Performance Evaluation of Two Different Usability Evaluation Methods in the Context of Collaborative Writing Systems

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ABSTRACT

In today’s world of rapid technological development one cannot deny the importance of collaborative writing systems. Besides many advantages of a collaborative writing system the major one is to allow its end users to work in collaboration with each other without having to physically meet.

In the past various researches has been carried out for the usability evaluation of collaborative writing systems using the think aloud protocol method however there is no study conducted on the comparison of different usability evaluation methods in the context of collaborative writing systems.

In this thesis work the authors have tried to find the limitations and capabilities of think aloud protocol and co-discovery learning methods in the context of a collaborative writing system called ZOHO, as well as the usability evaluation of ZOHO using think aloud protocol and co-discovery learning methods.

The authors found various usability errors in ZOHO. Apart from this the authors also observed the two usability evaluation methods when they were used for usability evaluation of ZOHO. The authors found that both the methods have its’ own benefits and drawbacks. While the co-discovery learning method was fast enough, it was expensive in terms of human resource. On the other hand think aloud protocol method was slow to perform but there was less human resource used. Both the usability methods found almost the same usability errors.

Keywords: Usability evaluation methods, Think aloud protocol, Co-discovery learning, Collaborative Writing System (ZOHO).
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CHAPTER 1: INTRODUCTION

The primary goal of this thesis is to evaluate two different usability evaluation methods by conducting usability tests of a collaborative writing system using think aloud protocol and co-discovery learning methods. This thesis will help in identifying the flaws and shortcomings related to a collaborative writing system through the feedback from its users. This feedback will help in making the system more usable.

Section 1.1, describes the outline of each chapter included in this thesis. Section 1.2 discusses the background study for this thesis work while section 1.3 is about the related work to this thesis.

1.1. Thesis Outline

A brief overview of all the chapters included in this thesis is as follows:

**Chapter 2** deals with the problem definition & goals. Section 2.1 of this chapter is about the problem definition. Section 2.2 discusses the aims and objectives of this thesis work. Section 2.3 describes the research questions which are going to be addressed in this thesis. Section 2.4 deals with the goals and results that we are going to achieve at the end of this thesis.

**Chapter 3** deals with the research methodology of this thesis work. Section 3.1 deals with an overview of the methodology that was followed in this thesis work. The methodology is discussed stepwise in the sections 3.2, 3.3, 3.4, 3.5 and 3.6.

**Chapter 4** is about the proposed work. Theory related to Usability, Usability evaluation methods and collaborative writing systems is discussed in this chapter. Section 4.1 of this chapter discusses the different models of usability. Section 4.2 outlines the two evaluation methods i.e. think aloud protocol and co-discovery learning method and section 4.3 describes collaborative writing systems, their functionalities and also some collaborative writing systems are enlisted. A brief introduction of ZOHO is given section 4.4.
Chapter 5 discusses the usability tests. Task preparation, participant selection, usability test planning and conduction are major part of this chapter. Section 5.1 describes the tasks planning for usability tests, section 5.2 outlines the tasks designing for the tests, section 5.3 is about post test questionnaires and its designing, section 5.4 is about the participant selection criteria and the participants selected for the usability tests, in section 5.5 and 5.6 a pilot test and pilot questionnaire was performed and discussed, in section 5.7 we discussed about the tests execution and in section 5.8 we discussed about the questionnaire distribution to the test participants after the test was conducted.

Chapter 6 deals with the results achieved from chapter 5. Results collection and results reporting is done in this chapter. Section 6.1 of this chapter deals with the time taken to complete tasks from both the usability tests, section 6.2 is about our observation of the tests’ participants during the tests and section 6.3 is about the participants’ feedback on the questionnaire.

Chapter 7 has the analysis and discussion part of the thesis. Section 7.1 is about the analysis of the time taken to complete a task in both the usability tests, Section 7.2 is an answer to one of the research question of this thesis by doing usability assessment of ZOHO, in Section 7.3 the capabilities and limitations of think aloud protocol and co-discovery methods are discussed, Section 7.4 deals with the validity assessment of our research while section 7.5 is the recommendation to ZOHO as well to both the usability methods to make them better in context of collaborative writing systems, in the end is a summary of this thesis and future work is proposed by the authors.

1.2. Background

Usability, in the field of HCI, is known to be the degree to which a system is effective, efficient and provides satisfaction. A system is said to be usable if it ensures effective and efficient tasks completion as well as it provides greater satisfaction to its users in usage (ISO 9241-11, 1998). To find out the degree to which a system is usable, usability evaluation is carried out. Usability evaluation can be regarded as a process of measuring the HCI characteristics of a system and identifying its weaknesses for future improvement (Granic et al., 2004; Shneiderman & Plaisant, 2004). Usability evaluation
can be performed using different usability evaluation methods such as think aloud protocol, co-discovery learning, questionnaire, coaching method, teaching method, retrospective method, remote testing and performance measurement of a system (Nielsen, 1993; UsabilityHome, n.d).

Of the many usability evaluation methods available, the authors are interested in focusing on think aloud protocol and co-discovery learning methods. In the think aloud protocol the participants are to speak aloud when they perform some tasks on the system. The list of tasks is given to them by the tester. The interaction of the participants with the system during the test is verbalized and recorded for later analysis (Nielsen, 1993). This method has its own advantages as well as disadvantages. The main advantage of this method is that it can help in the understanding of the reasons behind the users’ action when they interact with the system as well as through this method the evaluators can get to know about the users’ misconceptions about a system (Adebesin et al., 2009). Another major advantage of this method is that the participants do not have to remember their behavior during the test for later recall (Baauw & Markopoulous, 2004). However the main drawbacks of this method are that a user may feel uncomfortable in front of the camera as it is unnatural for them that their behavior is being recorded (Adebesin et al., 2009). In contrast to think aloud protocol there is another usability evaluation method known as co-discovery learning method. In this method instead of one participant there are two participants working together to perform some tasks on a target system. They are allowed to interact with each other and help each other to perform a common task. It is this interaction that makes the co-discovery method more natural as the participants feel comfortable in verbalizing their thoughts (Dumas & Redish, 1999; Wilson & Blostein, 1998; Nielsen, 1993).

Various research e.g. by Ross et al., (1995) Pinelle & Gutwin, (2000) Baker et al., (2001) Steves, et al., (2001) have been carried out on collaborative technologies. Apart from this there are also studies conducted on the comparison of different usability evaluation methods (Jeffries et al., 1991; Doubleday et al., 1997). Some researcher have even proposed their own framework for usability evaluation (Greenberg et al., 2000; Gutwin & Greenberg, 2000; Baker et al., 2001; Masemola & Villiers, 2006; Lee et al.,
According to Khan & Hassan, (2009), collaborative writing systems should be evaluated using a usability evaluation method other than think aloud protocol so that it can help in identifying an appropriate usability evaluation method for the future evaluation of any collaborative writing system. At present according to our knowledge there is no usability evaluation being conducted on collaborative writing systems using co-discovery method as well as there is also no investigation done yet to identify a better usability evaluation method for finding the usability of a collaborative writing system. Hence we are interested in carrying out usability evaluation of a collaborative writing system (ZOHO) using think aloud protocol as well as co-discovery method. We have selected ZOHO web-office suite because at present there is no usability test done on ZOHO as well as due to the fact that ZOHO is becoming a market leader in the online collaboration tools industry (Lynch, 2008). ZOHO office suite applications are a strong competitor to Microsoft office applications and there are many features in ZOHO that are not present in Google’s office suite which makes ZOHO a strong competitor of Google in terms of collaborative writing. In this research our aim is to investigate whether the think aloud protocol or co-discovery learning method is an appropriate method for the usability evaluation of a collaborative writing system. This study will also investigate and suggest improvements in ZOHO.

1.3 Related Work

Different researcher have proposed different usability evaluation frameworks for collaborative technologies (Urmetzer & Alexandrov, 2007; Tromp, et al., 2003; Nodder, et al., 1999; Steves, et al., 2001; Bowman, et al., 2002; Lee, et al., 2009). However there exist gaps between various researches that need to be considered seriously before we can finally conclude on a specific usability evaluation method for collaborative technologies.

In Lee, et al., (2009) the authors have proposed a discount usability evaluation method for usability evaluation of collaborative technologies. According to the authors in Lee, et al., (2009), there is an increased need for a discount usability evaluation method as the present methods for usability evaluation are expensive and requires hard work because the present methods emphasize on field observations. Hence the authors in Lee, et al., (2009) proposed a discount usability evaluation method for collaborative technologies.
Another research study was conducted by Tromp, *et al.*, (2003) for investigating the issues related to usability evaluation and design of collaborative virtual environments. The researchers in Tromp, *et al.*, (2003) carried out studies based on users’ behavior and the computational demands, usability inspection for each project demonstrators, assessing the utility and acceptability of demonstrators by consumers and design guidelines’ continuous preparation for future developers of collaborative virtual environments. Urmetzer and Alexandrov (2007) argued that usability during the software development lifecycle is usually neglected. Furthermore the authors have argued that usability evaluation of collaborative software tools is a complex task because of multiple user interfaces as well as the physical distribution of the collaborative software tools. In the end the authors have extended the traditional usability evaluation methods in order to support collaborative work. The authors then proposed and used a screen recording software tool for the purpose of observing all the users involved in collaborative working. In Steves *et al.*, (2001), the authors performed usability evaluation of a groupware system using two different scenarios. In one scenario user based techniques were used while in the other usability inspection methods were used. The results from these two scenarios were then compared and it was concluded that both the scenarios had their own pros and cons and as both the scenarios had some limitations that’s why it was proposed to used both user based techniques as well as traditional usability inspection methods together in order to achieve better results. Nodder, *et al.* (1999) discussed the changes in approaches used by usability engineers between the first and third version of a collaborative technology by Microsoft, that is Microsoft NetMeeting product. The authors in Nodder, *et al.* (1999) have argued that for collaborative applications the usability evaluation methods used by usability engineers must also iterate with the product itself. In Bowman *et al.*, (2002) the authors have compared two usability evaluation methods i.e. testbed evaluation and sequential evaluation in the context of virtual environments. The authors in Bowman *et al.*, (2002) concluded by presenting some new ways to link these two methods effectively for usability evaluation of virtual environments.
CHAPTER 2: PROBLEM DEFINITION/GOALS

This chapter deals with the problem definition, aims and objectives and research questions of the research work to be carried out in this thesis.

2.1. Problem Definition

In the fast growing world of technology nobody can deny the importance of online collaboration writing systems. Such systems are used by collaborators to work in collaboration with their team without having to physically meet. One such online collaboration writing system is ZOHO. ZOHO is a website that offers an online suite of web-office applications. Documents stored on ZOHO servers are secure and can be accessed from anywhere using the internet. ZOHO helps its users to collaborate and share information easily. ZOHO is also very economical because it offers free applications for individuals as well as paid applications for business use.

In the past research has been carried out to evaluate the usability of collaborative writing tools such as Faisal (2008) and Khan & Hassan (2009). They carried out usability evaluation using the think aloud protocol which is a qualitative testing method. The collaborative writing systems that were evaluated in these researches for usability are Google Docs and Think free. The main purpose of the study conducted in Faisal (2008) and Khan & Hassan (2009) was to evaluate the collaborative writing systems using a specific usability method using think aloud protocol method. However some authors such as Adebesin et al. (2009), Nielsen (1993) & Wilson (1998) have argued that co-discovery is more natural than think aloud protocol method. In the think aloud protocol method a participant verbalizes his thoughts alone while the co-discovery method involves conversation between the participants which in fact is the verbalization of their thoughts. Hence co-discovery method can be regarded as more natural than think aloud protocol method.

Based on these facts we think that in the context of collaborative writing systems, co-discovery learning method will perform better than the previously used think aloud protocol. We also believe that the limitations/capabilities of both these methods can be
figured out if both these methods are used simultaneously on a same collaborative writing system.

2.2. **Aims and Objectives**

Below are the aims and objectives that will be achieved at the end of this thesis work.

- **Usability evaluation of ZOHO:**
  Usability evaluation of ZOHO using two different usability evaluation methods i.e. think aloud protocol and co-discovery method will be performed. Both of these tests will be based on observing the users performing a set of well designed tasks as well as by observing the post test questionnaire.

- **Analysis of results:**
  The usability tests will give us results that we are going to analyze. Analysis will be done on the results that we get from each task performed by a user. In addition analysis will also be carried out on the feedback provided to us by the test participants.

- **Discussion on the results:**
  Another objective that is going to be achieved through this thesis will be the detailed discussion on the results that we got from the usability tests and their analysis.

- **Limitations/capabilities of Usability methods:**
  Based on the discussion our aim is to identify the limitations/capabilities of both think aloud protocol and co-discovery methods when used for usability testing of a collaborative writing system.

2.3. **Research Questions**

This thesis is going to address the following research questions:
1. To what extent do the findings of Think Aloud Protocol correspond with the findings of Co-Discovery Method in the context of collaborative writing?

2. To what extent is ZOHO effective, efficient and satisfactory in the context of collaborative writing?

3. What makes ZOHO ineffective, inefficient and unsatisfactory in the context of collaborative writing systems?

2.4. Goals/Results

The primary goal of this thesis is to evaluate two different usability evaluation methods by conducting usability tests of a collaborative writing system using think aloud protocol and co-discovery learning methods. The expected outcomes from this study will help in the identification of a suitable usability testing method for the usability evaluation of a collaborative writing system as well as the results from the usability evaluation of ZOHO will also be achieved. The findings from this study can be used as a baseline for carrying out usability evaluation of any collaborative writing system in the future.
CHAPTER 3: METHODOLOGY

This chapter deals with the research methodology of the research work to be carried out in this thesis. In this research work mixed research approach was used as in Creswell (2009). Mixed research approach is based on quantitative as well as qualitative research. In this thesis quantitative research was performed by conducting the statistical analysis of the task time completion as well analysis of the questionnaires’ feedback. Qualitative research was carried out in this thesis by using Think aloud protocol and co-discovery methods for observing the participants during both the tests and also by conducting interviews with the participants after the tests. Section 3.1 of this chapter outlines a brief overview of this thesis work.

3.1. Overview

This thesis was conducted using a step by step process. This step by step process is well illustrated in the following Figure 3.1. As seen in the figure, the first step of this thesis work was the literature review.

Figure 3.1: Methodology
3.2. Literature Review

In the literature review we studied literature related to our problem definition, different usability evaluation methods i.e. coaching method, performance measurement, Question-asking protocol, remote testing, retrospective testing, shadowing method, teaching method, think aloud protocol and co-discovery learning method were studied with a primary focus on think aloud protocol and co-discovery methods. Study about different collaborative writing systems was also conducted in the literature review phase. We were able to identify different functionalities of a typical collaborative writing system that are communication, coordination and cooperation (Lee et al., 2009).

3.3. Usability Evaluation Methods (UEMs)

After a thorough literature review we selected two different UEMs for two purposes. The first purpose was to evaluate usability of a collaborative writing system using two different UEMs and the second purpose was to investigate that which UEM is better than the other. The two different UEMs selected were Think Aloud Protocol and the Co-Discovery methods. The authors selected think aloud protocol and co-discovery learning method because of the reason that earlier research such as Faisal (2008) and Khan & Hassan (2009) were carried on collaborative writing systems using the think aloud protocol method and this thesis work is similar to them in the sense that the target system used in this thesis too is an online collaborative writing system. Co-discovery learning method was selected because its relevance with think aloud protocol is greater than any other method except for one difference, that is in the think aloud protocol method a participant works alone while in the co-discovery learning method a single task is performed by a group of two participants using the same system.

3.4. Usability Test / Target system

This step was carried out after the selection of two different UEMs in the earlier steps. In this step we selected collaborative writing system to be our target system. Using the UEMs selected earlier, we evaluated a collaborative writing system i.e. ZOHO. Two usability tests were performed using think aloud protocol and co-discovery learning
methods. After the tests, the participants were given a questionnaire for feedback in order to assess the usability of ZOHO from the user’s perspective. After the questionnaire the participants were asked some open ended questions as an informal interview.

### 3.5. Results

In this step we gathered the results obtained in section 3.4. We got two sets of results for the two different UEMs that we used. From the usability tests, the task time completion, and the usability errors were presented as results while the feedback from the questionnaires helped in figuring out the extent to which the users thought about the effectiveness, efficiency and satisfaction from ZOHO. The feedback from interviews was used for the validity assessment of our thesis.

### 3.6. Discussion

The results that we obtained in the above step were analyzed in this phase. After getting through this step we were able to identify the limitation and capabilities of both UEMs in the discussion part of this thesis. Analysis and discussions on usability assessment and usability errors in ZOHO was also conducted in this phase. The discussion about evaluating which usability evaluation method is better than the other was general in nature based on the results that we got in section 3.5.
CHAPTER 4: PROPOSED WORK

The topics discussed in this chapter are usability, usability evaluation, usability evaluation methods, collaborative writing systems and their major functionalities.

4.1 Usability

Usability of software is determined by the productivity and acceptance of the application by its users (Abran, et al., 2003). Usability of software cannot be regarded as a one and single attribute of a user interface. There are many different definitions of usability by different authors such as Borges et al., (1996); Granic et al., (2004); Keevil, (1998); Levi & Conrad, (n.d); Morkes & Nielsen, (1998); Tullis, (1998); Dix, (2003); Sharp et. al. (2007).

According to Nielsen (1993) usability is a combination of five important factors of a user interface; they are as follows:

- **Learnability**
  The software should be easily learnt by the user thus enabling him to work rapidly.

- **Memorability**
  It should be easy enough for a casual user to remember the system so that it is easy for him to return to use the system after a long time with less or no difficulty at all.

- **Efficiency**
  The system should be efficient with an increased productivity that is achieved once the user has learnt how to use it.

- **Satisfaction**
  The users must find the system’s interface to be pleasant and they must be satisfied from interacting with the system.

- **Errors**
  There should be a low error rate in the system and the user should recover from these errors easily.
Another definition of usability refers to usability as “the ease with which a user can learn to operate, prepare inputs for, and interpret outputs of a system or component” (IEEE, 1990). The International Standardization Organization has set two ISO models for usability. These two different ISO standards are ISO 9126-1 and ISO 9241-11.

According to ISO 9126-1 the definition of usability is “the capability of the software product to be understood, learned, used and attractive to the user, when used under specified conditions” (Abran, et al., 2003). Based on this definition there are four main factors in usability, they are understandability, learnability, operability and attractiveness as shown in the figure below.

ISO 9241-11 (1998) defines usability as “software is usable when it allows the user to execute his task effectively, efficiently and with satisfaction in a specified context of use”. This definition of usability outlines three distinct features of usability, which are effectiveness, efficiency and satisfaction. Effectiveness deals with how well the users can accomplish their goals using the system; efficiency is to figure out the resources used by the user to achieve his goals while satisfaction is to know about a user’s feelings while he interacts with the system to achieve his goals (Wixon & Wilson, 1997).
Usability of a website design can be carried in many ways (Borges et al., 1996; Granic et al., 2004; Keevil, 1998; Levi & Conrad, n.d; Morkes & Nielsen, 1998; Tullis, 1998; Dix, 2003; Sharp et. al., 2007). Different evaluators, based on their interests and capabilities, can use different evaluation criteria for usability of a product. For example if an evaluator uses Jacob Nelson’s criteria for usability then he will look for Learnability, memorability, efficiency, satisfaction, and errors in a given product. But if an evaluator follows the ISO 9241-11 model for usability then he will look for effectiveness, efficiency and satisfaction from the perspective of the user of a given product.

The authors of this thesis have followed the ISO 9241-11 usability model in this thesis. The motivation to select ISO 9241-11 usability model for this thesis work was its advantages below:

- It is the only model which addresses usability specifically (Abran, et al., 2003).
- It is adopted by many Human computer Interaction’s experts.
- Describes usability on the basis of only 3 factors that are effectiveness, efficiency and satisfaction.

Figure 4.1(b): ISO 9241-11 Usability Model
• In a specific context, usability can be measured directly by user performance and satisfaction.
• This model also specifies the usability aspects and context of use components to be emphasized upon in the specification, design and usability evaluation.

4.2 Usability Evaluation Methods

Apart from the usability evaluation criteria, an evaluator also needs to follow a certain method for usability evaluation. An evaluator, based on his interests and resources, may choose any usability evaluation method from the different evaluation methods available. According to Sharp, et al., (2007) it is necessary to perform usability evaluation of a system because “without evaluation, designers cannot be sure that their software is usable and is what the user wants”. Among these methods are coaching method, performance measurement, Question-asking protocol, remote testing, retrospective testing, shadowing method, teaching method, think aloud protocol and co-discovery learning method (Usabilityhome, n.d.).

It is worth mentioning here that the authors were interested in the think aloud protocol and co-discovery learning method due to the fact that earlier research such as Faisal (2008) and Khan & Hassan (2009) were carried on collaborative writing systems using the think aloud protocol method and this thesis work is similar to them in the sense that the target system used in this thesis is an online collaborative writing system. Co-discovery learning method was selected because its relevance with think aloud protocol is greater than any other method except for one difference. In the think aloud protocol method a participant works alone while in the co-discovery learning method a single task is performed by a group of two participants using the same system. Different usability evaluation methods are discussed briefly in the following sub-sections:

4.2.1 Think Aloud Protocol

In the think aloud protocol test a participant is given some tasks to perform. The participant speaks loud his thoughts while performing these tasks so the evaluator has a clear idea of what the participant has on his mind while interacting with the target
system (Sears, & Jacko, 2007; Dumas, 2003). While performing the given tasks on the target system, not only the participants’ thoughts are observed but also the time taken by them to perform a certain task is estimated (Schaffer, 2004).

The main advantage of this method is that an evaluator is able to judge easily from the user’s action what he/she thinks about the interface of the target system. An evaluator has also the chance to figure out what misconceptions/problems a user faces while interacting with the target system. However the key disadvantage of this method is that it might be considered unnatural by some participants, hence affecting their task performance (Adebesin, et al., 2009).

4.2.2 Co-discovery Learning

This method is a variation of the think aloud protocol method. In this method a group of two participants are given the tasks to be performed and rest of the procedure is the same as in think aloud protocol method. However in this case both the users are allowed to work in collaboration and verbalize their thoughts by talking to each other while they perform the given tasks (Adebesin, et al., 2009).

The primary advantage of this method is that it is more natural than the think aloud protocol method. Hence the participants may feel at ease when performing the given tasks. The verbalization is more natural in this method because of the fact that both the participants, working on the same system, communicate with each other. The main drawback of this usability evaluation method is that the participants needed for the test are more in number than the participants needed in think aloud protocol method. Another big shortcoming to consider is the cultural and verbal styles of different participants because if a group of participants consist of two individuals from two different culture or they have different verbal styles then it will affect the feedback from the test (Wilson, 1998).

4.3 Collaborative Writing Systems

Collaborative writing systems are used to work on the same document by different co-authors present at different geographical locations (Mendoza-Chapa, et al., 2000).
Collaborative writing is similar in nature to a problem solving activity performed by a group of people working together (Flower, & Hayes, 1981). Furthermore Flower & Hayes (1981) regard collaborative writing systems as systems that support “collaborative writing work”. The process of collaborative writing is described by Lay and Karis (1991) as “a process where co-authors, with abilities and different responsibilities, interact during the invention and revision of a common document”.

From various studies such as Vijayanand Bharadwaj (2004); Borghoff & Schlichter (2000); Calvary et al. (1997); Zigurs & Buckland (1998) on collaborative technologies, Lee, et al. (2009) has identified three major parts of a collaborative technology. They are communication, cooperation and coordination. According to Lee, et al. (2009) almost all collaborative technologies support these three functions. These functions are explained below:

4.3.1 Communication

Communication “refers to any aspect of a collaborative technology that supports the capability of group members to communicate with each other”. Thus we can say that from the viewpoint of the message sender, the collaborative technology should have the capability for the sender to effectively present and encode intent into a message while from the perspective of a receiver the collaborative technology should provide a mean for them to better understand the sender’s intention which is in the form of a message Lee, et al. (2009).

4.3.2 Cooperation

It is a mutual and parallel effort by members of a group for the completion of a collaborative task. Collaborative technologies has a support for cooperation in a way that it allow the members of a same group to mutually and concurrently work on shared objects Lee, et al. (2009). According to Gerosa, et al. (2004) cooperation includes constructing, modifying, refining and working on shared objects such as files, documents, charts, source code, design models etc.
4.3.3 Coordination

According to Malone and Crowston (1990), coordination is to manage the interdependencies among different tasks that are performed in order to achieve a specific objective. If there is no coordination among the users then their work will be redundant as well as there would be conflicts among leading to an overall state of confusion in the collaborative work performance. Therefore coordination can be called as a operating cost to perform a group task (Malone & Crowston, 1990).

4.4 ZOHO

Today in the market there are many web-applications that work as collaborative writing systems such as Google docs, Thinkfree, ZOHO, Microsoft office live and many more. The authors selected ZOHO as the target system for this thesis work. ZOHO is an online suite of applications that supports the collaborative work by its end users. There are two different versions of ZOHO; personal and business. The personal version consists of applications suite that can be used by individuals on a small scale for collaborative work while the business edition can be used by organizations for collaborative work by the organization.

ZOHO was selected for this thesis work because of the fact that no usability evaluation has been conducted on ZOHO yet according to the knowledge of the authors. Another reason why ZOHO was selected is because it has got many features that a user needs while working in collaboration with his group members. ZOHO includes everything from word processing, spreadsheets, chat support, email support, presentations, notebooks, wikis, online databases and project management. Thus it can be regarded as a powerful collaborative writing system due to the availability of variety of web-office applications.
Figure 4.4: ZOHO Applications Suite
CHAPTER 5: USABILITY TESTS

This chapter discusses the planning and conduction of the two usability tests using think aloud protocol and co-discovery learning methods. In section 5.1 we have discussed the planning before conducting usability tests, section 5.2 of this chapter describes the tasks designing for the usability tests, in section 5.3 we designed some questionnaires, in section 5.4 we identified and selected participants for the tests. A pilot test was conducted and discussed in section 5.5, a pilot questionnaire study was performed in section 5.6, in section 5.7 we have conducted and discussed the usability tests and in the end of this chapter in section 5.8 the questionnaires were distributed among the test participants in order to get their feedback.

5.1 Tests Planning

In this research thesis the target applications of ZOHO that were selected for usability testing were ZOHO Mail, Chat, Writer, Sheets and Show. Two participants worked in collaboration using ZOHO by performing a given set of tasks on one file/document each. The nature of these tests was kept simple because it reduced the complexity in our observations as well as due to the time and resources constraints. In the case of performing tests of two participants, one participant was observed by one author of this thesis and the other participant was observed by the other author of this thesis. The fact that in both the tests only two groups worked in collaboration with each other can be regarded as a limitation of this research as we believe that if there were more than two groups involved simultaneously in these tests then the result might have varied. However In order to perform tests on more than two participants simultaneously the authors needed more number of trained usability experts, which was not possible. The tasks that the participants had to perform are discussed in the next section.

5.2 Tasks Design

We designed a same set of tasks for both of the usability tests. There were 9 different tasks and each task had a number of closely connected steps. Out of these 9 tasks 7 tasks were related to the communication, cooperation and coordination aspect of ZOHO,
while the other 2 tasks were general in nature i.e. signing into ZOHO and signing out of ZOHO. For the communication in ZOHO, ZOHO Mail and Chat were selected for tasks performing, for the cooperation in ZOHO, ZOHO Writer, Sheets and Show were selected. While to test the coordination parts of ZOHO the file sharing and editing section of ZOHO were selected. Table 5.2 outlines the tasks that we used in the tests conduction.

Table 5.2: Tasks for Usability Tests

<table>
<thead>
<tr>
<th>LOGIN TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK: 1</td>
</tr>
<tr>
<td>01</td>
</tr>
<tr>
<td>02</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION TASK</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK: 2</td>
</tr>
<tr>
<td>01</td>
</tr>
<tr>
<td>02</td>
</tr>
<tr>
<td>03</td>
</tr>
<tr>
<td>04</td>
</tr>
<tr>
<td>05</td>
</tr>
</tbody>
</table>

| TASK: 3            |
| 01 | Now switch to ZOHO Chat. |
| 02 | Add one of your friend to your ZOHO messenger |
| 03 | Look for your friend to check whether he is online or not. |
| 04 | Send a Short message to your online friend. Use text as well as emoticons. |

<table>
<thead>
<tr>
<th>COOPERATIVE TASKS</th>
</tr>
</thead>
<tbody>
<tr>
<td>TASK: 4</td>
</tr>
<tr>
<td>01</td>
</tr>
<tr>
<td>02</td>
</tr>
<tr>
<td>03</td>
</tr>
<tr>
<td>04</td>
</tr>
<tr>
<td>05</td>
</tr>
<tr>
<td>06</td>
</tr>
<tr>
<td>07</td>
</tr>
<tr>
<td>08</td>
</tr>
<tr>
<td>09</td>
</tr>
</tbody>
</table>

| TASK: 5           |
| 01 | Now switch to ZOHO Sheet. |
These tasks were enough to figure out major usability problems in ZOHO because they were designed in such a way that the participants had to interact with the communicative, cooperative and coordinative sections of ZOHO, that according to Lee, et al. (2009) are major parts of a collaborative technology.

5.3 Questionnaire Design

We used questionnaire in this research thesis to figure out the effectiveness, efficiency and satisfaction level of ZOHO when a participant performs some tasks on it. Questionnaire was used as a qualitative research in order to know the users’ perception about ZOHO (Barnum & Dragga, 2001; Nielsen, 1993; Adebesin et al., 2009). We used Likert (1932) scale questionnaire format for designing our questionnaire.
Table 5.3(a): Post-Test Questionnaire

<table>
<thead>
<tr>
<th>Sr.</th>
<th>QUESTIONS</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Undecided</th>
<th>Disagree</th>
<th>Strongly Disagree</th>
</tr>
</thead>
<tbody>
<tr>
<td>01</td>
<td>Logging-in and logging-out in ZOHO was an easy task to perform.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>02</td>
<td>I felt comfortable while switching among different applications in ZOHO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>03</td>
<td>Using a valid username and password I could accurately sign in into ZOHO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>04</td>
<td>I was able to quickly Sign-in and out in ZOHO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>05</td>
<td>Working with ZOHO Mail was up to my expectations from a typical email system.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>06</td>
<td>I was able to accurately communicate with my partner using ZOHO mail.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>07</td>
<td>I felt comfortable while using ZOHO Mail.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>08</td>
<td>The icons/Labels used in ZOHO Mail helped me in identifying different actions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>09</td>
<td>While chatting with my partner I got the results accurately and as expected.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>10</td>
<td>ZOHO mail was quick to send my email.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>11</td>
<td>I was able to get a quick message from my partner in ZOHO chat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>12</td>
<td>I was able to communicate my message quickly using ZOHO chat.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>13</td>
<td>The icons/Labels used in ZOHO Chat helped me in identifying different actions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>14</td>
<td>ZOHO Writer’s interface was comfortable to work with.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15</td>
<td>Writing &amp; editing text/graphics gave me the same results that I expected.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>16</td>
<td>Sharing documents with my partner was done accurately through ZOHO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>17</td>
<td>I could accurately find the files that are shared with me or by me in ZOHO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>18</td>
<td>The icons used in ZOHO Writer helped me in identifying different actions.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>19</td>
<td>I was able to get accurate document from my partner in ZOHO Writer.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>20</td>
<td>Sharing documents with my partner was done quickly through ZOHO.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>21</td>
<td>I found ZOHO writer quick while working on a document.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>22</td>
<td>ZOHO Sheet was quick while I worked on a spreadsheet.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>23</td>
<td>I found ZOHO Show quick while working on a Presentation.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>24</td>
<td>I found ZOHO Sheets to be a complete solution for my spreadsheets’ work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>25</td>
<td>I found ZOHO Show to be a complete solution for my presentations’ work.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>26</td>
<td>The interface of ZOHO sheets was graphically pleasing.</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
The interface of ZOHO show was graphically pleasant to work with.

I could accurately find the author of a document that was shared with me.

It was easy to figure out what mistakes my partner has made in a document.

Commenting on a document shared by my partner was an easy task in ZOHO.

I could accurately manage the rights on a certain document while sharing it.

I could easily see Activity of my partner on a shared document.

Activity of my partner on a shared document was shown quickly to me.

I could quickly find any mistake in a document that is being shared with me.

I could easily find out a document’s creation and last modification time/date.

This questionnaire was designed for collecting the participants’ opinion about ZOHO in order to evaluate the usability of ZOHO. Questions in the questionnaire were based on the usability attributes of effectiveness, efficiency and satisfaction. The following table shows each of these attributes represented by a set of questions in the questionnaire.

Table 5.1(b): Questions Division

<table>
<thead>
<tr>
<th>Usability Attributes</th>
<th>Question Number</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Effectiveness</td>
<td>03, 05, 06, 09, 15, 16, 17, 19, 24, 25, 28, 31.</td>
<td>12</td>
</tr>
<tr>
<td>Efficiency</td>
<td>01, 04, 10, 11, 12, 20, 21, 22, 23, 29, 30, 32, 33, 34, 35.</td>
<td>15</td>
</tr>
<tr>
<td>Satisfaction</td>
<td>02, 07, 08, 13, 14, 18, 26, 27.</td>
<td>08</td>
</tr>
</tbody>
</table>

5.4 Participant Selection

The fact that 85% of the usability problems can be figured out by only 5 participants by Nielson (2000) & Granic et al. (2004) was kept in mind while deciding the number of participants. A total number of 14 persons were selected to participate in both of the usability tests, 6 out of these 14 persons participated in the think aloud protocol test while the remaining 8 participated in the co-discovery method. There were more participants selected for the co-discovery method because they had to perform in a group of two persons, so 8 participants in co-discovery made 4 groups. For the think aloud protocol method there were 3 participants that had no experience of using ZOHO while 3 participants had some skills in using ZOHO. Out of 8 participants in co-discovery method there were 4 participants that had no experience in using ZOHO while 4 had
some skills in performing tasks on ZOHO. Expert users were not selected for this test because the authors were more interested in the novice and intermediate users’ adaptation to ZOHO and the problems that they faced while they try to use the system. The participants selected for these tests were Master level students at Blekinge institute of technology, Ronneby. The authors were unable to find anyone else using ZOHO except the students here at Blekinge Institute of Technology due to the fact that ZOHO is a new and immerging technology and majority of the people with whom the authors interacted are using more popular systems other than ZOHO such as Google Docs. We believe that the selection of students only as test participants can be regarded as a limitation of this thesis and if the nature of the participants is changed that can affect the results achieved from this thesis.

5.5 Piloting Usability Tests

A pilot usability test was carried out in order to identify and remove unclear and confusing steps from the tasks that we have designed earlier. The pilot test was conducted on four different participants; two of them were intermediate ZOHO users while the other two were novice users of ZOHO.

The result of this pilot test was not included in the results that we got from the usability tests. However the observations that we got from this pilot test was used to make the tasks clear and easy to understand.

5.6 Piloting Questionnaire

After the pilot usability test, we distributed questionnaires among the participants of the test for a pilot study of the questionnaires. The feedback from the test participants on these questionnaires was not included in the result of the questionnaire that we distributed after the conduction of real usability tests. However the participants’ opinion and response on the pilot questionnaire helped in removing any ambiguity in the questions and to make them clearer as mentioned in Gillham (2000); Oliver (2004) and Shneiderman & Plaisant (2004).
5.7 Tests Conduction

Usability tests were conducted on selected participant using think aloud protocol and co-discovery methods. The time taken by each participant to complete a task was noted as well as any usability error or suggestion by the participant was also noted down. The participants were helped if they faced any difficulty in performing any given task.

5.7.1 Think Aloud Protocol Testing

In the think aloud protocol each participant performed the tasks given to him on ZOHO and worked in collaboration with another individual who was also given the same tasks to perform. Two participants worked in collaboration with each other simultaneously and were observed individually. The participants were told to verbalize their thoughts and to talk freely about any error that they face while performing any of the given tasks.

5.7.2 Co-discovery Learning Testing

Unlike the think aloud protocol method, there were two participants in a group to perform the tasks given to them in the co-discovery method. The two groups each consisting of two participants were given the tasks to perform on ZOHO and work in collaboration. The two individuals in a group were allowed to verbalize their thoughts by talking to each other and help each other while performing a given task. They were also allowed to discuss any confusion related to the task performance on ZOHO with the evaluator.

5.8 Questionnaire Distribution

After conduction of the usability tests, each group was given a questionnaire for a feedback. Questionnaire was distributed among 10 groups of the think aloud protocol and co-discovery testing. The participants were informed that the purpose of this questionnaire was to know their perspective about the effectiveness, efficiency and satisfaction of ZOHO.
CHAPTER 6: RESULTS

After the successful completion of usability tests, we got the test results and the tests participants’ feedback through questionnaires. Section 6.1 of this chapter deals with the tasks timing of the usability tests, section 6.2 is about our observation of the tests’ participants during the tests and section 6.3 is about the participants’ feedback on the questionnaire.

6.1 Tests Time

Time was noted by the authors against each task performed by the tests’ participants. It was noted that all the participants in think aloud protocol method performed all the tasks in about 2 hours and 48 minutes, while the same tasks were performed in the co-discovery method in about 1 hour and 18 minutes.

6.1.1 Think Aloud Protocol

The total time taken by all the participants of think aloud protocol testing was 2 hour and 48 minutes. Table 6.1(a) gives an overview of the time taken by a user for a given set of tasks.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Participants ID</th>
<th>Average Task Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>User 1</td>
<td>User 2</td>
</tr>
<tr>
<td>Task 1 Time</td>
<td>32</td>
<td>36</td>
</tr>
<tr>
<td>Task 2 Time</td>
<td>116</td>
<td>168</td>
</tr>
<tr>
<td>Task 3 Time</td>
<td>181</td>
<td>202</td>
</tr>
<tr>
<td>Task 4 Time</td>
<td>530</td>
<td>609</td>
</tr>
<tr>
<td>Task 5 Time</td>
<td>132</td>
<td>123</td>
</tr>
<tr>
<td>Task 6 Time</td>
<td>314</td>
<td>219</td>
</tr>
<tr>
<td>Task 7 Time</td>
<td>733</td>
<td>240</td>
</tr>
<tr>
<td>Task 8 Time</td>
<td>101</td>
<td>77</td>
</tr>
<tr>
<td>Task 9 Time</td>
<td>41</td>
<td>32</td>
</tr>
<tr>
<td>Total Test Time</td>
<td>2180</td>
<td>1706</td>
</tr>
</tbody>
</table>
Figure 6.1(a) shows the average completion time graph for the tasks completed by all of the tests participants in think aloud protocol evaluation method.

![Figure 6.1(a): Average Tasks Completion Timing](image)

6.1.2 Co-discovery Learning

The total time taken by all the participants of co-discovery learning method was 1 hour and 18 minutes. Table 6.1(b) gives an overview of the time taken by a user for a given set of tasks.

<table>
<thead>
<tr>
<th>Tasks</th>
<th>Participants ID</th>
<th>Average Task Time</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Group 1</td>
<td>Group 2</td>
</tr>
<tr>
<td>Task 1 Time</td>
<td>30</td>
<td>27</td>
</tr>
<tr>
<td>Task 2 Time</td>
<td>176</td>
<td>142</td>
</tr>
<tr>
<td>Task 3 Time</td>
<td>95</td>
<td>29</td>
</tr>
<tr>
<td>Task 4 Time</td>
<td>471</td>
<td>197</td>
</tr>
<tr>
<td>Task 5 Time</td>
<td>96</td>
<td>75</td>
</tr>
<tr>
<td>Task 6 Time</td>
<td>163</td>
<td>165</td>
</tr>
<tr>
<td>Task 7 Time</td>
<td>270</td>
<td>210</td>
</tr>
<tr>
<td>Task 8 Time</td>
<td>282</td>
<td>128</td>
</tr>
<tr>
<td>Task 9 Time</td>
<td>145</td>
<td>43</td>
</tr>
<tr>
<td>Total Test Time</td>
<td>1728</td>
<td>1070</td>
</tr>
</tbody>
</table>

Table 6.1(b): Tasks Timing (Seconds) in Co-Discovery Learning
Figure 6.1(b) shows the average completion time graph for the tasks completed by all of the tests participants in think aloud protocol evaluation method.

![Average Tasks Completion Time Graph](image)

Figure 6.1(b): Average Tasks Completion Time

6.2 Tasks Observations

During the task performance in both usability tests, the participants were carefully observed and any difficult faced by them to perform a task was noted. The authors observed that if the difficulties faced by the test participants were removed then the system would be more effective, efficient and satisfactory to use. In the next sub-sections we discuss the comments by the participants while they performed the given tasks on ZOHO.

6.2.1 Task 1

Task 1 was a general task about signing in into ZOHO. The user had to first visit the ZOHO system webpage and then sign in using a valid user id and password. The following comments were made by the participants during the performance of this task:

Think Aloud Protocol:

- The icons size is very small.
- ZOHO Logo does not look professional.
• Font’s size is very small.
• Login area is not prominent from rest of the page.

Co-Discovery Learning:

• Interface is congested, too many icons on the front page.

6.2.2 Task 2

Task 2 was a communication task about using ZOHO Mail. The user had to open ZOHO Mail and then compose and send a message to one of the collaborator. The user then had to check for any new email. The following comments were made by the participants during the performance of this task:

Think Aloud Protocol:

• There is no save option for adding the email address of a new contact.
• The font’s size is very small.
• Buttons are not visible clearly.
• Email sending is very slow.
• No prominent notification of in case of a new email.

Co-Discovery Learning:

• The background/foreground color scheme is too light.
• Buttons have a very light color, not looking prominent.
• The icons used are too much small.
• Switch To menu items cannot be differentiated properly; there should be a unique icon used for an item.
• Send button not properly visible.
• Buttons are placed too close.

6.2.3 Task 3

Task 3 was a communication task about using ZOHO Chat. The user had to open ZOHO Mail and then compose and send a message to one of the collaborator. The user
then had to check for any new email. The following comments were made by the participants during the performance of this task:

**Think Aloud Protocol:**

- There is no option for displaying the current status message.
- Invisible option is placed at a place where it cannot be reached easily.
- In the chat window there is a same colors used for sender and receiver making it difficult to differentiate between their messages.
- Dialog box for adding a new friend is too small.
- Chatting windows and inbox both are not properly synchronized.
- Icons used are very confusing.
- There is no confirmation for a successfully added friend.
- Extra page opens while switching to ZOHO Chat.
- ZOHO Chat does not ask about the gender.
- Switch TO button is not visible clearly.
- There is no use of Avatars in ZOHO Chat.

**Co-Discovery Learning:**

- ZOHO Chat is complicated as icons are not grouped meaningfully.
- There is no status information about the contacts.
- The colors used do not look good.
- There is no support for voice and video chat in ZOHO Chat.
- Switch To menu is not consistent in ZOHO Chat and ZOHO Mail.

**6.2.4 Task 4**

**Task 4** was a task related to cooperation. The user had to interact with ZOHO Writer by creating a new document, writing some text in it, editing text, inserting graphics in a document and changing layout of the document. The following comments were made by the participants during the performance of this task:
Think Aloud Protocol:

- There is no option to move from ZOHO Chat to ZOHO Writer.
- There was again a new pop-up window for ZOHO Writer.
- Buttons used in ZOHO Writer do not look very decent.
- Color selection for changing text color is not good, it is messy.
- There is no correction for spelling and grammar mistakes.
- Page layout of a document was hard to find out.
- There is no possibility of entering font size manually.
- There is no option to see the print preview of a document.
- Picture/graphics handling in a document was very hard.

Co-Discovery Learning:

- No option available to move from ZOHO Chat to ZOHO Writer.
- ZOHO Writer does not support manual font size.
- Same color used for both foreground and background thus making the buttons and ordinary text looks the same.
- No dictionary support for spell checking or grammar checking.
- Hard to find picture editing option.
- There is no notification when a file is saved.

6.2.5 Task 5

Task 5 was a cooperation task using ZOHO Sheet. ZOHO sheet is identical to Microsoft Excel. The user had to open ZOHO Sheet and then create a new spreadsheet and work around in this sheet and then save it. The following comments were made by the participants during the performance of this task:

Think Aloud Protocol:

- The icon used for creating new sheets is not good looking.
- There is no help provided for entering a formula in a cell.
- Icons used are not good looking.
Co-Discovery Learning:

- Security not defined well.
- Interface is not consistent (icons are changed).
- Hard to find the icon for “save”.
- Menu bar is congested.
- Difficulty in differentiated between buttons and text because same color is used.

6.2.6 Task 6

Task 6 was a cooperation task using ZOHO Sheet. ZOHO Show is identical to Microsoft PowerPoint. The following comments were made by the participants during the performance of this task:

Think Aloud Protocol:

- Icons are placed too close in the Switch To menu.
- There are no clear instructions for creating new slides.
- The name ZOHO show does not reflect its true meaning/purpose.
- There are very few buttons used in ZOHO Show.
- There is no detection of any spelling mistakes.
- ZOHO Show page is completely different from other pages of the same website.

Co-Discovery Learning:

- The page has totally different theme from other ZOHO pages.
- No clear instructions to insert a new slide.
- Hyperlinks are used, button would have been better.
- Difficulty in finding the “Save” button.
- Home area is very much small.

6.2.7 Task 7

Task 7 was a coordination task about file sharing in ZOHO. The user had to share a file with his collaborators and also to check what file is being shared with him by his
collaborators. The following comments were made by the participants during the performance of this task:

**Think Aloud Protocol:**

- Privileges are not defined well.
- Pages are not consistent.
- Buttons and ordinary text cannot be differentiated.
- File sharing is not easy and user friendly.
- ZOHO’s icon has changed on this page.
- My Files panel does not reflect its true purpose/meaning; it should be Shared Files instead of My Files.
- There is no notification for any file shared with someone.

**Co-Discovery Learning:**

- Complex procedure for sharing a file.
- File types are not recognizable.
- Save icon is not appropriate/very small.
- Pop-ups windows are annoying.
- Every change needs page refreshing.
- No hints/tooltips for unknown fields.
- Confusing on how to edit a shared file.
- There is no success notification for a file shared successfully.

### 6.2.8 Task 8

**Task 8** was a coordination task about figuring out certain properties of the file shared with the user by a collaborator in ZOHO. The user had to identify no. of words, author name, creation and modification date/time and any changes made the co-author. The following comments were made by the participants during the performance of this task:

**Think Aloud Protocol:**

- There is no file extension visible; making it hard to recognize the file type.
• Edit button is very small and in the corner.

Co-Discovery Learning:
• Difficulty in finding the no. of words in a document.
• File last modification date/time information is not clearly visible.
• No. of comments in a shared document is not shown.

6.2.9 Task 9

Task 9 was a general task about signing out from ZOHO. The user had to close any opened file in ZOHO then log out from the system. The following comments were made by the participants during the performance of this task:

Think Aloud Protocol:
• Because of the pop-ups, there are too many windows opened.

Co-Discovery Learning:
• Too many pop-up windows and not all of them are synchronized with each other.
• Logout button and Username are of the same color and placed too close.

6.3 Questionnaire Feedback

After performing each usability test, a questionnaire was handed over to the test participants for their feedback to figure out how effective, efficient and satisfactory they think ZOHO is. The structure of this questionnaire is mentioned previously in section 5.3 of this thesis. The next subsections will discuss the analysis of the participant’s feedback from the questionnaire.

6.3.1 Think Aloud Protocol

A total of 6 participants were given the questionnaire. A total of 35 questions were asked from the participants, out of which 12 questions were related to the effectiveness of ZOHO, 15 questions were related to the efficiency of ZOHO while the remaining 8 questions were related to the level of satisfaction that a user feels while interacting with
ZOHO. From the feedback we analyzed that when asked about the effectiveness related questions from the user 11% of the users strongly agreed that ZOHO is effective, 47% of the users marked Agree, 28% of the users marked Undecided, 8% of the users marked Disagree and 6% of the users marked Strongly disagree. For the efficiency of ZOHO, 11% of the users marked strongly agree, 43% of the users marked Agree, 21% of the users marked Undecided, 20% of the users marked Disagree and 4% of the users marked strongly disagree. When questions related to the user satisfaction using ZOHO, were asked, 10% of the users marked strongly agree, 23% of the users marked Agree, 43% of the users marked Undecided, 21% of the users marked Disagree and 4% of the users marked strongly disagree. These results can be represented clearly in Figure 6.3(a), 6.3(b) and 6.3(c). A detailed analysis and discussion on the data represented by the figures 6.3(a), 6.3(b) and 6.3(c) is done in the next chapter i.e. chapter 7 of this thesis.

![Effectiveness Pie Chart](image)

Figure 6.3(a): Effectiveness of ZOHO using Think aloud protocol Method
Figure 6.3(b): Efficiency of ZOHO using Think aloud protocol Method

Figure 6.3(c): Satisfaction Level of ZOHO using Think aloud protocol Method
6.3.2 Co-discovery Learning

A total of 4 questionnaires were given to 4 groups whereas each group consisted of 2 participants. The feedback from the participants of the Co-discovery learning test is given in Appendix 3. The same questionnaire as used in think aloud protocol test, was used here too in the co-discovery learning testing.

For the effectiveness of ZOHO, 19% of the users strongly agreed that ZOHO is effective, 44% of the users marked Agree, 23% of the users marked Undecided, 14% of the users marked Disagree and none of the users marked strongly disagree. For the efficiency of ZOHO, 12% of the users marked strongly agree, 48% of the users marked Agree, 22% of the users marked Undecided, 13% of the users marked Disagree and 5% of the users marked strongly disagree. When questions related to the user satisfaction using ZOHO, were asked, 3% of the users marked strongly agree, 22% of the users marked strongly Agree, 38% of the users marked Undecided, 31% of the users marked Disagree and 6% of the users marked strongly disagree. These results can be represented clearly in figures 6.3(d), 6.3(e) and 6.3(f). A detailed analysis and discussion on the data represented by the figures 6.3(d), 6.3(e) and 6.3(f) is done in the next chapter i.e. chapter 7 of this thesis.

![Effectiveness](image)

Figure 6.3(d): Effectiveness of ZOHO Using Co-Discovery Learning
Figure 6.3(e): Efficiency of ZOHO Using Co-Discovery Learning

Figure 6.3(f): Satisfaction Level of ZOHO Using Co-Discovery Learning
CHAPTER 7: ANALYSIS AND DISCUSSION

Discussions on the limitations/capabilities of think aloud protocol and co-discovery learning methods, usability of ZOHO and validity assessment of this thesis work are major parts of this chapter. Section 7.1 deals with analysis of task time performance in the think aloud protocol and co-discovery learning methods, section 7.2 is about the usability of ZOHO, limitations and capabilities of the think aloud protocol and co-discovery learning methods are discussed in section 7.3 and section 7.4 is about the validity assessment of this thesis research work. In the concluding part of this thesis, recommendations to ZOHO as well as to think aloud protocol and co-discovery learning are suggested, a conclusion is drawn based on the facts from earlier sections and a possible future work to this thesis is suggested.

7.1 Tasks Time Analysis

By comparing Figure 6.1(a) and 6.1(b), we get figure 7.1 below:

![Figure 7.1: Average Tasks Completion Time (seconds)](image)

From the analysis of figure 7.1 we can say that overall the participants performed the given set of tasks more quickly in co-discovery method as compared to think aloud protocol method. Task 1 to 7 were performed quickly by the co-discovery participants...
while task 8 and 9 were performed quickly the participants of the think aloud method. Although there is little difference between the completion time for task 1, figure 7.1 shows that there is a significant difference between the other tasks completion time in both the testing methods.

### 7.2 Usability Assessment of ZOHO

Earlier in section 4.1 we discussed different models for usability evaluation and that we have selected the ISO 9241-11 model for usability evaluation of ZOHO. We combined the results from both the usability tests and then calculated its mean in order to find the usability of ZOHO. The next subsections attempts to answers to our second and third research questions by discussing the effectiveness, efficiency and satisfaction that an end user feels as well as the common usability problems that an end user faces while he interacts with it.

#### 7.2.1 Effectiveness

In the previous chapter in section 6.3.1 and 6.3.2, we found the two different level of effectiveness for ZOHO from the participants’ feedback. In Table 7.1(a) we calculated the overall effectiveness of ZOHO using the think aloud protocol and co-discovery learning methods by calculating a mean value of the participants’ feedback from both the methods. We found out that overall 15% of the participants strongly agreed that ZOHO is an effective collaboration writing tool, 45% just agreed, 26% were undecided to rate it effective or not, 11% disagreed and only 3% strongly disagreed.

<table>
<thead>
<tr>
<th>Level of Agreement</th>
<th>Think Aloud Protocol</th>
<th>Co-discovery Learning</th>
<th>Mean Effectiveness</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Effectiveness</td>
<td>Effectiveness</td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>11%</td>
<td>19%</td>
<td>15%</td>
</tr>
<tr>
<td>Agree</td>
<td>47%</td>
<td>44%</td>
<td>45%</td>
</tr>
<tr>
<td>Undecided</td>
<td>28%</td>
<td>23%</td>
<td>26%</td>
</tr>
<tr>
<td>Disagree</td>
<td>08%</td>
<td>14%</td>
<td>11%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>06%</td>
<td>0%</td>
<td>03%</td>
</tr>
</tbody>
</table>

Table 7.2(a): Effectiveness of ZOHO
7.2.2 Efficiency

The mean value for efficiency from sections 6.3.1 and 6.3.2 is calculated in Table 7.1(b). From the fact that 45% of the participants’ feedback marked agree we concluded that the majority of the participants agreed with the efficiency of ZOHO, the next highest value was of those participants who were undecided whether ZOHO is efficient enough or not, however 17% participants feedback was that ZOHO is inefficient, 12% strongly agreed that ZOHO is efficient and only 4% strongly disagreed that ZOHO is efficient enough.

Table 2.2(b): Efficiency of ZOHO

<table>
<thead>
<tr>
<th>Level of Agreement</th>
<th>Think Aloud Protocol</th>
<th>Co-discovery Learning</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Efficiency</td>
<td>Efficiency</td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>11%</td>
<td>12%</td>
<td>12%</td>
</tr>
<tr>
<td>Agree</td>
<td>43%</td>
<td>48%</td>
<td>45%</td>
</tr>
<tr>
<td>Undecided</td>
<td>21%</td>
<td>22%</td>
<td>22%</td>
</tr>
<tr>
<td>Disagree</td>
<td>20%</td>
<td>13%</td>
<td>17%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>04%</td>
<td>05%</td>
<td>04%</td>
</tr>
</tbody>
</table>

7.2.3 Satisfaction

Mean value for satisfaction level of ZOHO is calculated in Table 7.1(c); it is based on the values from sections 6.3.1 and 6.3.2. If we analyze the values from the table where 40% of the participants’ feedback was undecided, we can conclude that majority of the participants were not sure whether they felt satisfied or not while interacting with ZOHO. Next highest value is 26%, it is of the users that disagreed with the fact that they felt satisfied. Then there are 23% of the participants who agreed that they felt satisfied with ZOHO. 6% of the participants strongly agreed while 5% of the participants strongly disagreed with the satisfaction that they felt while interacting with ZOHO.

Table 7.2(c): Satisfaction of ZOHO

<table>
<thead>
<tr>
<th>Level of Agreement</th>
<th>Think Aloud Protocol</th>
<th>Co-discovery Learning</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Satisfaction</td>
<td>Satisfaction</td>
<td></td>
</tr>
<tr>
<td>Strongly Agree</td>
<td>10%</td>
<td>03%</td>
<td>06%</td>
</tr>
<tr>
<td>Agree</td>
<td>23%</td>
<td>22%</td>
<td>23%</td>
</tr>
<tr>
<td>Undecided</td>
<td>43%</td>
<td>38%</td>
<td>40%</td>
</tr>
<tr>
<td>Disagree</td>
<td>21%</td>
<td>31%</td>
<td>26%</td>
</tr>
<tr>
<td>Strongly Disagree</td>
<td>04%</td>
<td>06%</td>
<td>05%</td>
</tr>
</tbody>
</table>
7.2.4 Usability Problems

This sub-section attempts to answer the third research question of our thesis work. After a careful analysis of the results from the two usability tests on ZOHO, we identified several major problems in its interface that caused the users to think of ZOHO as an ineffective, inefficient and unsatisfactory. They are as follows:

- **Icons** used by ZOHO are very small as well as confusing as there is no standard set of icons instead every page has different icons for the same operations. While some users had problem with the front page of ZOHO which has too many icons. In some pages the icons are good looking but are placed in such a way that seemed not meaningful to the user while on some pages it is difficult to find the icons for a certain task.

- **Colors** used are not impressive. On some pages the color of a button and text is the same, thus making the buttons hard to recognize while in the chat window the same color is used for both the users’ username making it hard to identify the text written by different collaborators. On some pages however the user feels that the background and foreground colors used are very light.

- **Buttons** presentation in ZOHO does not seem good to some users. The SWITCH TO button on the top of almost all the pages is not easily identified by some users. On some pages the buttons used have very light and confusing color, on some they are very small in size while on some pages there are no buttons at all thus making these pages not consistent with the rest of the system.

- **Font/Text** used in ZOHO is very small in size. Some users had problem with the text color because it was the same as the color used for buttons. Hence it was hard for them to differentiate between normal text and the buttons. In ZOHO Writer the users had problem with manually setting font size as they were unable to manually enter a font size of their own choice.

- **Pop-up Windows** are used in abundance by ZOHO. Almost all the users complained of these pop-up windows as they got really annoyed with too many windows opened in a browser for different services provided by ZOHO. Also another problem with these pop-up windows were that they were not properly
synchronized with each other, hence making changes in one window needed refreshing the windows so that the change would become visible.

- **In ZOHO Mail** some users felt unsatisfied because they did not get any save option for adding the email address of a new contact, some users felt unsatisfied because they did not get a prominent notification in case of a new email message.

- **ZOHO Chat** unlike other messengers had no option to display the current status message also the invisible status is placed at a place where some users found it hard to find. Some user complaint about no gender identification in ZOHO through which the users were not able to identify the gender of his/her collaborators. A critical error in ZOHO chat was that the chat windows were not properly synchronized as there were two different chat windows for two different users in a same session. Some users considered ZOHO ineffective because they were not informed about a successful adding of a user. Some user found the adding a friend box too small while some suggested avatars should be used by ZOHO Chat so that it becomes easy to know the gender of a collaborator. Unlike other messengers, there is no support for voice or video in ZOHO Chat.

- **ZOHO Writer** had some errors that became the reasons for its ineffectiveness, inefficiency and dissatisfaction. First of all there is no button or link that can switch from ZOHO Chat to ZOHO Writer. Some users found the buttons very indecent in ZOHO Writer while some found image handling to be very difficult. Some user found changing text color to be a messy job. Some users could not find the page layout button easily and some complaint about the missing features such as dictionary support for spell/grammar check, print preview of a document and manual font size setting.

- Users experienced some errors while interacting with **ZOHO Sheet** and **ZOHO Show**. Some users found ZOHO sheet to be ineffective because it does not provide any help regarding entering a formula into a cell. Some users were not satisfied with the icons used in ZOHO Sheet. Some users found the name ZOHO Show to be awkward, while almost all the users found ZOHO Show page to be inconsistent because it is completely changed in design from the other pages of
ZOHO. Some users argued on missing features such as no dictionary support spelling/grammar check as well as very less use of buttons.

- While performing **coordination tasks**, some users found file sharing very hard. It was also noted that the ZOHO Logo changed on sharing a file page which confused some users. The file extension was not visible which made it difficult for users to identify the file type that is being shared with him. When a user shared any file with his collaborators there is no success notification to the user due to which a user is not sure whether the file, that he was trying to share, is shared successfully or not. While sharing a document a user is asked about the role of the person with whom he is sharing the file, some users thought these rights are not explained in ZOHO.

### 7.3 Think Aloud Protocol & Co-discovery Learning

During the literature review, tests conduction and from the analysis of the tests results we came across several strengths and weaknesses of the think aloud protocol and co-discovery learning methods in the context of ZOHO. Although there are many limitations and capabilities of the think aloud protocol and co-discovery methods however we are interested in those that we encountered while performing usability tests on a collaborative writing system because of the fact that it will answer our first research question. The next subsection discusses the limitations and capabilities of think aloud protocol and co-discovery methods.

#### 7.3.1 Limitations & Capabilities

According to Jordan (1998) and Rubin & Chisnell (2008) participants in the think aloud protocol performs slowly because verbalization of a participant’s thoughts can cause interruption in performing a task. In our case we found from the analysis of both the usability testing methods that think aloud protocol is time consuming as compared to the co-discovery method. Some researchers have also argued that the participant’s response time is very slow (Barnum & Dragga, 2001; Van der Meij, 1997; Rhenius & Deffner, 1990). These facts about the time consumption by think aloud protocol is clearly visible from graph figure 7.1 shown in the previous section.
Apart from time consumption we also encountered another problem that we did not find anywhere in the literature review phase of this thesis work. The problem that we faced was that in the think aloud method we had to guide the participants whenever they needed any help while interacting with ZOHO. We found that it was this intervention as well as the verbalization of the participant’s thoughts that increased the time he took to perform a given task.

An advantage that we found in the think aloud protocol method was that as compared to the co-discovery learning method we needed less number of participants to find usability errors in a collaborative writing system while the number of usability errors were almost the same as well as the nature of the usability errors were also the same as was in the co-discovery learning method.

As compared to the think aloud protocol method, we found co-discovery method to be very much time efficient in the context of a collaborative writing system which in this case was ZOHO. The major reason for this fact was that the participants helped each other whenever they faced a problem and thus there was no reason for the evaluators to intervene. Hence we found out that in the co-discovery testing the participants were able to perform a task faster than the think aloud protocol testing because of the reason that the participants helped each others in a quick way.

However the major disadvantage of this method was its cost in terms of the number of participants needed. For a total of 4 groups, we needed almost 8 participants which are higher in number than the number of participants needed in the think aloud testing. Although the number of participant needed in co-discovery learning test was higher than the think aloud protocol method, but the usability errors identified by the participants of the co-discovery learning method were almost the same as those found by the participants of the think aloud protocol method. The authors see this increased number of participants as an expense as mentioned in Dumas & Redish (1999) in terms of human factor.
7.4 Validity Assessment

The authors carried out the validity assessment of the two usability tests. The criteria used for this assessment was the one proposed by Lincoln & Guba (1985). According to Lincoln & Guba (1985), qualitative research can be judged through factors such as credibility, transferability, dependability and conformability. The following subsections describe these criteria in details:

7.4.1 Credibility

It is to figure out that the results achieved from the qualitative research are realistic enough to be considered credible from the participants’ perspective. According to Lincoln & Guba (1985), as the research should be believable by the participants hence the credibility of the research can be judged by the participant themselves.

In the case of this thesis, the authors conducted interviews from the participants of the test. The questions asked in the interview were open ended. The interview questions and the feedback from participants are given in Appendix 2.

7.4.2 Transferability

It refers to the fact that the findings achieved from the research are applicable in other contexts. According to Lincoln & Guba (1985), transferability can be achieved by identifying and describing the context of the research being conducted and the assumptions that were considered for the research.

The assumptions for this research were; the participants were males, age group between 25-30, students of M.sc computer science and M.sc software engineering, the operating systems used during the test was Windows XP, the browsers used were Mozilla Firefox and Internet Explorer, the environment used was Blekinge Institute of Technology library, group rooms and silent rooms, the method used were think aloud protocol and co-discovery learning and the research context was its comparison in the perspective of a collaborative writing system. The authors believe that by considering all these assumptions, transferability of this research is possible.
7.4.3 Dependability

It refers to the fact that the findings can be repeated and they are consistent in nature. According to Lincoln & Guba (1985), dependability is to emphasize on the fact that the research must describe any changes that had effect on the research study and in what way do these changes affected the research study.

The authors achieved dependability in this thesis work by selecting students from the same university and performed usability tests during the participants’ free time. However in the case of usability evaluation methods used, they affected the research study. In the case of think aloud protocol, a greater task time was noted as compared to the task time in co-discovery method.

7.4.4 Conformability

It is the extent to which the findings from the research are the result of the participants’ bias, motivation or interest rather than that of the researchers. According to Lincoln & Guba (1985), Conformability is the extent to which the results from the research study could be confirmed by others.

In the case of this thesis work, documentation is done properly for each of the usability tests. For the sake of successful conduction of these tests literature review was done at the earliest phase of this thesis. Usability tests guidelines from other researchers were followed and in the end the procedure and results of this research was reviewed and examined by our advisor.

7.5 Recommendations

After a careful analysis and discussion we would recommend that ZOHO should try to solve the problems identified in section 7.2.4 of this thesis in order to attain an increased level of effectiveness, efficiency and satisfaction.

Apart from this we would also like to recommend some changes that can have a positive impact on the think aloud protocol and co-discovery learning methods in the context of collaborative writing systems. We recommend that in the think aloud protocol method a
participant should only verbalize his/her thoughts at time when he/she encounters a usability problem else he/she should concentrate on performing the task. This will reduce the time to perform a task by some fraction. Another recommendation to the think aloud method is that the evaluator should design a manual which should be a step by step guide on how to perform a certain task, and if during the test a participant needs any help then he/she should be allowed to see the manual and get help from there. For the co-discovery learning method we would recommend that the participants be given a minimum fixed time for finding usability errors and after the expiry of this time they can proceed with task completion. For example if the evaluator thinks a task can be done in an average 5 minutes then he should inform the test participants to explore the interface for any potential usability errors for at least 2 minutes or another way is that the evaluator sets the limit of a minimum time for completing a task, in this case he can set a time limit of 7 minutes so that both the participants spend greater time for exploring the interface and find more usability problems.

**Summary/Conclusion**

In this thesis work our primary objective was to figure out the limitations and capabilities of think aloud protocol and co-discovery learning methods in the context of ZOHO; a collaborative writing system. Apart from this the secondary objective of this thesis was to conduct the usability evaluation of ZOHO and to find out what makes ZOHO ineffective, inefficient and unsatisfactory. We carried out usability tests on ZOHO using the think aloud protocol and co-discovery learning methods.

After the tests results’ analysis we found the effectiveness, efficiency and satisfaction level of ZOHO in section 7.2.1, 7.2.2 and 7.2.3 while the usability problems that make ZOHO ineffective, inefficient and unsatisfactory are discussed in section 7.2.4 of this thesis.

Apart from the usability of ZOHO, we were also able to identify strong and weak points of the think aloud protocol and co-discovery learning methods when used for the usability evaluation of a collaborative writing system. We found that think aloud protocol testing is better if the evaluator is cost cautious or if he is looking for a detailed
usability problems but does not cares about the time taken by the test. However if the evaluator cares about the test time and he cares less about the cost in terms of participants required for the test then he should use the co-discovery method for testing a collaborative writing system.

**Future Work**

The effort done in this thesis was to figure out the limitation/capabilities of think aloud and co-discovery method in the context of collaborative writing system as well as the usability evaluation of ZOHO. This thesis is an effort by the authors to contribute to the knowledge in the area of usability evaluations of collaborative writing systems.

The authors suggest that a future work in this area would be the evaluation of another collaborative writing system using the think aloud protocol and co-discovery methods and then to compare its results with the results of this thesis work in order to have a clearer picture of the limitations and capabilities of both these evaluation methods. This will eventually help in deciding an appropriate method for usability evaluation of a collaborative writing system in the future as well as it will also help the usability evaluators to suggest modification to these traditional usability evaluation methods that can have a positive impact on the overall usability evaluation of a collaborative writing system.
References:


APPENDIX 1: ZOHO SCREENSHOTS

Screen 1: ZOHO Main Page
Screen 2: ZOHO Mail

Screen 3: ZOHO Chat
Screen 4: ZOHO Writer

Screen 5: ZOHO Sheets
Screen 6: ZOHO Show

Screen 7: ZOHO Share
APPENDIX 2: INTERVIEWS

INTERVIEW: 1

Q1: Have you ever used ZOHO before, explain?

Yes, I have used ZOHO but not for a very long time, but I started to work with it from the last two months. Still it proved to be very effective.

Q2: What impression of ZOHO did you get, when you performed tasks on it?

I can easily login and after login, I can choose various applications easily to work with. I can access every function through easy shortcuts. I can switch to other applications more quickly due to easily available switch options.

Q3: What are the advantages of using ZOHO for collaborative writing?

The interface of every application matters, and when ZOHO is on your browser for the first time, it gives a very attractive look in context of all functionalities present on the front page which, a user expect from a collaborative writing tool.

Another advantage is that you can sign in with different accounts, like Google, yahoo, which eliminate the need for spending more time for ZOHO sign up.

Chat with other collaborators on the same time, while working on different projects is an advantage too.

There are multiple applications available for the collaboration which doesn’t restrict to documents, presentation, and spreadsheets, but you can use planner and databases also.

Q4: What are the drawbacks in ZOHO from your own perspective?

When I logged in to ZOHO, the whole interface sometime automatically covert to Swedish language as I am currently in Sweden and I am not so much familiar with this language, so I always need to search the option to convert it to English. This should not happen with ZOHO.
Collaboration is more important aspect of ZOHO, and the most used applications used for collaboration should be available with more visibility. Although there is an option for switch to multiple applications in ZOHO but that is not more visible, and the user need to search for it. It should be in left panel with a clear visibility because, user repeatedly use the option to switch between applications.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

Yes, I would like to recommend the users to work with ZOHO, based on the above mentioned functionalities. Everyone can work with their own ease of time. You can easily collaborate on your projects.

**INTERVIEW: 2**

**Q1: Have you ever used ZOHO before, explain?**

I am using ZOHO from last one year. I am very much comfortable with its use, because I can collaborate with my colleagues easily. It proved to be very effective for me when I am engaged with my assignments, where we can communicate easily and without the need of exchanging so many emails back and forth.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

With ZOHO writer I can perform every task conveniently. I can easily write, save, change fonts color, size, undo, redo, etc. The shortcuts and icons make my job more efficient as the frequent used options are on the front. In the same manner I use ZOHO sheets and ZOHO Show for presentation; they also proved to be efficient.

**Q3: What are the advantages of using ZOHO for collaborative writing?**

I can easily notice the changes made by my collaborator, as we are working on a same project. Everyone participating on a similar project can contribute his work to the project and others can easily see it without the need of exchanging emails and waiting for response. Collaborators can also exchange information synchronously through instant messaging, which seem to be a good advantage.
**Q4: What are the drawbacks in ZOHO from your own perspective?**

Technology is changing and companies are developing new version of browsers with enhanced functionality. I used ZOHO with Google chrome, but I had not a better experience with it. The company should update ZOHO so that it will have better compatibility with Google chrome, and latest versions of IE and Firefox as it has with IE 6.0 and Firefox 2.0 versions, Or in a case if they have created plug-in for latest browser, so they should announce it more clearly.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

Yes, I would definitely like to recommend ZOHO to other user that is because of the reason that they can centrally work on a same project irrespective of time and space (distance). ZOHO is a good solution for academic and also for business users as ZOHO business apps assisting business users in multiple ways.

**INTERVIEW: 3**

**Q1: Have you ever used ZOHO before, explain?**

Yes, I am using ZOHO. I have also experience other collaborative tools like Google docs, and Thinkfree but Google docs seems to be a very simple and doesn’t allow access to multiple applications. Thinkfree takes too much time to load in browser and again lack of applications. This can be one possible reason, due to which I am using ZOHO.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

The interface of ZOHO is very attractive and user friendly. The applications are categorized in collaborative and business which make the tasks much friendly in selecting different applications. While performing tasks in the writer, in the left panel there is a nice hierarchical structure of directly, from where I can easily select my files, documents shared by others, check emails etc, which is also a very good impression and doesn’t allow me to think to perform tasks.
**Q3: What are the advantages of using ZOHO for collaborative writing?**

Centralized virtual work place for different collaborators working to achieve same goal, is a very good advantage of ZOHO. The goal of creating documents and projects, sharing, editing live and communicating live with others is been successfully achieved by this collaborative writing tools, which other lacks with somehow, lack of applications or functionality.

**Q4: What are the drawbacks in ZOHO from your own perspective?**

ZOHO Writer have an option for maximizing editor, but when i maximize the editor the switch to other application option disappear, which it shouldn’t be so that i might be able to switch to other applications in the same maximized editor.

When I am working on business applications like ZOHO project, I cannot switch to ZOHO main interface, which in some cases is required to select some other applications. There should be an option present to switch to the main ZOHO interface.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

Yes, I will recommend ZOHO to other users. Because of the reason if the users require a virtual work place to work collectively intending to achieve a similar goal, and interested to save time. ZOHO is also convenient in a way to provide working with multiple applications and is not just a collaborative writing tool.

**INTERVIEW: 4**

**Q1: Have you ever used ZOHO before, explain?**

I have used it before and was already familiar with it. It provides many facilities for user but still there are some problems while using ZOHO so it needs improvements. I still use it due to its innovative features.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

It was not difficult for me to while performing different tasks on ZOHO because I already had knowledge about these tasks. I found that there was lack of consistency
throughout layout and while performing new task every time new window opened so it was confusing for me. Some options dispersed. So it needs improvement for betterment.

**Q3: What are the advantages of using ZOHO for collaborative writing?**

ZOHO enables users to export their text in several formats, such as PDF, Word, HTML and others. With the help of ZOHO you can create your documents and share them publicly or privately.

**Q4: What are the drawbacks in ZOHO from your own perspective?**

In my perspective there are some drawbacks like lack of consistency in different interfaces. Icons are small and they change their shapes in different interfaces. Many icons are used on first page so it is confusing for a new user. Grammatical mistakes are not automatically identified and some font sizes are missing while selecting the text size for writing.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

I would recommend it to other users because it is an online word processor allowing for writing, sharing, and collaboration. It allows for accessing, editing, and sharing from anywhere with whomever you choose. It also protects documents while working in a shared mode and it is free and one can access it from different accounts also like Gmail, Yahoo etc.

**INTERVIEW: 5**

**Q1: Have you ever used ZOHO before, explain?**

No, it was my first interaction with ZOHO.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

At first time I was amazed that there is another application available like Google docs. While performing tasks on ZOHO I did not feel very comfortable. I got new window for every different application of ZOHO which was confusing for me. Furthermore there was no standardization of icons and the interface was not consistent.
**Q3: What are the advantages of using ZOHO for collaborative writing?**

In my opinion, there are many advantages of ZOHO for collaborative writing. As a student, sometimes we have to work in groups while working on different assignments and it is not feasible for us to sit together every time. So with ZOHO we can share our part of assignment with each other and can make changes at the same time. Furthermore we need that our documents should be accessible everywhere so that we can make presentations with it. Of course the big advantage is that it doesn’t need any kind of installation on the computer and its freely available everywhere.

**Q4: What are the drawbacks in ZOHO from your own perspective?**

In my opinion ZOHO have many drawbacks as well. Like I discussed earlier, its interface is not consistent while switching from on application to another. The interface is messy. There is no standardization of icons every application have their own style of icons and menus. After finishing working on it one has to close so many tabs which are not good.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

ZOHO provides many facilities for students for collaborative writing but still it has many problems with its interface and I think people are new to use these kinds of applications. As I know there are some good applications available with same functionalities, so I will recommend them to use another one, instead of ZOHO.

**INTERVIEW: 6**

**Q1: Have you ever used ZOHO before, explain?**

I have used it for the first time.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

The overall picture of ZOHO in my mind is satisfactory. It was performing satisfactory. But it still needs some enhancements.
**Q3: What are the advantages of using ZOHO for collaborative writing?**

ZOHO is freely available online and there is no need to download. It is easy to share with group. It is easy to use, real time collaborative and reliable.

**Q4: What are the drawbacks in ZOHO from your own perspective?**

It has some drawbacks like there are some main options at the bottom which should be on the top to show clearly. It crashes some times. The menus are not easily accessible. Simplicity is low. Graphical user interface is not consistent.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

Yes, there are some good features in ZOHO which are not available in other applications like Google docs. It provides a very way good reliable way for collaborative writing. It provides email, chat, collaborative writing under the same interface.

**INTERVIEW: 7**

**Q1: Have you ever used ZOHO before, explain?**

No, I use it seldom.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

It looks like a professional, while performing a task there are a lot of options, features and functions available. But these features are illustrated in a very complicated way because of which it’s very difficult for a layman to recognize the different functions. Different icons are used in different application such as save icon, Delete icon, Edit icon and print icon and so on. Menu design is not simple, different menu style is used in different application so it’s not clearly communicating and difficult to understand for layman. Most shortcuts are not meaningfully related to longer procedures.

**Q3: What are the advantages of using ZOHO for collaborative writing?**

In the market there are different collaborative writing systems. ZOHO is build very functionally and offers some very unique and useful features. It can perform quick
feedback. All the reporting can be exported to different format like PDF, RTF and SXW etc.

**Q4: What are the drawbacks in ZOHO from your own perspective?**

Using ZOHO is not very easy and simple for beginners. Most options are not clearly visible and sometimes it creates confusion. Technical language is used for labeling the icons. Icons are too small and not consistent.

**Q5: Would you like to recommend ZOHO to other users? Explain why?**

From the recommendation point of view I could divided the user in two categories that is Beginner level and Advance level.

For beginner users I totally disagree to recommend ZOHO because it’s very difficult to work with. Each and every application is not consistent and the design is not simple.

For Advance level users those who are already familiar with ZOHO or have worked with any collaborative system, I would recommend ZOHO. Advanced level users can easily find the relevant options or functions.

**INTERVIEW: 8**

**Q1: Have you ever used ZOHO before, explain?**

Usually I used ZOHO for assignment purpose.

**Q2: What impression of ZOHO did you get, when you performed tasks on it?**

ZOHO’s online office applications are good and affordable. While performing a task there are many features but offline support feature is very amazing. It allows me to work offline on my documents editing.

**Q3: What are the advantages of using ZOHO for collaborative writing?**

In collaborative work ZOHO permits a user to save the same document at different time intervals and it keeps the information of previous versions of the same document. A user can also compare these different versions of a document.
Q4: What are the drawbacks in ZOHO from your own perspective?

ZOHO’s user interface is not intuitive and simple. Most buttons are confusing and provide limited help. A bundle of application is displayed when you login into ZOHO. You probably have to do some searching to find what you require while using application.

Q5: Would you like to recommend ZOHO to other users? Explain why?

I would like to recommend ZOHO to mid or advance level users because it not only provides the productivity applications but it also contains different business application. There are 16 different application launched by ZOHO.