Flexible Process Support for Student Project Management

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Abstract

Student projects in higher education are used to help students prepare themselves for meeting the challenges they face in real world projects. However, the dynamic nature of a project had caused it to have ill-defined tasks during the planning process. The use of emails, face-to-face meetings and project reports to manage student projects do not appear efficient. The implementation of XCHIPS (a cooperative hypermedia system with flexible process support) in the EXTERNAL project has suggested that this system is able to provide efficient project management. This dissertation aims to answer the research question: “How a cooperative hypermedia based flexible process support approach is able to support project supervisors and students in managing student project”. A case study approach has been adopted to investigate this phenomenon. In order to provide compelling evidence to support the answer to our research question, data from different sources was collected. In addition, triangulation was used to increase the reliability of the study. Our findings from the case study demonstrated that the cooperative hypermedia based flexible process support approach can support project supervisors and students to create, monitor and adapt project plans cooperatively. Project supervisors and students can identify emerging problems from the project plan and discuss issues in project meetings. Furthermore, this approach also supports meeting process modifications and unplanned meeting process. Project meetings between project supervisors and students are facilitated by synchronous and asynchronous cooperation. Therefore, this approach provides flexible ways of solving emergent problems in a timely manner. No previous studies on using cooperative hypermedia based flexible process support in supporting student project management have been found. Therefore, this study can be taken as a pilot study that is able to provide invaluable knowledge to researchers who are interested in this field of study.
Declaration

In this dissertation, there is no portion of the work referred to in the dissertation has been submitted in support of an application for another degree or qualification of this or any other university or other institute of learning.

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Chapter 1: Introduction

Introduction and Problem Statement

In academic environment, student projects are used for learning and assessment. The main objective for educators is to provide and assess such projects. Another objective is to prepare students for the real world projects that they will encounter after graduation. The useful experiences that students gain from these projects will not only improve their technical skills but also non-technical skills such as inter-personal communication.

The dynamic nature of a project causes it to have not only well pre-defined tasks but also poorly defined or unstructured ones during the planning process. Therefore, in order to achieve project success, an improved appreciation of project management is essential (Munns, A.K. and Bjeirmi, B.F., 1996). Project management is the application of skills, tools and techniques to project activities in order to achieve a specific objective (PMI Standards Committee, 2000). The process of project management includes defining the requirements of the work, allocating the resources required, planning the execution of the work, monitoring the progress of the work and adjusting to deviations from the plan (Munns, A.K. and Bjeirmi, B.F., 1996).

Managing a student project is not an easy task for both the project supervisors and students. Most of the current project management software was not designed for the academic environment. Therefore, student projects are manage through different communication channels such as email, project reports and face-to-face meetings. Email is often used by the project supervisor to answer a student’s questions. Project reports display information about a student’s progress with respect to the project plan. Regular face-to-face meetings between a project supervisor and a student are conducted to discuss issues and review project progress. However, project supervisors rarely have the time to attend all the face-to-face meetings the students have requested because in a faculty they would be required to travel abroad to attend conferences and pay academic visits.
Chapter 1: Introduction

The drawbacks in using these communication channels are that they are unable to deal with changes effectively. As mentioned before, the dynamic nature of the project causes it to have ill-defined tasks during the planning process. These ill-defined tasks usually require refinement and change. These changes need to be accommodated by the project plan. The project plan therefore needs to be flexible. With the use of project reports, it is difficult to identify tasks that become affected once the changes are made elsewhere. Therefore, project plans are not able to help project supervisors and students in identifying problems that are liable to occur in the project.

With these challenges faced by the project supervisors and students, it is essential to have a project management tool that is able to provide flexible process support. Research on cooperative hypermedia systems have moved towards providing flexible process support. The cooperative hypermedia system, XCHIPS, is able to support cooperative tasks involving distributed teams, monitor task progress as well as modifying the underlying process models to adapt to the changing environment (Wang, W. et al., 2000). Its implementation in EXTERNAL project, an EU fifth framework project on information technology support for a new way of working, has provided positive results in supporting users to identify problems, their details and context, as well as make changes to the underlying process models to adapt to the changing environment (Wang, W. and Lillehagen, F., 2003). As a result of this, such a system could be a promising tool for efficient project management.
1.1 Scope for the Research Project

The purpose of this dissertation is to present a case study which explores the use of a cooperative hypermedia system with flexible process support in managing student's project. The study will investigate this phenomenon from two perspectives: the project supervisors and students.

Project management comprises five groups of processes (PMI Standards Committee, 2000):

1. **Initiating**
   Recognizing the project should begin and committing to do so. High level goals and objectives are properly defined and documented.

2. **Planning**
   Devising and maintaining a project plan to accomplish the goals and objectives of the project.

3. **Executing**
   Provide sufficient resources to carry out the plan.

4. **Controlling**
   Ensuring that the project objectives are met by monitoring and measuring progress and taking corrective action when necessary.

5. **Closing**
   Formalizing of the project and bring it to an orderly end.
Chapter 1: Introduction

Munns, A.K. and Bjeirmi, B.F. (1996) emphasized that project management is oriented towards planning and control. Therefore, this dissertation focuses on project planning and project control processes, assuming that a project is:

- Initiated with a well-defined goals and objectives.
- Resources that are required to perform student's project are provided.
- The project upon which the student is currently working is still on-going after the completion of this study.

In student projects, project planning processes includes: process tasks identification and project plan development. For controlling processes, these include monitoring project progress and solving emerging problems.

The tool that will be used to perform this study is called “PowerMeeting”. It is a cooperative hypermedia system which uses the concept of combining hypermedia-based process support with a shared hypermedia workspace. It is a Java-based follow-up system of XCHIPS (Wang, W. et al., 2000) which had been revised to tailor the needs of student project management. There are two changes made in this system, they are:

1. The use of Microsoft NetMeeting for audio conferencing has been replaced by Skype, a peer-to-peer internet telephony network.
2. Instead of TCP and UDP, the communication protocol has been changed to HTTP

The PowerMeeting system will be used throughout the duration of the study to investigate the use of a cooperative hypermedia system with flexible process support to support project supervisors and students in managing student projects.
1.2 Research Aim and Objectives

This research project aims to answer the following research question:

How a cooperative hypermedia based flexible process support system is able to support:
   a. A project supervisor in monitoring student projects?
   b. Students in project planning and monitoring?

In order to achieve the aim of this research project, the objectives of this research project are:

1. To identify a project supervisor's experiences and opinions in using a cooperative hypermedia based flexible process support system for monitoring student projects.

2. To identify students' experiences and opinions in using a cooperative hypermedia based flexible process support system for project planning and monitoring.

3. To identify the advantages and disadvantages of using a cooperative hypermedia based flexible process support system to support student project management.

1.3 Contribution of this Research Project

One of the important contributions of this research will make is that it will provide an empirical study on the use of a cooperative hypermedia system with flexible process support in supporting student project management. There have been a number of studies carried out to investigate the use of this approach in supporting business processes but it would appear that there have been no studies carried out in the context of supporting student project management. Therefore, this study can be seen as a pilot study that is able to provide invaluable knowledge to researchers on the use of cooperative hypermedia systems with flexible process support in student project management.
Another important contribution of this study is that it will provide an understanding of how a cooperative hypermedia system with flexible process support is able to support both the project supervisor and students in project planning and project control. Lessons learned from the study will be able to help researchers plan for a larger scale study on this topic. In addition, problems or limitations that are identified from this study can help researchers to improve their approach in conducting a larger scale study.

Finally, a set of social protocol have been identified for this study which will provide researchers with general rules to be followed when using the PowerMeeting system to perform a further larger scale study. Such protocols are able to keep researchers targeted on the participants of the study (Yin, R. K., 2003).

1.4 Outline of the Dissertation

Chapter 1: Introduction
Chapter 1 introduces the problem statement, aims and objectives of the study. It also describes the scope of the research and the contributions of this research project. This chapter concludes with a description of the structure of this dissertation.

Chapter 2: Background
Chapter 2 describes the background to the area of investigation. It includes a review of the literature on student project management, project management tools and on flexible support systems.

Chapter 3: Success Criteria
This chapter details all the research requirements that need to be fulfilled by a research project. In addition, the criteria related to these research requirements are also identified. This chapter will serve as a guideline for research design and implementation.
**Chapter 4: Design**

Chapter 4 is concerned with the design of the study. It includes research methodology, case study design, and data collection methods, procedure and data analysis techniques for quantitative and qualitative data. The research design described in this chapter is required to fulfil the success criteria mentioned in Chapter 3.

**Chapter 5: Realisation**

This chapter provides a detailed description of the case study that was carried out based on the research design described in Chapter 4. This included details about the participants of the study, case settings, procedures, and social protocol. Finally, observations made from the case settings will also be presented.

**Chapter 6: Results and Discussions**

Chapter 6 presents results and their supporting evidence gathered from the data source mentioned in Chapter 4. These results will be summarized with the main findings from the different sources of data.

**Chapter 7: Evaluation**

Chapter 7 contains an evaluation of the study including its approach. Therefore, this chapter will include:

1. Limitations identified from the case study.
2. An evaluation of the work that has been done against the success criteria defined in Chapter 3.

**Chapter 8: Conclusions and Further Work**

In this chapter, the conclusions of this study are presented and several recommendations are made to improve this research. Finally, a new area of investigation relative to the study is suggested.
Chapter 2: Background

Introduction

The objective of this chapter is to review the literature that is related to the area of this research. This chapter was divided into four sections. The first section refers to previous studies that conducted on student project management. In the second section, systems that have been developed to support project management in industry and academic environment will be discussed. The third section discussed previous attempts to apply flexible support to collaborative work and business processes, and finally a summary of this chapter will be provided.

2.1 Student Project Management

Team projects have become an essential part of college courses. These projects can help to provide students with practical experience with key project management activities. However, there are a number of problems that students faced in team projects. Some of these problems were highlighted by Pournaghshband, H. (1990) were poor communication among members, procrastination and lack of confidence. Solutions to these problems, as suggested by Pournaghshband, H. (1990) were to require the project team to prepare a brief description of all the goals of the project and establish deadlines for each task to be completed. This is to enable the instructor to review the documents, identify any disparities as well as monitor the progress of the project (Pournaghshband, H., 1990). Although the problems mentioned above applied to team projects, it is possible that individual student project could also face the same problems.

Tan, J. and Phillips, J. (2005) paper on project management in the academic environment is concerned with the management aspect of team projects. The paper stated that constant communication with the project supervisor is essential. Tan, J. and Phillips, J. (2005) had
suggested three channels of communication that should be used in project management. First, a web-based collaboration tool was used to post messages that are relevant to the project. Second, project teams are required to meet once a week to discuss milestones and progress. Finally, students are required to submit deliverable documents at the end of the course. One of the lessons learned from the study is that face-to-face project meetings may not be possible for students who are staying far away from school. Therefore, on-line meetings will be considered to better accommodate all students. Although the focus of this study does not involve the tools that support project management, it is able to provide us with a basis for understanding how student projects are manage in the academic environment.

In distance education, student projects will be managed differently compare to conventional classroom-based education. Since the team members and the instructor are not able to meet face-to-face, they require the use of web-based collaboration tools to make team work possible. Koppelman et al. (2000) study on team projects in distance education showed that multiple collaboration tools were used to support distributed team projects. In the study, project teams communicated through telephone conferencing and email. eRoom, a web-based collaborative workspace used by members of the distributed team, was used to shared documents. The project was completed within the schedule and positive feedback was received from the students and their instructor.

2.2 Project Management Tools

Communication, one of the most important knowledge areas in project management (PMI Standards Committee, 2000), remains a critical success factor in achieving project success. Some of the frequently used communication media in team projects are: e-mail, bulletin boards and instant messaging. Although these technologies are easily made available to users, they have some limitations which prevent effective communication among the team members. Galegher, J. and Kraut, R.E. (1990) pointed out that at certain stages of the project, it is often helpful to allow all members of the project team to view, to refer to and to manipulate a shared document or artefact. However, this is not possible with text-based
communication system such as e-mail. In addition, the lack of face-to-face contact could reduce an individual team member’s trust and commitment to the team which in turn will lead to poor team performance (Beise, C.M., 2004) but providing the technology to support face-to-face communication can be expensive (Galegher, J. and Kraut, R.E., 1990). Exchange of information between team members may seem to be sufficient by using computer-mediated communication (CMC) technology; however, due to their focus on communication, these systems do not support the group that tries to execute the task of the project (Haake, J.M. and Wang, W., 1997).

Version control systems such as CVS (Concurrent Version System) provides a central storage area to store a team’s work and a version control actions log which serve as a means for the instructor to monitor the contributions of the team members (Hartness, K.T.N., 2006). However, this system does not provide a comprehensive view of the overall progress of the team. Team progress can only be monitored manually and communication between team members can only achieved by using other communication systems. In addition, the system is not able to support cooperation between users for them to respond to any changes to the underlying task of the project.

A combination of workflow and collaboration tools to support student projects would seem to be useful. GradTools is an online collaboration and workflow tool developed by integrating workflow tools into an existing CLE (Collaboration and Learning Environment) in the University of Michigan (Lotia, M. B. and Teasley, S.D., 2005). It enables department staff to monitor student progress in their dissertation, provide students with process coordination support as well as the basic tools for communication and collaboration between students and department staff. GradTools is flexible in terms of supporting individual and informal parts of their work such as file storage, email notification of activity and threaded discussion (Lotia, M. B. and Teasley, S.D., 2005). However, the tool does not provide flexibility in terms of managing exceptional cases. Hence, students who are having problems with their research can only depend on other means of communication and face-to-face meetings.
Project management (PM) tools were developed to help project managers in resource management and project tasks planning. However, research has suggested that PM tools are not a complete solution in project management. Inconsistency between real tasks and the project plan can often be observed through overloaded resources and slipped deadlines (Bussler, C., 1998). This is because unexpected changes to the project plan have caused delays to the tasks. Making change which dynamically alters tasks in the project plan is one of the main issues in project management (Au, K.W.K. and Mann, T.M., 1999). Although there are times where this is unavoidable, careful consideration is essential to avoid affecting the progress of the project. Current PM tools have also treated project scheduling and resource allocation as separate problems despite the fact that they are highly interdependent (Chang, C.K. and Christensen, M., 1999). As a result of this, time spent on project scheduling and resource allocation tasks will increase due to this manual arrangement of resources on tasks in the project plan.

Early research on workflow management systems has always been criticized for its restrictive behaviour. This is because these systems require flexible communication systems to support organizational processes. This causes the users to decide on their own what to do next (Bernstein, A., 2000). Therefore, research on workflow management has put its focus on flexibility. In the early research on providing flexibility for workflow management systems, flexibility was categorize into two types, namely flexibility by selection and flexibility by adaptation (Heinl, P. et al., 1999). Heinl, P. et al. (1999) suggested that both categories of flexibility need to be included in a flexible workflow management application in order to allow the application to deal with orthogonal problems. Some of the workflow systems support exceptional handling. These systems have the ability to dynamically adapt to the changes in the process even though the process has begun its execution (Kammer, P.J. et al., 2000). However, exception needs to be identified by the team members before hand. Therefore, this may not be a complete solution to flexibility.

Both PM tools and workflow management systems are essential in project management. Bussler, C. (1998) explored the possibility of integrating PM tools with workflow
management systems to provide an environment where the planning and the execution tasks are consistent to each other. MILOS on the other hand is a tool which supports coordination of distributed software development teams by integrating project planning and workflow technologies over the Internet (Maurer, F. and Dellen, B., 2000). MILOS allows process changes on-the-fly and provides active support to the software development team. Work for Bussler, C. (1998) and MILOS both use the concept of integrating PM tools and workflow management systems to overcome the challenges faced by these tools by providing flexible process support. However, these systems lack support for cooperative tasks.

2.3 Flexible Support Systems

ConversationBuilder (CB) is a work support tool that provides flexible and active support for collaborative work activities (Kaplan, S.M. et al., 1992). The tool is used to provide support for thesis and paper writing activities in the University of Illinois. In order to provide flexible and active support for collaborative work activities, the tool was developed with three sets of facilities, they are:

- Facilities allowing users to work on, and relate among, arbitrary sets of activities.
- Group awareness.
- Other support facilities such as version control and email.

With these facilities, CB is able to provide flexible coordination and support on changing tasks. From the point of view of providing support for collaborative work in team projects, CB may seem to be a promising tool. However, from the project management point of view, the system lacks support for project planning and monitoring. Since all the actions a user can perform in CB are viewed as utterances in a conversation (Kaplan, S.M. et al., 1992), it is difficult for project team members to discuss milestones and monitor project progress. Furthermore, it is less effective to have discussions in text-based systems, because it is difficult to express certain details in text and may possibly lead to misunderstandings between group members.
Cooperative hypermedia systems are used to support project team members to share ideas or artefacts. Recent research on these systems has moved towards integrating cooperative hypermedia systems with process support in order to meet the needs of flexible process support. CHIPS (Cooperative Hypermedia Integrated with Process Support) uses cooperative hypermedia as a unifying representation of a shared information structure which provides support on process change, as well as developing emergent processes (Wang, W. and Haake, J.M., 2000). In addition, CHIPS also provides support for flexible coordination. CHIPS provides flexible coordination through shared hypermedia workspace and other cooperation features such as access control, concurrency control, group awareness, notifications and mediator agents (Wang, W. and Haake, J.M., 1998). Although the system provides a solution for the tailorability problem of groupware, it is not accessible through WWW.

XCHIPS (eXtensible Cooperative Hypermedia Integrated with Process Support) advances the feature of CHIPS by using advanced hypermedia structures and allows the system to be accessible through WWW (Wang, W. et al., 2000). Hence, the system is able to support cooperative tasks of distributed teams for creating and modifying project plans, resource assignments, monitoring progress of the project and carrying out the project tasks. XCHIPS has been implemented in EXTERNAL project. Feedback from users indicated that the hypermedia tool is able to help team members to identify problems, details and their context, as well as making changes to the underlying process models to fit the changing situations (Wang, W. and Lillehagen, F., 2003). The system provides shared workspaces to allow users to interact with each other while sharing their ideas. Hence, cooperative work execution between distributed team members is supported. The usage of CHIPS and XCHIPS has been studied in the context of providing business process support. However, the usage of these systems in the context of supporting student project management has not been discovered.
2.4 Summary

This chapter had reviewed the literature that is related to our area of investigation. The review had revealed the management aspect of student projects in the context of conventional classroom-based education and distance education. In addition, some of the limitations of previous attempts in developing project management tools to provide support in industry and in the academic environment have also been identified. Awareness of the management aspect of student projects had helped us to design the case study settings and procedures.
Chapter 3: Success Criteria

Introduction

The objective of this chapter is to identify the success criteria of this research project. These criteria serve as indicators to evaluate whether this research project is regarded as successful. In section 3.1, the research requirements that were obtained from literature sources will be discussed in detail. In section 3.2, the criteria related to the research requirements as suggested by literature and project supervisor of the author will be discussed.

3.1 Research Requirements

Research requirements are the prerequisites that are needed for the development of a good research project. It is sensible for a researcher to determine that the requirements be satisfied in the early stages of the research project (Sharp, J.A. and Howard, K., 1998). Therefore, research requirements should be clear in the mind of the researcher and determine what will be needed to meet these requirements. In order for this research project to be successful, some of the research requirements suggested by Sharp, J.A. and Howard, K. (1998) that should be met are as follows:

1. The Aim of the Research

   The aim of the research should be identified in the early stage of the research. The researcher always needs to have the research aim in mind and everything that is presented in the dissertation should be subordinated to the research aim.
Chapter 3: Success Criteria

2. Evidence of Awareness of the Literature
The researcher is required to review the literature which is linked to the study. The literature should be evaluated and critically analyzed in order to add knowledge in a given field.

3. Research Methodology
The researcher is required to identify a potential research methodology that is applicable to the research project and justify the reason for adopting it.

4. Analysis on Research Results
The completion of the data collection process will cause the researcher to possess a great amount of data. This data should be analyzed and present in a form which is consistent with the dissertation.

5. Evaluation of the Study
It is always sensible to provide reflections on the process/method involved in performing the study as well as the lessons learned from the approach taken to perform the study.

3.2 Success Criteria

The success of a research project requires researchers to satisfy the research requirements stated above (Sharp, J.A. and Howard, K., 1998). Therefore, based on these requirements, a list of evaluation criteria related to these requirements has been identified. The following are the criteria suggested by Sharp, J.A. and Howard, K. (1998) that should be met for a research project at Masters Level.
Chapter 3: Success Criteria

1. Provide evidence of an original investigation through
   - Clearly stated aims of the research and the context in which the research will be conducted.
   - Clearly stated research questions to be answered.

2. Provide evidence of a review of the literature related to the study including a critical analysis.

3. Ability to demonstrate understanding of appropriate research methodology by:
   - Providing a justification for the use of a specific research methodology.
   - Providing a justification for the use of multiple sources of data.
   - Clearly describing how the data is collected.

In addition to the criteria mentioned above, the following criteria were suggested by the author’s project supervisor.

4. Provide compelling evidence to support the answer to the research question. The data collected should be analyzed from two perspectives: project supervisors and students.

5. Clearly state the advantages and disadvantages of using the PowerMeeting system for student project management.

6. The results generated from qualitative analysis should corroborate results generated from quantitative analysis.

7. Provide reflections upon the research through
   - Clearly stated the limitations identified from the study.
   - Clearly stated the lessons learned from the study.
Towards the end of this research project, these criteria mentioned above will be used to evaluate the work which has been done in the research. Evidence should be provided to support any claims made. The dissertation is regarded as successful if it is able to meet all these criteria and thus the research requirements. A summary of all the requirements with their related criteria will be presented in Table 3.1. This summary will be used in Chapter 7 to evaluate this research project.

<table>
<thead>
<tr>
<th>No.</th>
<th>Research Requirements</th>
<th>Evaluation Criteria</th>
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</table>
| 1.  | The Aim of the Research | Provide evidence of an original investigation through:  
|     |                        | a) Clearly stated aims of the research and the context in which the research will be conducted.  
|     |                        | b) Clearly stated research questions to be answered. |
| 2.  | Evidence of Awareness of the Literature | Provide evidence of a review of the literature related to the study including a critical analysis. |
| 3.  | Research Methodology | Ability to demonstrate understanding of appropriate research methodology by:  
|     |                        | a) Providing a justification for the use of a specific research methodology.  
|     |                        | b) Providing a justification for the use of multiple sources of data.  
|     |                        | c) Clearly describing how the data is collected. |
| 4.  | Analysis on Research Results | a) Provide compelling evidence to support the answer to the research question. The data collected should be analyzed from two perspectives: project supervisors and students. |
Chapter 3: Success Criteria

b) Clearly state the advantages and disadvantages of using the PowerMeeting system for student project management.

c) The results generated from qualitative analysis should corroborate results generated from quantitative analysis.

<table>
<thead>
<tr>
<th>5. Evaluation of the Study</th>
<th>Provide reflections upon the research through</th>
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<tr>
<td></td>
<td>a) Clearly stated the limitations identified from the study.</td>
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<td></td>
<td>b) Clearly stated the lessons learned from the study.</td>
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Table 3.1 Research Requirements and Evaluation Criteria of Research Project

3.3 Summary

This chapter had identified a list of research requirements that need to be met. The evaluation criteria that are related to these research requirements have also been presented. Overall, this chapter had served as a guideline in designing and implementing the case study. In the next chapter, we will discuss on the design of the case study.
Chapter 4: Design

Introduction

This chapter describes the research design in detail. First, we describe the project management tool that used in the study together with the services that the tool offers (section 4.1). Then we will discuss and justify the research methodology used in this study (section 4.2 and 4.2.1). Next, we will discuss the design of the case study (section 4.3). After this, the sources of data collected in the study will be discussed (section 4.4). Finally, we will discuss our data analysis techniques that were applied to both the quantitative and qualitative data (section 4.5 and section 4.6).

4.1 The Technology Used

All the participants of the study used the PowerMeeting system as their project management tool. PowerMeeting is a cooperative hypermedia system which uses the concept of combining hypermedia-based process support and shared hypermedia workspace. Therefore, it is able to provide flexible process support in a cooperative hypermedia environment. Flexible process support in PowerMeeting includes:

- Support for defining and enacting processes.
- Support for changing and developing emergent processes.

In addition to providing flexible process support, the system allows users to monitor running processes to facilitate dynamic task planning and provide synchronous and asynchronous cooperation. In the following section, we will describe each of these services in detail.
1. Defining and Enacting Emerging Processes
The high-level abstractions of the PowerMeeting system are cooperative hypermedia based workspace that includes hypermedia object such as nodes, links, text, drawings and embedded links (Wang, W. and Haake, J.M., 2000). Users can use these objects to define, enact and change processes cooperatively.

a. Process Definition
A process is represented by a set of task nodes connected by links. Specifically, a process is a rooted directed acyclic graph consisting of (potentially nested) task nodes and links among task nodes (Haake, J.M. and Wang, W., 1997) (see Figure 4.1). Task nodes are also composite nodes that can contain other nodes and links. Therefore, users can add details as content of the task. In addition to task nodes, there are person nodes and position nodes. These nodes are used to represent an individual's responsibilities in a process.

![Figure 4.1: Project Workspace](image)
b. Process Execution

When a process is started, a person can activate a task by opening a task node, setting it to ‘activate’ and perform the task. When the task is finished, the person can change the status of the task to complete. The status of a task is visible on the user interface. It is represented by colours. For example, white for not ready, green for on-going and yellow for complete. The duration of a planned task can be changed by opening the task node.

2. Changing and Developing Emergent Processes

The execution states of each task are colour coded. Therefore, when the state of a task is changed, other tasks that are potentially affected by the change can be clearly shown in the process map. In addition, users can freely add or delete project tasks in the project plan.

3. Monitoring Running Processes to Facilitate Dynamic Task Planning

In the PowerMeeting system, the service that provides the monitoring running processes is called the Swim Lane tool. This tool provides an overview of the running processes with ordered tasks for each user (see Figure 4.2). The tasks are coded with colours to show the status of each task. Tasks that are coded green are ongoing while those coded yellow are for to-do tasks. Tasks that are code in white with red quotation mark indicate delayed tasks. There are a variety of filtering criteria that can be used to change the view according to the user's needs. With such a service, users are able to monitor project progress and detect delays at a glance.
4. Synchronous and Asynchronous Cooperation

In synchronous cooperation, multiple users access the shared hypermedia workspace at the same time to perform cooperative tasks using the synchronous collaboration tools such as audio conferencing and instant messaging. Instant messaging allows fast communication and stores chat history. During cooperative activity between multiple users, the presence and activities of other collaborators are shown in the workspace (Wang, W. and Haake, J.M., 2000). Therefore, group awareness is provided to all users and allows them to become better informed about the current activity of other users.
Asynchronous cooperation allows multiple users to access the workspace at different times using hypermedia objects such as text, drawings and lines. Users can express their ideas and add explanations to processes and tasks as annotations in the shared workspace (see Figure 4.1). This allows other users to view this information when they log onto the system at different times. The other hypermedia objects that support asynchronous cooperation are embedded links. Embedded links are references to a shared object in the system or resources in the Web. This includes \textit{xref}, a cross-reference to an existing object in the system, \textit{href}, a link which leads to a resource in the Web and \textit{webdoc}, an editable document that can be uploaded to the PowerMeeting server.

4.2 Research Methodology

The research methodology proposed for this research project is a case study. A case study approach focuses on understanding the dynamic present within single settings (Eisenhardt, K.M., 1989) and covers the logic of design, data collection techniques and specific approaches to data analysis (Yin, R. K., 2003). A key strength of the case study approach involves using multiple sources of evidence (Soy, S.K., 1997). The sources of evidence that used in case studies include observations, interviews and questionnaires. Therefore, data collected from these sources are quantitative and qualitative. The data analysis techniques need to be determined in the research design stage in order to present the findings and answer research question.
4.2.1 Justification on the Use of Case Study

There are different types of research methodologies available when performing research, such as experiment, survey and case study. According to Yin, R. K. (2003), case study approach is used when:

a) "How" or 'why’ questions are being posed.
b) The researcher has little control over events.
c) The focus is on a contemporary phenomenon within some real-life context.

As mentioned earlier in Chapter 2, the use of cooperative hypermedia based flexible process support approach in the context of student project management has not been discovered. Therefore, an empirical study in this area is valuable. The essence of this research project is to investigate how this approach is able to provide support to project supervisors and students in managing student projects. Therefore, a real-world case study is used to perform the investigation in order to gain a better understanding of the use of this approach in student project management. Since the investigation of this phenomenon is in a real-time context, the researcher had no control over actual behavioural events. Nevertheless, users' experiences and actions during the course of study are important source of evidence in the research. Therefore, direct observation and interview of the people involved in the study are essential. These requirements justify the use of case study methodology.
4.3 Case Study Design

There were two phases to the case study. The duration for each phase was six weeks. In the first phase the participants managed their project using the conventional method. This involved conducting face-to-face meetings, exchanging emails between project supervisor and students and submitting interim reports. Project meeting with project supervisors were face-to-face with details of times and places sent through emails. Regular meetings were held between project supervisors and students to update project status and discuss issues involved in the project. In the second phase of the study, participants used the PowerMeeting system to manage their projects. Therefore, project management activities such as project planning, project monitoring and project meeting will be facilitated by the PowerMeeting system. The purpose of having two phases in the study was to allow participants to experience the differences in managing a project using two different methods and to know whether the cooperative hypermedia based flexible process support approach is able to support student project management.

In order to provide compelling evidence in support of the answer to our research question, evidence from this case study was collected from four different sources: participant-observation, interviews, a questionnaire and system log data. As mentioned by Yin, R. K. (2003), interview data is commonly subject to bias, poor recall, and poor or inaccurate articulation. Therefore, the need for triangulation arises to corroborate interview data with other sources of data. Triangulation is the use of qualitative research to corroborate quantitative research findings or vice versa (Emma, B. and Bryman, A., 2003). Therefore, by using triangulation the conclusion drawn from the results of the case study are likely to be more convincing and reliable.

In the study, data from observations was collected throughout the second phase of the study. Interview sessions were carried out at the end of second phase to allow probing into questions that would otherwise not be answered during the observation period. In this way detailed information on users' experiences and opinions on the use of the PowerMeeting system in student project management can be collected. Following this, questionnaires were developed based on the findings gathered from the observations and the interviews.
The questionnaire was sent out a week after the interview session to test the reliability of the interview responses. System log data was collected from the PowerMeeting server and analyze. Both the questionnaire and the system log data will be used to support our findings obtained from the observations and interviews.

4.4 Data Collection

In this case study, multiple sources of evidence were collected by: observing and interviewing the participants, a questionnaire completed by the participants and system log data. Each of these sources will be described in detail in the following section.

4.4.1 Participant-Observation

Observation is a method that is used to perceive what actually happens in a case setting. Given that the author was involved in the case study, the type of observation that has been used is participation-observation. Participant-observation requires researchers to be involved in the case setting for an extended period of time. The role of a participant-observer is same as the complete participant, but members of the case setting are aware of the observer's status as a researcher (Emma, B. and Bryman, A., 2003). In the study, the participant-observer was both participating and observing activities performed in the second phase of the study and wrote field notes based on his/her observation. Some of the advantages in using participant-observation are (Yin, R. K., 2003):

- Ability to gain access to events or groups that are otherwise not available to others.
- Ability to perceive reality from the viewpoint of someone "inside" the case study rather than external to it.
- Ability to manipulate minor events, for example, convening a meeting of a group of persons in the case study.
As mentioned in Chapter 1, this dissertation will focus on project planning and control processes. Therefore, in this study, observations were made on:

a) Project Planning
b) Project Meeting
c) Project Monitoring

The participant-observer will take notes on the actions taken by the participants, the reasons for performing the action as well as the effects of performing it. Interview sessions were carried out following the observations to find out more detail information from the participants about the actions they took.

4.4.2 Interview

Interviews are an essential source of case study evidence because most case studies are about human affairs (Yin, R. K., 2003). In order to find out about participants’ experiences when they used the hypermedia system to support their project management, the data collection technique needed to be flexible in order to collect detailed information from the participants. Therefore, the data collection technique that was adopted is a semi-structured interview. This method will allow researchers to find out related areas to investigate that may help to answer the research question. One of the advantages of the semi-structured interview method is that the interview process is flexible.

Interview preparation is critical before the field study is conducted. The interviewer will have an interview guide which consists of a list of questions that need to ask the participants. The interviewee is allowed great flexibility when answering those questions. Impromptu questions may be asked as the interviewer picks up on things said by interviewees (Emma, B. and Bryman, A., 2003). Interview sessions are conducted online through the use of the PowerMeeting system in order to increase participation. An interview guide has been prepared to identify the topic areas and formulate questions that will help to answer the research question. The series of steps in formulating questions for an interview guide are presented in the following diagram.
The interview topics and questions are identified based on the research question and findings from observation sessions. As mentioned earlier, the aim of this research is to find out participants' experiences in using the hypermedia system to support project planning and project control. Therefore, the interview questions should be formulated based on these two topic areas. In addition, the interview questions are asked based on the perspective of the project supervisor and the students.
The design of the questions is critical for the case study. It must ensure that sufficient evidence was collected to answer the research question. Generally, the types of questions asked in interviews are open-ended ones. Open-ended questions allow:

- Researchers to ask respondents about facts of a matter or opinions about events (Yin, R. K., 2003).
- Exploring areas where researchers have little knowledge (Emma, B. and Bryman, A., 2003).
- Obtaining detail information upon certain area.
- The interviewer to clarify misunderstandings.
- Encouragement to build rapport between interviewer and interviewee.

The interview questions were reviewed to ensure that they could elicit relevant responses. Following this, a pilot interview was conducted with one of the participants to identify any novel issues that may arise. Issues were identified that required the interview questions to be further revised.

Prior to conducting the interview some other important factors that were taken into consideration include (Emma, B. and Bryman, A., 2003):

- Use language which is suitable to the people that you are interviewing.
- Ensure all the ‘facesheet’ information of general and specific kind is asked and recorded.
- A willingness to make notes to avoid missing some important information.

After each interview, the interviewer made notes on the interview process. The data, time and place where the interview was conducted were recorded. The information gathered from interviews will be analyzed to identify the concepts that are related to the study.
4.4.3 Questionnaire

The self-completion questionnaire is widely used in research. Respondents completed the questionnaire by themselves. One of the main advantages of this method is that it is convenience for the respondents. This is because respondents can complete the questionnaire at their convenience spending as much time as they need.

More often than not, self-completion questionnaires have a low response rate. In order to solve this problem, some of the important factors in designing the questionnaire have been taken into consideration such as the presentation of the questionnaire and the instructions on how to respond.

The questionnaire was organized into three parts:

a) The background information of the participants.

b) The experiences and opinions of the participants in using conventional method for student project management.

c) The experiences and opinions of the participants in using the PowerMeeting system for student project management

The use of quantitative data is to corroborate the findings from qualitative data. Therefore, the questions were formulated based on the findings from observations and interview sessions. Closed questions were asked in the questionnaire. Some of the advantages that close-ended questions offer are (Emma, B. and Bryman, A., 2003):

- Easy for respondents to complete.
- Clarify the meaning of questions for respondents.
- Easy for researcher to process answers.
- Enhance the comparability of answers, making it easier to make comparisons between respondents.

The questionnaire was posted on project workspace of each of the participant. An email was sent out to notify all participants that the questionnaire was available and that their
cooperation was required to fill it in. A reminder email was sent to participants who did not respond after seven days.

4.4.4 System Log Data

System log data was also used to support the findings from observations and interview sessions. The data was collected from the PowerMeeting server. System log data records step-by-step users' interactions with the system. In the PowerMeeting server, the system log records user's login/logout information. Details of this information includes: login/logout time, login/logout date and user name. Data gathered from the system log is used to analyze the usage frequency of each user.

4.5 Qualitative Data Analysis

Data gathered by qualitative methods are unstructured data. Therefore, the purpose of qualitative data analysis is to organize and interpret unstructured data in order to allow a presentation of the findings in a written report. Given that our study begins with the research question in mind, the qualitative data analysis technique proposed for this study is the grounded theory approach. Grounded theory is an emergent research process that can be used to discover answers to research question based on the data collected from the case study. Since the answers are drawn from data, it is very likely to offer insights and enhance understanding (Strauss, A. and Corbin, J., 1998). In order to fit this research process into our study, the steps in grounded theory depicted from Emma, B. and Bryman, A. (2003) has been modified and presented in the following diagram.
Steps

1. Research question
2. Participants are identified
3. Collect data
4. Coding
5. Constant comparison
6. Saturate categories

Outcomes

4a Concepts
5a Categories

Figure 4.4: Processes in Grounded Theory

In Figure 4.5, there are six steps involved in performing qualitative data analysis. Each of the steps and outcomes will be explained as follows:

Step 1: Researchers will begin with research question in mind.
Step 2: Participants are identified.
Step 3: Data is collected.
Step 4: Code the data generated from the observations and interviews. Concepts may be formed based on this data.
Step 5: Constant comparisons between data and concepts generating categories
Step 6: Categories are saturated.

Step 4 to 6 represent a process called coding. Coding are procedures that used to interpret and organize data (Strauss, A. and Corbin, J., 1998). These consist of conceptualizing, elaborating categories in terms of their properties and dimensions, and relating categories through a series of prepositional statements (Strauss, A. and Corbin, J., 1998).
Given that the purpose of coding in this study is to organize unstructured data, the best possible method to use is open coding. Open coding yields concepts, which are later to be grouped and turn into categories (Emma, B. and Bryman, A., 2003). The first step in coding data is conceptualizing. A concept is an abstract representation of an event, object, or action that a researcher identifies as being significant in the data (Strauss, A. and Corbin, J., 1998). The reason for conceptualizing data is to group similar events, object or actions. Therefore, the data was coded by analyzing a whole sentence to identify a distinct event, object or actions. Each of these distinctive items was labelled with a name that was suitable to the context of the study. Following this, these labels were reviewed to find out whether there is any useful information can be discovered. If there isn’t any, then we will have to repeat Step 3 to obtain more detail information.

As a result of conceptualizing the data, a number of concepts were found. These concepts were eventually group into different categories and these categories in turn into higher level ones. In other words, we are exploring relationships between categories and group them into higher level of categories. There is a high possibility that more than two concepts are make up a category. Therefore, categories are considered as a higher level abstraction than concepts. The names of the categories are given in the context of the study. As a result of coding unstructured data, a small number of categories were identified. The findings of this study will be presented based on the core categories that are identified in the data analysis process.


4.6 Quantitative Data Analysis

Data gathered from the questionnaire and system log will be analyzed using descriptive statistics. Descriptive statistics such as mean and frequency distribution are used to describe basic features of data in a study (Trochim, W.M.K., 2006). As mentioned earlier, data collected from the questionnaires and system log were used to corroborate our findings from the interviews. Therefore, descriptive statistics are used to produce a summary of the data collected from quantitative methods and compare them with our findings from qualitative analysis. There are three simple steps in the process of analyzing quantitative data, they are:

- Step 1: Produce clean data
- Step 2: Produce descriptive statistics
- Step 3: Produce graphs or charts

In Step 1, clean data are produced by ensuring all the data is correct. Missing data values should be clearly identified as missing data. Following this, data will be analyzed using descriptive statistics. Data gathered from the system log will be analyzed using frequency distribution while data gathered from the questionnaire will be analyzed using mean values. Finally, graphs will be produced to display results generated by the descriptive statistics.

4.7 Summary

The case study approach was selected as our research methodology. The data collected for the study are from four different sources: participant-observation, interviews, a questionnaire and system log data. Each of these sources of data was described in section 4.4. Qualitative and quantitative data analysis techniques were identified. This includes grounded theory for analyzing qualitative data and descriptive statistics for quantitative data. In the next chapter, we will provide a detail description of the case study that was carried out.
Chapter 5: Realisation

Introduction

In the previous chapter we present the design of this research project. In this chapter, a detail description of the case study that was carried out is provided. This chapter is divided into six sections. The first section is concerned with the participants of the case study (section 5.1). The role of the project supervisor and students in the case study are clarified (section 5.1.1). The second section is concerned with the design of the public workspace of the PowerMeeting system (section 5.2). The third section will describe the social protocol that was implemented in the study (section 5.3). The fourth section is concerned with the activities that had been carried out in each phase of the case study. (section 5.4.1 and 5.4.2). The fifth section will present our observations on the usage of the PowerMeeting system in supporting project planning and control processes (section 5.5). Finally, the chapter ends with a summary of what has been presented in this chapter (section 5.6).

5.1 The Participants

Seven postgraduate students from the School of Informatics in the University of Manchester volunteered to participate in the study. These students are currently taking Masters Degree or PhDs. The type of project that these students need to complete varies from a software development project to a research oriented project. The project supervisor of these students who is interested in this study also volunteered to participate.

An email message clarifying the nature of the research project and their degree of involvement was sent to all participants. The PowerMeeting system, the cooperative hypermedia system that has been used in the study, was provided to all participants in order to assist them in managing and performing their project. Participants were introduced to the
system by the author in the second phase of the study. An online system manual was available from the system.

5.1.1 The Role of the Project Supervisor and Students in the Case Study

Project supervisors are seen as the source of knowledge. They provide guidance and advice to students. This includes, providing guidance about the nature of the project, planning of the empirical work and necessary reading. When a problem is identified project supervisor will assist students with tackling the problem. In addition, project supervisor are responsible for monitoring the student’s progress and providing guidance when the student is behind schedule.

Students are responsible for completing their project in a given time frame. Once the project is started, students are required to arrange meetings with the project supervisor to discuss the tasks that need to be completed and raise issues that are encountered while performing the tasks. Students are required to prepare adequately before the meetings based upon the meeting’s agenda. Meeting minutes were taken in every meeting to document the items that had been discussed and actions that have been agreed upon.

5.2 Public Workspace of the PowerMeeting System

The public workspace of the PowerMeeting system is the general access point for all the participants when they log onto the system. In order to enhance usability of the system and allow better communication between students, a number of functional nodes have been created in the public workspace (see Figure 5.1).
Figure 5.1: Public Workspace of the PowerMeeting System

As shown in Figure 5.1, there are four types of functional nodes created in the public workspace: Bulletin Board node, Group Chat node, Contact node and Student Project node. The purpose of each of these functional nodes will be explained as follows:

a) Bulletin Board node

Users can leave public messages, for example, to provide information, requesting help from others or to announce events.

b) Contact node

Contact node consists of the contact information of all the participants such as email addresses to enable users of the system to communicate with each other when necessary. Students are responsible for updating their contact details.
c) **Group Chat node**

Group chat node is an embedded link that leads to opening a chat session in a new window. Participants can communicate with each other using this tool. The chat history will be archived.

d) **Student Project node**

Student project node is dedicated to students who participate in the study. Each student will be provided with a project node to create their project plan.

### 5.3 Social Protocol

For the purpose of this project a social protocol was implemented to provide participants with a set of guidelines when using the system. Social protocols that were implemented in the case study are:

1. Project meetings should only be conducted using the PowerMeeting system. That is, project meetings were conducted in a distributed virtual setting where the project supervisor and students will have real-time discussion.
2. Meetings should be arranged through email and the bulletin board.
3. Participants are not allowed to change another participant’s project plan.
4. Participants can only communicate by using services offered by the system such as audio conferencing, instant messaging and workspace.
5. When there are news updates on the bulletin board, the updates need to inform all the relevant parties.
6. Participants can only create information in their own nodes.
7. State in the project plan if there is a composite node.

The implementation of the social protocol helped eliminate complications that would have otherwise arisen during the course of the study. Therefore, the social protocol was created in the early stage of the case study.
5.4 The Case

As mentioned in the previous chapter, the case study was divided into two phases with each phase lasting for six weeks. The main project management activities that were involved in these phases are project planning, project monitoring and project meeting. In the following section, we will describe the activities that had been carried out in each phase of the case study.

5.4.1 Phase 1

The main aim of the first phase of the study is to define the major goals and objectives of the project and prepared a project plan that defines all the tasks that needs to be accomplished in a given time frame. Therefore, the project supervisor and students hold regular face-to-face meetings to develop project plans, allocate resources, perform project tasks and review student’s progress. The meetings took place on a bi-weekly basis. The date and time was decided upon during the first meeting. Students who are not able to attend the meeting are required to notify the project supervisor by email. Students prepared their own agenda items to discuss in the meeting and send it to the project supervisor one day before the meeting. In general, each meeting took up to one and a half hours. The meeting agenda was:

- Develop a project plan cooperatively between the project supervisor and the student.
- Identify details of project tasks or processes.
- Allocating resources to students by project supervisor to perform the project tasks.
- Discussion of emergent problems.
- Update progress of the project tasks.
- Discuss changes to the underlying project tasks or processes.

In between meetings, students who had urgent issues sent emails to the project supervisor to request for assistance. After the students had developed their project plans, they prepared
an interim report and submitted it to their project supervisor. An interim report consisted of a student’s project plan and details of the tasks that need to be accomplished in a given time frame. The project supervisor used the interim report as a guide to monitor student progress in the first phase of the study. Once the students had submitted their interim report they could then proceed to action their project tasks.

5.4.2 Phase 2

During the second phase of the study, the project supervisor and students continued with their project management activities using the PowerMeeting system. The public workspace of the system is the first page that loads once participants log onto the system (see Figure 5.1). The student project node in the public workspace is used to store project related information such as project plan, project task details and meeting agendas. Every student was given a project node with their name and project title on it. The project plan developed by the students in the previous phase of the study was created in their respective project node in the system. The students update their task status once they have started or completed a project task. In this way, the project supervisor is able to track a student’s progress using the swim lane tool.

Bi-weekly meetings between the project supervisor and students were conducted using this system. Participants attending meetings from different locations communicate with each other using instant messaging and audio conferencing that provided by the system. In the meeting, students discuss project related issues with the project supervisor. Participants are given synchronous access to shared workspace to perform cooperative tasks such as re-planning on project tasks (when changes are required to the project plan due to unforeseen circumstances). In order to find out how well the system is able to support the project supervisor and students in facilitating project meetings, the author had planned two types of meeting to be conducted during the study: group meetings and individual meetings.

For group meetings, a facilitator was chosen from among the students. The meeting facilitator was responsible for the collection of all the meeting agendas from the
participants and put in a meeting node prior to the meeting. S/he was also responsible to keep the group focused on the topic under discussion during the meeting. Any updates of the agenda and times were informed by the facilitator to all participants. For individual meetings, students arranged one-to-one meetings with project supervisor. The agenda for this second type of meeting will be sent to the project supervisor prior to the meeting.

Students are encouraged to learn from each other when performing their project. A Group Chat node and a Contact node (see Figure 5.1) were created in the public workspace so that students could communicate with each other via instant messaging or email. Students are, therefore, able to exchange or share ideas among each other and improve their learning experience. At the end of week twelve, phase two of the study was ended and the interview sessions were carried out. Questionnaires were distributed to all participants one week after the interview sessions had ended. System log data was collected from the PowerMeeting server after the second phase of the case study had ended.

5.5 Observations

In order to understand how cooperative hypermedia based flexible process support approach is able to support the project supervisor and students in student project management, the author observed the usage of the PowerMeeting system in the second phase of the study with a focus on project planning, project monitoring and project meetings. In the following section, we report how the PowerMeeting system was used to perform these project management activities.
5.5.1 Dealing with Project Planning, Project Monitoring and Process Change

Students created their project plans in their own project node. The project plan is captured as visual process maps with tasks and precedence relationships between tasks. An example of the project plan created by a student is shown in Figure 5.2. As shown in Figure 5.2, the project task is represented by a task node and precedence relationships between tasks are represented by a link. Every task node can contain sub-task nodes which describe the process for completing the tasks. For example, the task node of “Dissertation” contains the sub-task node that elaborates the process of completing dissertation (see Figure 5.3). The project tasks are colour coded to indicate the status of the project tasks. When a student starts to perform the project task, they change the task status to green which indicates that the project task is on-going. Once they have completed the work for a task, they will change the colour to yellow. Documents that are used as reference material for the project are also added in the project workspace as embedded links or notepad.

![Figure 5.2: A Student’s Project Plan in the PowerMeeting System](image-url)
One of the observations that have been noted is that project plans tend to change after the students have started to perform their project tasks. For example, Figure 5.4 shows the initial project plan developed by one of the students in the early stage of his/her project. The goal of this student is to complete his/her dissertation in a given time frame. However, the project tasks defined in the project plan did not reflect the goals that s/he needed to achieve. The project plan has only included tasks needed to complete a preparatory report for the project.
As the student progresses, project tasks that are not defined in the early stage of the project are added to the project plan. For example, as shown in Figure 5.5, there is a dramatic change in the project plan. The student had added more tasks to the project plan and these project tasks are clearly divided into different stages.
5.5.2 Conducting Project Meeting

Student project meetings with project supervisor are important activities as this is the time where student can receive guidance and advice from project supervisor on the issues they face. More importantly, project meetings allow project supervisors to monitor student’s progress and discuss problems that are liable to occur in their project tasks and adapt their project plan cooperatively. In the study, we observed three types of meeting being conducted: group meetings, individual meetings and ad hoc meetings. In the following sections, we will present our observations for each of these meetings.
5.5.2.1 Group Meetings

In group meetings, the facilitator plays an important role. Prior to the meeting, meeting facilitator created a meeting process map in a meeting workspace (see Figure 5.6). The meeting process map includes the name of the participants who will attend the meeting, the roles of these participants and their meeting agenda. Each student was given a meeting agenda node onto which to add their meeting agenda items. The meeting agenda nodes are labelled with the name of the student and the suffix “agenda items”, for example, “Laiyi’s agenda items”. Since there is more than one student who will want to discuss their agenda items with the project supervisor, the order of discussion is shown in the map. For example, “Laiyi’s agenda items” will need to be discussed before “Elaine’s agenda items”. After completing the process map, the facilitator posted a message on the bulletin board to request that those students who are participating in the meeting add their agenda items to their respective meeting agenda nodes. The date and time of the meeting was announced on the bulletin board as well.
On the day of meeting, all meeting participants logged onto PowerMeeting system. The meeting facilitator invited all participants to join the meeting workspace where the facilitator had created a meeting process map and launched the audio conference. This was done by clicking the ‘Invite’ and ‘Conferencing’ button on the left panel of the PowerMeeting browser. Once the users have logged on, their names would be shown on the left panel of the PowerMeeting browser (see Figure 5.7). The meeting commenced after all the invited users have logged on. The project supervisor, who is the chairperson of the meeting opened the first student’s agenda items and went through all the items before moving onto the next student. While discussing a particular student’s agenda items, it was observed that other students remained silent and did not add any comments or ideas. The actions of the participants are shown in the meeting workspace. The cursor provided awareness on who was currently touching the nodes in the shared workspace. User name on the bottom of a meeting agenda node indicate that the user is currently working in it.

![Meeting Process Map with Invited Meeting Participants](image)

Figure 5.7: Meeting Process Map with Invited Meeting Participants
The content of “Laiyi’s Agenda Items” is shown in Figure 5.8. The agenda items are represented as a process map and the student added an embedded link in the meeting workspace as supporting material for the discussion. Furthermore, participants may scribble in the meeting workspace using lines, text or shapes to assist in the discussion. The discussion continued until all the agenda items for that student were discussed and then chairperson returned to the meeting process map and moved on to the next student’s agenda items. After the discussions with all the students had been completed and there were no further questions, the chairperson ended the meeting. Students who have taken notes posted them on the meeting workspace for future reference.

On several occasions during project meetings, it was observed that meeting participants made changes to the meeting process map in order to adapt to the changing situation. For example, the meeting facilitator would remove agenda items of students who were not able to attend and re-plan the agenda on the meeting process map. Another example is that when
the meeting facilitator was not able to attend the meeting, his/her role will be given to another student. This change will be revealed in the meeting process map.

5.5.2.2 Individual Meeting

In individual meetings, only one student had a virtual meeting with the project supervisor. When meeting one-to-one with the project supervisor, the student created their agenda items in their meeting workspace prior to the meeting. An example of a meeting agenda created by a student for an individual meeting is shown in Figure 5.9.

![Figure 5.9: Meeting Agenda for Individual Meeting](image)

As shown in Figure 5.9, the meeting agenda contained a list of items to discuss as well as the date of the meeting. Supporting material that was used in the discussion was added to
Chapter 5: Realisation

the workspace as embedded links, notepad and folder. On the day of meeting, the student invited the project supervisor to the meeting workspace and launched an audio conference. During the discussion, it was observed that the student added new items to the meeting workspace to discuss as the meeting progressed. The project supervisor checked on each item that had been discussed. Some of the students added meeting notes to the meeting workspace as shown in Figure 5.10. After the discussion was completed, the student produced a summary of the discussion and posted it on the meeting workspace.

![Figure 5.10: Meeting Agenda with Meeting Notes](image-url)

The purpose of this meeting is to discuss some issues concerning Layla's Project

1. Review the last meeting (Meeting node one) and plan for the next one.
2. Discuss the issues concerning the questionnaire and the interview questions.
3. What should the evaluation section be like in a research oriented project?
4. Conduct an interview with the supervisor.

Meeting notes:

- Transition understanding
- Hyperlink access to history contents and process
- Notepad, email, text and graphic forms
- Combination of top-down and down-up
- Hypothesis
- Widely accepted methods
5.5.2.3 Ad-hoc Meeting

Ad-hoc meeting were unplanned meetings that were conducted without prior notice. This type of meeting did not happen frequently during the course of the study. Ad-hoc meetings were carried out when both the project supervisor and student were online at the same time and there was a need to have a meeting. Since the meeting was conducted spontaneously, there was no meeting agenda and meeting process map. Despite these materials being unavailable, students created meeting agenda and meeting process map cooperatively with the project supervisor during the meeting. In addition, students took meeting notes and recorded all the issues discussed and results in their meeting workspace.

5.5.3 Learning from Others

In the PowerMeeting system, users can communicate via instant messaging. Since the instant messaging tool is able to store chat history, we can monitor student usage of this tool to request help in learning how to use the PowerMeeting system tool, ask project related questions and communicate to one other. An example of the chat history is shown in Figure 5.11. From the conversation in Figure 5.11, we know that Nickil Patel is learning how to use the instant messaging tool from Yoke Chen.
Chapter 5: Realisation

5.6 Summary

This chapter had described the settings of the case study. In the first phase of the study, the participants managed their project using the three communication channels: email, face-to-face meetings and interim report. In the second phase of the study, the participants managed their project using the PowerMeeting system. Data was collected from the participants as well as from the PowerMeeting system after the second phase of the study. The design of the public workspace of the PowerMeeting system and the social protocol that was implemented during the study has also been described. In addition, observations that had been made on project planning, project monitoring and project meetings have been clearly described with the relevant screenshots.
Chapter 6: Results and Discussions

Introduction

This chapter will provide discussions of the evidence gathered from the different data sources mentioned in Chapter 4. In section 6.1, the results of the observations and interviews conducted with all the participants of the study will be presented. Following this, results from the questionnaire and system log data that was used to corroborate our findings from the interview will be presented in section 6.2 and 6.3 respectively. Finally, a summary of the results gathered from the different data sources will be presented in section 6.4.

6.1 User's Experiences and Opinions

Interview sessions were carried to obtain feedback from the project supervisor and students regarding their experiences and opinions in using the PowerMeeting system for project management. Interview data was collected from all participants, a total of seven students and the project supervisor. Each interview lasted an average of forty-five minutes. Interview notes were transcribed and analyzed using the grounded theory method. Our main findings from observations and interviews were organized according to five categories: issues in using the conventional method to perform project management activities, project planning and monitoring, project meetings, the advantages and disadvantages of using the PowerMeeting system for student project management. Each of these categories will be discussed from two perspectives: the project supervisor and the students.
6.1.1 Issues in Using the Conventional Method to Perform Project Management Activities

Currently, students' projects are managed through the use of face-to-face meetings, email and interim report. Face-to-face meetings are held regularly between the project supervisor and students to discuss issues on project tasks and their progress. However, the project supervisor commented that students tend to skip meetings. This had caused the project supervisor to have difficulties in identifying problems that are liable to be encountered in the project. In addition, the project supervisor observed that meeting minutes were not always taken during the meeting. Although some of the students had made the effort to create meeting minutes, usually they are not organized or complete.

An interim report is a formal document that is submitted to a project supervisor. It consists of a student's project plan and details of the tasks that need to be accomplished within a given time frame. Although students were required to follow the deadline stated in the project plan, the project supervisor commented that most students usually did not complete the tasks according to the timeline stated in the plan. Therefore, the project plans were changed unilaterally by the students and therefore the project supervisor is unaware of the changes being made. As a result of this, the project supervisors found it difficult in monitoring students' progress.

When a project supervisor travels abroad, students communicate with him/her through email. Some students find it difficult to communicate with the project supervisor by email. They are the international students whose first language is not English. They find that miscommunication often happen, especially when using email to solve complicated issues. They prefer to have verbal communication.

Most of the students interviewed mentioned that they often make changes to their project plan in the early stages of the project. This is due to some of the project processes not being define in advance. When a student makes changes to their project plan, they are unable to
identify subsequent tasks that will be affected by the change. Therefore, students found that the conventional method is unable to accommodate these changes.

6.1.2 Project Planning and Monitoring

All students used the PowerMeeting system to create their project plan. We observed that students often make changes in the early stages of the project. Students explained that in the early stages of the project, they are not able to identify all the project tasks. Therefore, they will have to refine the existing process or develop emergent processes. Students commented that the system provided great flexibility in supporting process change. They can easily identify and adapt all those tasks that are affected by change. The statuses of the project tasks were constantly being updated by the students and this served as a means of monitoring project progress which facilitated dynamic task planning.

The project supervisor used the PowerMeeting system to monitor student’s progress and provide assistance. The project supervisor found that it was not necessary to use the swim lane tool to monitor student progress. This was because the project plans created by the students were fairly simple and progress can be monitored using the project plan. The project supervisor will knew the current status of the project by checking the colour code of the project tasks. When the project supervisor discovered that a student was behind schedule, the student was informed by email. The project supervisor commented that using the system to monitor student progress was more effective compare to conventional method as changes made on the project plan were visible. Therefore, project supervisor is able to identify and discuss any problems that occur before making changes to the project plan.
6.1.3 Project Meetings

The project supervisor and students discussed emergent problems in project meetings. They solved emergent problems and adapted the project plan cooperatively through synchronous and asynchronous cooperation. In synchronous cooperation, the project supervisor used audio conferencing and shared workspace to discuss issues and perform cooperative tasks with the students. During meetings, notes were taken and placed on the meeting workspace by the student. Any disparity found in the meeting notes was notified by the project supervisor to the students and changes were made immediately. The meeting process map could be modified during project meeting sessions if the need arose. In the case for unplanned meetings, such as ad-hoc meetings, students can create a meeting agenda or meeting process map on the fly in meeting workspace. Both the project supervisor and students used visual artefacts such as writings and drawings to facilitate discussions. Asynchronous cooperation allowed students to post their questions in the project workspace and the project supervisor responded by writing the response in the same workspace but at a different time. The project supervisor commented that the system allowed supervisory support to be provided while travelling abroad. Therefore, the project supervisor felt that the system was very effective in helping students to solve issues quickly.

However, one of the students found that the system was unable to help solve complicated issues. Students defined complicated issues as issues that require a lot interaction with the project supervisor. This student who was doing a software development project found it difficult to use annotations and process nodes in the workspace. For example, when the student sought help in designing system architecture, the student found it difficult to draw the system architecture and show it to the project supervisor. Therefore, the student was unable to revise the system architecture in order to improve the software design.

Some of the students suggested that the system was able to help students by improving the management of meetings. Since the introduction of the PowerMeeting system, meeting agendas and meeting minutes were stored in the system. When the students were asked why they are willing to create these documents in the system, most of them replied that it
was fairly easy to create and maintain them in this system. In addition, students used the workspace as the centralized storage area in which to store project related information. The students found it useful for a number of reasons, for example, to identify details that helped them adapt the project plan.

6.1.4 Advantages of Using the PowerMeeting System for Student Project Management.

The PowerMeeting system provides coordination support. Participants were provided with workspace awareness. In this way, participants always knew the topic under discussion and who was interacting within the shared workspace. Users can use cursors to let other participants in the meeting become aware of items that they were addressing. This allowed the project supervisor and the students to work cooperatively. In addition to workspace awareness, the project supervisor allocated tasks to students using direct and indirect communication. Direct communication involved the use of instant messaging or audio conferencing. Indirect communication allowed users to leave annotations in the workspace to provide details and make comments.

Besides using the PowerMeeting system as a project management tool, most of the students commented that they are able to gain other benefits by using the system. One of the examples given was learning from others, because they were able to exchange information and share ideas by using the system. In group meetings, students were always aware of the topic under discussion. Thus, students are able to receive important information that is related to their projects from other participant's discussion.

Instead of having bi-weekly meetings, students were able to meet the project supervisor more frequently through ad-hoc meetings. In addition, students have also commented that their attendance at meetings has improved. Since communication with the project supervisor was informal, students felt comfortable when discussing issues with the project supervisor. As a result, the students are able to resolve issues more effectively and efficiently.
Chapter 6: Results and Discussions

6.1.5 Disadvantages of Using the PowerMeeting System for Student Project Management

One of the disadvantages for the project supervisor in using the PowerMeeting system is that the system relies upon students to update their project status. Observation on project planning activities revealed that there were a small number of students who created their project plan in the system without updating the status of their project tasks. This meant that the project supervisor was unaware of their progress. Another disadvantage that was felt by the project supervisor was an increase in workload. Since the introduction of the PowerMeeting system, the project supervisor’s workload has increased due to the increased number of meetings called by the students.

On several occasions in group meetings it was observed that students did not involve themselves in the discussion. They often remained silent. The students commented that this happened because they found it difficult to know when to speak in the meeting because there is no face-to-face contact between the participants.

In addition to the lack of face-to-face contact, students had pointed out another two disadvantages of the system. Firstly, students found that they were easily distracted by their surroundings since the meetings were conducted in an informal environment. Therefore, they often missed important information and were not able to contribute to the meeting. Secondly, there are no restrictions on the changes that could be made in their project workspace. This meant that any other users could edit or delete information in a student’s project workspace without permission.
6.2 Questionnaire

Questionnaires were distributed to all participants of the study which included seven students and one project supervisor. All questionnaires were returned after one week. The questionnaire was divided into three sections:

a) Background information.

b) Participants’ experiences in using conventional method for student project management.

c) Participants’ experiences in using the PowerMeeting system for student project management.

The participants were asked to state their level of agreement or disagreement with each statement provided in the questionnaire. A five-point scale was used in which the scoring of the items is as follows:

- Strongly agree = 5
- Agree = 4
- Neither agree nor disagree (Neutral) = 3
- Disagree = 2
- Strongly disagree = 1

In the following sections, we will discuss the responses received from the project supervisor and the students.
### 6.2.1 Response from the Project Supervisor

The responses from project supervisor are shown in Table 6.1.

<table>
<thead>
<tr>
<th>Category</th>
<th>Question No.</th>
<th>Statement</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issues on Conventional Method</td>
<td>3</td>
<td>It is difficult to identify liable problems that would occur.</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>4</td>
<td>It is difficult to monitor student progress using conventional method.</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>5</td>
<td>Meeting minutes are often not available or not organized.</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>6</td>
<td>Difficult to provide assistance to students effectively when the project supervisor is travelling abroad.</td>
<td>Agree</td>
</tr>
<tr>
<td>Project Planning and Monitoring</td>
<td>7</td>
<td>The system is able to support the project supervisor in monitoring student’s progress more effectively.</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>8</td>
<td>Changes made on the project plan are visible to the project supervisor.</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>The system enables the project supervisor to identify problem that liable to occur from the project tasks.</td>
<td>Agree</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>The project supervisor monitors student’s progress using the swim lane tool.</td>
<td>Disagree</td>
</tr>
<tr>
<td>Project Meetings</td>
<td>11</td>
<td>The system support flexible meeting process. Meeting processes can be created and modified during project meeting sessions.</td>
<td>Agree</td>
</tr>
</tbody>
</table>
## Chapter 6: Results and Discussions

<table>
<thead>
<tr>
<th></th>
<th>Statement</th>
<th>Agreement</th>
</tr>
</thead>
<tbody>
<tr>
<td>12</td>
<td>The system improves student’s meeting management.</td>
<td>Agree</td>
</tr>
<tr>
<td>13</td>
<td>The system enables the project supervisor to provide assistance to students when s/he is travelling abroad.</td>
<td>Agree</td>
</tr>
<tr>
<td>14</td>
<td>The system enable the project supervisor to resolve issues brought up by student in timely manner.</td>
<td>Agree</td>
</tr>
<tr>
<td>15</td>
<td>The system support coordination in project meetings.</td>
<td>Agree</td>
</tr>
<tr>
<td>16</td>
<td>If students does not update their status in project workspace, the project supervisor is not able to monitor project progress.</td>
<td>Agree</td>
</tr>
<tr>
<td>17</td>
<td>Since the introduction of PowerMeeting system for student project management, project supervisor’s workload has increased.</td>
<td>Agree</td>
</tr>
</tbody>
</table>

### Table 6.1: Questionnaire Response from Project Supervisor

Based on Table 6.1, we can see that the project supervisor agreed to most of the statements in the questionnaire. This implied that the project supervisor agreed with our findings from the interview. However, the project supervisor disagreed on the statement “The project supervisor monitors student’s progress using the swim lane tool”. This finding corroborates our findings from interview sessions where project supervisor found that using the swim lane tool to monitor student progress was not necessary as the project plans created by the students were fairly simple.
6.2.2 Response from the Students

The student responses are summarized in Table 6.2 where the average scores of the perceived degree of agreement or disagreement of each statement are presented.

<table>
<thead>
<tr>
<th>Category</th>
<th>Question No.</th>
<th>Statement</th>
<th>Results (Mean)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Issues on Conventional Method</td>
<td>6</td>
<td>It is difficult to resolve issues by using email.</td>
<td>4.3</td>
</tr>
<tr>
<td></td>
<td>7</td>
<td>The conventional method is not able to adapt to change effectively.</td>
<td>4.9</td>
</tr>
<tr>
<td>Project Planning and Monitoring</td>
<td>8</td>
<td>The system is able to provide flexibility to users in changing their project plan.</td>
<td>4.7</td>
</tr>
<tr>
<td></td>
<td>9</td>
<td>When a task is change in a project plan, the system enable users to identify all other tasks potentially affected by the change.</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>10</td>
<td>The system enable student to have a better view of their progress.</td>
<td>4.1</td>
</tr>
<tr>
<td>Project Meetings</td>
<td>11</td>
<td>The system support flexible meeting process. Meeting processes can be created and modified during project meeting sessions.</td>
<td>4.2</td>
</tr>
<tr>
<td></td>
<td>12</td>
<td>The system improves student’s meeting management.</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>13</td>
<td>The system is useful in helping students to identify project related information.</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>14</td>
<td>The system enables students to resolve issues with project supervisor even though the project supervisor is travelling abroad.</td>
<td>4.0</td>
</tr>
<tr>
<td></td>
<td>15</td>
<td>The system is able to support students in solving complicated issues with their project supervisor.</td>
<td>3.7</td>
</tr>
</tbody>
</table>
More project meetings were conducted with the project supervisor since the PowerMeeting system was introduced.

Students feel comfortable to discuss issues with their project supervisor using the system.

In project meetings, students are able to receive important information that is related to their project from other participant’s discussion.

The system support coordination in project meetings.

By using this system, students can learn from each other by exchanging and sharing ideas via instant messaging or audio conferencing.

Sometimes, students find it difficult to speak in the meeting due to lack of face-to-face contact.

There are no restrictions in making changes on the project workspace.

Sometimes students find it difficult to concentrate during project meeting.

**Table 6.2: Questionnaire Response from Students**

Based on the mean values shown in Table 6.2, we can see that most of the mean values are equal to or greater than 4.0. This implied that the students agreed with our findings generated from the observations and interviews.

However, the responses for the statement “The system is able to support students in solving complicated issues with their project supervisor” was less positive compare to the others. We have further analyzed the responses given for this statement and found that while 86% agreed, 14% of the students disagree with the statement. This finding corroborates with our
findings from the interview sessions where one of the students found that the system was not able to support students in solving complicated issues.

6.3 System Log Data

System log data collected from the PowerMeeting server was used to analyze the usage frequency of the system. System log data was collected for six weeks from June 2007 to July 2007 and analyzed. In order to make the usage frequency analysis more valid, it was assumed that users who log onto the system for less than three minutes do not perform any activities. This assumption was made based on the data collected from system log. In the system log it was observed that there were many users who log onto the system for durations of less than three minutes during the early introduction of the system. Therefore, we assume that these users merely log onto the system and logoff after they found that they could successfully do so. This data does not reflect the actual usage of the system and has to be removed. The remaining data was summarized into two bar graphs as shown in Figure 6.1 and 6.2.

![Project Supervisor's Usage Frequency of the PowerMeeting System](image)

**Figure 6.1: Project Supervisor's Usage Frequency of the PowerMeeting System**
Figure 6.2: Student's Usage Frequency of the PowerMeeting System

Figure 6.1 shows the usage frequency for the project supervisor during the six weeks while Figure 6.2 shows the usage frequency for each student during the six weeks. Based on these two graphs, we can see that project supervisor's usage frequency was dependent on the student's usage frequency. Figure 6.1 and 6.2 shows that both the project supervisor and students had their highest usage frequency in Week 6. In addition, usage frequency for both the project supervisor and students were at their lowest levels in Week 1. Student usage frequency became high when they used the system to create their project plan, post their questions in project workspace or conduct meetings with the project supervisor. Each of these activities required assistance from the project supervisor. Therefore, the usage frequency of the project supervisor increased as well. If the student usage frequency was low it meant that they were not using the system to perform any project management activities. In this case the project supervisor had no need to access the system.

In Figure 6.2, we can see that the usage frequency for all students is low in Week 1 and 2. The reason for this low usage frequency is that the first two weeks were introductory ones. In introductory weeks, participants were given training on how to use the system.
Chapter 6: Results and Discussions

Therefore, we can expect that there will be less usage of the system. Once the participants became sufficiently familiar with all the tools available their usage frequency increased as they are able to perform project management activities using the system. This is illustrated by Figure 6.2 where the usage frequency has been increased from Week 3 onwards.

Another observation to be made from Figure 6.2 is that some of the students have a very high usage frequency while others barely use the system. In order to understand the causes of low usage frequency for some of the students, the student’s background information was studied. This information included the degree that the students were studying, the student’s project type and project title, and the tools that they previously used in project management (PM tool). Table 6.3 summarizes the student background information that had been collected from our questionnaires.

<table>
<thead>
<tr>
<th>Student</th>
<th>Degree</th>
<th>Project Type</th>
<th>Project Title</th>
<th>PM Tool</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>PhD</td>
<td>Research Oriented</td>
<td>Constraint Management</td>
<td>MS Excel</td>
</tr>
<tr>
<td>B</td>
<td>PhD</td>
<td>Research Oriented</td>
<td>Cooperative Trust in Organization</td>
<td>MS Project</td>
</tr>
<tr>
<td>C</td>
<td>Masters</td>
<td>Software Development</td>
<td>Adaptive HT for Pupils</td>
<td>MS Project</td>
</tr>
<tr>
<td>D</td>
<td>PhD</td>
<td>Research Oriented</td>
<td>Information Exchange and Trust Building in Virtual Teams</td>
<td>MS Excel</td>
</tr>
<tr>
<td>E</td>
<td>Masters</td>
<td>Research Oriented</td>
<td>Tailored Mentoring using Hypermedia System</td>
<td>MS Project</td>
</tr>
<tr>
<td>F</td>
<td>Masters</td>
<td>Research Oriented</td>
<td>Meeting Facilitation using Hypermedia System</td>
<td>None</td>
</tr>
<tr>
<td>G</td>
<td>Masters</td>
<td>Research Oriented</td>
<td>Managing Student Project using Hypermedia System</td>
<td>MS Project</td>
</tr>
</tbody>
</table>

Table 6.3: Student Background Information
Based on Table 6.3, there are three observations that can be made. First, student E, F and G were doing a project that was related to a hypermedia system. Therefore, it is reasonable for these students to have a high usage frequency since using the system can be part of their study. Second, student D who was researching virtual teams could use the system to conduct virtual meetings as part of his/her study. Those students who had a low usage frequency are the ones who were doing a project that is unrelated to the system.

### 6.3.1 Findings from System Log Data

Based on the system log data, we can describe two main findings on the usage frequency of the project supervisor and students as follows:

1. The usage frequency of the project supervisor was dependent on the students' usage frequency. The reason for this relationship is that students require assistance from the project supervisor in managing their projects. Thus, as the student usage frequency increases, the project supervisor's usage frequency will increase as well.

2. Student's usage frequency was dependent on the nature of their projects that are often reflected by their project title.
Chapter 6: Results and Discussions

6.4 Results Summary

The results of the study showed that both the project supervisor and students have positive attitudes towards the use of the PowerMeeting system in student project management. The results gathered from the observations and interviews agree with results gathered from the questionnaire. Our findings from the results suggested that the PowerMeeting system is able to support the project supervisors and students in managing student projects effectively and efficiently by providing a number of services in project planning and control processes. In the remaining part of this section, we will summarize our findings from observations, interviews, questionnaires and system log data.

From the perspective of a project supervisor, the system is able to support project supervision by monitoring student progress and providing guidance to students in their projects more efficiently. Firstly, the project supervisor monitored student’s progress by using the project plan created by the students in the project workspace. Students who constantly updated the status of their project enabled the project supervisor to have an overview of their current progress. Therefore, students were no longer required to report their progress during project meetings. Changes made by the student to the project plan were visible to the project supervisor. Thus the project supervisor was able to identify problems that were liable to encounter in the project and provide guidance to students in tackling the problem.

Secondly, the rich media provided by the system allowed the project supervisor to provide guidance to students through synchronous and asynchronous cooperation. With this, the project supervisor was able to provide assistance to students effectively even if s/he was travelling abroad. In addition, meeting process maps and meeting minutes created by the students in the meeting workspace allowed the project supervisor to have a record of what had been discussed in previous meetings. The project supervisor made changes to the meeting minutes when there was any disparity or it was discovered that information was missing. This avoided any repetition of issues that had already been dealt with by the supervisor.
Chapter 6: Results and Discussions

The services provided by the system resolved many of the issues that were encountered by the project supervisor in using conventional method to manage student’s project. The resolved issues include: the inability to provide assistance to students while the project supervisor was travelling abroad, unable to track a student’s progress due to unpredictable changes made in the project plan and poor meeting management.

From the perspective of a student, the results generated from the study suggested that the system was able to support students in project planning and project control. Students created their project plan in their project workspace. The process structure of the project plan can adapt to change. Therefore, project tasks that could not be fully defined in the initial stage of the project could be refined during project execution as a student’s understanding grows. In addition, potentially affected tasks will also show up in the system. The status of the project tasks were updated on a regular basis. Therefore, project plan served as a means for the students to monitor their own progress.

Students obtain guidance and advices from the project supervisor in project meetings. There were three types of meeting that the students attended: group, individual and ad-hoc. These project meetings were conducted in a distributed virtual setting where the project supervisor and students participated in a real-time discussion. This approach supported flexible meeting process. Whether the meeting was planned or unplanned, the system was able to support the meeting process by providing a shared workspace for meeting planning and note taking. For planned meetings, students can create a meeting agenda, meeting minutes and a meeting process map in the meeting workspace. The meeting process map can be modified during project meeting sessions when the need arises. For unplanned meetings such as ad-hoc meetings, students can create a meeting agenda or a meeting process map on the fly in meeting workspace. As a discussion aid, visual artefacts such as writings and drawing are used.

Coordination support in project meetings allowed the project supervisor and students to perform cooperative tasks harmoniously. In addition to real-time discussion, students also received assistance from the project supervisor through asynchronous cooperation.
Students were thus able to resolve their issues in a timely manner. Besides receiving assistance from the project supervisor, students learnt from each other when using the system. This included the exchange and the sharing information via instant messaging or audio conferencing.

Although the system was useful in supporting the project supervisor and student in managing student projects, there were some limitations that have been highlighted by both the project supervisor and students. First of all, students who did a software development project did not find the system useful in helping them to discuss complicated issues with their project supervisor. Secondly, the project plan relied on the students to update their status. The project supervisor was unable to monitor a student’s progress if they did not update their project status on a regular basis. Thirdly, distributed meetings suffer from lack of face-to-face contact. Hence, students found that they had difficulties of knowing exactly when to speak in the meeting. Finally, since the introduction of the PowerMeeting system to students, the project supervisor’s workload had increased due to an increased number of meetings.

One of the interesting findings of this study was that the swim lane tool in the PowerMeeting system was found unsuitable in managing student projects. This was because students’ projects were mostly small scale ones. Therefore, the project supervisor and students monitored project progress by using the project plan created in the project workspace. Another interesting finding was that although the project supervisor and students provided positive feedback on the use of the PowerMeeting system in student project management, our results on student usage frequency are less positive. Based on our analysis from system log data, the usage frequency of students was dependent on the nature of the projects that the students were taking. If a student’s project was related to computer supported cooperative work (CSCW) then these students tended to have a higher usage frequency. In other words, the students are motivated to use the system because they could use their experience with the system as a source of information to complete their project. Based on this finding we raise the question of why some of the students were less motivated to use the system even though they find that the system is useful in managing their project.
Due to the time limitation of a master dissertation we were unable to provide an answer to this question in this research project. However, we believe that this finding offers another area for investigation that was related to the usability aspect of the system.

In next chapter, we will discuss the limitations found from the study and evaluate the work that has been done in this research project based on the success criteria identified in Chapter 3.
Chapter 7: Evaluation

Introduction

In this chapter, reflection and evaluation of the study carried out in this research project will be presented. In section 7.1, reflection on the approach taken in this research project will be presented. This includes reflection on the process or method used in performing the case study. In section 7.2, a review on this research project will be presented. This research project will be evaluated with the set of criteria identified in Chapter 3. Finally, in section 7.3, a summary of this chapter will be provided.

7.1 Reflections on the Study

The benefit of using a case study in this research project can be felt during the process of investigation, for example, the use of multiple sources of evidence. With multiple sources of evidence, we can corroborate our findings from qualitative data with the quantitative data. In addition, the use of a case study allows us to describe events that happened in real-time, provide explanations of the actions taken by the participants in these events and obtain users' experiences and opinions on the use of the PowerMeeting system. These benefits have not only helped to provide compelling evidence to answer our research question but also increased the reliability of the case study. However, there are also some limitations that have been observed.

One of the limitations that were found was that the participant-observer produced potential bias. When attending project meetings in distributed settings, participant-observer may not have had sufficient time to take notes about the activities performed by other participants because s/he was required to pay more attention to his/her role as a participant. In addition, the participants were aware that they were being watched when performing project management activities using the PowerMeeting system. When participants become aware that someone is watching them they become self-conscious. As they become self-conscious,
they tend to change the way they behave when using the system. Therefore, some of the students' actual behaviour may not be observed.

7.2 Evaluation on the Research Project

The evaluation criteria identified in Chapter 3 will be applied in this section to evaluate the work that has been done in the research.

7.2.1 Research Requirement: The Aim of the Research

a) **Criterion 1: Clearly stated aims of the research and the context in which the research will be conducted.**

The aim of the research and the scope of the study are clearly stated in Chapter 1. The former is stated in section 1.2 and the latter is stated in section 1.1. The aim of this study is to answer the research question: How a cooperative hypermedia based flexible process support system is able to support a project supervisor and students in managing student projects. Specifically, the study focuses on two project processes which were project planning and control. In addition, the results of the study were analyzed from the perspectives of the project supervisor and the students. With this, this criterion has been met.

b) **Criterion 2: Clearly stated research questions to be answered.**

This criterion has been met in Chapter 1, section 1.2. The research question of this research project is: How a cooperative hypermedia based flexible process support system is able to support: a) A project supervisor in monitoring student projects, and b) Students in project planning and monitoring.
Chapter 7: Evaluation

7.2.2 Research Requirement: Evidence of Awareness of the Literature

a) Criterion 1: Provide evidence of a review of the literature related to the study including a critical analysis.

In Chapter 2, the background to the area of investigation was presented. The literature has been reviewed in three different areas. This includes student project management, project management tools and flexible support systems. Conflicting views of these studies as well as the pitfalls of the approach taken in the study were critically analyzed. With this, the criterion has been met in this research project.

7.2.3 Research Requirement: Research Methodology

a) Criterion 1: Providing a justification for the use of a specific research methodology.

The research methodology that has been adopted in the study is Case Study. The definition of a case study and its use in the research has been clearly presented. In addition, the use of a case study has been justified with supporting literature. Therefore, this criterion has been met and the evidence can be found in Chapter 4, section 4.2 and 4.3.

b) Criteria 2: Providing a justification for the use of multiple sources of data.

There are four different sources of data were collected in the case study. This includes participant-observation, interviews, questionnaires and system log data. The use of these sources of data has been justified based on the nature of the project. In addition, the techniques used to collect and analyze the data were discussed. Hence, this criterion has been met and the evidence can be found in Chapter 4, section 4.4.

c) Criteria 3: Clearly describing how the data is collected.

The author had clearly described how data was collected in Phase 2 of the study in Chapter 4, section 4.3 and 4.4. The description includes how the data was collected.
during and after the Phase 2 of the study had been conducted. With this, this criterion has been met in this research project.

7.2.4 Research Requirement: Analysis on Research Results

a) Criterion 1: Provide compelling evidence to support the answer to the research question. The data collected should be analyzed from two perspectives: project supervisors and students.

Triangulation has been used in the case study to provide compelling evidence to support the answers to our research question. Hence, data collected for the study involves multiple sources of data: participant-observation, interviews, questionnaire and system log data (see Chapter 4, section 4.4). In order to analyze the data from the perspective of the project supervisor and the students, two different sets of interview questions and questionnaires has been prepared (see Appendix A, B and C). In participant-observation, action taken by both the project supervisor and students were recorded as field notes. Furthermore, the usage frequency of the project supervisor and the students were presented as two different graphs so that the data could be analyzed from different perspectives. The analysis of the results can be found in Chapter 6. With this, this criterion has been met in this research project.

b) Criterion 2: Clearly state the advantages and disadvantages of using the PowerMeeting system for student project management.

The advantages and disadvantages of using the PowerMeeting system in student project management can be found in Chapter 6, section 6.1.4 and 6.1.5. Each of the advantages and disadvantages presented are from the perspective of the project supervisor and the students. With this, this criterion has been met in this research project.
c) Criterion 3: The results generated from qualitative analysis should corroborate results generated from quantitative analysis.

The data gathered from the questionnaire has been used to corroborate the data gathered from the observations and interviews. The results for both quantitative and qualitative analysis as well as the final findings of the study are described in detail in Chapter 6. Therefore, this criterion has been met in this research project.

7.2.5 Research Requirement: Evaluation of the Study

a) Criterion 1: Clearly stated the limitations identified from the study.

This criterion has been met by providing the reflections on the research methodology used in the case. The evidence can be found in this chapter, section 7.1.

b) Criterion 2: Clearly stated the lessons learned from the study.

Lessons learned from the case study are presented in Chapter 8 (section 8.1) with examples together with recommendations on how to improve the study. Therefore, this criterion has been met in this research project.

In conclusion, this research project has met all the criteria identified in Chapter 3. The claims that were made in the review have been supported by the evidence. As mentioned in Chapter 3, the research project is regarded as successful if it is able to meet all the listed criteria.
7.3 Summary

This chapter has described the reflections on the use of the case study approach in this investigation. Its benefits and limitations have also been described. Following this an evaluation on the work that had been done in this research project was presented. The review for each criterion was provided with evidence to back up the claims that had been made. Overall, the research project had met all the criteria listed in Chapter 3. Thus, this research project was regarded as successful. Chapter 8 is the concluding chapter of this dissertation. It will present the conclusions and provide recommendations for further work.
Chapter 8: Conclusions and Further Work

Conclusions

The aim of this study is to answer the research question: "How a cooperative hypermedia system with flexible process support is able to support the project supervisor and students in managing student projects". Specifically, the study investigated how a cooperative hypermedia based flexible process support approach could support the project supervisor and students in project planning and project control. In order to investigate this approach in the context of managing student projects, a cooperative hypermedia system with flexible process support, the PowerMeeting system, was used in the study. Success criteria for this research project were identified. With the research question in mind, the investigation was carried out using a case study approach.

There were two phases to the case study. In the first phase of the study, the participants used the conventional method to manage their projects. Current conventional method refers to the three communication channels for managing student projects. It includes email, face-to-face meetings and interim reports. In the second phase of the study, the participants carried out their project management activities using the PowerMeeting system. In order to increase the reliability of the study, triangulation was used. Therefore, evidence was collected from four different sources: participants-observation, interviews, questionnaires and system log data. The author, who is also the participant-observer of the case study observed how the PowerMeeting system was used by the project supervisor and the students in managing the projects. Interview sessions were carried out with each of the participants after the second phase of the study ended. Following this, questionnaires were distributed to all the participants and system log data was collected from the PowerMeeting system server. Data gathered from these four sources were analyzed from the perspectives of the project supervisor and the students. Qualitative data was analyzed using grounded theory while quantitative data was analyzed by using descriptive statistics. Findings from quantitative data were used to corroborate findings from qualitative data.
Chapter 8: Conclusions and Further Work

The findings from the study revealed that a cooperative hypermedia based flexible process support approach was able to support the project supervisor and students in managing student projects. More specifically, this approach was able to support the project supervisor and students in creating, monitoring and adapting project plans cooperatively. Project supervisor and students can identify emerging problems from the project plan and discuss issues in project meetings. Furthermore, this approach also provides flexible meeting process support. Students can add emerging processes into the meeting workspace and modify existing meeting processes according to the changing situation. Therefore, this approach supports meeting process modifications and unplanned meeting process.

The project meetings were facilitated by synchronous and asynchronous cooperation. Thus, it is able to provide flexible ways of solving emergent problems in a timely manner. However, there are some drawbacks with this flexibility. This includes a lack of face-to-face contact during project meetings and some difficulties in solving complicated issues. This approach also provides coordination support. Therefore, the project supervisor and the students can work harmoniously when performing cooperative tasks. Overall, the findings from the study revealed positive feedback from the project supervisor and the students. Feedback from the project supervisor and the students suggested that by this approach they were able to resolve some of the issues they encountered in using conventional method to manage student project. In addition, the use of the swim lane tool in monitoring student projects is not necessary.

The benefit of using a case study as our research methodology was felt during the process of the investigation. It has provided an in-depth understanding about how the approach is able to support project supervisors and students in student project management. In addition, the approach has also allowed us to collect multiple sources of evidence in order to provide compelling evidence to support our answer to the research question. Although there are some limitations to this approach, we believe that these limitations can be easily overcome. Evaluation of this research project was carried out by using the success criteria that were identified in the early stages of the study. The results of the evaluation showed that the
research project had met all the criteria stated and therefore the research project was a success.

8.1 Further Work

In this study, the sample size was small. Thus, some of the findings may not be representative. For example, our findings from this study suggested that the PowerMeeting system is unable to support students who are doing a software development project in solving complicated issues. However, this finding might not be representative of a larger population as there was only one student who was doing a software development project. A larger sample would be required to perform an in-depth analysis on how the PowerMeeting system is able to support students who are doing different types of projects such as a research-oriented project or a software development project.

In order to have a high response rate and a short response time, questionnaires should only use open-ended questions. We identify this characteristic after sending out the first version of our questionnaire. The first version consisted of both open and closed questions. The response rate was very low even though reminder emails were sent. Only two out of eight participants returned the questionnaire and it was found that these participants did not answer any closed questions in the questionnaire. Therefore, the questionnaire was revised by removing all closed questions. The questionnaire was resent to all participants with a request to complete them. The response rate for this second version was high and all the questionnaires were returned completed in less than a week.

Interviews were carried out after the end of second phase of the study. In the interview sessions, when the students were asked about the issues in using the conventional method to perform project management activities, there were a small number of students who commented that they were unable to recall vividly the issues that they had encountered. We recommend that interview sessions should be carried out after each phase of the study in order to obtain more information on the experiences users have in using different methods to manage their project.
As mentioned in Chapter 7, the use of participant-observation in the case study had caused some participants to elicit atypical behaviour. Therefore, we suggest that the researcher should take the role of a complete participant in a case study. A complete participant is a fully functioning member of the social setting and members of the social settings are not aware of his/her true identity (Emma, B. and Bryman, A., 2003). With this, we believe that there may be no potential bias produced by the observer and participants of the study will behave naturally.

Finally, findings from the system log data have offered another area for investigation that was related to the usability aspect of the PowerMeeting system. Thus, further research can be carried out with reference to the lessons learned from this study.
References


References


References


References

Bibliography


Appendix A – Interview Guide

Questions for Project Supervisor:
1. How do you manage student projects currently?
2. What are the issues you faced using these methods?
3. Is PowerMeeting system able to support you in monitoring student project? If yes, how?
4. Is PowerMeeting system able to support you in providing assistance to students? If yes, how?
5. Does the system help you to provide assistance to students when you are travelling abroad? If yes, how?
6. Compare with the current conventional method you used, is PowerMeeting system able to resolve the issues you faced in using this method? If yes, how?
7. What are the disadvantages in using PowerMeeting system?
8. Besides what we have discussed above, what are other advantages of using the system?

Questions for Students:
1. How do you manage your projects currently?
2. What are the issues you faced using these method?
3. Is PowerMeeting system able to support you in project planning and project monitoring? If yes, how?
4. How do you receive assistance from project supervisor when using PowerMeeting system for student project management?
5. Are you able to receive assistance from project supervisor when he is travelling abroad? If yes, how?
6. Compare with the current conventional method you used, is PowerMeeting system able to resolve the issues you faced in using this method? If yes, how?
7. What are the disadvantages in using PowerMeeting system?
8. Besides what we have discussed above, what are other advantages of using the system?
Appendix B – Questionnaire for the Project Supervisor

As part of the Flexible Process Support for Student Project Management study, we are interested in finding out about your experiences with PowerMeeting system. This questionnaire includes questions about your experiences in performing your project with and without using the PowerMeeting system.

We are interested in your experiences and opinions. All information that you provide are confidential. Thank you for your participation.

Please put an ‘X’ next to each statement to indicate your appropriate response.

**Section A**

This section is to gather background information of the user.

1. How many student(s) under your supervision? _____

2. Before using PowerMeeting system, how do you manage your student's project? 
   (Please provide your answer in the space given below)

   ______________________________________________________
Appendix

Section B
This section is to find out your experiences and opinions on using conventional method to manage student project.

3. It is difficult to identify liable problems that would occur as I was not always informed by the changes made on the project plan.
   - Strongly Agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly Disagree

4. It is difficult to monitor student progress using conventional method.
   - Strongly Agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly Disagree

5. Most of the meeting minutes that students created are not organized or not complete.
   - Strongly Agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly Disagree
6. It is difficult to provide assistance to students effectively when project I’m travelling abroad
   - Strongly Agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly Disagree

Section C
This section is to find out your experiences and opinions on the use of PowerMeeting system for student project management.

7. I’m able to monitor student progress effectively by using the PowerMeeting system.
   - Strongly Agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly Disagree

8. I’m well-informed of the changes made by the students on their project plan.
   - Strongly Agree
   - Agree
   - Neither agree nor disagree
   - Disagree
   - Strongly Disagree
9. I'm able to identify problem that liable to occur from the project tasks.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

10. I'm able to monitor student's progress using swim lane tool.
    __ Strongly Agree
    __ Agree
    __ Neither agree nor disagree
    __ Disagree
    __ Strongly Disagree

11. The system support flexible meeting process, for example, users can create and modify meeting process map on the fly during project meeting sessions.
    __ Strongly Agree
    __ Agree
    __ Neither agree nor disagree
    __ Disagree
    __ Strongly Disagree

12. Meeting minutes and meeting agenda are properly documented since the introduction of PowerMeeting system.
    __ Strongly Agree
    __ Agree
    __ Neither agree nor disagree
    __ Disagree
    __ Strongly Disagree
13. I’m able to provide assistance to students through the use of PowerMeeting when I’m travelling abroad.
   ___ Strongly Agree
   ___ Agree
   ___ Neither agree nor disagree
   ___ Disagree
   ___ Strongly Disagree

14. The system enable project supervisor to resolve issues brought up by student in timely manner.
   ___ Strongly Agree
   ___ Agree
   ___ Neither agree nor disagree
   ___ Disagree
   ___ Strongly Disagree

15. The system support coordination in project meetings.
   ___ Strongly Agree
   ___ Agree
   ___ Neither agree nor disagree
   ___ Disagree
   ___ Strongly Disagree

16. The system relies on students to update their project status. Therefore, if students do not update their status in project workspace, project supervisor is not able to monitor project progress.
   ___ Strongly Agree
   ___ Agree
   ___ Neither agree nor disagree
   ___ Disagree
   ___ Strongly Disagree
17. Since the introduction of PowerMeeting system for student project management, my workload has increased  
__ Strongly Agree  
__ Agree  
__ Neither agree nor disagree  
__ Disagree  
__ Strongly Disagree

End of questionnaire
Appendix C – Questionnaire for the Students

As part of the Flexible Process Support for Student Project Management study, we are interested in finding out about your experiences with PowerMeeting system. This questionnaire includes questions about your experiences in performing your project with and without using the PowerMeeting system.

We are interested in your experiences and opinions. All information that you provide are confidential. Thank you for your participation.

Instruction: Please put an ‘X’ next to each statement to indicate your appropriate response

Section A
This section is to gather background information of the participants.

1. What degree are you currently taking?
   __ PhD
   __ Masters

2. What type of project are you currently doing? (e.g. Research-oriented project or Software development project)

   ____________________________

3. What is the title of your project?

   ____________________________
Appendix

4. Do you have experience in using any project management tool before? (E.g. Microsoft project)
   _ Yes (if yes, proceed to Question 2)
   _ No (if no, proceed to Question 3)

5. Name the project management tool that you have used before.

Section B
This section is to find out your experiences and opinions on using conventional method to manage your project

6. It is difficult to resolve issues with project supervisor using email when he is travelling abroad
   _ Strongly Agree
   _ Agree
   _ Neither agree nor disagree
   _ Disagree
   _ Strongly Disagree

7. The conventional method is not able to adapt to change effectively.
   _ Strongly Agree
   _ Agree
   _ Neither agree nor disagree
   _ Disagree
   _ Strongly Disagree
Appendix

Section C
This section is to find out your experiences and opinions with the use of PowerMeeting system on student project management.

8. The system is able to provide flexibility to users in changing project plan.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

9. When a task has been changed, it is easy to identify all other tasks potentially affected by the change in the system.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

10. I’m able to have a better view on the progress of my project using PowerMeeting system.
    __ Strongly Agree
    __ Agree
    __ Neither agree nor disagree
    __ Disagree
    __ Strongly Disagree
11. The system support flexible meeting process, for example, users can create and modify meeting process map on the fly during project meeting sessions.

   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

12. Meeting minutes and meeting agenda were properly documented since the introduction of the PowerMeeting system. Thus, it has improved student's project management.

   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

13. The system is useful in helping me to identify project-related information.

   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

14. I'm able to solve issues with my project supervisor when s/he is travelling abroad.

   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree
15. I’m able to solve complicated issues with my supervisor through the use of PowerMeeting system
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

16. More project meetings have been conducted with project supervisor since the introduction of PowerMeeting system
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

17. I feel comfortable to discuss issues with my project supervisor during online group meeting.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

18. In project meetings, I’m able to receive important information that is related to my project from other participant’s discussion.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree
19. The system support coordination in project meetings.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

20. I'm able to learn from other users of the system by exchanging and sharing ideas via instant messaging or audio conferencing.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

21. Sometimes, I find it difficult to speak in project meetings due to no face-to-face contact with other participants in the meeting.
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree

22. There are no restrictions on the changes made in the project workspace
   __ Strongly Agree
   __ Agree
   __ Neither agree nor disagree
   __ Disagree
   __ Strongly Disagree
23. I can get distracted by other things while having the project meeting in distributed virtual settings.

__ Strongly Agree
__ Agree
__ Neither agree nor disagree
__ Disagree
__ Strongly Disagree

End of questionnaire