach. It has been shown that by having learners collaborative with peers, they may come to externalize their knowledge, monitor each others' learning, and jointly negotiate meaning (Fischer, 2007).

The students need to find examples of every assignments and projects possible to understand the problems. Students will take longer time to gather and grasp all the information. However, this problem can be overcome collaboratively, which allows interaction between individuals. Each student can exchange information on research

design with others using computer mediated communication, thereby shortening the time needed to gather the different examples. Therefore, the collaborative approach to teaching and learning supported by electronic classroom can support a variety of topics and areas within a short period of time (Koschmann, 1992 as cited in Noriah *et al*, 2002).

In traditional education, students working on group projects must manage schedules. In distance learning environments, this may not even be possible, forcing participants to work independently. Computers may be used to support both cooperative and collaborative learning. Furthermore, computers may be used to support learning by co-located and by dispersed groups, and these groups may communicate synchronously, asynchronously or both (Alexander, 2004). When web-based collaborative tools are available, management of schedule is no longer an issue. Providing a project team with asynchronous discussions and file uploads, students can work in groups without the constraints of meeting together at a certain date, time, and location. It will give more flexibility to the students in term of timing and place to do the group work.

Raja Maznah (2004) from her research of A Collaborative Learning Experience of Evaluating a Web-Based Learning Tool discussed about collaborative spirit among team members. The students, the programmers and the researchers were able to collaborate and discuss issues far beyond their expectations, both in terms of quality and quantity. Having to work side by side with the programmers had given the students opportunities to discuss and ask for clarifications as soon as they were required. They were able to communicate their shared understanding of crucial tasks and develop appropriate work strategies. They were able to integrate and share their special skills

and expertise and to work collaboratively towards improving the module activities. As for team spirit, they experienced a sense of accomplishment and well-being. Their motivation was very high. They had mutual respect for each other's capabilities and strengths as they had worked together as a team in the classroom before.

The following advantages were reported as the strengths of their attachment in the development of the collaborative learning tool project (Raja Maznah, 2004):

i. Transfer of knowledge

The students were able to judge the quality of their prior knowledge and their ability to apply the knowledge, skill and experiences learned in the classroom to solve real problems in an actual work situation. For example, they were able to evaluate their expertise in project management, instructional design, audiovisual principles, and graphics and research skills. A realization of the knowledge and skills which they lacked would help them to continuously pursue their interests and enhance their learning.

ii. Sharing of experience

The students were enriched with the new experience of working collaboratively with information technology personnel. They were able to integrate what they knew about teaching, learning and classroom management to facilitate learning through information technology (IT).

iii. Working as a team

The students were able to apply the collaborative learning principles to perform their tasks in teamwork. Their ability to work together was an important outcome of their attachment. This experience would help them

to plan and organize future collaborative teaching and learning projects whether in schools or in other organizations.

iv. Shaping of positive attitudes and self-discipline

Besides gaining new knowledge and skills, the students benefited through a change of attitude. Having to adhere to rules and regulations of a real organization helped them to feel positive about themselves. In some ways, the strict work discipline had taught them to be more conscious of the quality of what they produced, thus making them feel that the organization was satisfied with their performance. The students were empowered.

v. Expanding creativity and innovation

The students reported that they were able to expand and stretch their creativity to think of innovative ideas.

2.23 **Instructional Design Model**

Instructional design is defined by Taylor (as cited in Berger & Kam, 1996) as the systematic development of instructional specifications using learning and instructional theory to ensure the quality of instruction. It is the process of analysis of learning needs and goals and the development of a delivery system to meet those needs. It includes development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities.

Instructional design is also know as instructional systems design. It is the analysis of learning requirements and systematic development of instruction. Instructional Design Models will become the guidelines or sets of strategies when the learning processes are based on teaching by instructor approach. Effective instructional models are based on learning theories, which describe the ways the theorists believe that people learn the new ideas and concepts.

Instructional designers frequently use instructional technology or educational technology as tools for developing instruction. Instructional design models usually specify a method, which will facilitate the transfer of knowledge, skills and attitude to the recipient of the instruction. Instructional design model often explain the relationship between acknowledged information and the new information we are trying to discover.

Instructional design models or theories may be defined as frameworks for developing modules or lessons that:

i. Increase and/or improve the possibility of learning
ii. Encourage the commitment of learners so that they could learn faster and understand deeper.

There are several types of instructional design model for example ADDIE Model, ASSURE Model, Dick & Carey Model, Hannafin & Peck Model, Waterfall Model, Rapid Prototyping Model and so on. In this chapter, only three popular and commonly used instructional design models are discussed. Although many instructional design models exist, they all generally follow six generic phases:

1. Site definition and planning (Analysis)
2. Information architecture (Analysis)
3. Site design (Design)
4. Site construction (Development)
5. Site marketing/implementation (Implementation)
6. Tracking, evaluation, and maintenance (Evaluation)

2.5.3 ADDIE Model

The ADDIE model is the generic process traditionally used by instructional designers and training developers. There are five phase in ADDIE Model; Analysis, Design, Development, Implementation and Evaluation. This model uses the rapid prototyping which is the idea of receiving continual or formative feedback while instructional materials are being created. One advantage of this model is it save cost and time by catching problems while they are still easy to fix.

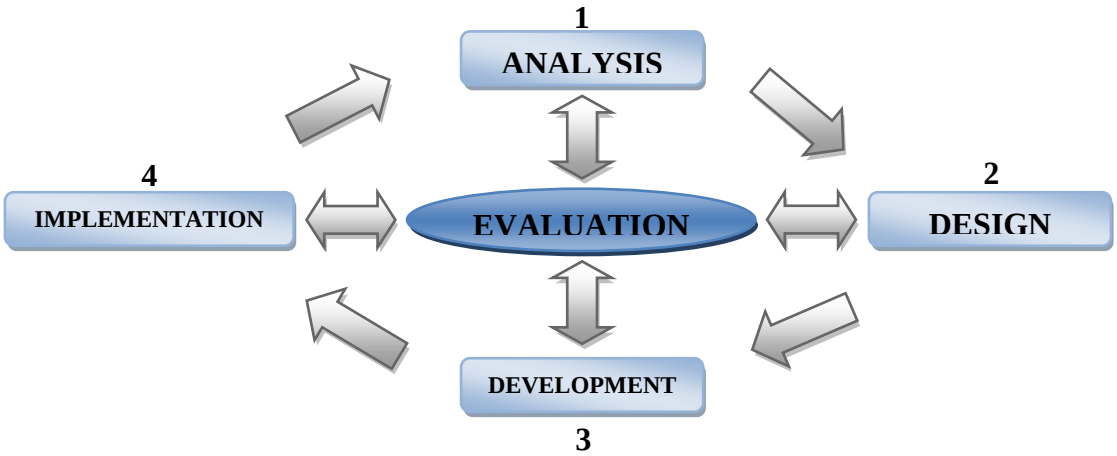

Figure 2.1: ADDIE Model

Analysis phase identified or clarified the instructional problem, the instructional goals and objectives are established, the audience's needs, existing knowledge, and any other relevant characteristics. Analysis also considers the learning environment and learner's existing knowledge and skills.

The design phase deals with specifying learning objectives, assessment instruments, exercises, content, subject matter analysis, lesson planning and media selection. The design phase should be systematic which means logical, orderly method of identifying, developing and evaluating a set of planned strategies targeted for attaining the project's goals. Besides that, the design face must be specific in terms of each element of the instructional design plan needs to be executed with attention to details. In this phase as well, the detailed storyboards and prototypes are often made, and the look and feel, graphic design, user-interface and content is determined here.

The development phase is the actual creation or production and assembly of the content and learning materials based on the Design phase. The programmers act upon to develop and/or integrate technologies and the testers perform debugging procedures. Then the project is reviewed and revised according to any feedback given.

During the implementation phase, the plan is put into action and a procedure for training the facilitators and the learners is developed. The facilitators' training should cover the course curriculum, learning outcomes, method of delivery, and testing procedures. In this phase, the project manager must ensure that the books, hands on equipment, tools, CD-ROMs and software are in place, and that the learning application or Web site is functional. After delivery, the effectiveness of the training materials is evaluated.

The evaluation phase consists of two parts; formative and summative evaluation. Formative evaluation is present in each stage of the ADDIE process.

Summative evaluation consists of tests designed for criterion-related referenced items and providing opportunities for feedback from the users which were identified. Revisions are made as necessary.

2.24 **Grid Portal Technology**

The popularity of the Internet as well as the availability of powerful computers and high-speed network technologies as low-cost commodity components have led to the possibility of using distributed computers as a single, unified computing resource, leading to what is popularly known as Grid computing (Baker, 2002). Foster (2004) defined a Grid as a system that coordinates distributed resources using standard, open, general-purpose protocols and interface to deliver nontrivial qualities of services.

"A computational grid is a hardware and software infrastructure that provides dependable, consistent, pervasive, and inexpensive access to high-end computational capabilities." (Foster, I., & Kesselman, C., 2004)

In addition, Foster (2002) suggests that the essence of the definitions can be captured in a simple checklist or key elements, according to which a Grid is a system that:

i. *Coordinates distributed resources*

A Grid integrates and coordinates resources and users that live within different control domains—for example, the user's desktop vs. central computing; different administrative units of the same company; or different companies; and addresses the issues of security, policy, payment, membership, and so forth that arise in these settings. Otherwise, we are dealing with a local management system.

ii. *Using standard, open, general-purpose protocols and interfaces*

A Grid is built from multi-purpose protocols and interfaces that address such fundamental issues as authentication, authorization, resource discovery, and resource access. It is important that these protocols and interfaces be *standard* and *open*. Otherwise, we are dealing with an application specific system.

iii. *To deliver nontrivial qualities of service*.

A Grid allows its constituent resources to be used in a coordinated fashion to deliver various qualities of service, relating for example to response time, throughput, availability, and security, and/or co-allocation of multiple resource types to meet complex user demands, so that the utility of the combined system is significantly greater than that of the sum of its parts.

Grids enable the sharing, selection and aggregation of a wide variety of resources including supercomputer, storage systems, data resources and specialized devices that are geographically distributed and owned by different organizations for solving large-scale computational and data intensive problems in science, engineering and commerce. The grid infrastructure can benefit many applications, including collaborative engineering, data exploration, high-throughput computing and distributed supercomputing (Baker, 2002). It also can be viewed as seamless, integrated computational and collaborative environment.

The grid can be used to provide several types of services from the end-user point of view such as computational services, data services, application services, information services as well as knowledge services.

Figure 2.2: A Conceptual View towards Grid Computing (Baker, 2002)

According to Foster (2004), the Grid fabric layer provides the resources to which shared access is mediated by Grid protocols, for example, computational resources, storage systems, catalogs, network resources and sensor. The grid also defined as a system that coordinates distributed resources using standard, open, general purpose protocols and interfaces to deliver nontrivial qualities of services.

2.6.3 Grid Architecture

The Grid architecture identifies the fundamental system components, specifies the purpose and functions of these components, and indicates how these components

interact with each other. The architecture is divided into four layers; fabric, resources and connectivity protocol, collective services and user applications.

i. Computational resources

Mechanisms are requires for starting programs and for monitoring and controlling the execution of the resulting processes. Management mechanisms that allow control over the resources allocated to processes are useful, as are advance reservation mechanisms. Introspection functions are needed for determining hardware and software characteristics as well as relevant state information such as current load and queue state in the case of scheduler-managed resources.

ii. Storage resources

Mechanisms are required for putting and getting files. Third-party and high performance transfer are useful. So are mechanisms for reading and writing subsets of a file and/or executing remote data selection or reduction functions. Management mechanisms that allow control over the resources allocated to data transfers (space, disk bandwidth, network bandwidth, CPU) are useful, as are advance reservation mechanisms. Introspection functions are needed for determining hardware and software characteristics as well as relevant load information such as available space and bandwidth utilization.

iii. Network resources

Management mechanisms that provide control over the resources allocated to network transfers (e.g., prioritization, reservation) can be useful. Introspection functions should be provided to determine network characteristics and load.

2.25 **Data Collection via Internet**

Rodham and Gavin (2006) in their research assessed three types of qualitative data via the internet. They outlined three approaches to online data collection which are online focus groups, online interviews and message boards.

Online interviews can be conducted with respondent on a 0ne-to-one basis through an exchange of emails. This type of interview provides greater scope for in-depth probing of the respondents' experiences, thus enabling exploration of the complex feeling and attitudes embedded within an emotionally loaded topic (Rodham, 2006).

Online interviews could be used in synchronous or asynchronous manner. The asynchronous manner presents numerous advantages over synchronous or 'real-time' manner. Being separate over time, asynchronous communication eases the pressure of immediate response, allowing the participants to respond at a time which is convenient to him or her, facilitating their reflexivity and deferring cognitive resources to the content rather than the management of the conversation (Joinson, 2003 as cited in Rodham and Gavin, 2006).

Vighnarajah, Wong and Kamariah (2009) in their research had discussed on students' perception on participation in the interactive e-learning community (iELC) discussion platform. From the discussion, majority of students had positive perception in participation in the iELC discussion platform using the forum, chat and dialogue

tools. The frequent feedback on this positive perception is in the feasibility of seeking learning help from peers and teachers without being ridiculed. Some students also hinted that the forum, chat and dialogue tools made it easier to make new friends that share the same interest. Meanwhile, other students mentioned that obtaining answers and opinions from their peers also gave them the mood and motivation to study harder to be at par with them (Vighnarajah, Wong and Kamariah, 2009).

2.26 **Adult Learning**

Part of being an effective educator involves understanding how adults learn best (Lieb, 1991). Adult learning or also known as andragogy is a theory that holds a set of assumptions about how adults learn. The field of adult learning was pioneered by Malcom Knowles, an American practitioner and theorist of adult education. Adults have special needs and requirements as learners compared to children and teens where andragogy emphasizes the value of the process of learning. In addition, andragogy uses approaches on problem-based and collaborative rather than teaching in their learning, and also emphasizes more equality between the teacher and learner.

According to Stephen Lieb (1991), one of the principles of adult learning is autonomous and self-directed. Adult learners resist learning when they feel others are imposing information, ideas or actions on them (Fidishun, 2000). They need to be free to direct themselves. The teachers must actively involve adult participants and facilitate a students' movement toward more self-directed and responsible learning as well as to

encourage the student's internal motivation to learn. They also should guide the participants to their own knowledge rather than supplying them with facts. Specifically, they must get participants' perspectives about what topics to cover and let them work on projects that reflect their interests. They should allow the participants to assume responsibility for presentations and group leadership. Finally, they must show participants how the class will help them reach their goals (Lieb, 1991).

A second principle of adult learning is adults bring life experiences and knowledge to learning experiences. Adults have gained a foundation of life experiences and knowledge that may include work-related activities, family responsibilities, and previous education (Lieb, 1991). Therefore, they like to be given opportunity to use and apply their experience to their learning. To help them do so, participants' experience and knowledge which is relevant to the topic should be draw out. Facilitator must relate theories and concepts to the participants and recognize the value of experience in learning.

Third, adults are goal-oriented. Adult students become ready to learn when "they experience a need to learn it in order to cope more satisfyingly with real-life tasks or problems" (Fidishun, 2000). Adult usually have their own goal to attain when scrolling in a course. Hence, they would appreciate an educational program that is well organized and has clearly defined elements. Instructors must show participants how this class will help them attain their goals. Besides, this classification of goals and course objectives must be done early in the course (Lieb, 1991). Instructor must facilitate a student's readiness for problem-based learning and increase the student's awareness of the need for the knowledge or skill presented.

The next adult principle in learning is adults are relevancy-oriented. Adult learners want to know the relevance of what they learn to what they want to accomplish or in other words they must see a reason for learning something. Typically, learning has to be applicable to their work or other responsibilities to be of value to them. Therefore, instructors must identify objectives for adult participants before the course begins whereby the theories and concepts must be related to a setting familiar to participants. This need can be fulfilled by letting participants choose projects that reflect their own interests (Lieb, 1991).

The fifth principle in adult learning is adults are very practical. Adult may not be interested in knowledge for its own sake but more focusing on the aspects of a lesson most useful to them in their work. Therefore, instructors must tell participants unambiguously how the lesson will be useful to them on the job. The students move from classroom and textbook mode to hands-on problem solving through practical fieldwork experiences, interacting with real clients and their real life situations so that they can recognize directly what they are learning applies to life and the work context.

Finally, as do all learners, adults need to be shown respect. Instructors must acknowledge the wealth of experiences that adult participants bring to the classroom. These adults should be treated as equals in experience and knowledge and allowed to voice their opinions freely in class (Lieb, 1991).

2.27 **Conclusion**

It has been found that electronic communication can be an effective tool for supporting collaborative learning as it overcomes the difficulties related with distance and time in a distance education environment. The integration of web-based learning components bring added value to traditional education. Students and lecturers benefit from using the communication and assessment tools. Students have a customized approach to knowledge acquisition that suits learning styles and busy schedules. The advantages of online education make a significant impact in higher education today and, as technology evolves, promise to deliver even greater benefits in the future.

CHAPTER 3

RESEARCH METHODOLOGY

3.0 Introduction

This chapter discusses in detail the research methodology used in this research. It includes the model used in the design of teaching and learning to assist developers in producing quality learning materials. There are several phases involved in the development process based on the selected instructional design model. The discussions will also cover on the population, study samples and research instruments used and data analysis.

Research Design

Research design is a conceptual structure, a blueprint or an outline of what the researcher will do. In other words, research plan refer to a plan for collecting and

utilizing data so that desired information can be obtained with sufficient precision. Therefore, a research needs a design or a structure before data collection or analysis can commence. In this research, the research design could be the phenomenology approach. Through phenomenology approach, researcher could know the experience of an activity or concept from the particular participants' perspective. Therefore, the researcher could understand the how the activity appears to others.

According to Aiken (1994, as cited in Ayesa Yinka, 2009), phenomenology is defined as the study of a phenomenon (of objects or of events) as seen or as experienced by an observer. A phenomenology also defined by Hancock (1998, as cited in Asmau Imam, 2008) as the study of phenomena.

> *"It is a way of describing something that exists as part of the world in which we live. Phenomena may be events, situations, experiences or concepts"*. (Hancock, 1998)

Further opinion from Hancock (1998, as cited in Asmau Imam, 2008), phenomenological research will not necessarily provide definitive explanations but it does raise awareness and increases insight.

Overall, the design of this research was in qualitative form. The data were collected by email interview and discussion through blog.

3.1 Research Procedure

In general, research procedure is a description of the overall approach and rationale for the study, the site and sample selection, the researcher's role, data collection methods, data management strategies, data analysis strategies, trustworthiness features, ethical consideration, potential contributions of the research and limitation of the study (Gay, 2009). However, the procedure in qualitative study may vary in forms and degrees of specific depending on the researcher.

First of all, the researcher identified current issues or development of educational technology in the field of education before began with the research. Then, the researcher selected the topic or title of the study based on the preliminary research study.

After the title has been obtained, the researcher identified the early picture of study by conducting a research on the online learning by the students in teaching and learning process. Then, researcher identified the problem occurred in group work activity among the students. This process leaded the researcher to set the objectives of the research as well as the research questions. After that, the researcher recognized the scope and significant of research so that this research will grant benefit to some parties.

Subsequently, the researcher set the research methodology as a guide during the research. In general, research methodology includes a description of the research design and procedure, research population and sample, measuring instrument, data analysis,

pilot study, credibility and dependability or trustworthiness. The sample of this research is chosen purposively; 36 undergraduate students who enroll course SPM2322 (Authoring Language). The instrument used to collect the data is through the discussion in the blog.

The next procedure, the collected data then was analyzed manually by the researcher. From the collected data, the researcher made discussion and conclusion on the overall findings of the research. Finally, the researcher came out with some recommendation for further research that can be carried out. Figure 3.1 shows the flowchart of the research procedure.

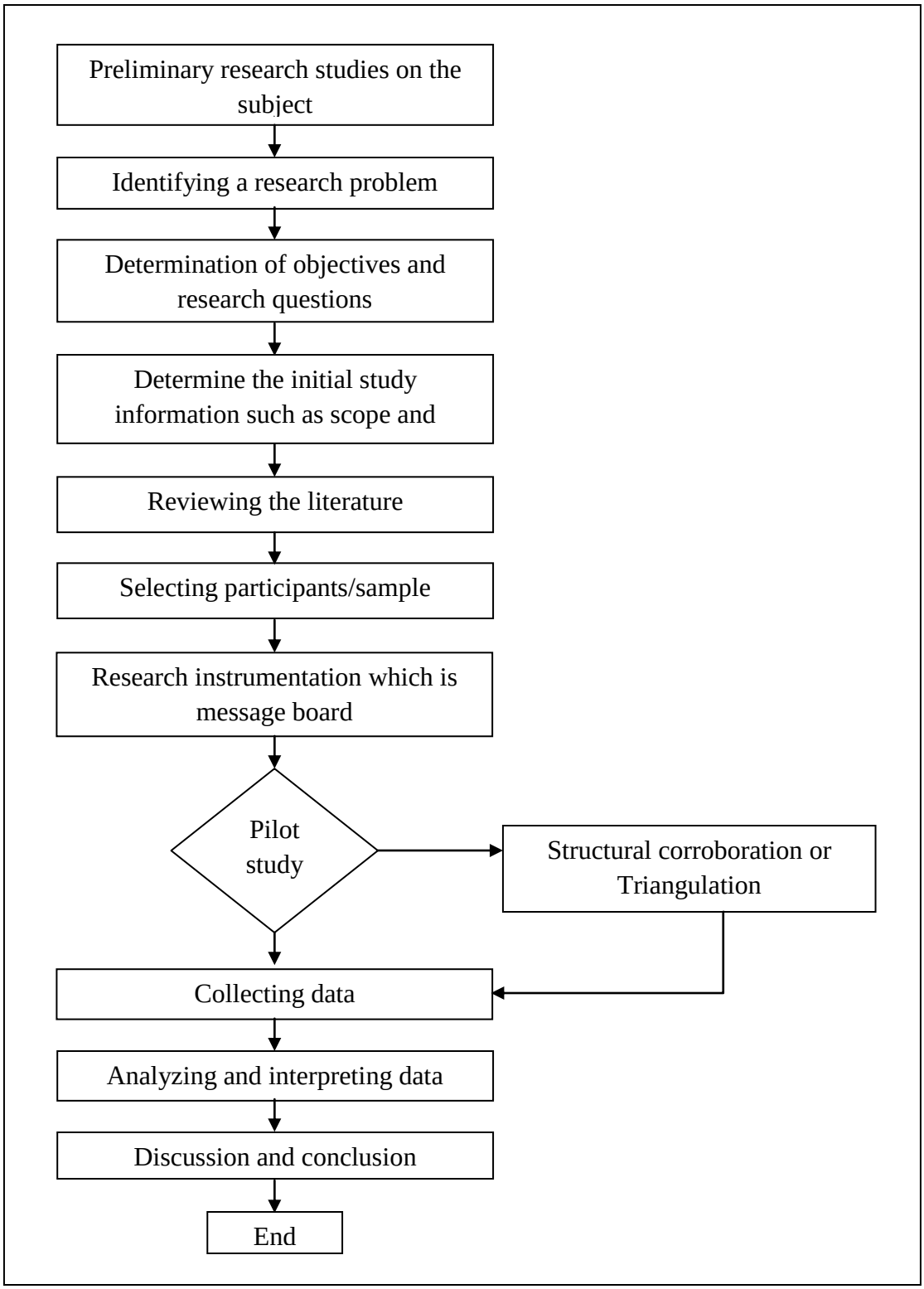
Preliminary research studies on the subject
Identifying a research problem
Determination of objectives and research questions
Determine the initial study information such as scope and
Reviewing the literature
Selecting participants/sample
Research instrumentation which is message board
Pilot study
Structural corroboration or Triangulation
Collecting data
Analyzing and interpreting data
Discussion and conclusion
End

Figure 3.1: Flowchart of Research Procedure

3.2 Research Population and Sampling

The population is the group of interest to the researcher, the group to which the researcher would like the results of the study to be generalizable (Gay, 1987). According to Gay (2009), qualitative sampling is the process of selecting a small number of individuals for a study in such a way that the individuals chosen will be good key informants who will contribute to the researcher's understanding of a given phenomenon. Qualitative sample is generally different, smaller and less representative compared to sample selected from quantitative research. Qualitative research requires more in-depth data collection because of the interest in participants' perspectives, immersion in the setting and the research topic under study.

In this research, the researcher uses the purposive sample to meet the requirements of the research (Mohd Najib, 2003). Purposive sampling is the process of selecting the sample that is believed to be representative of a given population. The advantage of using purposive sampling is the sample selection is based on the researcher's knowledge and experience of the group to be sampled using clear criteria to guide the process (Gay, 2009).

Therefore, the population which is also the sample of this research consists of undergraduate students who enrolled SPM2322 (Authoring Language) course in semester I session 20102011. The number of students enrolled this course is 36 students.

The SPM2322 (Authoring Language) course allow students to learn an overview of basic concept of authoring language, authoring process and types of authoring language for a standalone application development. It will also give opportunities for students to learn and to build their skills in developing educational courseware or digital learning objects by using current authoring language software. This subject will also emphasize on other aspects such as basic programming concept in Authoring Language, packaging and distributing multimedia files for standalone applications.

4.0 Instrumentation

An instrument is a test or tool used for data collection in the study. In education research, the data is about human behavior. Data can be collected accurately using several techniques.

Currently, internet has become a part of the everyday life of many people. Due to the enormous media presence of the Internet as a phenomenon and the possibilities

of using it, most people have at least rough idea about it. Thus, Internet has been discovered as an object of research and also tool to use for research.

One of the attractions of using Internet to collect data is that vast amounts of qualitative data can be acquired with relative ease. According to Rodham (2006), collecting data in a textual form significantly reduces work efforts by eliminating the laborious task of transcription. Although subtle, visual, non-verbal cues, which help to contextualize the interaction are lost, it has been argued that what is effectively automatic transcription reduces human error, thereby enhancing the accuracy of data collection, and increasing the validity of any inferences made (Rodham, 2006).

Apart of using traditional observation and interview, online data are obtained using methodologies implemented through the Internet or often described as "virtual methodologies". The research instruments used in this particular study were blog and UTM Grid Portal. The method used to obtain the information required in need analysis was e-mail interviews where by the researcher post three question related to the first research objective.

3.5.5 **Needs Analysis**

The need analysis was conducted to collect required information of the target learner (characteristic and their experience working in team conventionally), identify problem in conventional courseware authoring in group and ways of addressing the identified problems. Referring to the results obtained from the need analysis, it helped

the researcher to design and develop a portal that could gather students doing group work and discussion through online.

3.5.1.3 **E-mail Interview**

Personal e-mail interview was the main instrument used in conducting the needs analysis. The aim of conducting e-mail interview was to draw out important clues from the participant that can be used in explaining characteristic and their experience working in team. This can be extracted by getting the target participant to talk through their own words of how they perceive a particular idea or issue.

E-mail interviews is another relatively new approach to interviewing research participants. The availability of internet access around the campus make it easier for the researcher and the participant engaging in ongoing conversation using e-mail. Researcher and the participants can respond to e-mail either synchronously (identical to a real-time conversation with the researcher) or asynchronously (at some other time when researcher and partcipant are not both sitting at their computer).

From the e-mail interview researcher do not have to transcribe a taped interview, the transcription of the interview has already been done for the researcher by the respondent. Through the e-mail interview, researcher gained information which was later implemented in designing and developing the grid portal environment based on needs of the participant.

Below are the three questions was posted to target participant intend to find out characteristic, their experience working in team and their personal problems in conventional authoring activities environment.

1. What are your thought about group work in this course?
2. Do you “hate” group work?
3. List down your personal problems in designing the graphic assignment and authoring project given.

3.5.6 **Blog**

Blog was used for summative evaluation of this research. The summative evaluation was done to measure the effectiveness of the UTM grid Portal to overcome the group work problem as obtained from the need analysis. Through blog, researcher can perceive the students' participation and involvement in group work.

A blog is a type of website or part of a website which are usually maintained by an individual with regular entries of commentary, descriptions of events, or other material such as graphics or video. Although blog is usually maintained by an individual, the entries can be posted by up to 100 authors and other individuals can read and respond to the entries, which can stimulate discussion. As initial, the researcher will come out with a topic or lead question for the respondent to answer and discuss. In the blog, the researchers can access discussions that have been completed, or can follow discussions as they develop over time based on the lead question given.

Besides that, this instrument is easily administered, save time and money of researchers during data collection. In addition, the respondents can communicate in a place and time that is most convenient for them.

Blog can be 'open' where anyone can read, post or respond to messages or 'closed' where in order to read or participate in discussion, individuals must register with the site and obtain a password to gain access. In this research, the blog is closed to public and only the undergraduate students attend course SPM2322 (Authoring

Language) can access this blog. The respondents could use their blogger account as well as their email account in order to access the forum after being invited by the moderator.

Table 3.1: Summary of Blog Site Criteria

	Blog
Foundation	Topic based
Process	Moderator posts questions, waits for responses, probes where necessary.
Topic posted by	Moderator
Information controlled by	Moderator
Information is	Mostly text based
Access	Private, password protected, allow only invited participants
All topics answered	Yes
Level of moderator control	High

The method in this forum is open-ended interview. The researcher guides the discussion by introducing the topics or leading questions from the discussion outline and posting follow-up questions. Respondents are free to express their opinion in the forum based on the leading question given by the researcher. Some of elements will be discussing by the respondents are on task distribution, problem occur during developing courseware, support to other group members and so on.

Throughout the process, the researcher encourages the respondents to provide the greatest possible amount of detailed information about any and all of their pertinent

experiences, thoughts, feelings, attitudes, decision-making processes and behaviors-that are related to the purposes of the study.

The duration of the discussions for data collection can be designed as long as needed to accomplish the research objectives. However, 3 days to 2 weeks are the most common lengths. On the other hand, for this research, the duration of data collection is a bit longer, 1 semester of study because the researcher would like to study the data in depth. The extra time available to the researcher and to the respondents allow them to ask more reflective and insightful follow-up questions. Besides that, the extended of discussion time would give convenience to the respondents to participate and respond to the forum.

5.0 Pilot Study

Pilot study is a small-scale trial of a study conducted before the full-scale study. A pilot study can reveal deficiencies in the design of a proposed experiment or procedure. As the results of the pilot study, the research plan could always be modified before time and resources are expended on large scale studies.

A pilot study is normally small compared to the main experiment. Therefore, it could only provide only limited information on the sources and degree of difference of response measures. Besides that, the pilot study also could check the dependability and credibility of results.

In this study, pilot study was done to a group of 37 students who enroll in SPM4332 CD-ROM Based Multimedia Development course. First, they have to give their email address so that they will be invited by the researcher to be an author to the blog. The blog for pilot study could be access through http://spm4332.blogspot.com. Figure 3.2 below shows an example of pilot study blog interface.

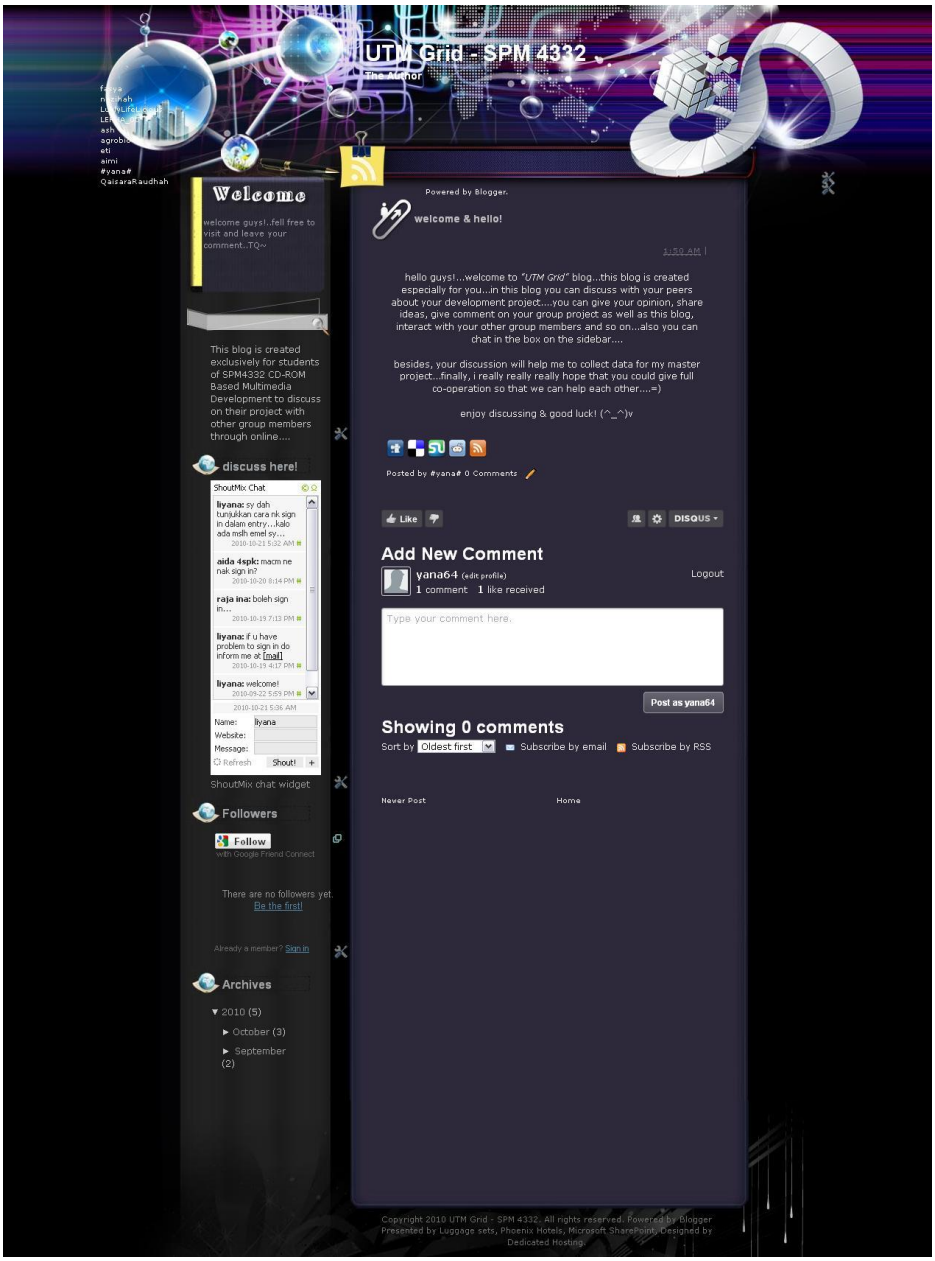

Figure 3.2: Example of Pilot Study Blog Interface

However, this blog is not accessible by the students after a period of time. Based on the feedback through email, they do not know how to access this blog. Therefore, to

overcome this problem the researcher posts an entry to guide the students how to accept the invitation to become an author of this blog.

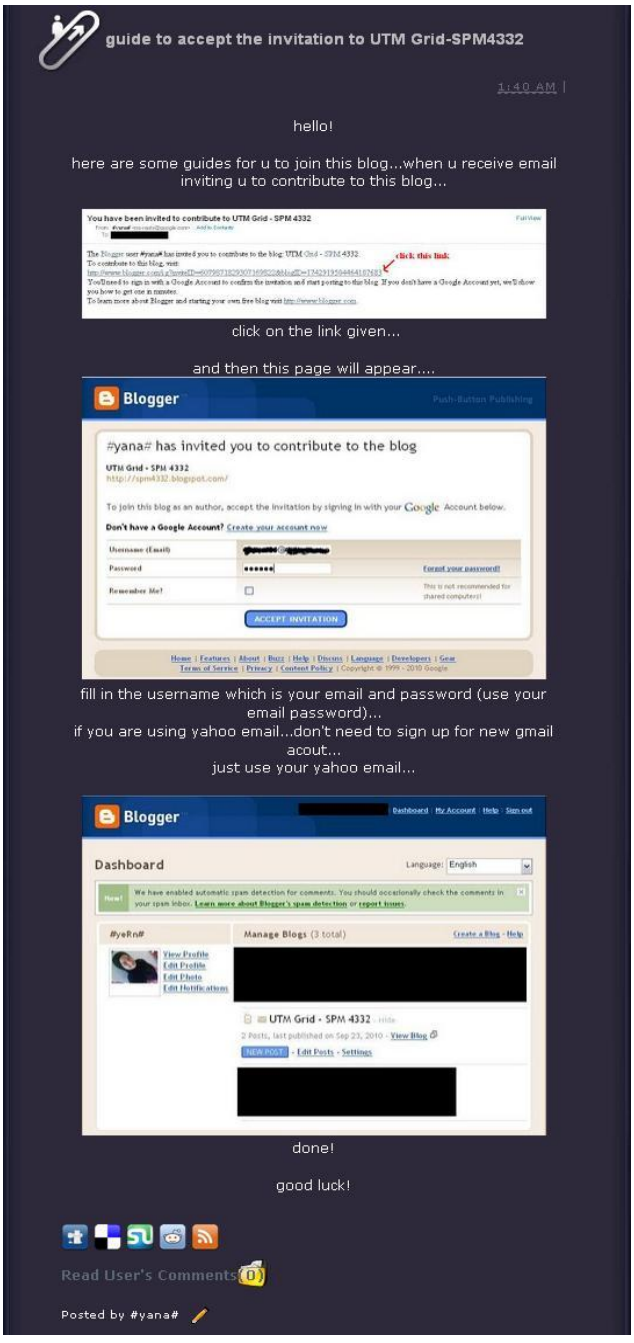

Figure 3.3: Example of Guide to Accept the Invitation

As a result, some students managed to accept the invitation even though majority still do not give any respond. There are also some students did not managed to accept the invitation although alternative ways to access the blog were given. According to Wynne (2010), adults learn at various rates and in different ways according to their intellectual ability, educational level, personality and cognitive learning styles.

Furthermore, to provide a clearer picture on the functions of this blog, researcher posts a guide on what the students have to do. The guide includes the step to post an entry as well as giving comment or respond to other students' entries. The example of guide given by the researcher is shown in Figure 3.4 (a) and Figure 3.4 (b).

Figure 3.4 (a): Example of Guide on What Students Have to Do

Figure 3.4 (b): Example of Guide on What Students Have to Do (continue)

First, researcher guides the discussion by introducing the topics on task distribution. Example of the topic posted as in Figure 3.5.

Figure 3.5: Example of Topic on Task Distribution

From the pilot study, some weaknesses and deficiencies were identified and steps to overcome these were taken such as posted some guides in the blog. This proved that pilot study is very essential as the blog could be improved before implementing to the real experiment.

3.7 Dependability

Dependability or trustworthiness refers as extent to which variation can be tracked or explained (Ary *et al*, 2009). Qualitative studies expect variability because the context of studies changes compared to the quantitative study, in which tight controls enhance replicability. Besides that, dependability also refers to the stability of the data collected.

Triangulation is the process of using multiple methods, data collection strategies, and data sources to obtain a more complete picture of what is being studied and to cross-check information (Gay, 2009). This research used the within-method triangulation which is the subtype to methodological triangulation. The within-method triangulation involves the use of varieties of the same method to investigate a research issue (Denzin, 1989as cited in Flick, 2009). A combination of approaches which are entry posting, comment and chat box involved in the blog of this research.

3.8 Credibility

Credibility in qualitative research concerns the truthfulness of the inquiry's findings. Credibility or truth value involves how well the researcher has established

confidence in the finding based on the research design, participants and context (Ary e*t al*, 2009).

According to Guba (1981, as cited in Gay, 2009), credibility is defined as the researcher's ability to take into account all of the complexities that present themselves in a study and to deal with patterns that are not easy to explained. The researcher has a responsibility to represent the realities of the research participants as accurately as possible and must provide assurances in the report that his or her obligation was met.

The method for enhancing the credibility of this research is structural corroboration. According to Eisner (1998, as cited in Ary *et al,* 2009), structural corroboration is "means through which multiple types of data are related to each other to support or contradict the interpretation and evaluation of a state of affairs". Triangulation is referring to multiple uses of data sources, multiple observers and/or multiple methods.

To measure the credibility of this research, within-method of methodological triangulation is used. The approaches involved in triangulation for credibility is similar to the triangulation for dependability.

8.0 Data Analysis

According to Mohd Najib (2003, as cited in Noor Adreen, 2007), analysis means categorizing, giving rank, manipulating and concluding data to obtain answers to the research. Data analysis in qualitative research involves summarizing data in a dependable and accurate manner that has an air of undeniability (Gay, 2009). Data analysis is a process of finding the meaning and understanding of those collected data.

Qualitative data processing involves several stages for analysis (Dayang, 2009):

a) Transcribe the data into text form
b) Data Organization
c) Data conditioning (familiarized with the data)
d) Development of coding and data category
e) Development of theme and pattern
f) Demonstration of reliability and validity
g) Making report

Since the data for this research is collected through email interview and blog, the data is originally in the text form. So, the first step which is transcribing the data into text form could be skipped.

9.0 Conclusion

As the conclusion, this chapter has discussed the research methodology of this study. Research methodology is very important is very important in providing guidelines to the researcher. The proper and accurate selection of instruments, sampling and analysis of data could help get higher validity in the research.

CHAPTER 4

GRID PORTAL DESIGN AND DEVELOPMENT SPECIFICATIONS & INFRASTRUCTURES

4.1 Introduction

In order to produce a good portal, proper steps should be taken. This chapter will discuss further on the phases involve through the portal development process according to the instructional design model. In the analysis phase, the researcher identified the problems occurred in the group work activity. Then, from the data collected, a design to overcome these problems was produced. For the third phase, the development phase, the process for installation the portal according to the design in the second phase was running. Next, the grid portal was implemented to the purposely chosen samples. Finally, the feedback was collected through the blog for evaluation. The details discussion on the development of each phase was discussed through out this chapter.

4.2 ADDIE Instructional Design Model

Instructional design is the systematic process of translating general principles of learning and instruction into plans for instructional materials and learning. It includes development of instructional materials and activities; and tryout and evaluation of all instruction and learner activities. There are several instructional design can be used in web development for example ADDIE Model, ASSURE Model, Dick & Carey Model, Hannafin & Peck Model, Waterfall Model, Rapid Prototyping Model and etcetera. ADDIE Model is used for the development of this portal. ADDIE Model provides designers with the necessary structure for designing any curriculum, regardless of the instructional methods employed. The relevant of using this model is that learning and performance professionals use a systematic process that includes analysis, design, development, implementation, and evaluation.

Following is the overview of the ADDIE Model.

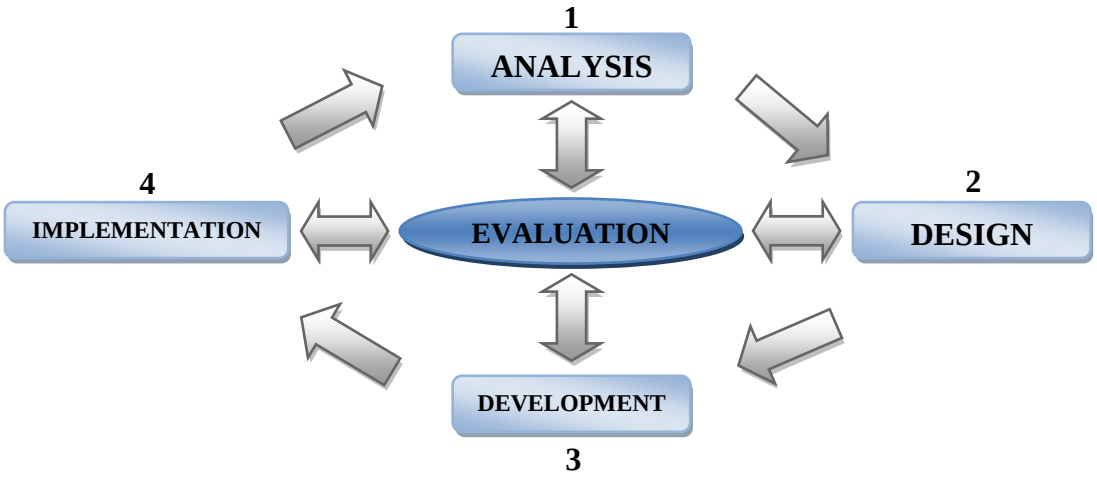

Figure 4.1: ADDIE Model

As discussed in Chapter 2, the ADDIE model is based on and named after five elements of interactional design: analysis, design, development, implementation, and evaluation. In the ADDIE model, analysis is the input for the system. The design, development, and evaluation are the process and implementation is the output. These elements overlap somewhat, depending on the project.

4.2.11 Phase 1: Analysis

Analysis phase is the first phase in ADDIE Model intends to facilitate the development of the grid portal. According to Learning Theories Knowledgebase (2010), during analysis, the designer identifies the learning problem, the goals and objectives, the audience's needs, existing knowledge, and any other relevant characteristics. Analysis also considers the learning environment, any constraints, the delivery options, and the timeline for the project.

4.2.1.3 Need Analysis

The need analysis was conducted to collect required information of the target learner on characteristic and their experience working in team conventionally, identify problem in conventional courseware authoring in group and ways of addressing the identified problems. The details required includes biographical data about the learner, problems and ways of dealing the problem.

The three questions was posted to target participant intend to find out characteristic, their experience working in team and their personal problems in conventional authoring activities environment.

4. What are your thoughts about group work in this course?
5. Do you “hate” group work?
6. List down your personal problems in designing the graphic assignment and authoring project given.

The data collected for need analysis are then identified and distributed into categories and subcategories. The number of these categories and subcategories are not limited depending on the data obtained.

Table 4.1: Template for Open Coding of Need Analysis

Category	**Subcategory**	**Properties/Definition**	**Coding example**
Category 1	Subcategory 1		-
Category 2	Subcategory 1		-
	Subcategory 2		-
Category 3	Subcategory 1		-
	Subcategory 2		-
	Subcategory 3		-
Category 4	Subcategory 1		-
	Subcategory 2		-
	Subcategory 3		-
	Subcategory 4		-

Table 4.1 above shows the example of table used for open coding of need analysis. The table is divided into four columns including category, subcategory, properties or definition and coding example. The properties of each category is defined and that causes a coding is placed into those categories.

4.2.12 Phase 2: Design and Development Specifications

4.2.2.3 Grid Portal Technology

A Grid is a collection of independently owned and administered resources which have been joined together by a software and hardware infrastructure that interacts with the resources and the users of the resources to provide coordinated dynamic resource sharing in a dependable and consistent way according to policies that have been agreed to by all parties (Dayang *et al.*, 2010). The Grid is the mixture of network infrastructure and software framework distributing computer services based on distributed hardware and software (Bing Wu *et al.*, 2004 as cited in Dayang *et al.*, 2010).

The Grid Portal allows students to do courseware job virtually without the need to meet with members of the group. The students will have the opportunity to searching, uploading, visualizing output and file saving by the help of UTM grid Portal. Besides, the students also could have discussion with peers in the blog linked from the UTM Grid Portal. This blog creates a collaborative environment activity among students to give opinions, sharing ideas, distribute task and others in asynchronous time.

Figure 4.2 shows the infrastructure of UTM Grid Portal Technology. The infrastructure comprising of the client, Grid Portal, proxy server, storage server, grid appliance, head node and parallel computing system. The head node and grid appliance used Sun Grid Engine (SGE) or Torque as the job scheduler to monitor all the jobs.

Figure 4.2: Infrastructure of UTM Grid Portal Technology

4.2.13 Phase 3: Development

Users are able to interact with the Grid Portal through an https connection from a web browser. The Grid Portal uses GridSphere to run the portal and Apache Tomcat as the web server to run the web-interface. The GridSphere is used to provide information about the job status using SGE or Torque. The UTM Grid Portal uses MySQL database for the database of information about users, clusters, applications and job status that it needs to run the Portal. The architecture also includes a MyProxy server to store user certificates, a storage server connected to the Grid Portal to provide storage space for pool only users, and a visualization server to drive the software that is optionally required to provide through-the-web data visualization services to users.

A schema Web Service Definition Language (WSDL) using tools such as Neatbean IDE, GlassFish as web engine, C compiler and Parallel Virtual Machine (PVM) was created in the grid portal service. After finish, clients can access web service portal from a server as called as distributed or grid Computing. Users can access web service portal from a server as called as distributed or grid. Grid portal supports a framework to provide a web service interface to the existing applications without having to write extra code or modify the existing web services (Dayang *et al.*, 2010).

4.2.3.13 **Web Services Technology**

Web programming is the design and construction of a program, e.g., an applet, to perform a task on a web page. In the web services development, some concept on GUIs, concurrency, event handling, graphics, network communication, and software engineering techniques and tools are exploited.

For this kind of relationship, service oriented architecture (SOA) style is chosen. Each web services are easily maintainable since there is loose coupling between interacting nodes. The development of this architecture is based on several programming language as it involves algorithm implementation on C, parallelization using Parallel Virtual Machine (PVM) and Java for web services development. The grid computing platform is an open source-based and will be develop under Linux environment. The platform development will increase the acceleration and scaled out across a virtualized grid. The clusters of processors involved in this platform are developed on increasingly larger computational hardware with inexpensive architecture.

4.2.3.14 **Workflow Editing**

The workflows can be graphically created at the client machine by the Workflow Editor written as a Java Web-Start application. A simple workflow used in a real-life meteorology application is shown in Figure 4.3.

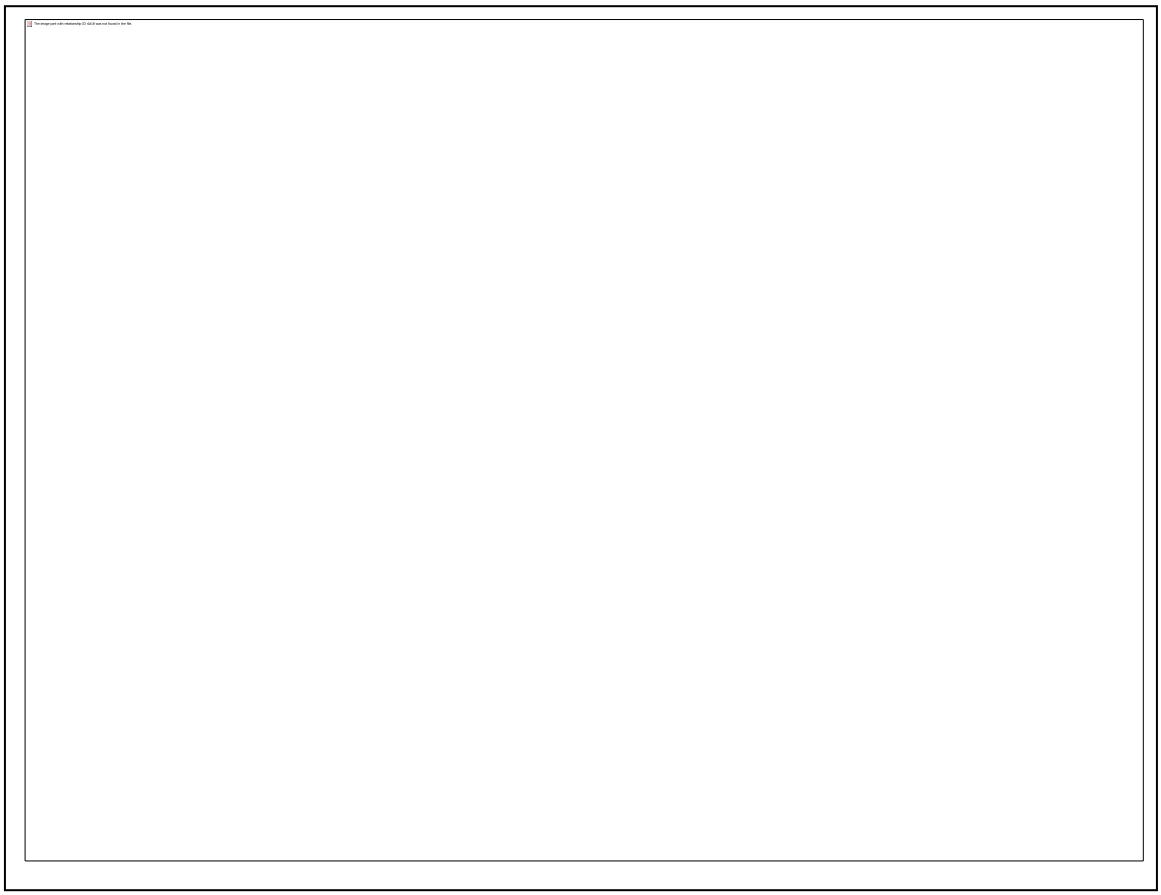

Figure 4.3: Process Flow of Grid Portal Technology

Once user press Go / Enter key, the browser will, (1) request *input.htm* from the web server in IIS Server Cluster. The web server will furnish the request by displaying the *input.htm* page. A new user needs to provide several mandatory parameters as requested for the first time in the *input.htm.*

The user needs to submit the *input.htm* to the web server via (2) Http Post protocol. The web server will process the request by calling the *PERL-CGI script*. Once called, the script will run as a server background process.

After that user will able to sign in and view the list of all clusters as well as list of programs with different clusters by the provided user name and password. For example, an inserted numerical simulation source code (3) interacts with selected C program in the application directory. The C program will also run as a server background process. The C program process calculates the mathematical problem in the cluster using all the nodes and returns the result to PERL-CGI process. The PERLCGI process will then terminate the C program process. In another word, the PERL-CGI process spawns C program process and wait for its response.

The PERLCGI process (4) generates a HTML page and embeds the results in it. The generated page will be (5) displayed to the web browser. Files are identified by their logical name and location. It should be also defined if the file is a permanent one or used only temporarily. In the latter case when the job using the temporary file has been finished, the file is automatically removed from the Grid. After creating the workflow on the client machine it should be uploaded to the portal server machine.

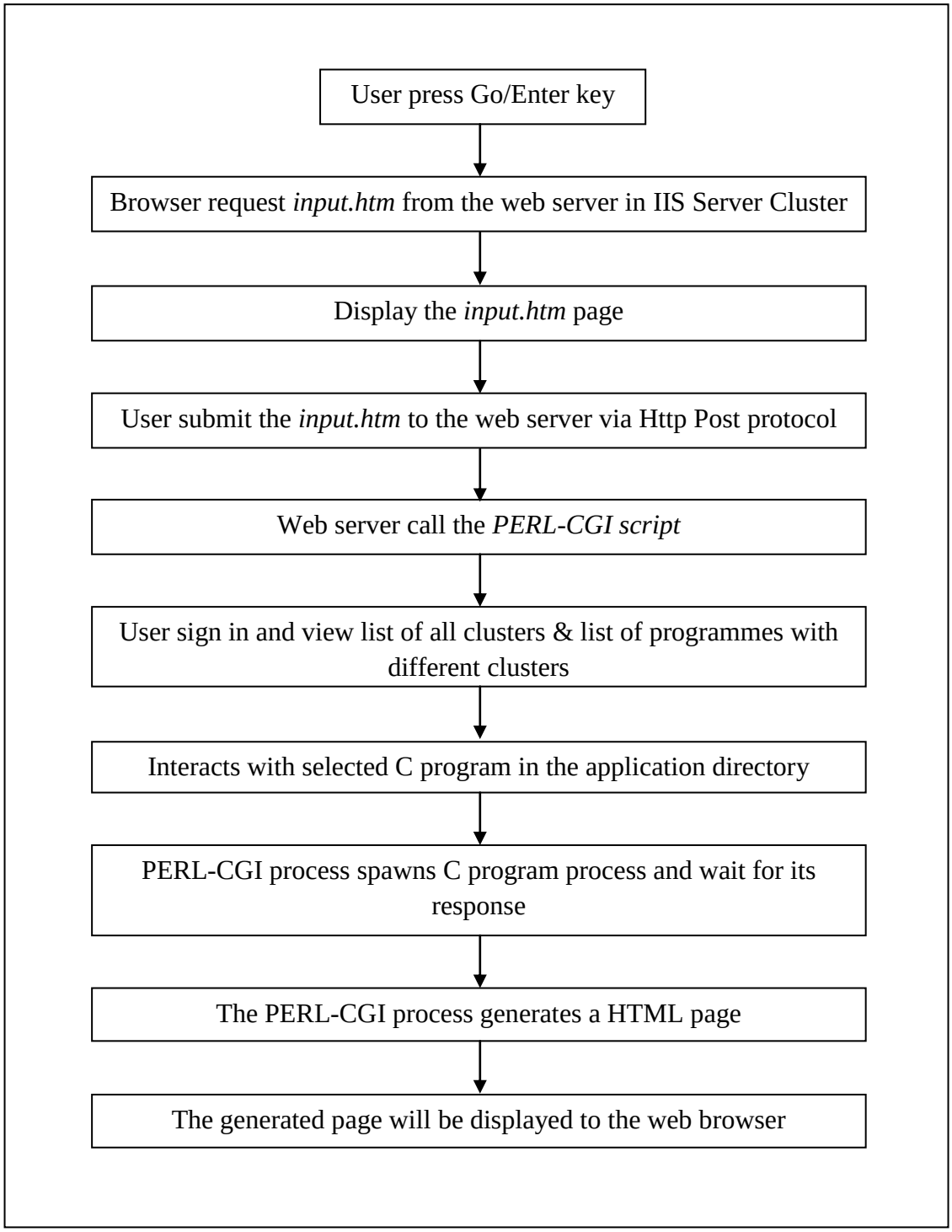
User press Go/Enter key
Browser request *input.htm* from the web server in IIS Server Cluster
Display the *input.htm* page
User submit the *input.htm* to the web server via Http Post protocol
Web server call the *PERL-CGI script*
User sign in and view list of all clusters & list of programmes with different clusters
Interacts with selected C program in the application directory
PERL-CGI process spawns C program process and wait for its response
The PERL-CGI process generates a HTML page
The generated page will be displayed to the web browser

Figure 4.4: Flowchart of Workflow

4.2.3.15 **Service-Oriented Architecture**

Grid portal services must be located in the bigger framework of Service Oriented Architectures (SOA). SOA is being used to construct worldwide scalable Grid systems. SOA offers methods for systems improvement and incorporation where systems group functionality around parallel computing procedures and enclose these as controlled services. A SOA maintains service integration through published and easy to discover or user friendly interfaces. They can be incorporated in a collection of frameworks as they are message-based relatively attached to an application interface. The UGP model presents a very flexible programming environment, under the hypothesis that the message semantics do not transform. Administrator and students/users are open to choose the accomplishment and backend logic and services separately of each other (Thomas, M.P., 2005as cited in Dayang et. al., 2010).

4.2.3.16 **Web Service Paradigm**

The web services provided the contents page which will present a synopsis of the selected subject. Then, the user can follow the hypertext link to further comprehensive details. It will provide a parallel programming exercise and user can

viewed the solution after he/she completed the exercise. For the beginning, user can retrieve a solution template. The web services covers most topics excluding domain decomposition technique, data parallelism, concurrency and domain and functional partitioning, message passing paradigm, performance measurements and provide the some numerical libraries in exploiting parallelism for grand challenge applications for the authoring environment.

Through grid portal web service paradigm, user will able to perform the following operation:

a) Need to share resources among the campus clusters:
    i. Better equipment utilization
    ii. Energy saving
b) Diverse cluster ownership and operation
    i. Owners reluctant to give login ids to any but their users
c) A number of users have login ids on multiple clusters
    i. Need to get to them from one interface/location

UTM Grid Portal supports two types of users:

a. Cluster Users

    A cluster user has a login id on one or more of the clusters participating in the Grid. A cluster user can get this login id by being a member of a research group that owns one of the clusters. Someone with computational needs also can normally apply for a login id on any cluster that is provided as a campus service.

Cluster users have home directories on each of the clusters they can access. They use their home directories to store files. Cluster users can use the Grid Portal to access files on and submit jobs to the clusters they have access to. Cluster users can also submit jobs to resource pools as a Pool User.

b. Pool-Only Users

Students, staff, and faculty members who do not have login ids on any of the clusters can easily sign up on the Grid Portal to be Pool-Only Users.

Each Pool-Only User is assigned a storage area on the Storage Server connected to the Grid Portal. The Pool-Only User can submit jobs to resource pools.

Figure 4.5: Web Portal Interface for Users

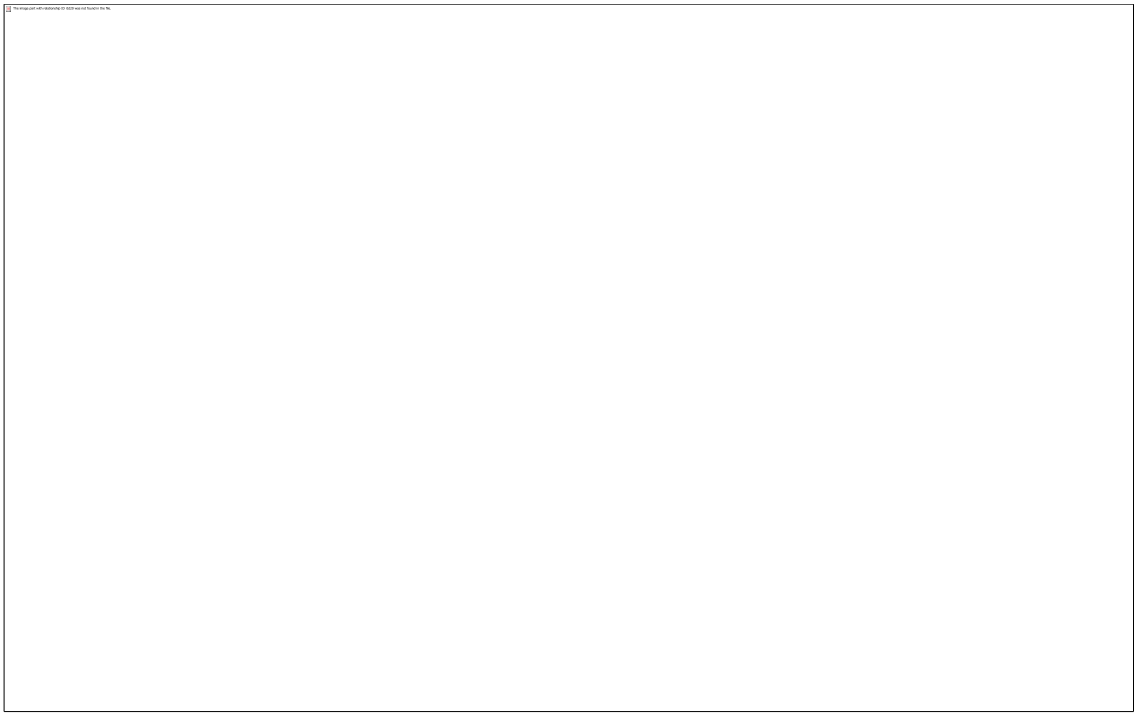

Figure 4.6: Pool Job Output

4.2.3.17 **Web Service Performance**

The process of visualization has becomes extremely fast, reliable and precise with high performance computing. The parallel performance makes the product really attractive because of its high speed, efficient, effectiveness and high temporal performance algorithm. In terms of numerical performance, the result are also precise, highly convergence, stable and accurate to the exact solution.

Low cost High Performance Computer (HPC): The operating system uses is open source. It is one of the most significant examples of free software in Linux Fedora and open source development. Its underlying source code can be freely modified, used, and redistributed by anyone, as long as they fully comply with the GPL License. Linux is one of the most prominent examples of free software and open source development; its underlying source code can be freely modified, used, and redistributed by anyone, as long as they fully comply with the GPL License. The platform is capable in performing a complex computational to solve the real end-to-end solution run on high performance and high-productivity computing.

Robustness: The robustness of the software that well suits on any future upgrade distributed memory architecture. Productivity is understood to be a composite of system performance, portability, user friendly, administrative concerns and reduced the "expertise gap".

Open source web based software: The open source product built on Linux platform in web-based format is really famous nowadays. This feature makes the software easy to be reach and access by user at any level instead of providing latest information (see Table 4.2).

Feature of the software development: The visualization is presented in webPerl-CGI and PHP are emphasized to develop the software instead of MySQL database to store significant information. The productivity is understood to be a

composite of system performance, system robustness, programmability, portability, and administrative concerns.

Real time solution: The mathematical modeling grants user the accurate prediction of engineering problems on a real time solution. This includes efficient visualization between mathematical simulation and exact solution of engineering problems.

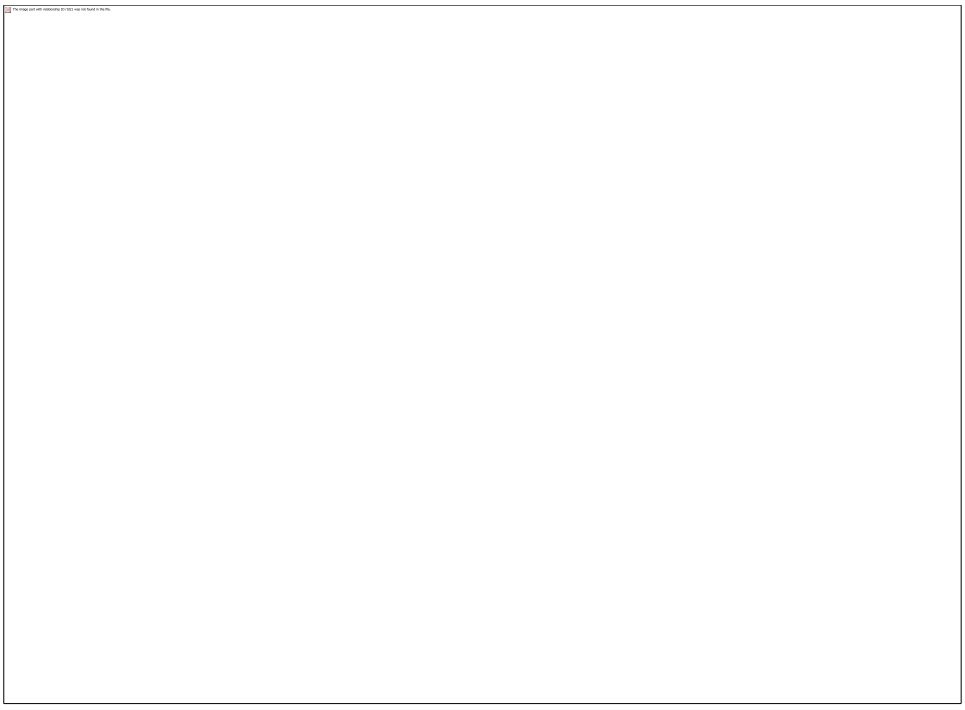

Figure 4.7(a): Web Portal Interface for Users Showing All Cluster Lists Along With List of Applications

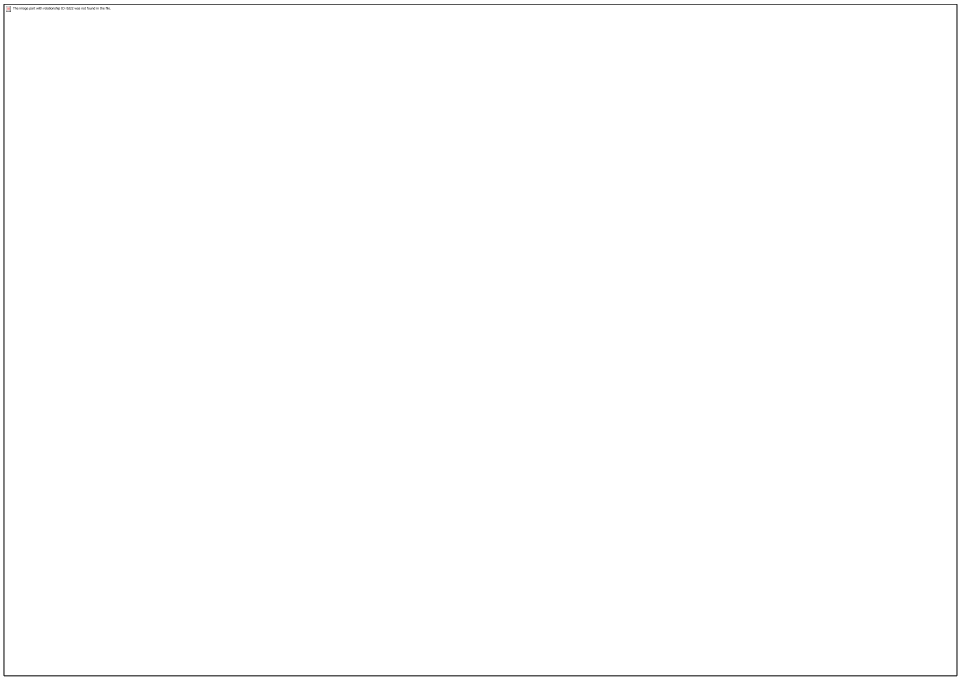

Figure 4.7(b): Web Portal Interface for Users Showing Contents for Sharing

Based on the Grid Portal with distributed parallel computer systems in University Technology Malaysia (see Figure 4.7), a numbers of software have been developed to assist users in numerical field and software engineer in manufacturing industries.

Table 4.2: Comparison between Open Source and Price Based Software

Open source (free)	Price based on version
Capture the smooth graph	Coarse graph
Highly convergent to exact solutions	Slowly convergent
Simulation based in web portal	Simulation is not provided
Server is provided	Server is not provided

High speed	Low speed
High performance of parallel computing	Low performance of sequential computing

4.2.3.18 **UTM Grid Blog**

A blog is created to evaluate the effectiveness of the portal. This blog is a link from the UTM Grid Portal for the users to give feedback and make discussion among the group members. The blog also can be access directly through http://utmgrid.blogspot.com. The blog is created using Blogger, a free website from the internet.

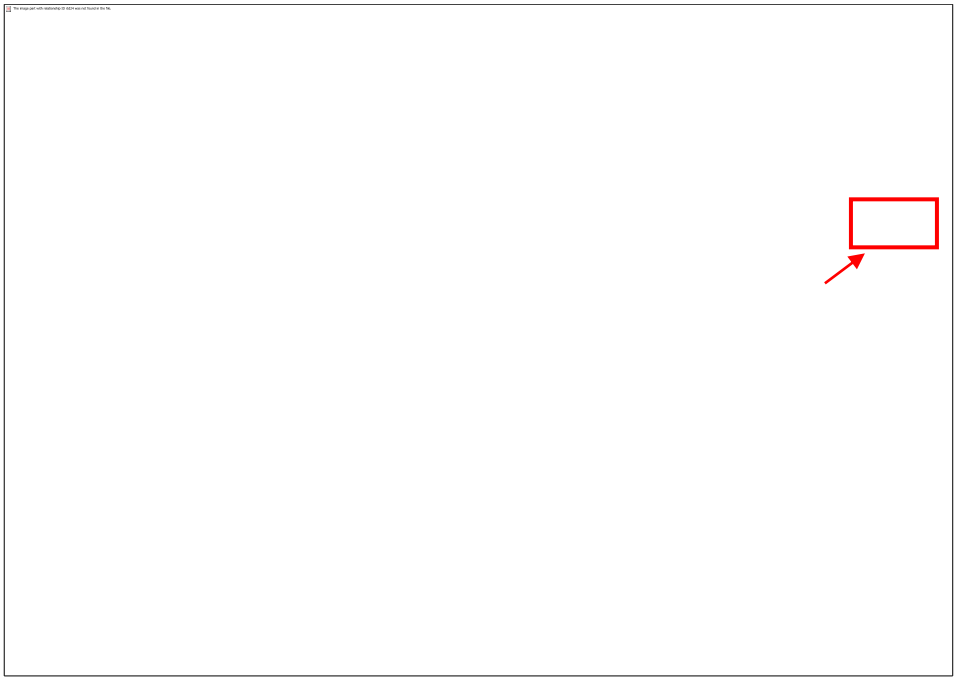

Figure 4.8: Link to Blog from UTM Grid Portal

The reason Blogger is chosen because it cost no charge for hosting and easy to manage. In addition, it allows more than one person to write in the blog. Blogger allows up to 100 persons to contribute as authors in one certain blog with one administrator. Therefore, it provides enough quorums for the students enrolled in SPM2322 (Authoring Language) course to join this blog.

In general, there are three main parts involve in the blog as shown in Figure 4.9. The first part is the entry where students could post their ideas, opinion, problems, update and so on. By expressing opinions, sharing ideas and so on is one of the characteristics of adult learner. According to Wynne (2010), adults have established opinions, values and beliefs which have been built up over time.

The second part is the comment button where the student can give feedback of the entries. To do so, they have to click on the "Read Users Comment" or "Comment" button and the page will direct to the comment column where the students can add their comment. Adults learn best in a democratic, participatory and collaborative environment. Adults need to be actively involved in determining how and what they will learn, and they need active, not passive, learning experiences (Wynne, 2010). By comments and give feedback to others show that they are actively involve in the collaborative environment.

The third part is the chat box placed on the sidebar of the page. This is the place where students could give motivation and support to other group members. Adults may

have insufficient confidence (Wynne, 2010). Therefore, motivation and support from others will increase the confidence level within themselves. Besides, the chat box also might be a medium for chatting among group members as well as with administrator if they have any problems regarding the blog.

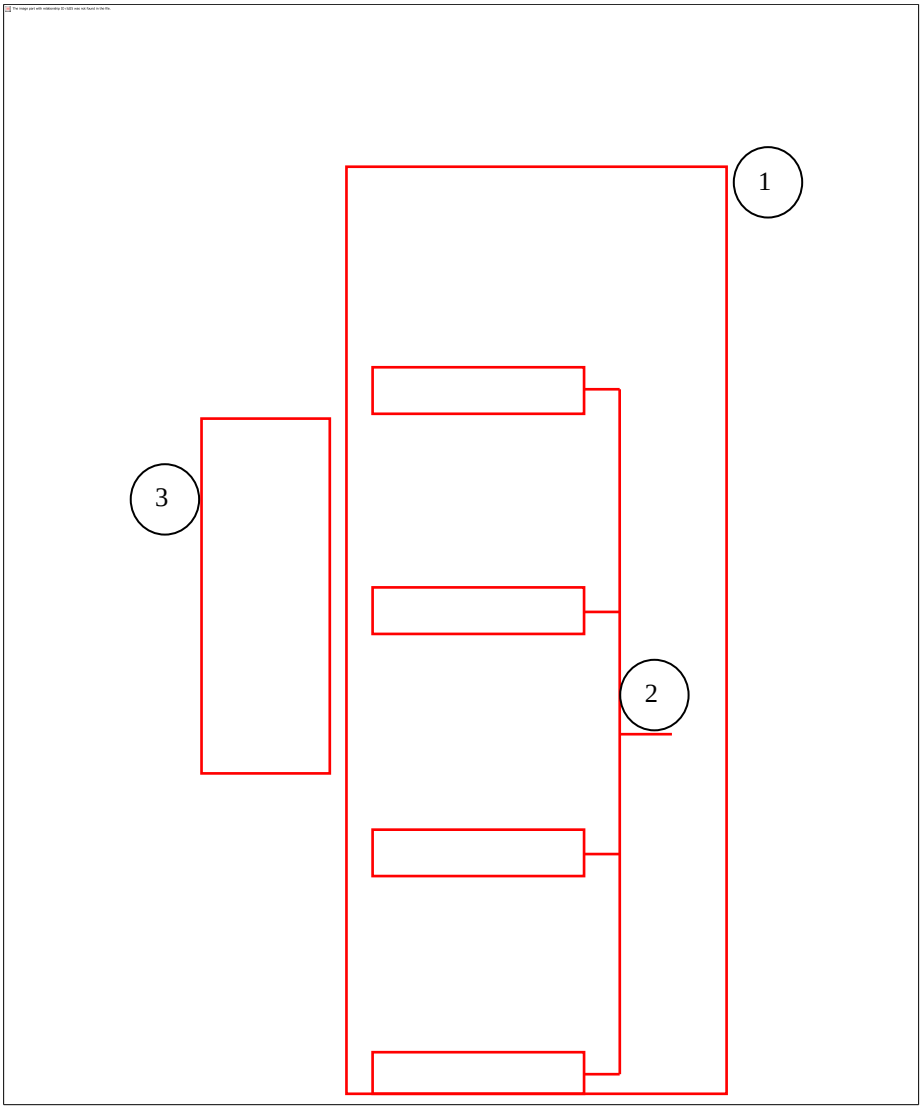

Figure 4.9: Blog of UTM Grid Portal Interface

The environment for comment is modified to resemble a forum environment. This environment is hosted by Disqus website that can be access through http://www.disqus.com. In the website, moderator is able to manage all the comments posted in the blog.

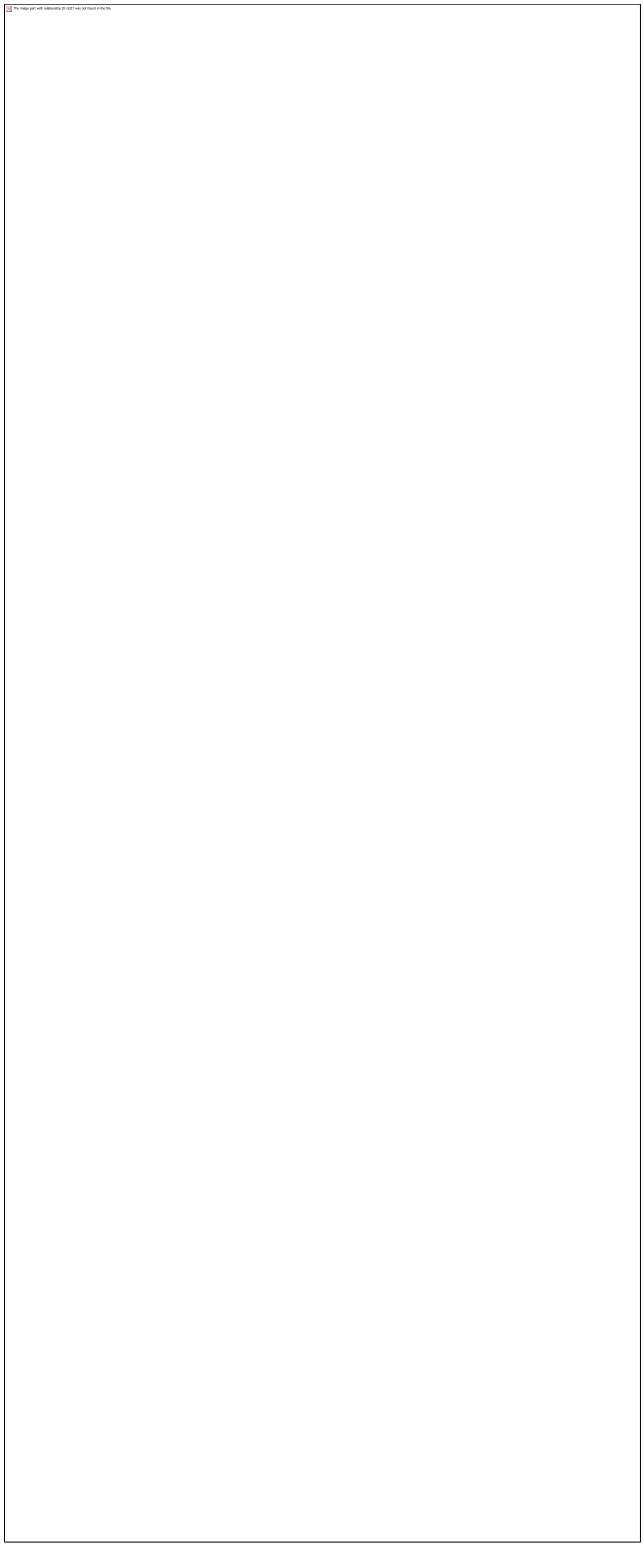

Figure 4.10: Example Comment Environment in the Blog

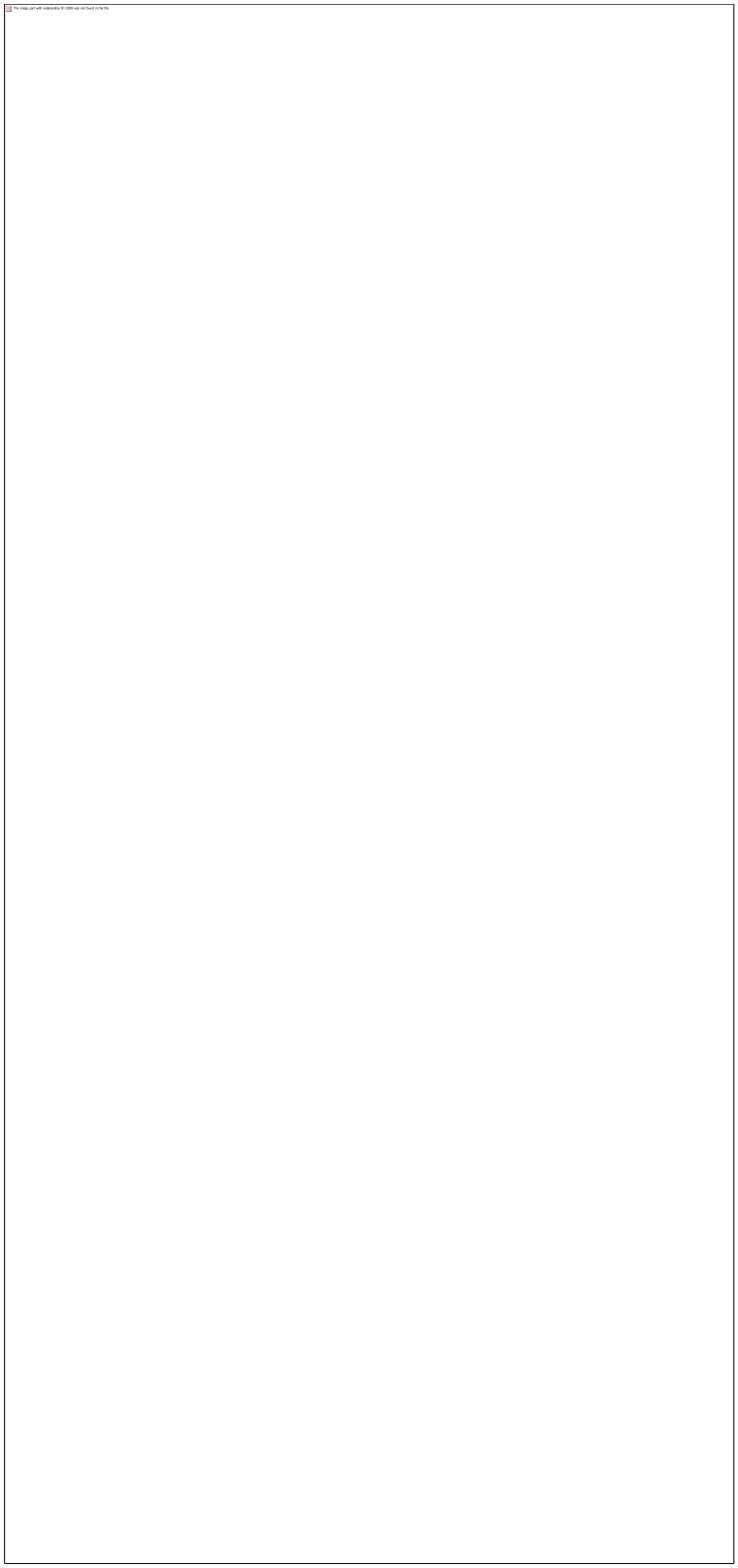

Figure 4.11: Example Comment Retrieved from Disqus

4.2.14 Implementation

According to Learning Theories Knowledgebase (2010), during implementation, the plan is put into action and a procedure for training the learner and teacher is developed. In implementation phase, the materials are delivered or distributed to the student group. This is also the phase to ensure that the grid portal and blog is functional.

First, the students enrolled in the SPM2322 (Authoring Language) course will be invited to contribute to the blog through email. Then, they have to accept the invitation by click on link given and they will be directed to the Blogger website as shown in Figure 4.12 and Figure 4.13 below.

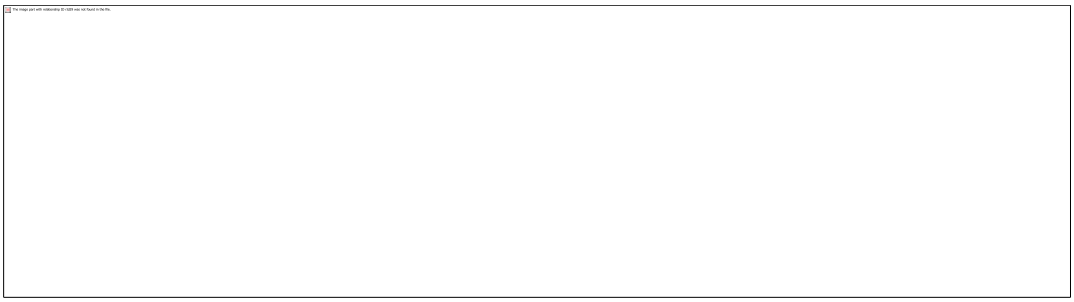

Figure 4.12: Invitation to Contribute to Blog

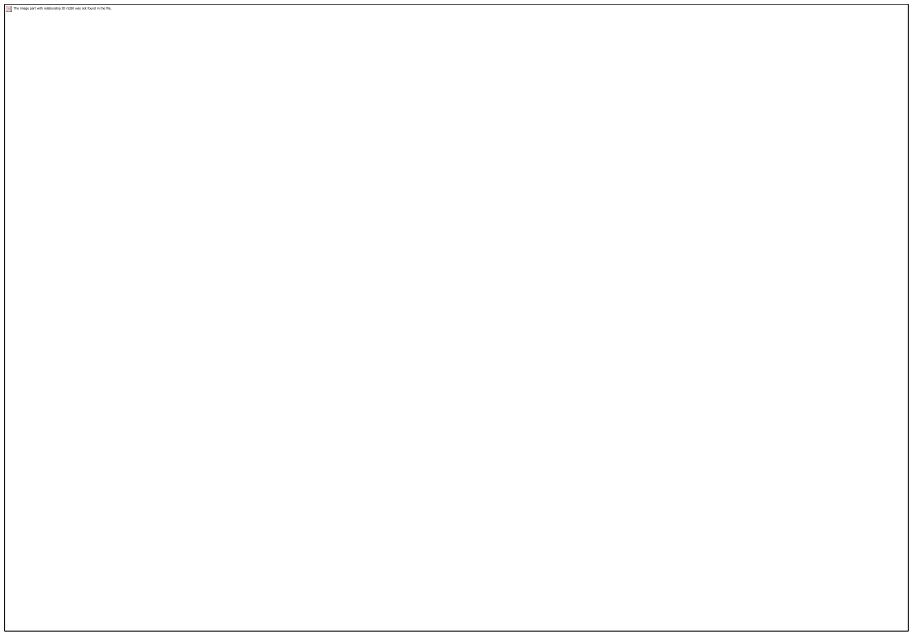

Figure 4.13: The Blogger Website

At the Blogger website, the students need to sign in using the same email address and password to their email account. Once they successfully sign in into Blogger account, the dashboard page will appear. Dashboard is the place where they can manage the post either to post new entry or edit their previous post.

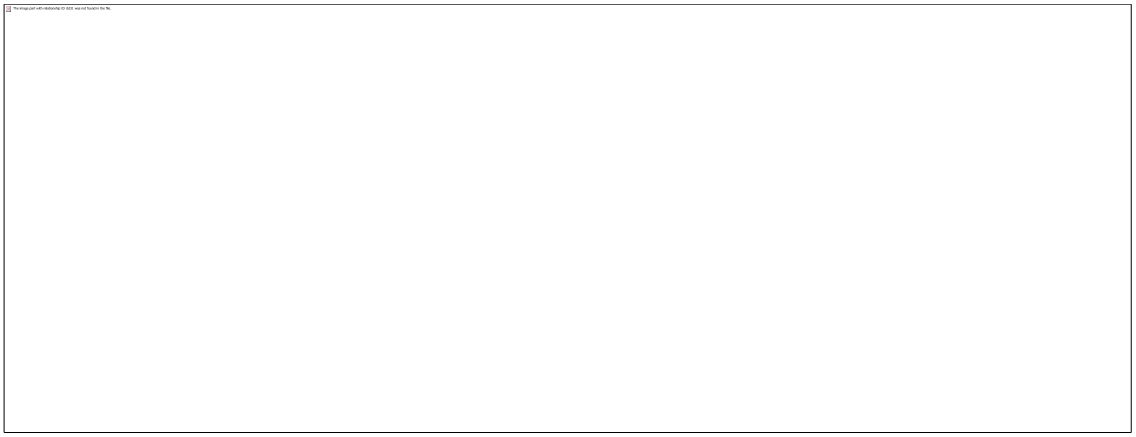

Figure 4.14: Interface of Blog Dashboard

Once the students successfully access the blog, they could be one of the authors of UTM Grid Blog. In the blog, the students are able to post their own entry as well as drop comments on the entries available in the blog from others. This is where the discussion among members of the group takes place.

4.2.15 Evaluation

After delivery, the effectiveness of the blog is evaluated. The evaluation phase consists of two parts which is formative and summative. Formative evaluation is present in need analysis and pilot study phase. Summative evaluation consists of analysis from the blog providing opportunities for feedback from the users on the group work activity.

Table 4.3: Template for Summative Evaluation

Category	Subcategory	Definition/Properties	Coding example
Category 1	Subcategory 1		-
	Subcategory 2		-
	Subcategory 3		-
	Subcategory 4		-
Category 2	Subcategory 1		-
	Subcategory 2		-
	Subcategory 3		-
Category 3	Subcategory 1		-
	Subcategory 2		-

Table 4.3 shows the template used to analyze the data collected from the blog consist of category, subcategory, definition or properties and coding example. It uses the same method as in need analysis to analyze the data collected.

4.3 Summary

Development phase is very crucial in developing a learning material such as grid portal because it requires a lot of focus and emphasis in all aspects. However, a rigorous planning as well as follow the strategy that was set to will guide the developer through out the process. Besides that, it would also produce a good quality and attractive material at the end of the process.

CHAPTER 5

DATA ANALYSIS AND RESULTS

5.9 Introduction

Data analysis in qualitative research involves summarizing data in a dependable and accurate manner. It is the presentation of the findings of the study in a manner that has an air of undeniability (Gay, 2009). Researcher performs the data analysis to get in depth understanding and find the meaning of the data. This chapter discussed further the result obtained from the study consists of the need analysis and the data collected from discussion in Grid Portal Blog.

5.10 Need Analysis

Followings are the results of need analysis that have been obtained. The data collected are divided into several categories and subcategories for more details.

Table 5.1: Open Coding for Question 1

Category	Subcategory	Properties/Definition	Coding example
Cooperation and collaboration	Learning	Cooperative and collaborative learning are instructional contexts in which peers work together on a learning task, with the goal of all participants benefiting from the interaction. Therefore, cooperation and collaborative in learning means students could share their knowledge, ideas as well as problems within group members. Students with better understanding could teach and share their knowledge with other group members. Students also could criticize their work for improvement and produce a good quality product.	Chung Pei - all the group members can learn from each other while searching for information and using different techniques to produce an assignment Fatima Ria - members who are good/creative can help the weaker ones Jolene - Group work is about learning together, one must not be selfish Mubina - Some of us understand things better and faster than the others. So through group work we can help each others

			Muni - Therefore with the help from my group I will be able to learn more and do the assignment well Ng Seiw Fong - Group work encourage co-operation learning. We can take the chance to learn from one another. Nirdawati - Working in group for this course after me to learn more from my friends Nurul Suhaili - I can learn many things when working in group because we can discuss and gain knowledge among us
	Critic		Nurul Farah - lists of idea can be shared and critized,

			which lead to the development of good works Nurul Izyan - students can criticise their work together (look at identify/the weaknesses together)
	Ideas		Bibiana - Can share ideas especially when you design or develop courseware Chong Wei Keat - Good and strong idea Chung pei - I believe that more ideas given by group members can produce a better product Everlyn - It promotes ideas as we can discuss our opinions and share problems and solution.

			Fatima Ria - Members can help each other and more idea can be generated from different brains Goa - more people can contribute, more idea, more interesting and more challenging Marione - With the combination of interesting ideas and design, a group can be capable to produce an impressive product. Mubina - it combine different idea from different people Nurul Farah - lists of idea can be shared and critized, which lead to the development of good works

			Nurul Izyan - through groupwork, more ideas can be combined Student 1 - student can share their ideas, opinions and thoughts
	Sharing		Muni - group work will allow me and my group to discuss and share our problems Nurhidayah - group work can make us perform better because of we are able to ask and share the information or knowledge from others.
Support	Motivation	Peer support groups can help students create a healthy social responsibility commitment to get work done. In group work, group members provide	Mohd Sazwan - this is a good situation where people who are lazy become hardworking after being push and

		each other with various types of help, motivation, listening to and accepting others' experiences which lead to effective performance.	scold by the group members Nirdawati - Give myself a motivation to look, search and finish the tasks that being assigned.
	Interaction		Chung Pei - all group members can interact with each other and cooperate to accomplish the assignment
	Effective and productive		Mawaddah - I can work better in group and become more effective and productive in group Siti Patimah - having a group work in this course can help students to work more effectively
Task distribution	Less workload	Task distribution is very crucial in group work. An equal distribution of task among group	Fatima Ria - Task/assignments can be done easily because members

		members will decrease the workload and reduce the burden of the students. An equal task distribution might less the pressure of the students as well.	can devide the tasks Goa - I think group work is good in a sense that many people make work light Jolene - Works are able to be divided. Therefore our workload will be lesser. Marione - Being in a group for this course assignment help to lighten our burden as a student. Mubina - it is also helps to reduce the burden of the student Nurul Farah - learning in group would ease your workload. Nurul Falah - it will help to lessen our work by dividing our works

			equally
	Less pressure		<u>Chung Pei</u> - While working in a team, you'll feel less pressure because all the group members will share the burden together
Self management	Time and energy	Doing group work will indirectly develop self management of the students. Self management includes time management as well as enhances the soft skill.	<u>Muni</u> - It also save a lot of time and energy <u>Nurul Farah</u> - group work can reduce the time needed to finish/complete the assignment
	Soft skill		<u>Ng Seiw Fong</u> - as well as improve our social skills <u>Yeo</u> - self management and self improvement are considered importants.
Problem within group members	Communication	Group work does not escape from having problems. The common	<u>Jolene</u> - Sometimes group members do not

		problems faced in group work are communication and involvement of the group members whether active or passive.	communicate with each other.
	Inactive involvement		Jogina - However group work can be 'negative' if there is a passive member. He/she might not learn anything and depends too much on the others. Mohd Sazwan - There must be somebody that called 'parasite'. They just keep silent when the group is discussing over the meeting. They did not even contribute their idea or opinion. Student 1 - there might be students tend to be the 'passengers' in a group.
	Dominant involvement		Fatima Ria - Sometimes my friends (group

			members) tend to do something according to their wish. <u>Lio</u> - they have a dominant person & other just relay on them

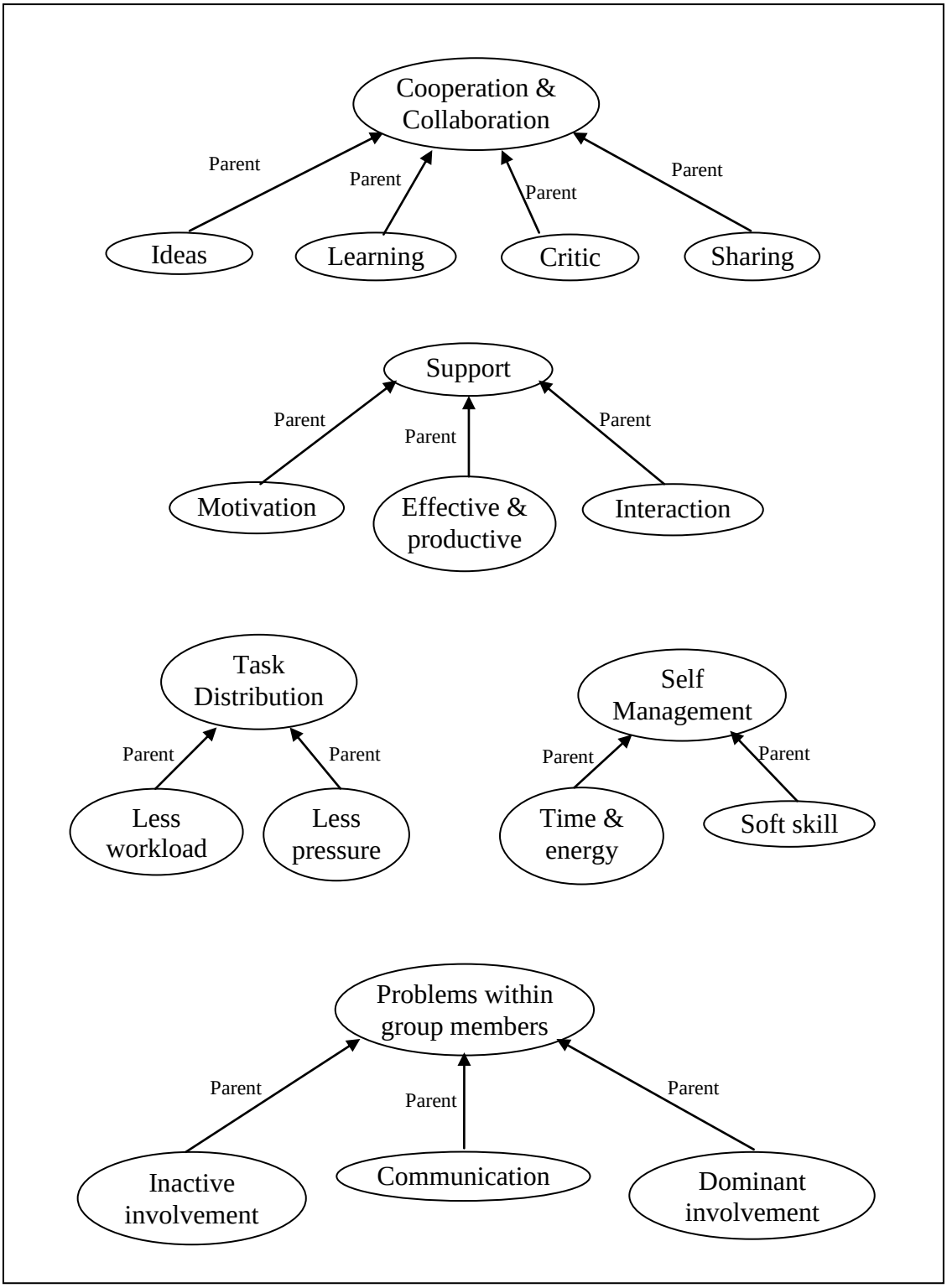

Figure 5.1: Categories and Subcategories for Question 1

The first question posed to students is “What are your thought about group work in this course?”. From the respond given by the students, five categories can be created which are cooperation and collaboration, support, task distribution, self management and problem within group members.

The researcher defined cooperative and collaborative for the first category as instructional contexts in which peers work together on a learning task, with the goal of all participants benefiting from the interaction. Therefore, cooperation and collaborative in learning means students could share their knowledge, ideas as well as problems within group members. Students with better understanding could teach and share their knowledge with other group members. Students also could criticize their work for improvement and produce a good quality product.

From the definition, cooperation and collaboration category was divided into four subcategories which are learning, critic, ideas and sharing. Most of the students said that group work is about sharing ideas among group members. They believe that each person contributes to different ideas which results to better and impressive product. This is followed by learning together with group members as well as they could learn more from their group members. Besides that, the critic from other group members could make them identify their weaknesses which lead to development of excellent group work. In group work also, students could share problems together as well as sharing information or knowledge from others. Therefore they can perform better for the project or assignment.

Support category is defined as peer support groups can help students create a healthy social responsibility commitment to get work done. In group work, group

member provides each other with various types of help, motivation, listening to and accepting others' experiences which lead to effective performance.

Support is divided into three subcategories which are motivation, interaction, and effective and productive. Students claim that they feel more motivated to do the task when working in group. Besides that, they can interact with each other to accomplish the assignment. Some of the students also feel that they can work better, more effective and productive in group.

The third category is task distributions which very crucial in group work. An equal distribution of task among group members will decrease the workload and reduce the burden of the students. An equal task distribution might less the pressure of the students as well. Most students said that group work will reduce the workload because they can divide the task among group members. When the task is distributed equally among group members, it will automatically less the pressure at the same time.

Next category is self management, which is divided into two subcategories; time and energy as well as soft skill. Doing group work will indirectly develop self management of the students. Self management includes time management as well as enhances the soft skill. Students believed that by doing task in group, they can reduce the time to complete the assignment. They also can improve their soft skill such as social skills.

Besides positive feedback in doing group work, there is also disadvantage of group work. The final category is problems within group members which includes communication, inactive and dominant involvement. There also situation where group members do not communicate with each other. In addition, among the group

members there might be students tend to be passenger and do not contribute in the discussion. In contrast, there might be students that play as dominant and do something according to their wish.

Table 5.2: Open Coding for Question 2

Category	Subcategory	Properties/Definition	Coding example
Like	Cooperate and collaborate	Some students like to do task in group work because of several benefits. Some of the benefits are they can cooperate doing the task, share ideas, get support from other group members, able to increase their soft skills and also divide work equally.	Bibiana - can share ideas Diyana - I need group member to support me doing group work and share ideas and understanding as well Jolene - able to do things together - able to exchange ideas and opinions Lyeyana - help us in things that we don't understand Mawaddah - members of the group might have different skills of creativity and each

			can tackle different area. Muni - allow me to share my thought and work along with my friends Nurhidayah - help me to understand better Nurul Izyan - can coorperate with each other Yuzaimi - can exchange ideas towards the task given
	Support		Everlyn - supportive and have the same shedule as me Jogina - support each other well until given project is done on time given Nurhidayah - very good to enhance the learning process

	Soft skill		Goa - it give me an opportunity to work with many people Lio - working with people sometimes help broden our experinces & view as we can learn from them Marione - a very good opportunity to improve my communicating skill and social skills among my friends Mubina - we need to learn to cooperate with people even with the people that we did not like. its one of the important softskills Yeo - become more mature in deal

			problems which is unexpectable and unpredictable Yuzaimi - provide good communication among students
	Product/ assignment		Fatima Ria - Completing a task/assignment in a group is faster, easier and more creative
	Task distribution		Nurul Farah - group work do ease my workload
Dislike	Group members contribution/ involvement	Most of the students do not like to do group work due to the problems with group members. Some of the group members may give less contribution and do not give full cooperation to the group.	Chung Pei - couldn't find a suitable person to be my group member - group members do not give the commitment and contribution that I need in doing the assignment Eliyana - If I get passangers in my group

			Goa - no cooperation among group members Nurhidayah - we still have sleeping partners Siti Patimah - the kind of that always want to do task given at the last minutes and delayed work till the last moment

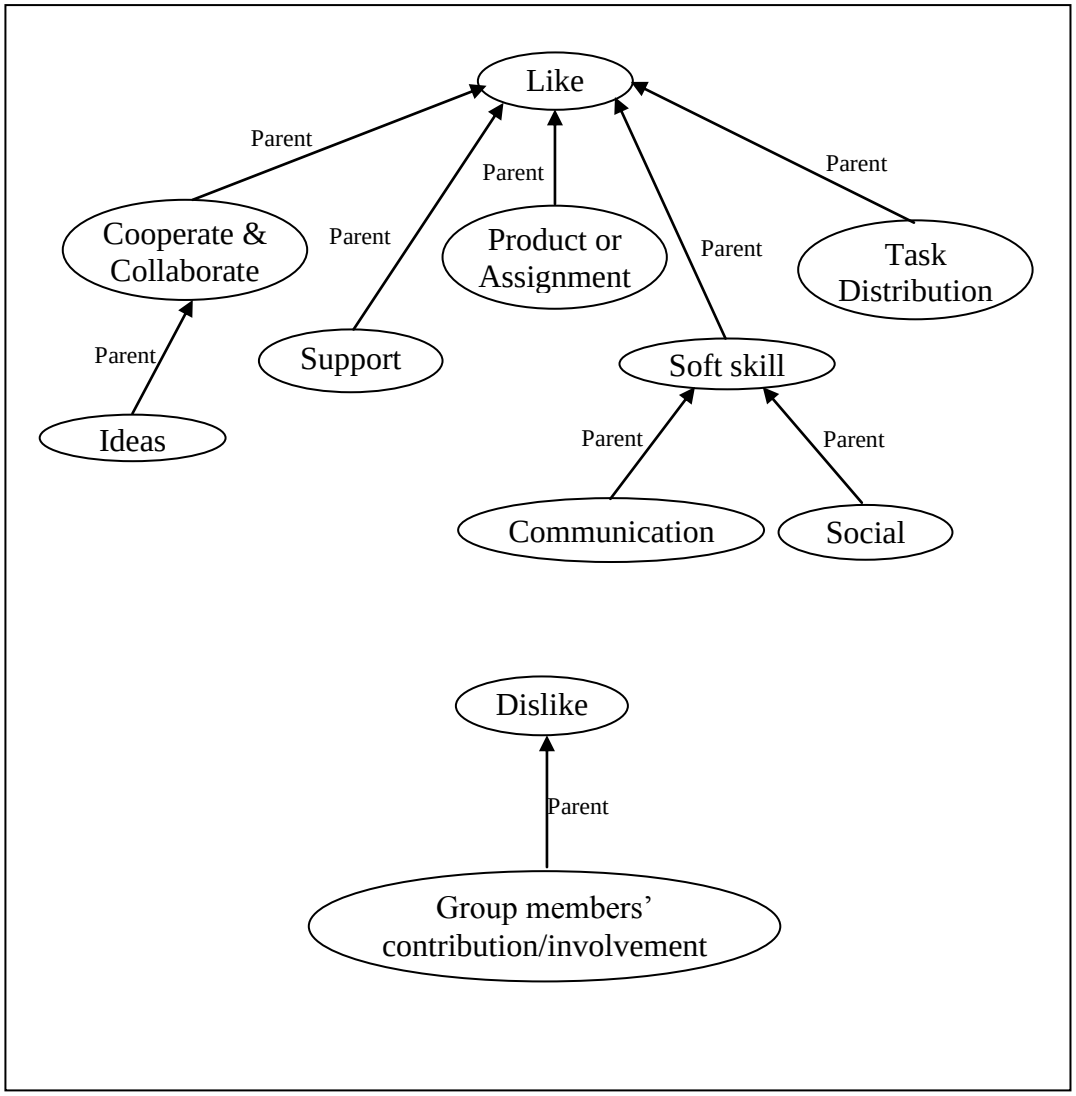

Figure 5.2: Categories and Subcategories for Question 2

Second question posted to the students is "Do you 'hate' Group work?". From the respond given by the students, it can be divided into two categories which are like and dislike. Most students like group work but there are also do not like group work for certain reasons.

Five subcategories have been included in like category. These subcategories are cooperation and collaboration, support, soft skill, product or assignment and task

distribution. In collaboration and collaboration subcategory, students like group work because they can share ideas and thoughts with others and they can work along together with friends. Besides, each group members might have different skills of creativity; therefore each of them can tackle different areas.

Besides that, when doing task in group, group members could support one another until the given task is done on time provided. In addition, group work as well could improve soft skill especially in communication with other people. They also can learn in dealing the unexpected and unpredictable problems that occur. Students also can complete their task faster, easier and more creative as the workload is less when doing group work.

On the other hand, some students dislike group work due to the problems with group members. Some of the group members may give low commitment, less contribution and do not give full cooperation to the group. Problem in group work also occur with the presence of passenger or sleeping partner.

Table 5.3: Open Coding for Question 3

Category	Subcategory	Properties/Definition	Coding example
Constrain	Time	Time constraint is the main problem faced by the students since everybody has their own activity and difficult to	Goa - hard to find the time to do the groupwork Jogina - group members are

		find the suitable time that fixed everybody. Besides, the task requires a lot of time to complete it.	very difficult to get to gether/meeting Lyeyana - the task requires a lot of time and we don't have much time Mawaddah - Need to spend a lot of time for 'trial and error' session Mubina - did not have much time to practise the technique Nurul Izyan - hard to fix time for everyone to be free Nurul Falah - Time constrain - there are too many things going on in the same time
Skill and knowledge	Lack of knowledge / understanding the task	Students have not as much of knowledge and skills using the software. They also difficult to understand the task	Bibiana - lack of knowledge Chong Wei Keat - Low knowledge in doing graphic - Hard to

		given by the lecturer and lack of creativity.	understanding, recognise Chung Pei - not understand what does the assignment outline require us to do Lyeyana - i don't really understand the task Marione - i was a bit confused with the task Nurul Suhaili - Lack of knowledge Siti Patimah - lack of knowledge and interest
	Knowledge and Skill using Software		Chung Pei - do not know how to we the software Diyana - Hard to handle the program Eliyana - asused by my in using the software Fatima Ria - no so good in

			computer Jogina - lack of knowledge in using the software Diyana - Knowledge of the program too little! Marione - i do not have the enough amount of computer skills Mubina - in adding extra elements in our work Muni - not familiar with the program and the courseware Nirdawati - I have to do a lot af exercise to be familiar with the software Nurhidayah - not so good in the multimedia course and handling the

			software Nurul Farah - lack of skills in handling the software. Nurul Suhaili - Lack of skills Siti Patimah - do not familiar with the function on the software Student 1 - a lot of functions in photoshop that i am not familiar with and don't know how to use them Yuzaimi - not enough skills in using the software
	Creativity		Mawaddah - Lack of creativity Mubina - lacking of creativity Nurul Falah - not very creative person
Group members	Perception	Students have problem with group members in term of perception and	Nurul Izyan - Different members have different

		ideas which is different for everybody.	perceptions
	Clash of ideas		<u>Fatima Ria</u> - face problems like clash of ideas
Reference	Book	Lack of reference to refer to in order to complete the task.	<u>Mubina</u> - not enough book in the library to refered to

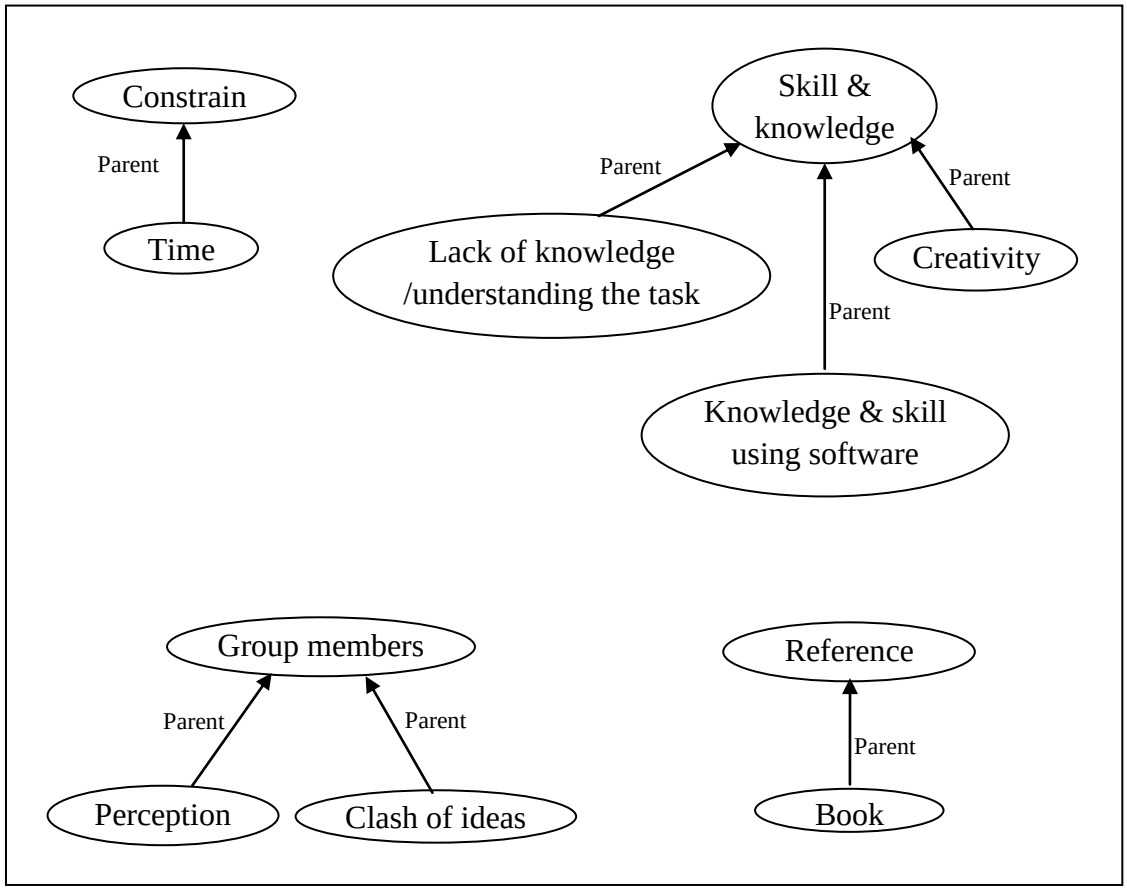

Figure 5.3: Categories and Subcategories for Question 3

The final question asked to the students is “List down your personal problem in designing the graphic assignment given?”. The personal problem could be in

technical or non-technical aspect. From the feedback, it can be divided into four categories which are constrain, skill and knowledge, group members and reference.

The first category which is constrain is directed to the time constrain. Time constraint is the main problem faced by the students since everybody has their own activity and difficult to find the suitable time that fixed everybody. Besides, the task especially in designing the graphic assignment requires a lot of time to complete it. The students also need to spend a lot of time for trial and error in using the software.

Next category is skill and knowledge which consist of knowledge of the task itself as well as knowledge and skill using the software. Lack of creativity moreover becomes a problem to the students in designing the graphic assignment. Majority of the students stated that the main problem faced is lack of knowledge and skill using software. They are not familiar with the software environment and do not know how to use the tools and function in the software.

Third category is problem with other group members in terms of perception and clash of ideas. This is because different person have different perception and ideas that will lead to misunderstandings and disagreements within group members. The fourth category is lack of reference materials in the resource centers.

Table 5.4: Open Coding for Suggestion

Category	**Properties/Definition**	**Coding example**
Online program	Online program as a medium for students to 'meet' their group member virtually and discuss as well as do the task through online.	Chung Pei - a forum in discussing on the assignment can be posted on the e-learning Everlyn - a program which allows real-time environment for users to login and edit their graphic assignments it would be much better Jogina - all the members in a group can meet online/discuss or if possible do our graphic artwork online together Nurul Falah - I wish there is a some kind of hand on activity online
Group member	How member of the group is selected and number of members for each group.	Eliyana - if i can pick my own group-mates, which shouldn"t exceed 4 Nurul Izyan - It is better for the students to choose their own group's members

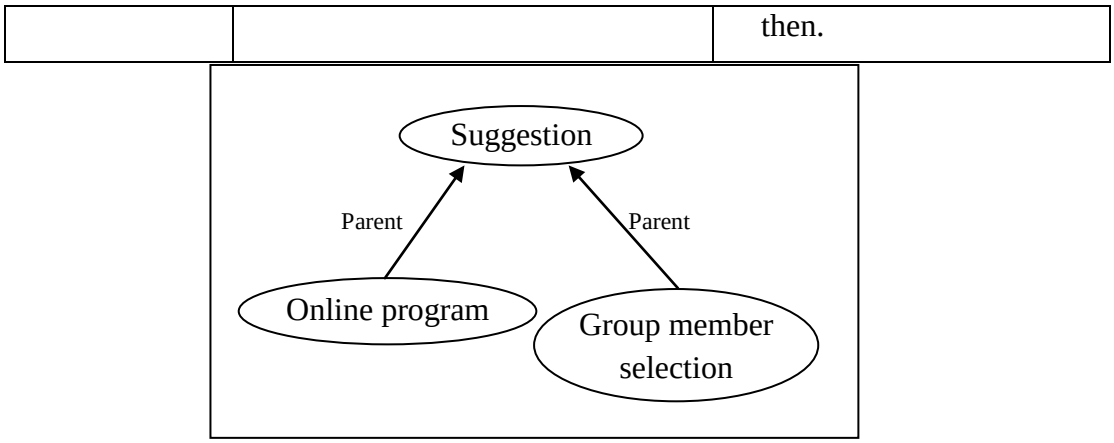

Figure 5.4: Categories for Suggestion

From the need analysis, some of the students come out with a few suggestions to overcome these problems. One of the suggestions is to have an online program as a medium for students to meet their group members virtually and discuss as well as do the tasks through online. Another suggestion is to choose their own group members and the numbers of members should not exceed four people per group.

According to the need analysis and suggestion from the students, there is a requirement for developing an online collaborative tool as proposed. The online collaborative tool could overcome the problems occur in group work such as time constrain, equal task distribution and so on.

5.11 **Analysis of Blog**

After the data collection process, the analysis process was performed on these data. This stage is considered the most important in determining the success of the proposed study (Dayang & Hafidz, 2009). The stages involve in qualitative data processing have been discussed in Chapter 3.

The first step which is transcribing the data into text form is skipped since the data is collected is originally in the text form. The data collected are organized and compiled by two methods; the date and thread. By organizing the data, the researcher would easily make a referral to the data.

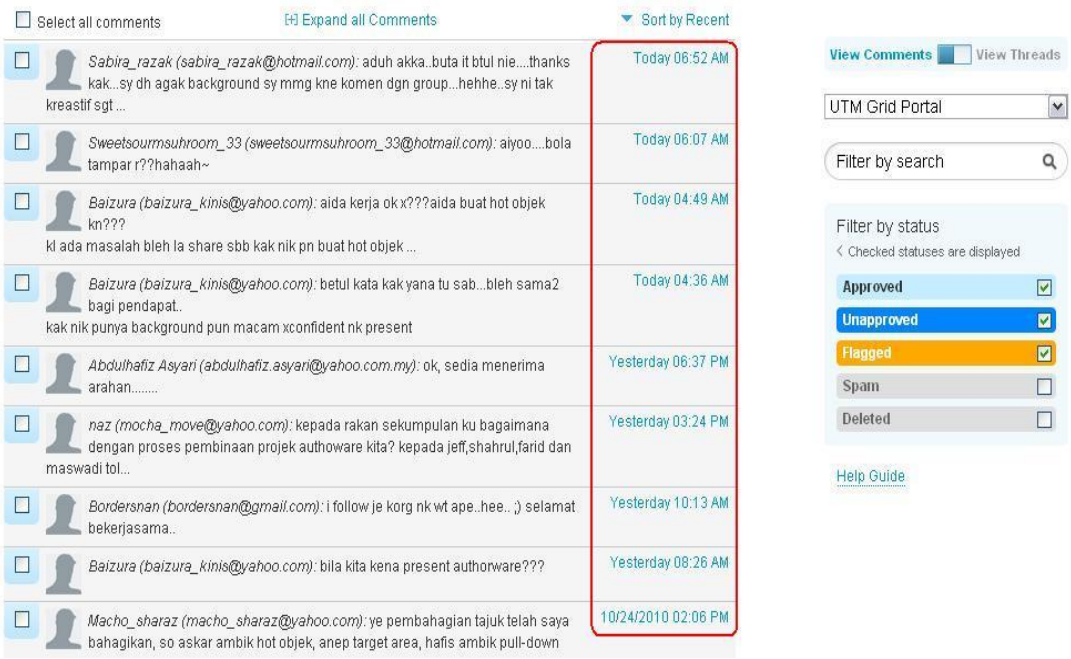

Figure 5.5: Example Data Organized by Date

Figure 5.5 shows how the data collected are organized by date. Researcher can choose to sort the date by recent or oldest. Therefore, researcher could easily acknowledge the presence of new comments posted by the respondents. Besides that, researcher also organized the data according to the thread as shown in Figure 4.9.

Figure 5.6: Example Data Organized by Thread

The researcher organized the data by thread because it easy to know where the comments given by the respondents are referred to. Therefore, the researcher would understand the data better and the next stage which is development of coding and category would be easier.

The next step is to develop categories from the collected data. For several, categories refer to encoding of data or index data (Dayang & Hafidz, 2009). Categories is develop to identify the theme or pattern such as ideas, concepts,

behavior, interaction, events, terms or expression used (Dayang & Hafidz, 2009). There are two ways to create categories which are pre-determined categories and emergent categories. In this study, both categories are used.

Initially, some categories were determined and the data related to the topics or categories were being searched. Some of the pre-determined categories are cooperative and collaborative in terms of sharing ideas, task distribution and support by giving motivation and showing respect. Then, from the data collected, several other categories appear in to be repeatedly in the data. Hence, new categories for the data defined in addition to the existing categories such as sharing problems, sharing information, opinion and so on.

Coding the material has the aim of categorizing and/or theory development (Flick, 2009). The data are divided into categories and subcategories as in Table 5.5 below to give a clearer picture.

Table 5.5: Open Coding

Category	Subcategory	Definition/Properties	Coding example
Cooperative & Collaborative	Sharing ideas	Students share ideas to develop the courseware from the beginning till the end of the process.	akina - "so, kalau korang ada idea, sila lah share ye.." Nur nadia Razali - "Pemilihan tajuk....biarla bersesuain dengan subjek pengajian kita...mudah sikit kita nak generated

			idea dan mudah juga untuk kita nak membina soalan soalan...” <u>uchuk orient</u> - “huhuhu... xde idea la...ayuh my group same2 generate idea....” <u>ct kadeja</u> - “klau nk bg idea pon oke gak”
	Sharing problems	Students share problems that occur during the development process.	<u>Iera</u> - “cme aku isau la background aku tak lawa la” <u>Zero</u> - “Guys, sapa yang dah pakar dalam skill target area?? meh la sama2 share, kawe dok buat nie tok sih jadi” <u>Iera</u> - “kenapa saya letak suara....screen yang lain tak blh nak run....blh tlg x” <u>Aida</u> - “mcmne nak bt ni??xpaham..????” <u>Baizura</u> - “nk tanya hot objek kena

			letak time dan tries jgk ker...” sabira - “nape i letak try limit...2 kali tapi tak blh jugak...dia kasi respon sekali jer aw” Feng12 - izit any problem if put TotalCorrect at the end of the Question?? confuse bout it....
	Sharing information	Additional information from other sources such as internet, books, articles apart from what they learn in class. The information is very useful to the students and their other group members in completing the task.	Zero - “well ni some information yg aku dapat from you tube tapi bahasa thai la pandai2 la korang nak follow ahaha http://www.youtube.com/watch?v=rUAP88s2cJo” Marianie - “mari kita berkongsi ilmu.....”
	Opinion & suggestion	Students ask for opinion and suggestion from peers and at the same time giving theirs to others.	ijat - “BERI CADANGAN?” Abdulhafiz Asyari - “kita nak pilih ape ye...??????ada cadangan x ??????” ijat

			- “tajuk sukan la ke?” Sweetsourmushroom_33 - “x pyh semua soalan letak sound lo...i letak kt overall ~depan je..ok x?” Amendaqis - “kte mcm dah tau jer aper tajuk yg sesuai....bahan pon senang jer nk cri.....sume pon agk pakar lah dlm tjuk nie.....” Akina - “ct khadijah, zurina, feeda n noradibah agaknya kita wat tjuk berkaitan ngan sukan la...senang ckit kita nk cri info k... sukan hoki ke, netbol ke...badminton pun bole.. hehehe....atau ada cadangan dri ct, nk wat tjuk yg bersesuaian untuk kanak2....pada pndapat u all, mna yg korg nk....give ur opinion yer....heheh....” mar_jubd - “rsanya better kita buat kuiz or sesuatu yg berbentuk soalan supaya

			dapat menggunakan semua yg telah kita belajar sprti hot spot, soalan random dan mcm2 lgi...” Baizura - “bleh sama2 bagi pendapat..”
Support	Motivation	Students motivate and give support to other group members to do the task. This might rise up their spirit in completing the assignment given although it is difficult.	Nur nadia Razali - “selamat menyiap kan tugasan yang perlukan banyak idea untuk diperah..” Nur nadia Razali - “SELAMAT BERUSAHA SEMUA.....” Nor Anis Razak - “selamat berdiskusi semua!!!!” HAVE FUN !!!(^_^) naz - “tolong ingat-ingat kan rakan yang lain ok.” Feng12 - “kawan2...buat yang terbaik ya...i will try my best to do the text entry...”

			Baizura - "sab,mei jing ,pei shien,azham...cayok...cayok.." Aruna - To all my team mbers....dalimah, salfarina, iada, robin and myself..caiyok2 for our project... mar_jubd - to all my member, lets do our job...:) *nik* - "kepada rakan-rakan seperjuangan...buat assignment leklok...fokus dan disiplin asas kejayaan..." *Mar* - "jom rkan2...siapkan assgmnt kita..." *Nur nadia* - "selamat menyiapkan projek....." *Nur nadia* - "semoga u all semua berjaya siapkan projek ni dengan lancarnya dan dengan

			sepurna...amin.....” Baizura - “kl ada masalah bleh la share sbb kak nik pn buat hot objek ...”
	Showing respect & listen others opinion	Students listen and respects others opinion and take it as positive feedback.	Sabira - “thanks kak...” Abdulhafidz - “ok, sedia menerima arahan.....” Baizura - “betul gak tu...pakai satu sound kat depan sampai tamaat...” Sabira - “tak pe la...i setuju la kita letak satu sound untuk semua screen okey”
	Update progress	Every student keeps on updating the progress of the project with group members. So, they will know if any problem occurs, how the condition of other group members is, how much work has been completed and so on.	naz - “projek dah 30%” Mohdfaridnazmi - “kerja kita dah nak siap dah tggl lg skit je ni.....” Baizura - “hot objek macam mana??? ada kn betulkn ker???” Baizura

			- “kawan-kawan kerja kita brapa % agy nk complik???” *sabira* - “ape ctr projek skrg nie wei” Naz - “kepada jeff,shahrul,farid dan maswadi tolong update kan segala perkembangan projek kita di UTM grid ini ok” Naz - “kepada rakan-rakan ku...adakah bahagian-bahagian kamu sudah disiapkan...tolong updatekn perkembangan nya ok.....”
	Concern	Students concern about the development of project by asking the group members’ situation, problem and so on.	$iL3nt _WorLd - “sab,kak nik,azaham,leaf shien..project ok x??ade ape mslh?” Baizura - “kalu ada pape yang ingin dibetulkn jgn lupa bagitahu....” *nik* - “sahabat-sahabat...projek

			korang camner?” Naz - “kepada rakan sekumpulan ku bagaimana dengan proses pembinaan projek authoware kita?” Baizura - “aida kerja ok x???aida buat hot objek kn???”
Task Distribution	Less workload	Students distribute task equally among group members.	Akina - “kte akan bahagikan banyak kerja” mar - “nnt kita bicang bahagian mna setiap org kena buat...k....ASAP...” Amendaqis - “then kte bahagi kn kejer k” Macho_sharaz - “ye pembahagian tajuk telah saya bahagikan, so askar ambik hot objek, anep target area, hafis ambik pull-down menu, ijat hot spot, n aku(razmi) akan buat montaj, text entry, dan button...”

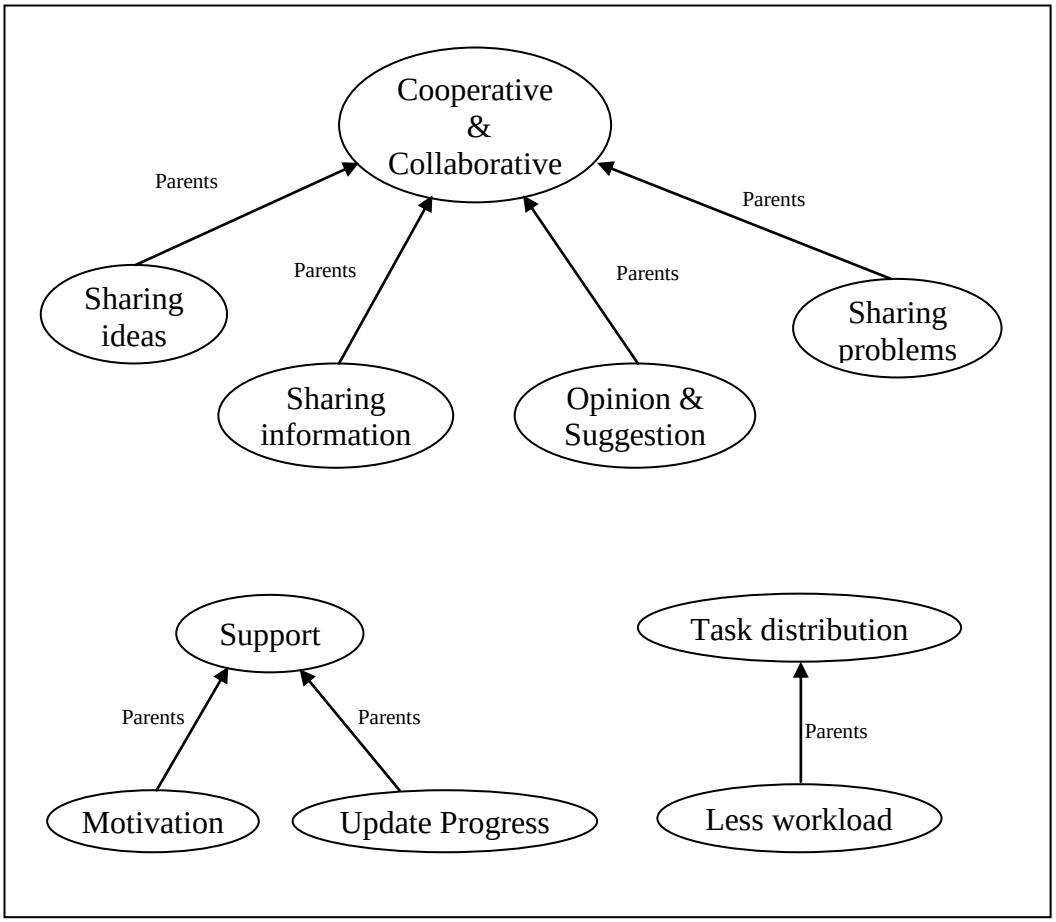

Figure 5.7: Categories and Subcategories for the Data

In general, the data are divided into three categories which are cooperative and collaborative, support and task distribution. Then, each category is divided into several subcategories to get detail and more accurate categories for the collected data.

The first category is the cooperative and collaborative which is divided into four subcategories. These subcategories are sharing ideas, sharing problems, sharing

information, and opinion and suggestion. In the sharing idea subcategory, researcher wants to know if the sharing ideas activity occurs in the group work. So, it is defined as students share ideas to develop the courseware from the beginning till the end of the process. From the data collected, the students ask other group members to share ideas as well as generate ideas together.

Second subcategory for cooperative and collaborative category is sharing problems. Researcher defined this subcategory as students share their problems that occur along the development process. Sharing problems with other group members will lighten the burden of the students. When someone stuck with a problem especially in using software, they will unable to continue the work. Sharing problem with other group members is one of the easiest and fastest ways to solve the problem because each member has their own expertise. From the data collected, the students will share problems with group members when they face problems using the software during the courseware development process.

Third subcategory is sharing information. researcher wants to know whether there are other additional information from other sources apart from what they had learn in class such as internet, books, articles and so on. The information and knowledge are very useful in order to complete the task as what they learn in class is not enough especially in using software. From the data, the student share link with others on a video from YouTube website which related to their task.

The final subcategory for cooperative and collaborative is opinion and suggestion. Opinion and suggestion are combined in one category because they relate one another. The students ask for opinion and suggestion from peers and giving theirs to others at the same time. This subcategory; opinion suits one of the

characteristics of adult learners. According to Wynne (2010), adults have established opinions, values and beliefs which have been built up over time and arrived at following experience of families, relationships, work, community, politics, etc. These views cannot be dismissed and must be respected. This could be seen from the data where some of the students ask for other group members' opinion on their suggestion for the project. In the suggestion, they come out with reasons and relevance of the suggestion given.

The second category; support is divided into four subcategories which are motivation, showing respect and listen to others opinion, update progress as well as concern. According to Wynne (2010), adults are intrinsically motivated and learners increase their effort when motivated by a need, an interest, or a desire to learn. However, motivation and support by other group members in group work might rise up their spirit and be more motivated to complete the difficult task. From the data collected, most of the students give loads of motivation and support one another. Furthermore, the students also encourage their peers and themselves as well to accomplish the task given.

Second subcategory for support is showing respect and listen others opinion. As do all learners, adults need to be shown respect (Lieb, 1991). These adults should be allowed to voice their opinions freely in class. In this study, students listen and respects others opinion and take it positively. By showing respect, other group members will feel comfortable to work together and give full cooperation that will lead to more conducive working environment.

Next subcategory included in support is update progress. Every students keep on updating the progress of the project with group members. So they will

know if any problem occurs, how the condition of other group member is, how much work have been done and so on. From the data collected, the students always seek for update from other group members so that they can keep track on the task development.

The last subcategory for support is concern. The students are very concern about the development of the project by asking the current situation, problem faced and so on from other group members. They also remind the group members to tell if there are things that need to be corrected, modified and done.

The third category formed from the data is task distribution. Task distribution is very crucial in group work as the students should distribute the task equally among group members. A subcategory is created for task distribution which is less workload. When a bunch of work is divide equally, the workload will be less and automatically ease the burden. From the data collected, it can be seen that the students do divide the task among group members.

5.12 **Conclusion**

Data analysis and interpretation are critical steps in the research process that require the researcher both to know and to understand the data (Gay, 2009). From the data analysis of this research, it helps researcher loads in understanding the study in depth. By analyzing the data, the researcher will be able to answer the questions in terms of the implications of the findings.

CHAPTER 6

DISCUSSION, CONCLUSION & RECOMMENDATION

6.11 Introduction

This chapter discussed further the need analysis and analysis of blog discussion from the results obtained. Then, the researcher made conclusion for the overall study and relate it to the objectives. Finally, some recommendations for future research were made.

6.12 Discussion

6.2.5 Discussion on Need Analysis

Need analysis was analyzed based on the three questions posted to target participants in order to find out characteristics, their experience working in team

and their personal problems in conventional authoring activities environment. The three questions posted were:

1. What are your thoughts about group work in this course?
2. Do you “hate” group work?
3. List down your personal problems in designing the graphic assignment and authoring project given.

From the first question, researcher wanted to know the students thought about group work in the course. From the feedback given, five categories were created to represent their thoughts on group work. These categories include cooperation and collaboration, support, task distribution, self management and problem within group members.

In cooperation and collaboration category, students believed that they can work and learn together from other group members. Most of the students said that group work is about sharing ideas among group members. According to Damon & Phelps (1989), peer collaboration where students share ideas to jointly solve the task is one of the peers learning that characterized by the type of engagement that is fostered. Besides that, in group work activity they could share problems regarding the task given as well as sharing information and knowledge.

Support category stated that peer support can help students create a healthy social responsibility commitment to get work done by giving motivation and interaction between each other. Students felt more motivated in completing the task and they could work in more effective and productive when working in group. Besides that, some students felt that working in group will develop self management as well as enhance the soft skill. According to Educational Broadcasting Corporation (2004), mixed-skill groups can be especially helpful to students in developing their social abilities.

The very crucial element in work group is task distributions. Equal task distribution will reduce the workload as well as ease the burden of the students. In addition, doing work in

group also is time saving as they could complete the task given in within a shorter period. Therefore, the collaborative approach to teaching and learning supported by electronic classroom can support a variety of topics and areas within a short period of time (Koschmann, 1992 as cited in Noriah *et al*., 2002).

The disadvantage of group work is the problems within group members. Less communication, inactive and dominant involvements are some examples of problems occur within the group members.

The second question was posted to identify whether the students like or not doing group work. Most of the students like the group work however there are also a number of students who do not like group work. Students like group work because they could support one another, share ideas and thoughts as well as complete the task faster, easier and more creative. On the other hand, some students dislike group work due to problems with group members such as low commitment and contribution as well as less cooperation.

Lastly, researcher wanted to know the problem students faced in designing the graphic assignment. One of the problem faced by students was time constraint in completing the task since everybody have their own activity plus the task in designing software requires lots of time. Another problem occurred was lack of skills in using the software and lack of creativity. Sometimes different person have different idea and this might lead to misunderstanding and disagreement within group members. Conflict in group work can also arise from personal issues such as some members not completing the task given, or disagreement over intellectual interpretation of some themes being discussed in the group (Noriah *et al*, 2002).

Besides respond to the questions given, the students come out with some suggestion as well. One of the suggestions was to have an online program as a medium for students to meet their group members virtually, make discussion and do the tasks through online. The students also requested to choose their own group members the numbers of members should not exceed four people per group. Teams were allowed to select their own members for a number

of reasons. Trust within a team improves the likelihood of success (Jarvenpaa *et al.*, 1998 as cited in Alexander, 2004).

6.2.6 Discussion on Analysis of Blog

Data collected from blog was based on the discussions of the students with their group members in the UTM Grid Blog on the group assignments. The data collected can be divided into three categories which are cooperative and collaborative, support as well as task distributions.

The cooperative and collaborative category consists of sharing ideas, sharing information, opinion and suggestion, and sharing problems. From the students' discussion it can be seen that there was sharing ideas activity among students in group work. Besides, they also shared the problems occur during the development process with other group members especially problems in using the software. Then, other group members tried to help to overcome the problems. Collaborators engage in sharing, proposing, discussing, ratifying, and disseminating to create and maintain a common ground (Alexander, 2004 as cited in Moran, 2000)

The good part in collaborative learning activity was the students shared any additional information related to the task with group members such as link to other webpage, video and so on that might be useful in completing the task. Each student can exchange information on research design with others using computer mediated communication, thereby shortening the time needed to accumulate the different examples (Noriah, Siti Rahayah, Rosseni & Aidah, 2002). Furthermore, group work allowed the students expressed their opinion and give suggestion to other group members.

Next, students gave support to peers by motivating them with words of encouragement and enthusiasm. The motivation could rise up their spirit and increase their effort in doing the task. Furthermore, the interaction provides students with the synergy and motivation to excel (Alexander, 2004 as cited in Leidner & Jarvenpaa, 1995).

"As for team spirit, they experienced a sense of accomplishment and well-being. Their motivation was very high. They had mutual respect for each other's capabilities and strengths as they had worked together as a team in the classroom before." (Raja Maznah Raja Hussain, 2004)

The students also showed respect to others opinion and take it positively where it established an essential working environment. Collaborative activities are both socially and emotionally demanding and most often require students not only to articulate their own points of view but also to listen to the views of others (Noriah *et al*, 2002). The students also updated the current progress of their project in the discussion.

Finally, task distribution is very crucial in group work. From the data collected, the students did divide the task equally among group members. Cooperation is associated with tasks that are fairly structured and this makes it relatively easy for group members to divide up the work and to work on sections separately (Alexander, 2004 as cited in Strijbos, Martens, & Jochems, 2004). Task distribution caused less workload and eased the burden of the students.

6.13 Conclusion

The project has presented a collaborative tool and an authoring environment which is the UTM Grid Portal using the grid portal technology with high performance computing platform supporting Web Based Education (WBE) and has been implemented to the users through blog. This project has been completed successfully fulfilling the objectives and scope specified.

From the need analysis, researcher could identify student's difficulties in completion their authoring activity or collaborative work in conventional environment. According to the data collected, some of the problems faced by the students in authoring activity are time constraint, lack of skills using the software and clash of ideas within group members. The results also show the need of having an online program as a medium for students to meet their group members virtually, make discussion and do the tasks through online. Therefore, by developing the UTM Grid Portal is the best solution to overcome the problems.

The grid portal overcome problems occur in group work especially in time constraint because students can do discussion in the blog with group members virtually without have to meet face-to-face at anytime. Besides, lecturer could monitor the students' job activity and performance through grid portal.

Finally, from the blog discussion researcher identified the activities that take place in the work group. According to the results obtained, students cooperate and collaborate with other group members by sharing ideas, sharing information, sharing problems on coursework as well as giving suggestion and opinion. Besides that, students show their support in the group work by motivating others with words of encouragements and update the project progress frequently. Furthermore, the students also do divide the task equally among group members.

The results show that the virtual group work activities obtained perform the criteria on group work activities in need analysis such as sharing ideas, task distribution, support and so on.

6.14 Limitation of Research

This research has several limitations that occur during the process. The limitations are:

1. Even though UTM Grid Portal is installed and deployed successfully, currently one grid portal admin can only access the portal. The implementation is not possible because of the Proxy server deployment and access permission denied from CICT, UTM because of security purpose.
2. The Blogger website has limitation in the setting where the students can read other group members discussion. Therefore, each group does not have privacy and might be reluctant to discuss in the blog as other group could read their discussion.

6.15 Recommendation for Future Research

This research could be extended to the following directions to for better performance and more effective usage. Some of the recommendations are:

1. To overcome the problem, the alternative way to implement grid portal is to link with MyREN Malaysia, which was advised by CICT UTM.
2. Search for another website which provide environment for discussion to replace Blogger website. The other website should provides setting to allows only the members of a group to enter the topic for his/her group discussion and restrict students from other group to enter the discussion forum. This will give privacy to the group to discuss on their project without interference from other parties.
3. Provide some tutorials in the Grid Portal on how to use the software. This is because one of the problems faced by the students in courseware development is lack of skills in using the software.

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