Online Glossary Tools for Technical Reading

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ONLINE GLOSSARY TOOLS FOR TECHNICAL READING

by

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Dedication

To my parents, Professor Dr. Aslam Noor and Professor Dr. Khalida I. Noor

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Abstract

An automatic glossary tool and a user updateable glossary tool were developed. The performance of both glossary tools was evaluated with respect to how useful they were to users reading technical articles online. The results of the experiments with these tools were analyzed using statistical means to determine: (a) whether the presence of a glossary tool was beneficial to users, (b) if either of the tools was more useful than the other. While the study conducted resulted in inconclusive data regarding the superiority of one of the glossary tools to the other, it was shown that the presence of either of the glossary tools did indeed significantly improve user performance.

List of Abbreviations and Symbols Used

No abbreviations or symbols were used in this paper.

Chapter 1: Introduction

In recent years, there has been an explosion of online information, and an increasing number of people are turning to the World Wide Web as a source of information (Figure 1.1).

Figure 1.1: Growth of the Internet (Clickyellow.com, 2001)

There are a large number of tools and software programs currently available for viewing online information. Although a large variety of these tools and programs exist, people tend to use these programs only if they are more useful than the known alternatives (Wright, 1991). According to Nielsen (1996, Page 279), the *usability* of a system typically depends on five of its characteristics. These are:

1-How easy the system is to learn,

2-How efficient the system is in completing the tasks it was designed for,

3-Once having learnt the system, how easy it is to re-use it on a later occasion,

4-How rarely errors tend to occur when the system is being used, and

How pleasing the system is to use, in general. (Nielsen, 1996)

For a system to be better than its known alternatives, it must at least rival or excel over these alternatives in the above areas. The effectiveness of the system and user satisfaction in using it must also be taken into consideration when determining whether a system will be accepted over its alternatives (Nielsen, 1996).

World Wide Web browsers have become prevalent in many people's everyday interactions with online information. *Browser software* provides users with a semi-standardized way of obtaining online information. They also provide the capability of hypertextual linking. This increases the ease with which users of web browsers can retrieve useful information from the Internet. It allows users to maximize their experience online.

The concepts of hypertext and hypertextual linking apply directly to the glossary tools designed because that is the means with which the glossaries present information. The tools are also meant to be used on the Internet where information is usually presented in some form of hypertext. Hypertext is defined as

> "text which does not form a single sequence and which may be read in various orders, specifically, text and graphics (usually in machine-readable form) which are interconnected in such a way that a reader of the material (as displayed at a computer terminal, etc.) can discontinue reading one

> document in certain points in order to consult other related matter" (Simpson and Wiener, 1994, Page 152).

This term was first coined by Ted Nelson. Hypertext is commonly thought of as referring to a group of nodes (documents) and links (cross-references between the documents) (Dictionary.com). Using a browser program, a user would be able to navigate through the nodes using the links (Dictionary.com).

Hypermedia is usually used as a non-specific term that covers multimedia in general, hypertext and other related applications that involve grouping information into nodes (Dictionary.com). Users of these applications can access the nodes dynamically. Both hypertext and hypermedia are usually both referred to as hypertext (Dictionary.com).

Since the advent of these technologies, a variety of software and programs have become readily available for viewing information on the World Wide Web. For a system or program to be more useful than traditional texts, it should offer desirable functionality that is unavailable in this traditional medium, as well as retaining the functionality of printed documents (Wright, 1991). Users will make the transition from traditional texts more readily if the functionality is accessible in a manner similar to that which they are accustomed to (Wright, 1991). Norman (1988) states that consistency, or standardization, assists users in becoming faster accustomed to novel technology or software.

Wright (1991, 1993) has done much research in the area of hypertext usability and has helped the hypertext community become better acquainted with usability aspects such as cognitive costs involved in hypertext linking. Wright (1991) states that documents in electronic format may be able to facilitate some of the tasks that users need to perform in order to obtain desired information. These documents can do this if they provide functionality not readily available with printed documents (Wright, 1991).

Often when reading a text, users encounter unknown or partially known words. They may want or need to learn the definitions of these words in order to fully understand the text as a whole or to satisfy their information retrieval needs. When reading traditional texts, users may have to rely on external sources as a means of clarifying terminology that is not completely familiar. Alternatively, a glossary may be provided as an additional section of the same text. If they exist, notes made in the margins of the text by other readers or by the current reader on a previous occasion may also be referred to as a means of clarifying some terms. The author of the text may also have provided some clarification in the form of footnotes or endnotes.

These methods of clarification for readers are the closest counterparts to integrated glossary links that are available with printed texts. Because there are no counterparts to integrated glossary links within printed texts, readers of printed material often have to interrupt their reading if they feel that they must

understand certain terms foreign to their vocabulary before they can continue reading the rest of the material. For this reason, a useful addition to an online system for learning from written material would be a glossary tool that would allow users to easily look up the meanings of words they encounter without the disruption associated with traditional means. It should be noted that this discussion makes the assumption that most readers want or need to concentrate on their current reading task with as few interruptions as possible.

A glossary tool could also be a particular benefit to readers who are new to a field or a particular topic but require information about a query in that area. It is reasonable to speculate that such users would often not be willing to take the time and effort required to familiarize themselves with all the specific terms pertaining to the field in question just to fulfill their information needs. They may, however, want or need to understand the meanings of terms directly related to their query in order to obtain a more complete answer to their question. If a glossary tool with entries for these terms were available, it would be useful to readers in this situation. With access to such a tool, the readers would find it easier and less disruptive to simply consult the glossary entries corresponding to the terms they need to understand rather than having to consult external sources or simply deciding to not understand the terms.

- The rest of this document first discusses previous work done in the area of online glossary tools and link generation. It then discusses the process of reading

texts online. The design of the systems developed is described, followed by a description of the experimental design. The results of the experiments are presented followed by a discussion of their possible interpretations. The document concludes with a summary and possible future work.

Chapter 2: Background

This chapter will first discuss existing research that has been conducted in the area of automated glossaries that facilitate the reading of online articles. The second section of the chapter will then discuss the process of reading an article.

2.1: Previous Work

This section discusses work done in the area of glossary tools for reading texts on computers. It is divided into two subsections, discussing firstly, the work done in the area of user interface and usability and secondly, work done in finding useful methods of automatic link generation. Comprehensive research in the area of glossary tool research has not been conducted recently. As a result, the research reviewed in this section is somewhat dated. The latest reference to work done in this area is from 1999 (Kaindl and Kramer, 1999)

2.1.1: Usability Issues

Black et al. (1992) discuss several different styles of glossary tools. Their research involved thorough experimentation into the factors surrounding the usability and effectiveness of different styles of glossary tools. Varying styles of glossary entry presentation were also studied (Black et al., 1992).

Most of the tools studied by Black et al. (1992) employ the use of links embedded in the main text that the user is reading. The links are anchored to terms in the text that have corresponding entries in the glossary. Clicking on these links would

allow users to access these entries. These links are referred to as *integrated glossary links* (Black et al., 1992).

Some form of visual marking was also typically used to identify which words in the text had associated entries (Black et al., 1992). Wright (1991) states that simply making functionality available to a user is not enough unless the user is made explicitly aware of the presence of this functionality. This view is echoed by Norman (1988) who states that the perceived functionality of a system is what is important to users, even though it may be very different from the system's actual functionality. So if some form of highlighting is used, when a user encounters a completely or partially unknown term that is defined in the glossary, the user will be made aware that clicking on the term will provide the corresponding entry.

Black et al. (1992) also discuss varying presentation styles for glossary entries. Once accessed, a glossary entry may occlude the main text or it may be presented in the margins alongside the text. Alternatively, the entry may be presented to the user through auditory means. If the auditory presentation style is used, attempting to access a glossary entry would result in a sound file reciting the entry as opposed to the visual presentation of the same entry (Black et al., 1992).

An alternative to integrating glossary links into the main text is presenting a list of glossary terms separately from the main body of text. Terms in the text that is

currently being viewed on the screen may be highlighted in the list to make their presence in the glossary more prominent to the user. The glossary entries can then be accessed using the list. This style of glossary is directed more at readers who wish to supplement their vocabulary either before or after reading, but not during (Black et al., 1992).

The list style of glossary has certain advantages and disadvantages when contrasted against glossaries that employ the use of integrated glossary links. While leaving the original text unaltered is an advantage of not having integrated glossary links, Wright (1991) found that the lack of these links produced a drop in users' willingness to access glossary entries. They speculated that this decrease in willingness was due to the increase in cognitive overhead involved (Wright, 1991). *Cognitive overhead* can be defined as the added concentration and exertion required in order to maintain multiple tasks or trains of thought at a single time (Wright, 1991).

Despite this disadvantage, this style of glossary is preferable over other glossary styles in certain respects, including ease of implementation, as well as allowing users free access to glossary entries at any point in time as opposed to only when they encounter terms in the course of their reading the main text. Combining integrated glossary links with this style of glossary allows for individual differences in reading styles. As Wright (1993) states, any generalizations about users' styles of reading should be made with care.

Individual user styles can vary depending on several factors. A user's level of expertise with a system usually has a major impact on how the user will interact with the system. Other simpler factors, such as level of fatigue and mood can also cause differences in user behavior. Because of differences in individual users, care should be taken to ensure that systems are not designed for a specific kind of user behavior. (Nielsen, 1996)

2.1.2: Automatic Link Generation

Much work has been done in the area of automatic glossaries (Kaindl and Kramer, 1999; Gloor, 1991; Salton, 1989; Thistlewaite, 1997; Rearick, 1989). The focus of such work is often on the automatic generation of integrated glossary links. Of particular interest is the work done by Kaindl and Kramer (1999). They developed an algorithm for the semi-automatic generation of glossary links for hypertext documents (Kaindl and Kramer, 1999). Semi-automatic link generation involves interaction with the user who decides which links should or should not be included in the current hypertext (Kaindl and Kramer, 1999).

The major differences in the work done in the area of automatic link generation for glossary tools lie in the way in which the algorithms devised locate terms belonging to the glossary in natural language text (Kaindl and Kramer, 1999). This process involves several complications (Kaindl and Kramer, 1999). These are directly related to the structure of the language of the text (Kaindl and

Kramer, 1999). In this paper, we are concerned only with texts written in the English language.

Glossary terms may consist of two or more words. This means that terms may overlap with or encompass other terms in the glossary. In addition, terms may appear in modified forms due to morphology. Problems also arise when attempting to account for synonyms, acronyms, and abbreviations of glossary terms (Kaindl and Kramer, 1999).

Several approaches to these complications exist. One of these approaches estimates similarities between terms in the text and glossary terms (Kaindl and Kramer, 1999). This is done using a simple formula that could be used, for example, for automatically linking similar news articles (Kaindl and Kramer, 1999). Techniques using this approach perform well with respect to speed but do so at the expense of sophistication (Kaindl and Kramer, 1999).

Other techniques opt for a more sophisticated approach. One such approach was employed by Salton (1989). He used a *vector-space model* in his algorithm. This is a representation of documents where they are converted into vectors. This model represents glossary terms as term vectors (Salton, 1989).

Gloor (1991) clusters glossary terms into what he refers to as *hyperdrawers* - which are constructed using the same similarity measure employed by Salton

(1989). A similar similarity measure is used by the SmarText system (Rearick, 1989). The SmarText system allows for more flexibility than Gloor's method, however (Kaindl and Kramer, 1999). It allows for parameter adjustments by allowing manipulation of the keyword list as well as the *stop-word list* – which is a list of words that do not have much semantic content, such as prepositions. (Rearick, 1989).

Other approaches address different complications involved in the automatic link generation problem. An example of this is finding structure in spatial arrangements of objects (Kaindl and Kramer, 1999). *Intermedia* is a hypertext system developed by a research group at Brown University (Coombs, 1990). Full-text searching is used as a basis for automatic link generation in the Intermedia system (Coombs, 1990).

DeYoung (1989, 1990) suggests generating isomorphic links between a section in different versions of the same text. She does not, however, address the problem of finding inherent links into a glossary (DeYoung, 1990). Thistlewaite (1997) classifies links into different categories depending on whether or not they are referential links. If they are, he claims that the identifiers for the targets of the links can be computed as some function of the strings that are being used as the links' anchors (Thistlewaite, 1997). Despite making this claim, Thistlewaite (1997) does not provide any such function.

The most complete approach to the problem of automatic link generation appears to be the one presented by Kaindl and Kramer (1999). They provide a function for the more specific problem of generating glossary links.

2.2: The Reading Process

Research and experimentation conducted in the area of usability issues, discussed above, have increased the understanding of how people read online texts. This section is a presentation of some of the most prominent observations that have been made about the reading process.

Users exhibit different behaviors while reading depending on their reasons for doing so. Users skim through, or scan, articles or text when they want to quickly determine whether or not further study of the article or text would be beneficial to them. Once they have determined that they will read the article or text more thoroughly, many users will often browse the text to find specific parts or sections of the text that are of particular use or interest. When users know that an article or text contains specific information related to their information retrieval needs and they search for that information, they are said to be querying the text (Blustein, 1999).

When a user stops reading a text to look up a definition of an unknown word, cognitive overhead is involved (Wright, 1991). This affects users' willingness to use tools that involve such overhead and it should be taken into consideration

when designing a glossary tool. An attempt should be made to keep the cognitive overhead of accessing a glossary entry at a minimum so that users will be more likely to use the tool, and will find it helpful when they do use it.

Regardless of the design decisions made, cognitive overhead will be involved when a glossary tool is used. Users will still have to pause while they are reading in order to check the glossary entry associated with a term and this incurs cognitive overhead. The benefits of reading an entry, or the use of a glossary tool in general, are hoped to outweigh the disadvantages caused by doing so.

Reading style also affects how users may employ an available glossary tool and will have an impact on the interface that they would prefer. Some readers may prefer to enhance their vocabulary with completely or partially unknown words either before or after they have read the main text, but not while they are reading (Black et al., 1992). This may stem from a desire for a minimal amount of cognitive overhead. Other readers may only wish to learn the meanings of partially or completely unknown words as they encounter them. Wright (1993) warns that generalizing about how readers consult external material while they are reading a text should only be done with care. Dillon and Gabbard (1998) also mention the need to accommodate individual differences in users. For this reason, catering to as many groups of readers as possible is important as reading styles vary widely.

There are other factors affecting the reading process. The font size and face used both have an impact on how fast reading occurs. Bernard et al. (2002) conducted research to determine which fonts were best for reading online material. They found that reading efficiency did not differ among different font types. They did, however, conclude that different fonts produced significantly different reading speeds. They concluded that Verdana was the most preferred font overall because it was read relatively quickly and participants viewed it as quite legible. (Bernard et al., 2002)

Figure 2.1: Samples of text in various font faces at font size 12

Another aspect of an article's format that affects the speed of reading is the line length. This has been known for over a century. Research has shown that the optimal line length on paper documents is between 3 and 3.5 inches with a font size of 10. The least optimal line length for these documents is 7.3 inches with a font size of 10. For online texts, users tend to read faster if line lengths are longer, up to 10 inches. If the line length is too short (under 4 inches), reading slows down. Users tend to prefer line lengths of moderate length (between 7 and 9 inches) for general online reading. (Bailey, 2002)

Chapter 3: System Design

The development of the glossary tools went through several stages. Initially, the programming language used was Java with the intention of accessing applet functions using JavaScript online. Since the glossary tool system accesses files on the users' system, this introduced security problems. Because of this, the implementation language was switched to C++. The functions were used online with CGI. The final system consisted of roughly 800 lines of code.

The interface of the glossary tools used in the experiments discussed in this paper was designed using information gathered from previous research with similar systems (Wright, 1991; Black et al., 1992). This research is discussed in more depth in Section 2.1.1. Existing literature describes experimentation on certain design aspects of glossary tools, and reports on which design decisions were found to be preferable when tested with users (Wright, 1991; Wright, 1993; Black et al., 1992). Since the purpose of this paper is not to compare the usability of different interfaces for glossary tools, this existing literature was used as a reference for creating an interface that might otherwise have suffered from serious usability flaws.

The interface for the automatic glossary tool is divided into three sections (Figure 3.2). A list of glossary terms is provided in the left-hand division, while glossary entries are displayed in the bottom division. The main text is displayed in the largest division, which is located in the upper right. Glossary terms in the main

text are underlined and clicking on these underlined terms displays the corresponding glossary entries in the bottom division. Glossary entries can also be accessed by clicking on the terms listed in the left-hand division. A toolbar at the bottom of the window will be available to users of the user-updateable glossary tool (Figure 3.1). This toolbar will allow these users to modify or delete existing entries or to add new entries to the glossary.

Figure 3.1: User Updateable Glossary Tool

Figure 3.2: Automatic Glossary Tool

Wright (1991, 1993) has researched glossary tools for reading text on a computer in depth. She states that providing the user with the ability to access glossary entries is not always enough to be entirely useful (Wright, 1993). Wright expects that the functionality would be much more useful if it had visual support from within the display itself (Wright, 1993). Black et al. (1992) also mention the importance somehow marking the presence of terms that have entries in the glossary. This means that the usability of the glossary would benefit from highlighting the terms in the main text with associated glossary entries. The glossary tool interface designed underlines glossary terms in the main text and creates hypertext links anchored to these underlined terms. Clicking these links will allow users to access the corresponding entries.

It has been found that the visual presentation of information affects users' consultation strategies when using a glossary tool (Black et al., 1992). Readers' willingness to consult definitions was influenced by whether the definitions occluded the main text or left it visible (Black et al., 1992). Users were more likely to consult the glossary tool when the text remained visible (Black et al., 1992). The interface designed in this case leaves the main text visible, as glossary entries are presented in the bottom division and do not occlude any other part of the interface.

While Black et al. (1992) state the willingness of user to access glossary entries when they encounter completely unknown terms increases when the glossary terms are visibly marked, they also mention that users' willingness to look up partially known terms will depend on whether the method of marking the glossary terms in the main text disrupts the users' flow of reading. It has already been established that signaling the presence of glossary terms is necessary in order to allow the glossary tool's potential to be employed more fully. Underlining these terms does not disrupt the flow of the main text as well as signaling to the users that a corresponding glossary entry exists for the underlined terms. Many readers may also be familiar with the convention of underlined hypertext links on the World Wide Web, and will therefore, be more comfortable with clicking on the glossary term to access its entry.

Wright (1993) states that separating users' access to glossary terms from the main text (e.g. having the terms listed in another division of the window or in a separate window entirely) decreases their willingness to access the glossary entries. This drop in willingness was found to be the case even if the list of glossary terms and the main text were presented on the screen at the same time without occluding each other (Wright, 1993). This research supports the decision to integrate glossary links into the main text. In this way, users' willingness to access glossary entries will rely more heavily on their perceived level of familiarity with the terms they encounter and less heavily on the glossary tool's interface.

Some readers may prefer to enhance their vocabulary with completely or partially unknown terms in the text either before or after they are done reading, but not during (Black et al., 1992). If users' access to glossary entries is restricted to clicking on the integrated glossary links, users who prefer this style of reading will have to adapt to a different style of reading or will be discouraged from using the glossary tool at all. This adaptation process will cause an increase in cognitive overhead. For this reason, a list of glossary terms is provided in another division of the interface. Having a separate list of terms allows users to access entries without having to locate them in the main text. Integrating both styles of glossary term presentation caters to both styles of reading, so that neither type of reader is at a disadvantage.

Black et al. (1992) experimented with different media for the presentation of glossary entries. They found that additional cognitive overhead was incurred when users had to switch from one medium to another in order to access glossary entries. In the research discussed, users were presented with text in visual form but glossary entries were presented in the form of sound files (Black et al., 1992). Users' willingness to access entries dropped in contrast to users who were presented with visual glossary entries (Black et al., 1992). The interface designed for the current project presents both entries and text in visual format, thus avoiding an increase in cognitive overhead.

Bailey (2002) concluded that varying line lengths in online texts produce different reading speeds in users. For this reason, maintaining a consistent line length across the different articles ensures that this is not a deciding factor in users' reading speed. It was also concluded that users prefer lines that are of moderate length. (Bailey, 2002) The articles were formatted to have line lengths between 7 and 10 inches when displayed on screen.

Chapter 4: Experimental Design

As Wright (1991) states, a binary judgment indicating that a system either functions effectively or does not ignores the importance of the interaction between the numerous design decisions that were involved in creating the system. For this reason, experimentation on the usability of a system is necessary in order to determine what its strengths and weaknesses are. Such a process allows for improvement of the system by increasing its usability and effectiveness. This kind of evaluation is known as *formulative evaluation*, the evaluation of a system as it is being developed (Hix and Hartson, 1993).

Wright (1991) claims that the main deciding factor for the reception of a new technology or system is how favourably it compares to known existing alternatives. This means that a suitable control needs to be used for experimental purposes in order to properly evaluate the usability and effectiveness of the glossary tools. Since the tools being evaluated in this study are glossaries to be used for reading online texts, the control would be a similar system for reading the same texts that lacks any kind of glossary functionality.

As part of this research, two different glossary tools, an automatic tool and a user-updateable tool, were developed. These tools can be considered feasible alternatives to each other. Comparisons are also made between the results of the users of the two tools in order to determine whether or not one of the tools is

more effective than the other. If this is true, the results will also indicate which of the glossary tools is the more effective.

4.1: Methodology

The usability test involved participants reading technical articles concerning selected health conditions (Appendix C). Users' understanding of these articles was measured through the use of questionnaires with related questions. Users' subjective appreciation of the glossary tools was also measured with another questionnaire designed for this purpose. In addition, the users were given the opportunity to leave general comments about the system. The methodology that was used and is described in this section was adopted from techniques outlined by Rubin (1994).

Each participant was greeted by the researcher. At that point, the participants were asked to read and sign consent forms describing the study and their willingness to take part in it (Appendix H). The participants received scripted introductions and orientation concerning the study (Appendix G). The function of this was to explain the purpose of the study as well as to provide the participants with additional information regarding what was required of them as part of the study. The participants were then made aware that they would be observed and that their actions with regards to the glossary tools would be logged by the software. After the participants had taken part in the orientation, had asked any questions they wished answered and were satisfied with the information they

received, they were asked to proceed with the study. The study was conducted entirely on a Dell laptop computer with a 13-inch LCD screen.

The study started with participants answering questions about a health condition. This condition was randomly chosen from asthma, bronchitis or influenza. After they had answered the questions, participants were presented with an article about the same health condition. The article may have been presented without a glossary tool, with an automatic glossary or with a user updateable glossary. This was also random. Once the participants were comfortable with the material in the article, they were asked to fill out another set of questions about this same health condition. This process was repeated one more time with another health condition, randomly chosen but different from the first condition. Every participant was presented with an article without a glossary tool and another article with either an automatic glossary or a user updateable glossary. The type of glossary tool they received was random. A sample scenario for the study is presented in Appendix A.

The researcher was present in the usability labs observing the participants. The time taken for each participant to complete reading each of the articles was recorded. Notes were also made about relevant participant behavior, any comments the participant may have had or any unusual incidences that occurred. The researcher did not interfere with the progression of the study unless a question about the test procedure arose. The glossary tool software also logged

the number of glossary terms accessed for viewing, editing and deletion. Also, the numbers of glossary entries created by users of the user-updateable glossary were also recorded.

When the participants had completed reading the articles and answering the questionnaires about them, they were asked to complete a questionnaire measuring their subjective appreciation of the glossary tool they were given to use. A debriefing session followed where participants were asked to express any comments about their performance during the study. The debriefing session allowed participants to openly express their views on the software and describe what areas they felt required improvement. It also proved useful in the collection of subjective data from the participants.

4.2: Participants

A large part of the general computer literate population turns to online articles to obtain information about health conditions that may be of interest to them. For example, the WebMD website, which provides a large database of health information for this part of the population, claims to receive more than 20 million users every month (WebMD, 2002). It is suspected that readers of this and other similar websites often encounter medical terms that they do not recognize or remember. A glossary tool would help alleviate this problem.

Participants were recruited through the use of posters asking for volunteers (Appendix I). These posters were placed around the city, especially on University campuses. Some computer familiarity was a prerequisite for participants taking part in the study. The focus was on individuals who may have had a particular interest in the health conditions described in the articles being used. The conditions discussed in the articles were asthma, bronchitis and influenza.

40 participants from various backgrounds took part in the study. All participants were familiar with the use of computers and as such, represented the target audience for the glossary tool. Self-selection bias was not expected. Therefore, the presence of any skewing due to selection bias is not expected in the results.

The participants were informed that they were taking part in a user study that was attempting to determine the usability of glossary tools for technical reading as well as their usefulness for such a purpose. The participants were also told that a summary of the results of the study was likely to be published.

4.3: Materials

The articles used for the study discussed asthma, bronchitis and influenza (Appendix C). These are health conditions that affect a considerable part of the general population. A large number of individuals may therefore be interested in reading about these conditions. It is likely, however, that these individuals are not

familiar with the specific details presented in the articles chosen. This would give the participants incentive to read the articles with greater attention to detail.

Asthma is a chronic disease that affects the lungs (GlaxoSmithKline Inc., 2003). People with asthma have irritated and swollen airways (GlaxoSmithKline Inc., 2003). This inflammation is constantly present even when the individual is not suffering from an asthma attack (GlaxoSmithKline Inc., 2003). Certain medicines and a lifestyle that avoids substances that trigger attacks are used to control this condition (GlaxoSmithKline Inc., 2003).

Asthma is a major cause for admissions to hospital for Canadians of all ages (Glaxo Wellcome Inc, 2000). Over 2 million Canadians in 2000 were diagnosed as suffering from asthma (Glaxo Wellcome Inc, 2000). This included 10 – 15% of all Canadian children (Glaxo Wellcome Inc, 2000). It is approximated that 520 Canadians die of asthma every year, the majority of these being adults (Glaxo Wellcome Inc, 2000).

Bronchitis is characterized by the limitation of airflow in the respiratory system (Ontario Lung Association, 2003). Chronic bronchitis occurs when this limitation is present over a period of years (Ontario Lung Association, 2003). It is irreversible (Ontario Lung Association, 2003). Symptoms of bronchitis and chronic bronchitis include a constant cough, mucus production in the airways and weakened gas exchange (Ontario Lung Association, 2003).

Chronic bronchitis is one of the top ten leading causes of death for Canadians (Ontario Lung Association, 2003). It is the fourth leading cause of death in men and the seventh in women (Ontario Lung Association, 2003). Between 1998 and 1999, it was found that approximately 3.2% of the adult Canadian population had been diagnosed with chronic bronchitis (Ontario Lung Association, 2003).

Influenza is an infectious viral disease commonly referred to as the flu (American Lung Association, 2003). Although influenza is usually considered a respiratory illness, it affects the entire body (American Lung Association, 2003). Symptoms of influenza include sneezing, coughing and a fever (American Lung Association, 2003). The lining of the respiratory tract also becomes swollen. This is usually temporary (American Lung Association, 2003).

In 1996, over 95 million cases of influenza were reported in the United States of America (American Lung Association, 2003). It is typically considered a moderately severe illness (American Lung Association, 2003). Awareness of the disease is important in its prevention, which is done through the administration of vaccinations (American Lung Association, 2003). Influenza is treated through the use of anti-viral drugs. (American Lung Association, 2003)

4.4: Environment

A usability lab was used as the locale for the user study. Participants were provided with a laptop to perform the study on. A workstation mouse was available so that users who were unfamiliar with the laptop equivalents did not experience a learning curve because of this. There was only one participant taking part in the study at a time.

Before each participant was seated at the laptop, it was ensured that a browser session containing the appropriate article was running. The operating system running on the laptop was a Windows OS, specifically Win98. An instrumented browser designed for usability testing was used for the study. It is part of the Uzilla testing service (Edmonds, 2003).

The service enables the easy observation of participants' interactions with the glossary tool software (Edmonds, 2003). It consists of two parts. One component is a customized web browser that logs user activities (Edmonds, 2003). The second is an Internet-based collection server (Edmonds, 2003). Data stored on this server can easily be analyzed and there is no need to compile it manually (Edmonds, 2003).

4.5: Hypotheses and Evaluation Measures

The purpose of the experiment using the two glossary tools was to:

a) Determine if the presence of a glossary tool increased the performance or speed of users reading online technical articles.
b) Determine whether or not one glossary tool was superior in speed or performance or both.

To measure if there is a significant difference between the performance of users with a glossary tool and without a glossary, the following hypotheses were used:

H_0: Having a glossary tool did not make a difference to users' scores

H_A: Having a glossary tool did make a difference to users' scores

The following hypotheses were used to determine if there was a significant difference in speed between using a glossary tool and not having a glossary tool present:

H_0: Having a glossary tool did not make a difference to users' speeds.

H_A: Having a glossary tool did make a difference to users' speeds.

Similar hypotheses were used to determine if there were significant differences in the speed of completing the post-test questionnaires and reading the articles alone as opposed to their combined speeds.

To determine whether one tool was more effective or efficient than the other, the following hypotheses were used:

H_0: There is no difference in performance or time between the two types of glossary tool.

H_A: There is a difference in performance and/or time between the two types of glossary tool.

To determine if the number of terms clicked on by users increases the improvement in performance when a glossary tool is used as opposed to when no glossary tool is present, the following hypotheses were used:

H_0: There is no relationship between the number of terms clicked on and the improvement of performance when a glossary tool is used.

H_A: There is a clear relationship between the number of terms clicked on and the improvement of performance when a glossary tool is used.

In order to have the data to test the hypotheses above, the following evaluation measures were collected and calculated:

1. The average time taken to read each article.
2. The average increase or decrease in scores from the preliminary questionnaires to the post-test questionnaires.
3. The average time taken to complete the post-test questionnaires.
4. The average number of glossary terms accessed for viewing when a glossary tool was provided with the article.
5. The average number of glossary terms that were edited or deleted when the user-updateable glossary tool was provided.
6. The average number of new glossary entries that were created when the user-updateable glossary tool was provided.

The aim was to determine whether there was a statistically significant difference between the measures obtained for articles read without any glossary tool and articles that were read with the help of either of the two glossary tools. A comparison between the data collected for the two tools was also intended to be made in order to determine the presence of any significant differences.

Feedback was also collected from the users by asking them to fill out a questionnaire rating their experience with the glossary tool and by allowing them to make general comments about the tool. This allowed a subjective analysis to be made about what users thought of the glossary tools. This can be used as a supplement to the analytical data retrieved from their performance and speed during the study.

Chapter 5: Results

Two types of data were collected during the study: subjective and statistical data. These two types of data in turn produce different kinds of results: descriptive and analytical results respectively. The first section of this chapter deals with the descriptive results while the second section discusses the analytical results.

5.1: Descriptive Results

Subjective data was collected in two forms:

1. Users were asked to fill out a questionnaire about their experience with the glossary tool.
2. Users were asked to express any comments they had about the software during the debriefing session after the study.

The subjective questionnaire used for this study was the SUS questionnaire. This is a simple 10-question user survey developed in 1986 by Digital Equipment Co. Ltd. The survey is based on a 5-point Likert Scale (Brooke, 1986).

The questionnaire is designed to be given to the user after they have used the system or software in question and before any debriefing has taken place (Brooke, 1986). This was the case for the study conducted. Every user answered all of the questions in the survey in the intended manner.

The cumulative results of this questionnaire are shown in Appendix F. The results of the odd-numbered questions are scored with: scale position - 1 (Brooke, 1986). The values of the answers to these questions are rated as going from low to high with a score of 5 being the highest and 1 being the lowest. The results of the even numbered questions are scored with: 5 - scale position (Brooke, 1986). The values of the answers to these questions are rating as going from high to low with a score of 1 being the highest and 5 being the lowest. The sums of these are then added together and multiplied by 2.5 for the final score (Brooke, 1986).

Calculating this for the data collected resulted in an average final score of 24.8 (Appendix F). A “perfect” score for this questionnaire would be a 0 and the scale is from 0 to 100 (Brooke, 1986). The score obtained indicates that users had at least a favorable impression of the glossary tool software.

During the debriefing sessions, users were encouraged to express their opinions about their experiences with the glossary tools they were given. Most users expressed satisfaction with the tools. The majority of users also said that they would like to have such a tool available when working with unfamiliar topics.

A large number of users commented that they would have made more extensive use of the glossary if they were more concerned about understanding the material in the articles. A number of these users cited studying for quizzes or

exams that would count towards their course marks as an example of such a situation.

Users that were given the user updateable tool admitted that although functionality was present that allowed them to modify the glossary, they felt no need to do so. The most commonly stated reason for this was that they did not feel it was worth the effort because they would not be able to access the glossary ever again. Users said that in situations where this was not the case, they would consider the use of these features more helpful.

5.2: Analytical Results

As part of the study conducted, each user was given an article with a glossary tool and one without any kind of glossary. Since each user was subjected to both cases, we use paired sample t-tests to determine significant differences in performance and time when a glossary tool is used and when there is no glossary tool present. Conducting paired sample t-tests means making the assumption that the changes being measured are normally distributed. Normal P-P plots are used to test this assumption. All data was analyzed through the use of SPSS statistical software (SPSS Inc., 2003).

Performance (effectiveness)

Performance here is used to mean a user's level of understanding of the articles that he or she has been given to read. It is also a measure of the effectiveness of

the glossary tool since the purpose of the tool is to increase users' understanding of the articles or text that they are reading. Users with a higher level of understanding have higher performance than those with a lower level of understanding. This understanding is measured by the scores that users receive on sets of questions about the articles that they are presented with.

The normal P-P plot of the changes in users' scores (Score with glossary tool – Score without Glossary Tool) shows that the distribution of this data is close to the normal distribution (Figure 5.1). This allows a t-test to be performed to determine a significant difference between the two sets of scores.

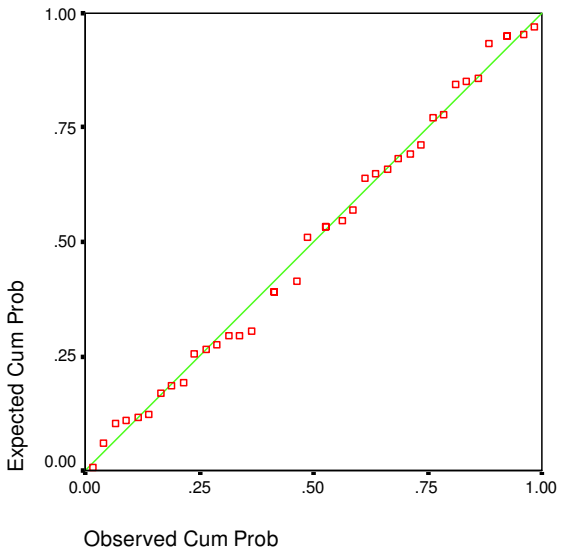

Figure 5.1: Normal P-P Plot for changes in score

To measure if there is a significant difference between the performance of users with a glossary tool and without a glossary, we use the following hypotheses:

H_0: Having a glossary tool did not make a difference to users' scores

H_A: Having a glossary tool did make a difference to users' scores

From the results of the t-test, we see that there is enough evidence to reject the null hypothesis in this case ($t=5.505$, $df = 39$, $p < 0.05$) (Table 5.1). Rejection of the null hypothesis indicates that the presence of a glossary tool did significantly improve users' performance during the study. An improvement in performance means that there is significant evidence that the glossary tool is effective in its purpose.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Glossary Score	.36	40	.24	.04
Without Glossary Score	.07	40	.24	.04

Paired Samples Correlations

	N	Correlation	Sig.
Glossary Score & Without Glossary Score	40	-.008	.959

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Glossary Score - Without Glossary Score	.29	.34	.05	.18	.40	5.505	39	.000

Table 5.1: Paired Sample t-test for changes in score

The frequency histogram showing the distribution of the scores obtained by users when they were presented with glossary tools indicates a mean score of 0.36

and a standard deviation of 0.24 (Figure 5.2). The distribution does not have a singular peak near the center. The curve superimposed on the histogram shows the normal distribution for that mean and standard deviation.

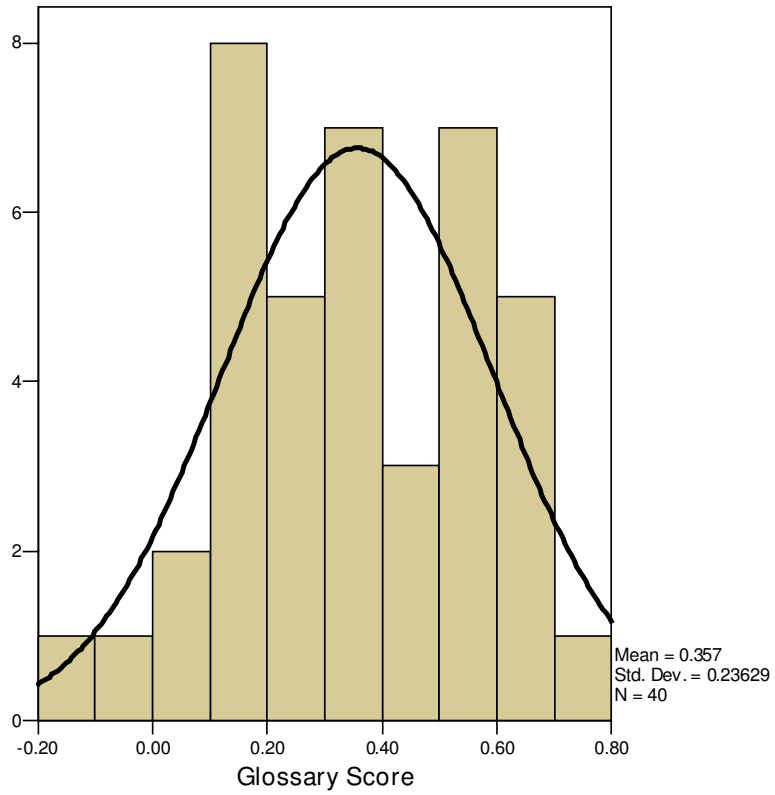

Figure 5.2: Frequency histogram for scores obtained with glossary tool

The frequency histogram showing the distribution of the scores obtained by users when they were not presented with a glossary tool indicates a mean score of 0.07 and a standard deviation of 0.24 (Figure 5.3). The distribution has a peak at a score of 0.0, roughly at the center. The curve superimposed on the histogram shows the normal distribution for that mean and standard deviation.

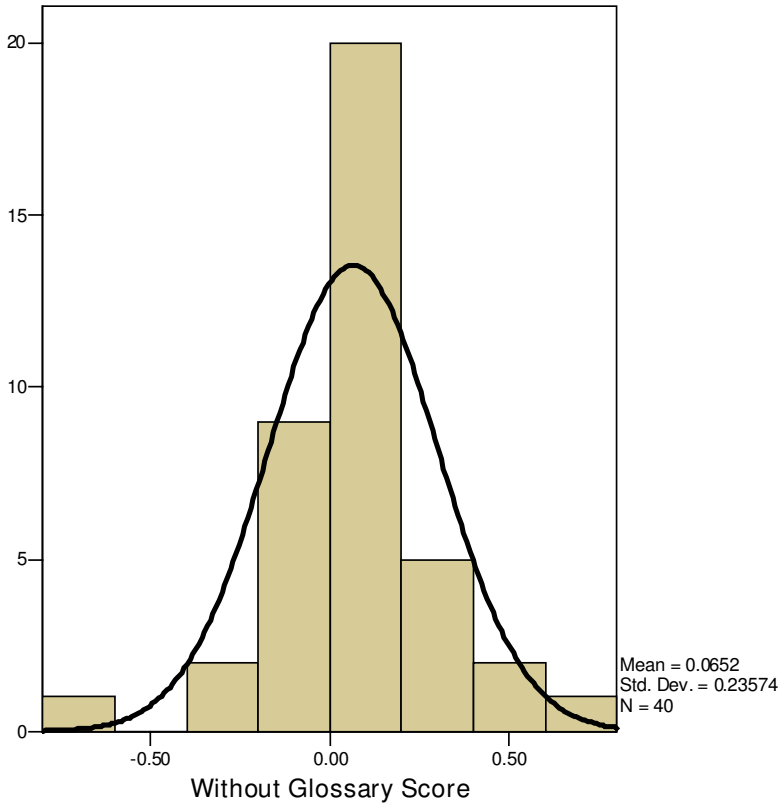

Figure 5.3: Frequency histogram for scores obtained without a glossary tool

Speed (Efficiency)

User speed is used as a measure of users' efficiency while they read the given articles and answer the associated sets of questions. The normal P-P plot of the changes in users' total speeds which included answering both sets of questions as well as actual article reading time (Speed with a glossary tool – Speed without a glossary tool) shows that the distribution of this data is close to the normal distribution. (Figure 5.4) This allows a t-test to be performed to determine a difference between the two sets of speeds.

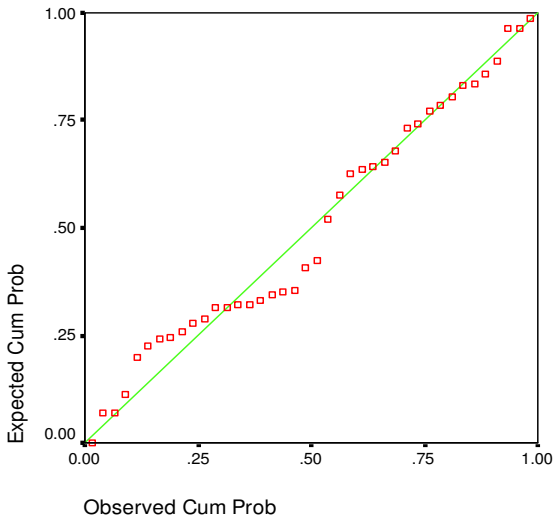

Figure 5.4: Normal P-P Plot for changes in total speed

The following hypotheses are used to determine if there is a significant difference in speed between using a glossary tool and not having a glossary tool present:

H_0: Having a glossary tool did not make a difference to users' speeds.

H_A: Having a glossary tool did make a difference to users' speeds.

From the results of the t-test, we see that there is enough evidence to reject the null hypothesis in this case ($t=2.550$, $df = 39$, $p < 0.05$) (Table 5.2). This means that users' mean speed of 603.01 seconds while using the glossary tool is significantly slower than users' mean speed of 548.99 seconds without a glossary tool.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Glossary Total Time	603.01	40	131.37	20.77
Without Glossary Total Time	548.99	40	114.07	18.04

Paired Samples Correlations

	N	Correlation	Sig.
Glossary Total Time & Without Glossary Total Time	40	.411	.008

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Glossary Total Time - Without Glossary Total Time	54.02	133.99	21.19	11.17	96.88	2.550	39	.015

Table 5.2: Paired Sample t-test for changes in total speed

Another way of looking at the change in speed is to consider users' speed reading the actual article separately from the speed of answering the questions after the articles. The normal P-P plot for the changes in users' speeds reading the articles given (Speed reading article with glossary tool – Speed reading article without glossary tool) shows that the distribution of this data is roughly approximate to the normal distribution. (Figure 5.5)

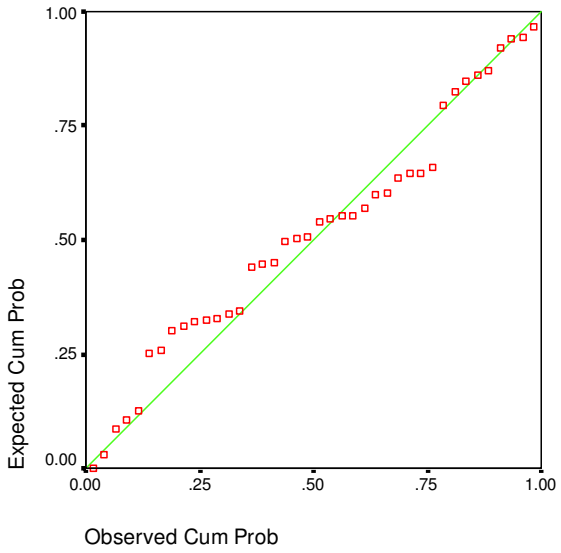

Figure 5.5: Normal P-P Plot for changes in speed reading articles

To determine if there is a significant difference between the speed of users reading an article with a glossary tool and without a glossary tool, the following hypotheses are used:

H_0: Having a glossary tool did not make a difference to users' speed reading the articles.

H_A: Having a glossary tool did make a difference to users' speed reading the articles.

The results of the t-test on this data show that there is not enough evidence to reject the null hypothesis in this case. (Table 5.3) This means that the mean time of 255.12 seconds spent reading articles with glossaries is not significantly differently from the mean time of 267.35 seconds spent reading articles without any glossary tool.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Glossary Reading Time	255.12	40	96.45	15.25
Without Glossary Reading Time	267.36	40	95.39	15.08

Paired Samples Correlations

	N	Correlation	Sig.
Glossary Reading Time & Without Glossary Reading Time	40	.224	.165

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Glossary Reading Time - Without Glossary Reading Time	-12.24	119.49	18.89	-50.45	25.98	-.648	39	.521

Table 5.3: Paired Sample t-test for changes in speed reading articles

The normal P-P plot for the changes in users' speeds answering the questions after the given articles (Speed of answering questions after article with glossary tool – Speed of answering questions after article without glossary tool) shows that the distribution of this data is roughly approximate to the normal distribution (Figure 5.6).

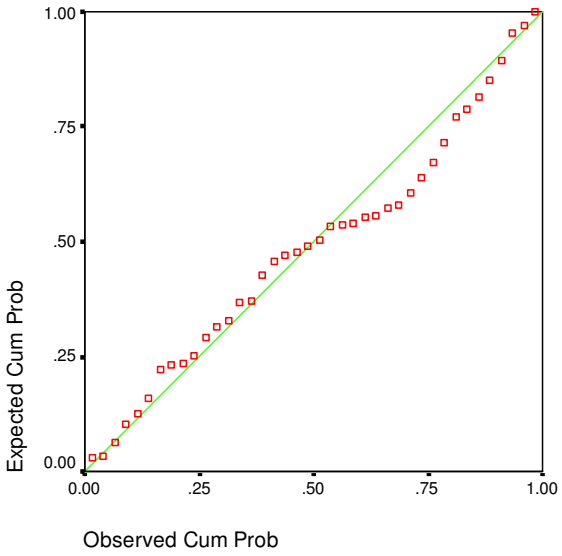

Figure 5.6: Normal P-P Plot for changes in speed answering questions after articles

To determine if there is a significant difference between users' speed answering sets of questions after reading an article with a glossary tool and their speed answering questions after reading an article without a glossary tool, the following hypotheses are used:

H_0: Having a glossary tool while reading an article did not make a difference to users' speeds answering the questions after that article.

H_A: Having a glossary tool while reading an article did make a difference to users' speeds answering the questions after that article.

The results of the t-test on this data show that there is enough evidence to reject the null hypothesis ($t=4.522$, $df = 39$, $p < 0.05$) (Table 5.4). This means that the mean speed of 187.69 seconds to answer questions after reading an article with a glossary tool is significantly slower than the mean speed of 139.69 seconds to answer questions after reading an article without a glossary tool.

Paired Samples Statistics

	Mean	N	Std. Deviation	Std. Error Mean
Glossary PostTest Time	187.69	40	73.79	11.67
Without Glossary PostTest Time	139.69	40	54.65	8.64

Paired Samples Correlations

	N	Correlation	Sig.
Glossary PostTest Time & Without Glossary PostTest Time	40	.487	.001

Paired Samples Test

	Paired Differences					t	df	Sig. (2-tailed)
	Mean	Std. Deviation	Std. Error Mean	95% Confidence Interval of the Difference				
				Lower	Upper			
Glossary PostTest Time - Without Glossary PostTest Time	48.00	67.14	10.62	26.53	69.47	4.522	39	.000

Table 5.4: Paired Sample t-test for changes in speed answering questions after articles

The frequency histogram showing the distribution of the total time taken by users when a glossary tool was provided shows a mean speed of 603.0 seconds and a standard deviation of 131.37 (Figure 5.7). There is no single peak at the center of the distribution as would be the case in the normal distribution, which is shown in the superimposed curve.

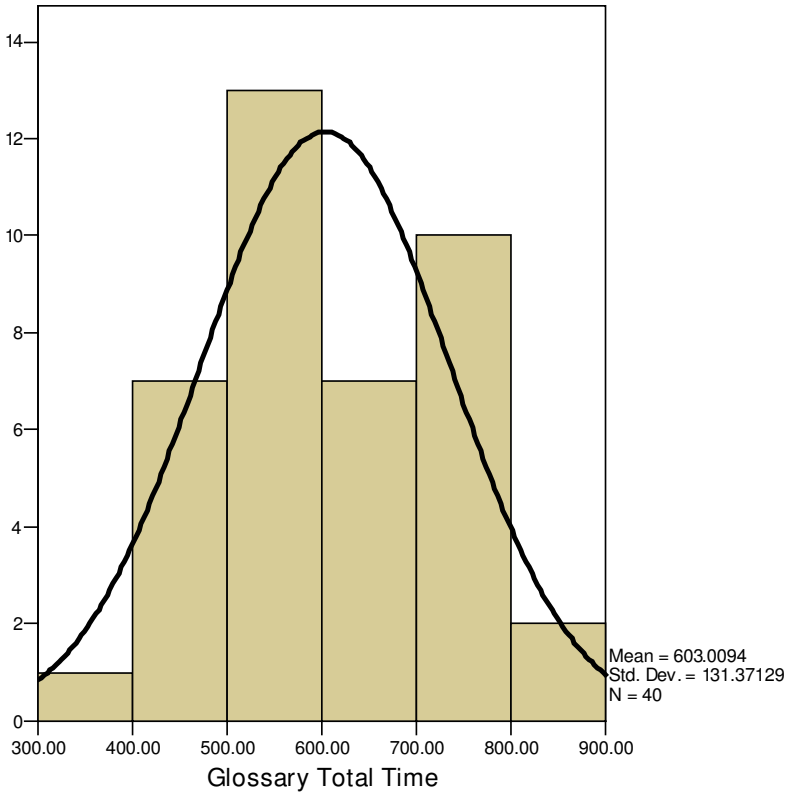

Figure 5.7: Frequency histogram for total speed with a glossary tool

The frequency histogram of the total time taken by users when a glossary tool was not used shows a mean speed of 549.0 seconds and a standard deviation of 114.07 (Figure 5.8). The distribution of time taken here roughly resembles that of the normal distribution, which is shown in the superimposed curve.

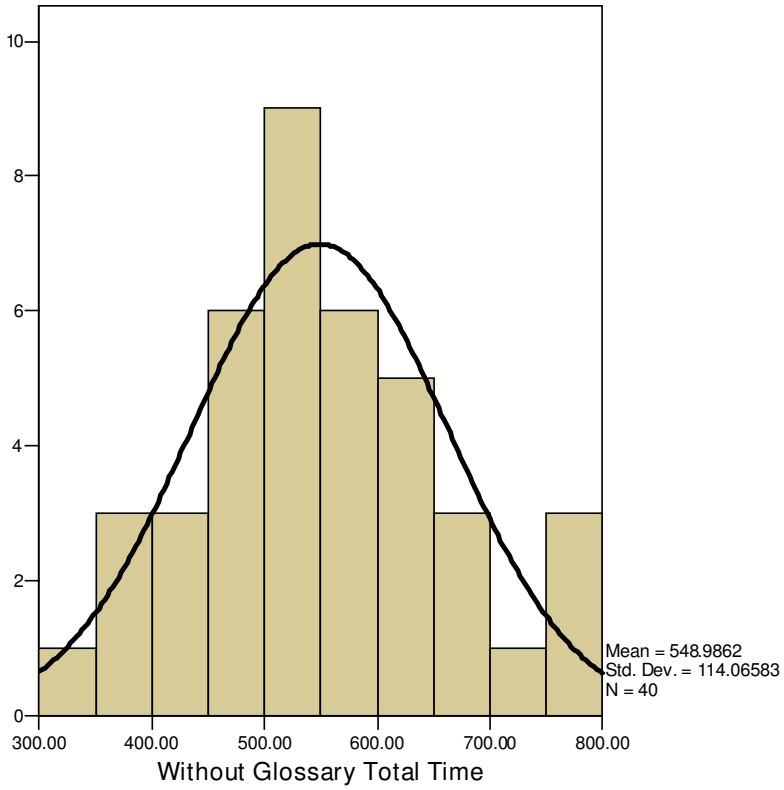

Figure 5.8: Frequency histogram for total speed without a glossary tool

Difference in Glossary Tools

Two types of glossary tool were developed for this study, an automatic tool and a user updateable tool that allowed users to create, edit or delete terms and entries in the glossary. To determine whether one tool was more effective or efficient than the other, the following hypotheses are used:

H_0: There is no difference in performance or time between the two types of glossary tool.

H_A: There is a difference in performance and/or time between the two types of glossary tool.

The participants of the study did not make use of the updateable glossary's functionality. Thus, there was essentially no difference to them between the two types of glossary tools. Not enough data was available to determine whether or not the null hypothesis can be rejected.

Number of Terms Clicked On

To determine if the number of terms clicked on by users increases the improvement in performance when a glossary tool is used as opposed to when no glossary tool is present, we use the following hypotheses:

H_0: There is no relationship between the number of terms clicked on and the improvement of performance when a glossary tool is used.

H_A: There is a clear relationship between the number of terms clicked on and the improvement of performance when a glossary tool is used.

The following figure shows an attempt to fit linear, quadratic and cubic regression lines to the relationship between the number of terms clicked on and the improvement in performance for users when they were given a glossary tool as opposed to when there was no such tool present (Figure 5.9). The graph indicates that there is no clear relationship that can be described from the available data.

Figure 5.9: Attempt to fit regressions to relationship between terms clicked and score

The frequency histogram for the number of terms clicked on by users shows a mean of 1.4 and a standard deviation of 1.985 (Figure 5.10). It is clear from the distribution of the number of terms clicked on that the majority of users clicked on between 0 and 2 terms. A large number of users clicked on no terms at all which supports the idea that this data is not suitable for regression analysis. The curve superimposed on the histogram shows the normal distribution for that mean and standard deviation.

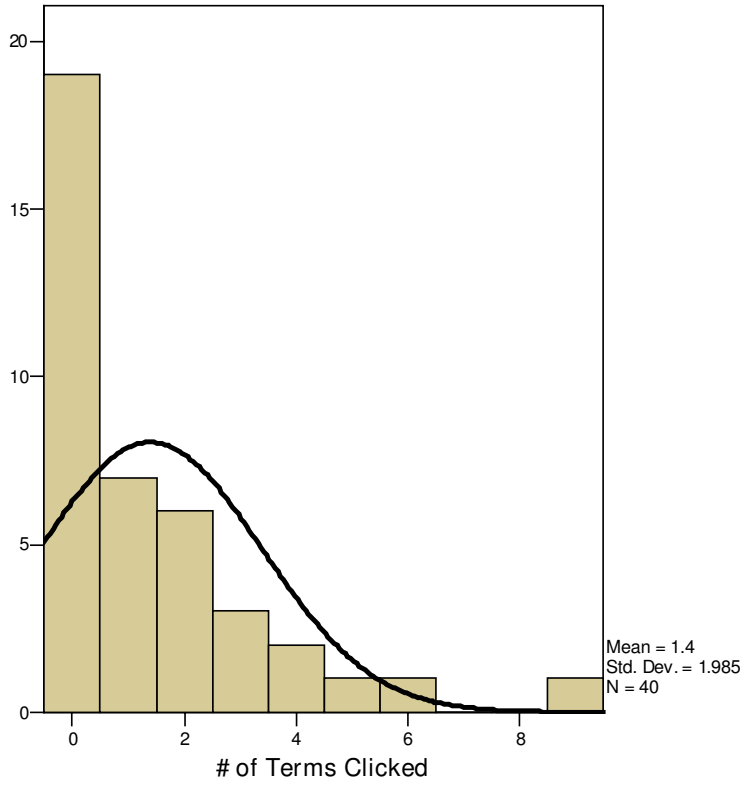

Figure 5.10: Frequency histogram for number of terms clicked on by users

Since a large number of users did not click on any terms at all, further studies need to be conducted in order to verify whether or not the glossary tool alone contributed to the improvement in scores and whether other factors also added to any improvement shown.

Chapter 6: Discussion

The results of the study indicate that the presence of glossary tools did indeed significantly improve performance in users. This supports the idea that such tools would be useful to the target population of general Internet users. Both tools were shown to have this effect, so either kind of glossary tool would be useful for increased performance.

The presence of a glossary tool was shown to have decreased users' speed by a significant amount. It was also shown that the actual article reading times did not differ significantly when a glossary tool was used as opposed to when no such tool was present. Since the presence or absence of a glossary tool will have no bearing on the speed of answering questions before the article is even viewed, it seems reasonable to assume that the difference in total speeds may result from a significant difference in speeds answering questions after the articles have been read. This assumption was also confirmed by the results of the study.

There may be several explanations for this. A reason for the decrease in speed may be that users spent more time answering questions if they knew the answers as opposed to simply stating that they did not know the answer. Also, with better recall, it may be reasonable to speculate that users would have more detailed answers. Typing out these answers would generally take more time than if users had simpler, shorter responses.

None of the users employed the user updateable glossary tool's specific functionality. Many users explained this behavior during the debriefing sessions by saying that there was little motivation to expend the effort of modifying the glossary since they would not be using it after the study. They also explained that they would be more willing to use this functionality in real-life situations where they would be able to access the glossary for a long time and where their changes would remain permanent.

Another reason that users may have not felt the need to use the updateable functionality could be that the articles used in the study were too short and presented on one page. The length and presentation of the articles would not provide much motivation for making or editing entries since any new knowledge the user obtains would be from the current article. Any information that the users may add or change could easily be found again by scrolling to the appropriate location.

Many users did not click on any glossary terms at all. Despite this, there was a significant increase in the performance of users when they were given a glossary tool. This may be partly due to the effectiveness of the glossary tool itself, and in the case of users who did not click on any terms, due to the highlighting of certain words and phrases by transforming them into glossary links. The emphasis on glossary terms in the text may distract the user into noticing and remembering these words and phrases when they otherwise would not have,

consequently improving their performance on the questions about the articles. Further experimentation needs to be conducted in order to confirm or reject this speculation.

The subjective results of the study show that users found the glossary tools easy to use as well as useful. The analytical results show that user performance increased without any significant decrease in users' speed of reading the articles meaning that the glossary tools were effective and pleasing to users at no significant cost to efficiency. While more detailed studies need to be conducted in order to determine the superiority of one of the glossary tools over the other, it can be concluded from these statements that the presence of glossary tools, either automatic or user updateable, is an improvement to users' experience with online texts.

Chapter 7: Concluding Summary

The purpose of this project was to determine whether or not a glossary tool incorporated into a web browser would be beneficial to users reading articles on technical material, such as certain health conditions. Another purpose of the project was to determine whether a glossary that users can update and therefore have more control over would be more beneficial than one that they could not modify. Previously published studies have focused on studying the effects that the presentation of glossaries have on users' willingness to use them but not on their usefulness (Wright 1991).

Two glossary tools were developed for this project, an automatic tool that did not allow users to modify, create or delete glossary entries and an updateable tool that included these functionalities. A user study was conducted in order to collect enough data to answer the problems discussed above.

The software was developed using previously published algorithms (Kaindl and Kramer, 1999). The programming language used was C++ and the web interface used CGI. The user interface for the software was designed based on interfaces that proved to be the most effective according to previous research (Black et al., 1992).

Not enough data was collected to determine the superiority of one glossary tool over the other. However, the subjective results of the study showed that users

found both of the glossary tools easy to use as well as useful. The analytical results showed that user performance increased without any significant decrease in users' speed of reading the articles meaning that the glossary tools were effective and pleasing to users at no significant cost to efficiency.

Chapter 8: Future Work

It was noted in the results that the study conducted did not produce data that allowed for a comparison between the automatic glossary tool and the user updateable tool. An extension of this work would be to conduct studies that provided more motivation for users to employ the updateable features. For example, users may be asked to take part in multiple sessions where the changes made to glossaries remain from session to session. A longitudinal experiment could also be conducted, for example, with students in an undergraduate introductory course, such as a first-year psychology course. This would provide additional information on how users in real-life situations would use glossary tools and how much benefit they would receive from this use.

Another shortcoming of the study conducted is that users were not given enough motivation to click on glossary terms. As a result of this, no clear relationship could be defined between the number of terms clicked and the improvement in performance. Further studies may create scenarios where users are more inclined to use the glossary tool. The results of these studies could then be used to see if there is indeed any relationship between the number of terms clicked and any improvement shown.

Because a large number of users did not click on any glossary terms and there was still a significant improvement in scores, it is not clear whether the glossary tools alone produced the improvement or whether the fact that certain words and

phrases were highlighted also contributed. A study similar to the one carried out for this project could be conducted where users would be presented with identical highlighting in two articles, one of which would be accompanied with a glossary tool and the other would not. The analysis for this study would be similar to the analysis done here.

Further study could also be conducted to determine whether the accuracy of the answers provided by users when they were given a glossary tool to use improved over the accuracy of their answers when there was no glossary present. A score out of 10 could be assigned by an impartial marker, for example, to the accuracy level of answers provided. This information could be used as an indicator of any improvement in recall exhibited by users of glossary tool software since it can be assumed that accuracy will improve with increased recall.

There was no particular order assigned to the glossary terms in the term lists presented by the glossary tools developed. Further research into the factors used to order menus, for example, could provide more insight into the most useful ordering of glossary terms in these lists. Alternatively, additional studies could provide the answer to the best arrangement of the terms.

Other studies could be conducted to build upon and clarify the results obtained in this study. The work done here can be considered as a pilot study as part of more extensive research that can be conducted in the future.

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Appendices

Appendix A: Sample Test Scenario

Start Screen:

Text on the screen:

Project User Study Initialized

Please answer the questions presented before each article, then proceed to read the article. When you are comfortable with the material, please proceed to answer the following questions.

Users get to the next screen by clicking the “start” button in the taskbar

First Task's First Questionnaire:

Text on the screen:

Please complete survey:

This text is followed by questions for the user about the article to be presented in Task 1.

Users get to the next screen by clicking the "complete" button in the taskbar.

Instructions for the first Task:

Text on the Screen:

Instructions

After answering the initial survey questions, please read the article on the health condition. When you are comfortable with the material in the article, press complete and continue to answer the post-test questions.

Users get to the next screen by clicking the “continue” button in the taskbar.

First Screen of First Task:

Text on the Screen:

Start Usability Test

Users get to the next screen by clicking the link text on the screen.

Second Screen of First Task:

Text on the Screen:

Text of the first article presented with an automatic glossary tool.

Users get to the next screen by clicking the “complete” button in the taskbar.

First Task's Second Questionnaire:

Text on the Screen:

Please complete survey:

This text is followed by questions for the user about the article presented in Task 1.

Users get to the next screen by clicking the "complete" button in the taskbar.

Second Task's First Questionnaire:

Text on the Screen:

Please complete survey:

This text is followed by questions for the user about the article to be presented in Task 2.

Users get to the next screen by clicking the "complete" button in the taskbar.

Instructions for the second Task:

Text on the Screen:

Instructions

After answering the initial survey questions, please read the article on the health condition. When you are comfortable with the material in the article, press complete and continue to answer the post-test questions.

Users get to the next screen by clicking the “continue” button in the taskbar.

Second Task:

Text on the Screen:

Text of the first article presented without any kind of glossary tool.

Users get to the next screen by clicking the “complete” button in the taskbar.

Second Task's Second Questionnaire:

Text on the Screen:

Please complete survey:

This text is followed by questions for the user about the article presented in Task 2.

Users get to the next screen by clicking the "complete" button in the taskbar.

Subjective Questionnaire:

Text on the Screen:

Please Complete Survey

This text is followed by questions about user experience with the glossary tool. Users get to the next screen by clicking the “next >> ” button at the bottom of the survey.

Thank You Screen:

Text on the Screen:

Thanks!

Thank you for taking part in this study. Your participation is appreciated.

Appendix B: User Data

User ID	Glossary Score	Without Score	Glossary Article	Without Article	Glossary Type	Change In Score	Glossary Article Time	Glossary Pre Time
1318	0.44	-0.02	1	2	0	0.46	476.54	243.54
1336	-0.16	-0.04	0	2	0	-0.12	227.94	144.46
1423	0.14	0.02	0	1	0	0.12	270.57	110.9
1434	0.36	0.03	0	2	0	0.33	260.13	77.66
1437	0.57	0.27	1	0	1	0.3	307.91	129.19
1438	0.14	0.06	0	1	1	0.08	467.96	172.8
1439	0.56	0.13	1	2	1	0.43	160.17	78.16
1443	0.57	0.16	0	1	0	0.41	242.88	170.11
1444	0.33	0.13	2	1	0	0.2	70.09	345.98
1445	0.13	0.26	2	0	0	-0.13	273.81	50.37
1447	0.56	0.08	1	2	0	0.48	399.144	90.23
1448	0.39	0.04	0	1	0	0.35	234.157	244.251
1449	0.13	-0.67	2	1	1	0.8	130.237	161.382
1454	0.26	0.49	2	1	1	-0.23	283.418	176.083
1455	0.8	-0.04	0	1	0	0.84	185.637	258.322
1456	0.57	0.02	1	2	1	0.55	147.072	171.076
1457	0.26	0.36	0	2	1	-0.1	236.109	150.336
1458	0.36	-0.06	2	1	1	0.42	325.137	179.368
1459	0.38	-0.27	1	2	0	0.65	104.741	67.337
1460	0.68	-0.18	0	2	0	0.86	98.882	160.511
1462	0.36	0.04	0	1	1	0.32	154.512	222.611
1463	0.68	0.04	1	2	1	0.64	174	115.025
1464	0.03	-0.08	2	1	0	0.11	257.09	244.802
1465	0.67	0.78	1	0	0	-0.11	217.804	114.345
1466	0.14	0.03	1	2	0	0.11	220.527	156.846
1467	0.58	0.04	0	2	0	0.54	187.42	117.149
1475	0.46	0.26	1	0	0	0.2	431.24	90.06
1477	0.48	0.03	0	2	0	0.45	339.498	171.396
1478	0.16	0.16	0	1	0	0	265.312	70.261
1479	0.26	0.04	0	2	1	0.22	224.073	137.738
1481	0.14	0.17	0	1	0	-0.03	179.788	244.882
1482	0.13	-0.07	2	1	0	0.2	371.804	273.944
1483	-0.1	0.44	2	1	0	-0.54	264.961	168.222
1484	0.25	0.26	1	0	1	-0.01	234.787	165.048
1485	0.67	0.04	0	1	1	0.63	259.703	111.03
1486	0.58	-0.34	0	2	0	0.92	285.811	110.669
1487	0.38	0.06	0	1	0	0.32	419.303	152.65
1488	0.03	-0.06	2	1	1	0.09	308.503	304.197
1489	0.24	0.17	1	0	0	0.07	274.244	114.555
1490	0.67	-0.17	0	2	1	0.84	231.713	140.732

Glossary Post Time	Without Article Time	Without Pre Time	Without Post Time	Terms Clicked	Terms Edited	Terms Deleted	Terms Created
160.11	303.51	153.73	238.71	2	0	0	0
185.27	288.08	208.55	169.45	0	0	0	0
226.73	341.58	149.12	128.8	1	0	0	0
101.47	273.03	75.31	101.89	4	0	0	0
107.49	151.54	121.39	111.28	0	0	0	0
131.94	263.15	81.23	77.61	0	0	0	0
267.16	336.2	94.58	107.27	5	0	0	0
271.39	253.15	101.17	227.45	2	0	0	0
85.36	501.43	58.88	86.45	0	0	0	0
89.42	348.28	64.15	145.05	3	0	0	0
185.907	221.038	194.059	77.602	6	0	0	0
300.603	264.22	239.234	275.335	0	0	0	0
197.334	192.907	197.334	119.208	9	0	0	0
258.292	350.093	215.51	212.165	2	0	0	0
255.378	213.637	137.688	193.869	4	0	0	0
150.467	147.512	100.234	114.705	2	0	0	0
219.866	247.606	135.695	162.824	3	0	0	0
201.44	474.091	82.319	70.081	1	0	0	0
134.137	131.9	90.33	80.315	1	0	0	0
259.453	188.351	196.783	141.464	0	0	0	0
180.53	152.56	209.952	94.245	2	0	0	0
152.809	241.377	56.712	181.802	1	0	0	0
275.717	140.442	169.554	250.05	0	0	0	0
91.111	380.106	219.636	165.468	0	0	0	0
214.969	187.96	209.602	171.987	1	0	0	0
131.7	169.523	184.145	91.141	1	0	0	0
178.727	394.437	163.174	167.881	0	0	0	0
224.042	216.922	57.212	163.816	0	0	0	0
430.639	233.416	77.171	160.47	0	0	0	0
149.004	220.677	75.458	77.151	0	0	0	0
219.655	160.481	189.533	153.33	0	0	0	0
102.107	362.891	184.546	84.131	0	0	0	0
79.424	357.625	75.89	76.47	0	0	0	0
195.671	205.095	155.894	138.089	3	0	0	0
219.035	256.108	140.302	164.607	0	0	0	0
170.084	187.009	176.955	206.747	2	0	0	0
235.418	308.403	196.422	133.973	1	0	0	0
97.06	221.98	173.51	116.057	0	0	0	0
112.742	339.278	138.389	64.343	0	0	0	0
257.86	466.541	126.542	84.131	0	0	0	0

Total Glossary Time	Total Without Time
880.19	695.95
557.67	666.08
608.2	619.5
439.26	450.23
544.59	384.21
772.7	421.99
505.49	538.05
684.38	581.77
501.43	646.76
413.6	557.48
675.281	492.699
779.011	778.789
488.953	509.449
717.793	777.768
699.337	545.194
468.615	362.451
606.311	546.125
705.945	626.491
306.215	302.545
518.846	526.598
557.653	456.757
441.834	479.891
777.609	560.046
423.26	765.21
592.342	569.549
436.269	444.809
700.027	725.492
734.936	437.95
766.212	471.057
510.815	373.286
644.325	503.344
747.855	631.568
512.607	509.985
595.506	499.078
589.768	561.017
566.564	570.711
807.371	638.798
709.76	511.547
501.541	542.01
630.305	677.214

Appendix C: Articles Used

ASTHMA

WHAT IS ASTHMA?

Asthma is a disease of the bronchial tubes, or airways of the lungs, characterized by tightening of these airways.

When a person breathes, air is taken into the body through the nose, then passes through the windpipe and into the bronchial tubes. At the end of the tubes are tiny air sacs called alveoli that deliver oxygen to the blood. These air sacs also collect unusable carbon dioxide, which is exhaled out of the body.

In people with asthma, allergy-causing substances and environmental triggers make the bands of muscle surrounding the airways tighten, and air cannot move freely. Less air causes a person to feel short of breath, and the air moving through the tightened airways causes a whistling sound known as wheezing.

WHO IS AFFECTED BY ASTHMA?

Asthma is a lung disease that affects 12-15 million Americans. Asthma may occur at any age, although it's more common in younger individuals (under age 40).

Anyone can develop asthma at any time.

HOW CAN I TELL IF MY CHILD HAS ASTHMA?

Not all children have the same asthma symptoms, and these symptoms can vary from episode to episode in the same child. Signs and symptoms to look for include:

Frequent coughing spells, which may occur during play, at night-time, or while laughing. It is important to know that cough may be the only symptom present.
Less energy during play
Complaint of chest tightness or chest "hurting"
See-saw motions in the chest from labored breathing. These motions are called retractions.
Shortness of breath, loss of breath
Tightened neck and chest muscles

HOW COMMON IS ASTHMA IN CHILDREN?

Asthma affects as many as 10-12% of children in the United State and, for unknown reasons, is steadily increasing. It can begin at any age, but most children have their first symptoms by age 5.

There are many risk factors for developing childhood asthma. These include:

Presence of allergies
Family history of asthma and/or allergies
Frequent respiratory infections
Low birth weight

Exposure to tobacco smoke before and/or after birth

Being male

HOW IS ASTHMA DIAGNOSED IN CHILDREN?

Medical History & Symptom Description: Your child's doctor will be interested in any history of breathing problems you or your child may have had, as well as a family history of asthma, allergies, a skin condition called eczema, or other lung disease.

Physical Exam: During the physical examination, the doctor will listen to your child's heart and lungs.

Tests: Many children will also have a chest X-ray and pulmonary function tests. Also called lung function tests, these measure the amount of air in the lungs and how fast it can be exhaled. The results help the doctor determine how severe the asthma is.

Other tests include allergy skin testing, blood tests, and X-rays to determine if sinus infections or gastroesophageal reflux disease are complicating asthma.

MY CHILD IS ONLY A TODDLER. HOW DO I GIVE MY CHILD ASTHMA MEDICATIONS?

You will probably give your child asthma medications using a home nebulizer, also known as a breathing machine. A nebulizer delivers asthma medications, usually bronchodilators, by changing them from a liquid to a mist. As a mist, your child will breathe the medications through a facemask.

Like some toddlers, your child may be able to use a metered dose inhaler (MDI) with a spacer. A spacer is a chamber that attaches to the MDI and holds the burst of medication. This allows your child to breathe the medication into his lungs at his own pace.

WILL MY CHILD OUTGROW ASTHMA?

Once a person's airways become sensitive, they remain that way for life. However, about 50% of children experience a noticeable decrease in asthma symptoms by the time they become adolescents, therefore appearing to have "outgrown" their asthma. About half of these children will develop symptoms again in their 30s and/or 40s. Unfortunately, there is no way to predict whose symptoms will decrease during adolescence and whose will return later in life.

WHAT SYMPTOMS INDICATE THAT MY ASTHMA IS GETTING WORSE?

If early warning signs and symptoms are not recognized and treated, your asthma episode can progress and symptoms may worsen. Symptoms of worsening asthma include:

A cough that won't go away

Wheezing

Tightness in the chest

Shortness of breath

WHAT IS AN ASTHMA ATTACK AND HOW DO I KNOW IF I'M HAVING ONE?

An asthma attack is the episode in which bands of muscle surrounding the airways are triggered to tighten. This tightening is called bronchospasm. During the attack, the lining of the airways becomes swollen or inflamed and the cells lining the airways produce more and thicker mucus than normal.

Other symptoms of an asthma attack include:

Severe wheezing

Coughing that won't stop

Very rapid breathing

Chest pain or pressure

Tightened neck and chest muscles, called retractions

Difficulty talking

Feelings of anxiety or panic

The severity of an asthma attack can escalate rapidly, so it's important to treat these symptoms immediately once you recognize them.

Without immediate treatment, your breathing will become more labored, and wheezing will be louder.

As your lungs continue to tighten, you will be unable to use the peak flow meter at all. Gradually, your lungs will tighten so there is not enough air movement to produce wheezing. This is sometimes called the silent chest, and it is an ominous sign.

If you do not receive adequate treatment, you will eventually be unable to speak and will develop a bluish coloring around your lips. This color change, known as cyanosis, means you have less and less oxygen in your blood. Without aggressive treatment in an intensive care unit, you will lose consciousness.

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BRONCHITIS

WHAT IS CHRONIC BRONCHITIS?

Bronchitis is an inflammation of the lining of the bronchial tubes. These tubes, the bronchi connect the windpipe with the lungs. When the bronchi are inflamed and/or infected, less air is able to flow to and from the lungs and a heavy mucus or phlegm is coughed up. This is bronchitis.

Many people suffer a brief attack of acute bronchitis with cough and mucus production when they have severe colds. Acute bronchitis is usually not associated with fever.

Chronic bronchitis is defined by the presence of a mucus-producing cough most days of the month, three months of a year for two successive years without other underlying disease to explain the cough. It may precede or accompany pulmonary emphysema.

WHAT CAUSES CHRONIC BRONCHITIS?

Cigarette smoking is by far the most common cause of chronic bronchitis. The bronchial tubes of people with chronic bronchitis may also have been irritated initially by bacterial or viral infections. Air pollution and industrial dusts and fumes are also causes.

Once the bronchial tubes have been irritated over a long period of time, excessive mucus is produced constantly, the lining of the bronchial tubes

becomes thickened, an irritating cough develops, air flow may be hampered, and the lungs are endangered. The bronchial tubes then make an ideal breeding place for infections.

WHO GETS CHRONIC BRONCHITIS?

Over 8.8 million Americans are diagnosed with chronic bronchitis annually. The prevalence rate of chronic bronchitis has been consistently higher in females than in males. Chronic bronchitis affects people of all ages, but is higher in those over 45 years old.

No matter what their occupation or lifestyle, people who smoke cigarettes are those most likely to develop chronic bronchitis. But workers with certain jobs, especially those involving high concentrations of dust and irritating fumes, are also at high risk of developing this disease.

Higher rates of chronic bronchitis are found among coal miners, grain handlers, metal molders, and other workers exposed to dust. Chronic bronchitis symptoms worsen when atmospheric concentrations of sulfur dioxide and other air pollutants increase. These symptoms are intensified when individuals also smoke.

HOW SERIOUS IS CHRONIC BRONCHITIS?

In 1999, aver 8.8 million Americans were diagnosed with chronic bronchitis. During that same year over 1,100 Americans died as a result of chronic

bronchitis. Together with emphysema and other chronic lower respiratory disease, excluding asthma, COPD is the fourth leading cause of death in the US.

Chronic bronchitis is often neglected by individuals until it is in an advanced state, because people mistakenly believe that the disease is not life-threatening. By the time a patient goes to his or her doctor the lungs have frequently been seriously injured. Then the patient may be in danger of developing serious respiratory problems or heart failure.

HOW CHRONIC BRONCHITIS ATTACKS

Chronic bronchitis doesn't strike suddenly. After a winter cold seems cured, an individual may continue to cough and produce large amounts of mucus for several weeks. Since people who get chronic bronchitis are often smokers, the cough is usually dismissed as only "smoker's cough."

As time goes on, colds become more damaging. Coughing and bringing up phlegm last longer after each cold.

Without realizing it, one begins to take this coughing and mucus production as a matter of course. Soon they are present all the time, before colds, during colds, after colds, all year round. Generally, the cough is worse in the morning and in damp, cold weather. An ounce or more of yellow mucus may be coughed up each day.

TREATMENT FOR CHRONIC BRONCHITIS

The treatment of chronic bronchitis is primarily aimed at reducing irritation in the bronchial tubes. The discovery of antibiotic drugs has been helpful in treating acute bacterial infection associated with chronic bronchitis. However, people with chronic bronchitis do not need to take antibiotics continually.

Bronchodilator drugs may be prescribed to help relax and open up air passages in the lungs, if there is a tendency for these to close up. These drugs may be inhaled as aerosol sprays or taken as pills.

To effectively control chronic bronchitis, it is necessary to eliminate sources of irritation and infection in the nose, throat, mouth, sinuses, and bronchial tubes. This means an individual must avoid polluted air and dusty working conditions and give up smoking.

If the person with chronic bronchitis is exposed to dust and fumes at work, the doctor may suggest changing the work environment. All persons with chronic bronchitis must develop and follow a plan for a healthy lifestyle. Improving one's general health also increases the body's resistance to infections.

WHAT SHOULD YOU DO IF YOU HAVE CHRONIC BRONCHITIS?

A good health plan for any person with chronic bronchitis should include these rules:

See your doctor or follow your doctor's instructions at the beginning of any cold or respiratory infection.

Don't smoke!

Follow a nutritious, well-balanced diet, and maintain your ideal body weight.

Get regular exercise daily, without tiring yourself too much.

Ask your doctor about getting vaccinated against influenza and pneumococcal pneumonia.

Avoid exposure to colds and influenza at home or in public, and avoid respiratory irritants such as secondhand smoke, dust, and other air pollutants.

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INFLUENZA

WHAT IS INFLUENZA (FLU) AND HOW IS IT CAUSED?

Influenza is a contagious disease caused by a virus. Influenza viruses infect many parts of the body, including the lungs.

When someone who has influenza sneezes, coughs, or even talks, the influenza virus is expelled into the air and may be inhaled by anyone close by.

WHAT HAPPENS WHEN YOU GET INFLUENZA?

When influenza strikes the lungs, the lining of the respiratory tract is damaged. The damage is rarely permanent. The tissues usually heal within a few weeks.

Influenza is often called a respiratory disease, but it affects the whole body. The influenza sufferer may also have a sore throat and a dry cough, nausea, and burning eyes.

The fever mounts quickly; temperature may rise to 104 degrees Fahrenheit (40 degrees Celsius) but after two or three days, it usually subsides. The patient is often left exhausted for days afterwards.

IS INFLUENZA CONSIDERED SERIOUS?

For healthy children and adults, influenza is typically a moderately severe illness. For people who are not healthy or well to begin with, influenza can be very severe and even fatal.

Most of these complications are bacterial infections because the body can be so weakened by influenza that its defenses against bacteria are low. Bacterial pneumonia is the most common serious complication of influenza. In addition the sinuses and inner ears may become inflamed and painful.

WHO GETS INFLUENZA?

Anyone can get influenza. In 1996 alone, over 95 million cases of the flu were reported. People who are not healthy or well to begin with are particularly susceptible to the complications that can follow. These people are known as high risk and should be immunized.

For anyone at high risk, influenza is a very serious illness. You may be at high risk if you:

Have chronic lung disease such as asthma, emphysema, chronic bronchitis, bronchiectasis, tuberculosis, or cystic fibrosis.
Have heart disease.
Have chronic kidney disease.
Have diabetes or another chronic metabolic disorder.
Have diseases or are having treatments that depress immunity.
Are over 50 years of age.

A doctor, nurse, or other provider of care to high risk persons should be immunized to protect high risk patients.

HOW ARE INFLUENZA AND COMPLICATIONS PREVENTED?

Influenza can be prevented with a high degree of success when a person receives the current influenza vaccine or influenza shot. This vaccine is made each year so that the vaccine can contain influenza viruses that are expected to cause illness that year.

The viruses in the vaccine are inactivated so that someone vaccinated cannot get influenza from the vaccine. Instead the person vaccinated develops protection in his or her body in the form of substances called antibodies.

The amount of antibodies in the body is greatest 1 or 2 months after vaccination and then gradually declines. For that reason and because the influenza viruses usually change each year, people should be vaccinated each fall with the new vaccine.

A yearly vaccination has been found to be about 75 percent effective in preventing influenza. It may also reduce the severity of influenza and can be lifesaving.

At the first sign of influenza symptoms see your doctor. Many physicians now use antiviral medications when they are confident of the diagnosis.

WHAT ABOUT REACTIONS TO THE VACCINE?

Most people have little or no reaction to the vaccine. One in four might have a swollen, red, tender area where the vaccination was given.

A much smaller number, probably more children than adults, might also develop a slight fever within 24 hours. They may have chills or a headache, or feel a little sick. People who already have a respiratory disease may find their symptoms worsened. Usually none of these reactions lasts for more than a few days.

In addition, adverse reactions to the vaccine, perhaps allergic in nature, have been observed in some people.

WHO SHOULD BE VACCINATED?

People at high risk should be vaccinated yearly against influenza. In addition, those who provide care to high risk patients should be vaccinated. If you are not in a high risk group, you may want to be vaccinated to avoid the flu and its complications.

CAN YOU HAVE A RECURRENCE OF INFLUENZA?

A person can have influenza more than once. The virus that causes influenza may belong to one of three different influenza virus families, A, B or C. Influenza A and influenza B are the major families.

Within each influenza virus family are many viral strains, like so many brothers and sisters. Both A and B have strains that cause illnesses of varying severity. But the influenza A family has more virulent strains than the B family.

If you have influenza, your body responds by developing antibodies. Your antibodies are less effective or ineffective against unfamiliar strains.

HOW ARE INFLUENZA AND COMPLICATIONS TREATED?

For uncomplicated influenza, your doctor will probably tell you to stay in bed at home as long as the sickness is severe, and perhaps for about two days after the fever is gone. Common medications, such as acetaminophen, are used to treat fever and aches and pains.

Two antiviral drugs called amantadine and rimantadine have to be used for treating someone who develops influenza A, particularly if given as soon as possible after the onset of influenza. These drugs also can be used as a preventive measure, but for prevention it must be taken daily as long as influenza cases continue to occur in a community.

In addition, two news drugs, Zanamivir and Oseltamivir, one inhaled and one in pill form have been shown to reduce flu symptoms if taken at the onset of the flu. These newer drugs can be used to treat strains from both the Influenza A & B families. Oseltamivir has also been approved for preventative use in those 13 years and older.

Some antiviral drugs cause side effects such as difficulty sleeping, tremulousness, depression and gastro-intestinal upset; these are usually mild and often go away even when the medicine is continued. One drug may cause worsening of asthma.

WHY IN SOME YEARS DO MORE PEOPLE GET INFLUENZA THAN IN OTHERS?

Every 10 years or so, an influenza virus strain appears that is dramatically different from the other members of its family. When this major change occurs a worldwide epidemic, called a pandemic, almost inevitably follows. Few people have antibodies that are effective against the new virus.

References

American Lung Association, Influenza (Flu), [Online] Available at: http://www.lungusa.org/diseases/luninfluenz.html, January 13, 2003

Appendix D: Questionnaires Used

ASTHMA – Preliminary Questionnaire

Question	# Correct / Total
What is asthma?	3/25
What organ(s) does asthma primarily affect?	19/25
Is asthma more common in younger individuals (<=45) or older individuals (>45) or does it effect both age groups similarly?	18/25
How is asthma usually treated?	5/25
What kinds of things trigger asthma attacks?	11/25
Can asthma be cured?	6/25
What may be some of the warning signs that something is wrong with a person's asthma?	5/25
What happens during an asthma attack?	4/25
What are some symptoms of asthma?	8/25

ASTHMA – Post-test Questionnaire

Question	# Correct / Total
What are alveoli?	18/25
When do most children with asthma first start exhibiting symptoms of the disease?	19/25
What is one of the many risk factors for developing childhood asthma?	21/25
How can asthma be diagnosed?	22/25
What is a nebulizer?	16/25
How is a spacer helpful for administering asthma medication?	18/25
Can asthma be outgrown?	16/25
What is one of the symptoms that may indicate that a person's asthma is worsening?	16/25
What is the tightening of the airways during an asthma attack called?	11/25
When does cyanosis occur?	16/25

BRONCHITIS – Preliminary Questionnaire

Question	# Correct / Total
What is bronchitis?	8/30
What is chronic bronchitis?	6/30
What is the most common cause of bronchitis?	10/30
What organ(s) does bronchitis primarily affect?	27/30
Is chronic bronchitis more common in younger individuals (<45) or older individuals (>45) or does it effect both age groups similarly?	16/30
Is either bronchitis or chronic bronchitis considered a serious illness?	16/30
What are some symptoms of bronchitis?	26/30
How is chronic bronchitis treated?	7/30
Is either bronchitis or chronic bronchitis contagious?	20/30

BRONCHITIS – Post-test Questionnaire

Question	# Correct / Total
Is chronic bronchitis more common in males or in females or in neither?	21/30
Can death occur from chronic bronchitis?	25/30
Is chronic bronchitis a sudden or gradual disease?	20/30
What do treatments for bronchitis focus on doing?	12/30
What kinds of drugs help relax and open up air passages in the lungs?	12/30
What is one step that can be taken to treat chronic bronchitis?	20/30
Why is chronic bronchitis often left untreated for large periods of time?	27/30
What is an example of a profession that suffers from a high rate of chronic bronchitis?	24/30
What is the coughed-up mucus from bronchitis called?	17/30
What is the main difference between bronchitis and chronic bronchitis?	18/30

INFLUENZA – Preliminary Questionnaire

Question	# Correct / Total
What is influenza commonly called?	19/25
Is influenza usually considered a serious illness?	20/25
What can be done to prevent the contraction of influenza?	13/25
How is influenza usually treated?	9/25
What organ(s) does influenza primarily affect?	10/25
What are some of the factors that increase the seriousness of influenza in some individuals?	5/25
In most cases, around how long does influenza usually last?	15/25
What are some symptoms of influenza?	23/25
Who is susceptible to influenza?	21/25

INFLUENZA – Post-test Questionnaire

Question	# Correct / Total
Is influenza a viral or bacterial disease or neither?	21/25
What happens to the lining of the respiratory tract when influenza has been contracted?	13/25
When does influenza become a serious threat?	18/25
What is the most common serious complication of influenza?	10/25
What is an example of a condition that causes an individual to be particularly susceptible to the complications that can follow influenza?	21/25
What are individuals who suffer from the afore-mentioned techniques usually called?	14/25
What precautions should such individuals take?	21/25
Are the precautionary measures that are usually employed effective in preventing the contraction of influenza?	22/25
Are there drawbacks to such measures?	19/25
What are the different families of influenza virus?	12/25

Appendix E: Frequency of Terms Clicked On

Term	Frequency
COPD	2
Bronchodilator	1
Wheezing	2
Alveoli	2
Lung function tests	2
Gastroesophageal reflux disease	4
Cyanosis	2
Pneumococcal pneumonia	3
Bronchial tubes	2
Pulmonary emphysema	1
Phlegm	1
Metered dose inhaler	1
Peak flow meter	2
Bronchiectasis	3
Zanamivir	1
Metabolic disorder	2
Major families	1
Uncomplicated influenza	2
Emphysema	1
Tremulousness	1
Pandemic	1
Bacterial pneumonia	1
Gastro-intestinal	1
Allergic in nature	1
Ineffective	2
Oseltamivir	1
Rimantidine	1
High risk	1
Retractions	2
Eczema	1
Resistance to infections	1
Exposed	1
Bronchospasm	1
Silent chest	1
Mucus	1
Intensified	1
Heart failure	1

Appendix F: Responses to Subjective Questionnaire

Likert Scale: Strongly Agree = 1, Agree = 2, Neutral = 3, Disagree = 4, Strongly Disagree = 5

1. I think I would like to use this system frequently.

Count	Response
5	4
10	1
12	3
13	2

Median: 2

1 2 3 4 5

Score = [(5*4 + 10*1 + 12*3 + 13*2) – 40*1]/40 = 1.3

2. I found the system unnecessarily complex.

Count	Response
6	3
9	5
25	4

Median: 4

1 2 3 4 5

Score = [40*5 – (6*3 + 9*5 + 25*4)]/40 = 0.925 ≈ 0.9

3. I thought the system was easy to use.

Count	Response
7	3
12	1
21	2

Median: 2

1 2 3 4 5

Score = [(7*3 + 12*1 + 21*2) – 40*1]/40 = <u>0.875 ≈ 0.9</u>

4. I think that I would need the support of a technical person to be able to use this system.

Count	Response
6	3
13	5
21	4

Median: 4

1 2 3 4 5

Score = [40*5 – (6*3 + 13*5 + 21*4)]/40 = <u>0.825 ≈ 0.8</u>

5. I found the various functions in this system were well integrated.

Count	Response
8	1
14	3
18	2

Median: 2

1 2 3 4 5

Score = [(8*1 + 14*3 + 18*2) – 40*1]/40 = 1.15 ≈ 1.2

6. I thought there was too much inconsistency in this system.

Count	Response
8	3
11	5
21	4

Median: 4

1 2 3 4 5

Score = [40*5 – (8*3 + 11*5 + 21*4)]/40 = 0.925 ≈ 0.9

7. I would imagine that most people would learn to use this system very quickly.

Count	Response
7	3
13	1
20	2

Median: 2

1 2 3 4 5

Score = [(7*3 + 13*1 + 20*2) – 40*1]/40 = <u>0.85 ≈ 0.9</u>

8. I found the system very cumbersome to use.

Count	Response
6	3
12	5
22	4

Median: 4

1 2 3 4 5

Score = [40*5 – (6*3 + 12*5 + 22*4)]/40 = <u>0.85 ≈ 0.9</u>

9. I felt very confident using the system.

Count	Response
7	1
12	3
21	2
Median: 2	

1 2 3 4 5

Score = [(7*1 + 12*3 + 21*2)] – 40*1]/40 = <u>1.125 ≈ 1.1</u>

10. I need to learn a lot of things before I could get going with this system.

Count	Response
1	1
8	3
10	5
21	4
Median: 4	

1 2 3 4 5

Score = [40*5 – (1*1 + 8*3 + 10*5 + 21*4)]/40 = <u>1.025 ≈ 1.0</u>

Total Score = (1.3 + 0.9 + 0.9 + 0.8 + 1.2 + 0.9 + 0.9 + 0.9 + 1.1
+ 1.0) * 2.5
= <u>24.75 ≈ 24.8</u>

Appendix G: Orientation Script

Orientation Script

Hi, my name is Mona Noor and I'll be working with you in today's session. I'd like to take this opportunity to thank you for volunteering your time to help me test my glossary tool. I will be reading from this scrip t to ensure consistency among participants.

Let me explain why I have asked you to come in today. I am interested in identifying the usability issues of a glossary tool that I have developed. It is used for reading articles online and helps to provide definitions or explanations for words you encounter that you may not be familiar with. You will be reading a couple of articles today one without any kind of glossary tool, and one with a glossary tool. I'd like you to read them as you normally would. For example, try to work at the same speed with the same attention to detail as you normally would. There will be questions about the topics of the articles that I'd like you to answer before and after you read each of them.

I'll just briefly describe the layout of one of the glossary tools to you. <show screen shot>. Entries are listed on the side here <indicate> you can also click on them as you encounter them <indicate>. And this is where they are displayed. <indicate>

Understand that this exercise is to test the glossary tool and its usability and in no way implies your abilities. If at any time you feel uncomfortable, please inform me and I will terminate the exercise. I'll be recording the session so that I can gather as much information as possible from it.

Your ideas and opinions are important to me. Whenever possible, please speak your thoughts freely. Do not be concerned about offending me. If you forget to think out loud, I'll remind you to keep talking.

While you are working, I'll be sitting nearby taking notes and timings. You may ask questions at any time, but I may not answer all of them, since this is a study of the product and I need to see how it works with a user such as yourself working independently.

My only role here today is to discover both the flaws and advantages of this product from your perspective. Even though I may not be able to answer your questions during the session, please ask them. I'll note them down and answer them at the end of the exercise.

Do you have any questions?

<Answer any questions the participant has>

[If that's all]/[If not], then let's begin with the procedure.

Appendix H: Consent Form

Glossary Tools for Technical Reading

Principal Investigator: Mona Noor (Masters Candidate) <noor@cs.dal.ca>
Supervisor: Dr. James Blustein <jamie@cs.dal.ca>
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6050 University Ave., Halifax, Nova Scotia B3H 1W5, Canada

Contact Person: Mona Noor <noor@cs.dal.ca>

Introduction

We invite you to take part in a research study at Dalhousie University which is being conducted as part of the Masters project of the principal researcher, Mona Noor. Taking part in this study is voluntary and you may withdraw from the study at any time. The study is described below. This description tells you about what you will be asked to do, and any risks, inconvenience, or discomfort which you might experience. Participating in the study might not benefit you, but we might learn things that will benefit others. You should discuss any questions you have about this study with Mona Noor or James Blustein.

Purpose of the Study

Glossary tools can be used to assist readers unfamiliar with certain terms when they are reading technical articles with a computer in areas where the readers are not specialists. We want to determine how useful such a tool would be to users and which aspects of the tool would be the most beneficial. This is what our study will attempt to discover.

Study Design

We are collecting data to use in the research part of the principal researcher's Masters project. We are conducting a user study of two glossary tools by asking users to use the tools. The subjects will read pre-selected technical articles based on certain health conditions and be asked to answer certain questions about the articles. The glossary tools will be integrated into the software used for viewing the articles.

The technical articles used in this study will describe three different health conditions. There will be an article for each of these conditions. These conditions are asthma, influenza and bronchitis. The questions that will be asked at the end of the study will be of the type "What are some of the symptoms of condition X?" and "Is condition X usually considered a serious illness?"

Who can Participate in the Study

You may participate in this study if you are computer-literate and have some interest in reading about the health conditions discussed in the articles selected for the study. The health conditions that will be described in this study are asthma, influenza and bronchitis.

Who will be Conducting the Research

Mona Noor is responsible for the background study and user updatable glossary design. James Blustein provides guidance to Mona Noor's study. He also makes sure that the research is on the right track by reviewing Mona Noor's work. You can contact either one of them for questions about this study.

What you will be asked to do

You will be asked to complete a preliminary questionnaire containing questions about the health conditions discussed in the articles in the study. The questions will be used to determine your prior knowledge of the conditions discussed in the articles.

You will be asked to answer questions about the given articles. This will all be done on a computer. Please read the given articles thoroughly, making use of the glossary tools as you feel necessary. Please also note how useful you find the tools to be when you answer the questions about the articles. After you are comfortable with the material in the article that you have been given, please answer the associated questions. You may return to the article at any point while you are attempting to answer the questions.

Your answers will be treated anonymously. Your data will be identified only by an ID number that will be assigned to you. This number will be never be associated with your name.

Possible Risks and Discomforts

There is no greater risk in answering the questions than in everyday life. There may be the risk of inaccurate medical information as we have not checked their accuracy. Please keep this in mind while reading the articles. Your answers will always be treated anonymously.

Possible Benefits

Participating in the study might not benefit you, but we might learn things that will benefit others.

Compensation/Reimbursement

Any contribution to the research is appreciated. However there is no compensation for participation.

Confidentiality

Your name and address will not be required when you answer the questions about the articles. Your data will be treated anonymously. Data will only be identified by the ID number associated with you. This number will not be associated with your name.

All participants will be kept anonymous in any reports or publications. Participants will be identified only by ID numbers assigned to them. These numbers will not be linked to their names in any way. Dalhousie University policy requires that data be stored securely by Dr. James Blustein for 5 years after publication. The data will be stored securely in paper format as well as on CD in the office of Dr. James Blustein in the Computer Science building at Dalhousie University.

Problems or concerns

In the event that you have any difficulties with, or wish to voice concern about, any aspect of your participation in this study, you may contact the Human Research Ethics / Integrity Coordinator at Dalhousie University's Office of Human Research Ethics and Integrity for assistance: her telephone number is (902)494-1462; her e-mail address is <patricia.lindley@dal.ca>.

Signature

By signing below, you agree to the following statement:
"I have read the explanation about this study. I have been given the opportunity to discuss it and my questions have been answered to my satisfaction. I hereby consent to take part in this study. I acknowledge that my participation is voluntary and that I am free to withdraw from the study at any time."

_____	_____
Participant's Name	Participant's Signature
_____	_____
Researcher's Name	Researcher's Signature

Appendix I: Recruitment Poster

Volunteers Needed for Masters Research

The study involves assessing how useful glossary software is while reading technical articles on a computer. The articles used in the study will be about asthma, influenza and bronchitis.

If you are interested, please e-mail: noor@cs.dal.ca for further information.
Thank You.