EFFECTS OF A WEB-BASED INTERNET SEARCH SCAFFOLDING TOOL ON METACOGNITIVE SKILLS IMPROVEMENT OF STUDENTS WITH DIFFERENT GOAL ORIENTATIONS

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ABSTRACT

EFFECTS OF A WEB-BASED INTERNET SEARCH SCAFFOLDING TOOL ON METACOGNITIVE SKILLS IMPROVEMENT OF STUDENTS WITH DIFFERENT GOAL ORIENTATIONS

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In this study, the aim was to investigate the effects of the web-based internet search scaffolding tool (WISST) on the improvement of metacognitive skills of 7th grade students associated with their goal orientation. This study utilized a static-group pretest-posttest design. The first experiment group received web-based metacognitive scaffolding tool treatment; the second experiment group received teacher-based metacognitive scaffolding; and the control group had no scaffolding. The designed tool aimed to scaffold users throughout web searching by emphasizing certain metacognitive skills improvement. Three main instruments were used to gather data: metacognition inventory for Internet search (MIIS), patterns of adaptive learning scale (PALS), and achievement test. 76 7th grade elementary school students in Ankara, Turkey participated in this study. The data gathered from the participants were analyzed through quantitative and qualitative data analysis methods. The results of the study indicated that WISST tool helped students improve certain metacognitive skills including monitoring, planning, controlling, and strategy generation. Its unique effectiveness was on the improvement of controlling skills. Teacher scaffolding group was also successful in

improvement of strategy generation skills. No effects of goal orientations on the improvement of metacognitive skills were found in the analyses. Within hierarchical regression models, only pre-MIIS scores significantly contributed to the model. Students having less improved metacognitive skills were found associated with less trials and less visits. Students having poor performance work grades were tended to copy-paste more, try less, and visit less. Task difficulty and task type was observed to influence the search patterns of students. Search patterns and reflections also indicated that scaffolded groups made positive difference in search patterns.

Keywords: Metacognition, Metacognitive Scaffolding, Goal Orientations.

ÖZ

İNTERNET ARAMALARINI DESTEKLEYEN WEB-TABANLI ARACIN FARKLI HEDEF YÖNELİMLİ ÖĞRENCİLERİN ÜSTBİLİŞSEL BECERİLERİNİN GELİŞMESİ ÜZERİNDEKİ ETKİSİ

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Bu çalışmanın amacı, İnternet aramalarını destekleyen web tabanlı aracın farklı hedef yönelimli öğrencilerin üstbilişsel becerilerine etkisini araştırmaktır. Statik grup öntest-sontest araştırma deseni kullanılmıştır. İlk deney grubu web tabanlı destek alırken, ikinci grup sadece öğretmenden destek almıştır. Son grup ise İnternet aramalarını herhangi bir yardım almadan sadece kendileri tamamlamıştır. Bu çalışmada 3 temel araçla veri toplanmıştır: Internet aramalarında kullanılan üstbilişsel beceriler anketi (MIIS), hedef yonelimi anketi (PALS) ve başarı testi. Bu çalışmaya Ankara'dan 76 tane 7. sınıf ilköğretim öğrencisi katılmıştır. Katılımcılardan toplanan veriler nicel ve nitel yöntemler kullanılarak çözümlenmiştir. Bulgular, web-tabanlı üstbilişsel desteklemenin üstbilişsel becerileri geliştirdiğini ortaya koymuştur. Web-tabanlı desteklenen grubun izleme, planlama, kontrol ve strateji geliştirme becerilerinde kontrol gruba göre anlamlı bir gelişme olmuştur. Öğretmen-tabanlı üstbilişsel destekleme yapılan grup web-tabanlı desteklenen grupla aynı derecede strateji kullanma becerilerini geliştirmiştir. Hedef yöneliminin, öğrencilerin üstbilişsel becerilerinin gelişimi üzerinde bir etkisi bulunamamıştır. Tanımlanan hiyerarşik regresyon modeline göre üstbilişsel becerilerin

(son-MIIS puanlarının) tahmininde ön-test puanları anlamlı katkıda bulunmuş ancak bunun haricindeki diğer değişkenlerin bir etkisi görülmemiştir. Az gelişmiş üstbilişsel beceriye sahip öğrencilerin daha az deneme yapmaya ve daha az sayıda site ziyaret etmeye yönelimli olduğu kanonik ilgileşim sonucunda tespit edilmiştir. Bunun yanında performans ödevlerinde düşük notlar alan öğrencilerin daha çok kopyala-yapıştır yapmaya, daha az deneme yapmaya ve daha az sayıda site ziyareti yapmaya yönelimli olduğu gözlemlenmiştir. İçerik analizleri ise ilginç sonuçlar ortaya çıkarmıştır. Verilen arama görevinin zorluğu ve tipinin öğrencinin arama deseninde belirleyici olduğu gözlemlenmiştir. İnternette arama yapma şekilleri ve öğrencilerin yansıtıcı günlüklerinden anlaşıldığı kadarıyla desteklenen gruplarda olumlu pek çok gelişme gözlemlenmiştir.

Anahtar Kelimeler: Üstbiliş, Üstbilişsel Destekleme, Hedef Yönelimi.

To my son, Alkım

To my husband, Polat

To my parents, Hasibe & Akif…

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CHAPTER 1

INTRODUCTION

The transformation from the Industrial to Information Age had affected many social institutions. Education as a social institution is almost at the center of all changes for other institutions due to interdependence between institutions. In this era, the rapid improvements in the information and communication technologies lead to changes in the roles of teachers and learners, which mean a paradigm shift in education (Reigeluth, 1999). One of the main actors during this shift is computer and its related technologies. As such kinds of technologies, new formations emerged in terms of instruction phenomenon.

Computers in education have been used in many forms such as Computer Aided Instruction (CAI), Computer-Supported Collaborative Learning Environments (CSCL), Virtual Learning Environments (VLE), and so forth. Many researchers from different fields started to integrate computer technologies into their specific fields of research as computers become available and affordable in PC forms. The idea of the use of computers as cognitive tools has emerged from the combination of the fields of psychology, education, and computers. Jonassen (2000) is one of the pioneers of this concept and its practice. Recently, a new idea has emerged about the way how computers can be used for educational purposes; computers as metacognitive tools. Azevedo, Zimmerman, Tsikalas, White, and Frederiksen are the some leading names for the practice and theory in this current idea.

As Bransford (1999) stated, one of the main principles for the creation of qualified learning opportunities for learners is that "teaching of metacognitive skills should be integrated into the curriculum in a variety of subject areas" (as cited by Goodison, 2003, p. 550). Computers have great potentials for different learning opportunities, thus they can be integrated into different course curriculum in order to increase the level of metacognition. Graesser, McNamara, and VanLehn's (2005) definition of ideal student refers to the demanded cognitive and metacognitive skills, but they claim that there is not too many ideal students in schools due to lack of rich learning environments providing certain scaffolding for cognitive and metacognitive strategies. In this sense, computers can be used as supplementary tools (Hargis, 2001) for metacognitive instruction embedded into such casual course curriculum as science and technology. This in turn can serve for the problem of scientific thinking skills like hypothesis testing and problem solving.

Traditional learning environments are open to many distracters; nonetheless, when compared with the web, they can be considered as quite innocent since the elimination of distracters is very hard or even impossible to overcome sometimes on the web. This is valid especially within the Internet search context which is one of the most frequent ways to search for homework or project assignments (Kuiper, Volman, & Terwel, 2005; VanAalst, Hing, May, & Yan, 2007). Despite being a simple process, Internet search results generally fail to answer specific questions. The level of expectations from results can vary according to certain factors and the lack of motivation is one of the most common ones (Thompson, Meriac, & Cope, 2002).

Today, computers offer quiet advanced opportunities to access information, but the processing of information belongs to individuals. In order to use the Internet as an effective resource requires multiple skills (Howland, Jonassen, & Marra, 2012). Although many young learners know well how to use technology, access information and much more, the majority of them cannot reflect on the processes or steps or content of the materials (Chadwick, 2002). The main aim of the study is derived due to the low quality of these knowledge and skills of learners. One can find easily teachers who

constantly complain about how homeworks are lack of elaborations, interpretations, and many other higher order thinking skills. Instead, teachers generally receive copied and pasted low quality homework that are most of the time untouched by the student. At that point, the quality of tasks (whether they are open-ended or not) can be critical as well as the outcomes of students. On the other hand, the process of Internet search as well as the output of the search can be important to understand where students or the teachers made mistakes or what confuses students or why they refer to copy-paste.

The concept of scaffolding has been used in many situations in education. Besides the instructional settings, it has been also integrated to self-study or self-regualted environments. Internet can be presumed as one of the self-regulated environments, thus the Internet search can be considered as a self-regulated learning process. The copied-pasted homeworks not satisfying the teachers can be a sign of deficiencies in self-regulated learning process, therefore an intervention or support should be provided to students either inside or outside of the school. Unfortunately, there are no compulsory computer courses in Turkey, but students are offered some related courses as electives or there are computer clubs within the school. On the other hand, students were assumed to be computer literate to some extent which is obviously not enough to be successful or competent searchers on the web. The teachers might not have time to scaffold students within the intense curriculum requirements, therefore other ways of scaffolding can be beneficial in that sense. One of the motivations of this study is to investigate if software scaffolding can be as effective as teacher scaffolding.

The increasing trends of computer and Internet use in school settings and the accessibility of mobile technologies everywhere introduced many new areas of research in education. It might be challenging for young learners to develop multiple skills to use these technologies effectively. The Internet serves as one of the primary resources for students' homeworks and projects, therefore, some help might be necessary for them to shape and develop their skills. In this study, considering this need of students, students were scaffolded metacognitively. In this way, their metacognitive skills as well as Internet search skills were aimed to be developed. This study included an attempt to

integrate metacognitive scaffolding techniques to a web-based system comparing with teacher-based metacognitive scaffolding and non-scaffolding conditions.

1.1. Purpose of the Study

The main aim of this study was to explore the effects of a web-based internet search scaffolding tool on the seventh graders' metacognitive skill improvement when compared with teacher scaffolding and no scaffolding context. The associations between students' metacognitive skill improvements and other dimensions including goal orientation types, achievement, and search patterns were also investigated in this study. Furthermore, students' improvements in search patterns, performance works, and reflections were explored throughout the study. A specific web-based metacognitive scaffolding application was designed and used according to the principles stated by Quintana, Zhang, and Krajcik (2005). This specific tool served the needs of scaffolding as well as the support for metacognitive skill improvement throughout the Internet search process. The tool aimed to help searchers without any assistance of the teacher. There were two other groups that were teacher scaffolding (TS) and no scaffolding (NS) groups. The aim of the inclusion of these groups was to understand the bare effects of web-based metacognitive scaffolding. In TS group, the teacher followed the similar strategies with the WISST, but the scaffolding agent was the teacher. In both TS and NS groups, students did not use WISST. They searched with the help of Google search engine.

1.2. Research Questions

Throughout the research, the answers of following questions were investigated:

1.What are the participants' in WISS, TS, and NS groups profiles?

1.1.What are the participants' goal orientation types?

1.2. What are the participants' metacognitive skills both at the beginning and at the end of the study?

2. What are the participants' in WISS, TS, and NS groups search patterns throughout the study in terms of:

2.1. The number of used keywords

2.2. The number of trials

2.3. Rank of the first visited link within the search result list

2.4. Total time spent for search

2.5. Frequency of copy-paste action

2.6. Frequency of added idea or interpretations

2.7. The number of visited sites?

3. How do students' in WISS, TS and NS groups metacognitive skills, search patterns (trials across tasks, use of keywords, visited links and search durations), performance works, and reflections on the topic and search processes change throughout the study?

4. Are there significant mean differences between the students' in WISS, TS and NS groups post-MISS scores when their pre-MIIS scores are controlled?

4.1. Are there are significant mean differences between the students' in WISS, TS and NS groups post 'reflection and regulation, monitoring, planning, coping with distracters' and 'generating strategies' scores?

5. Are there significant mean differences between the students' with mastery, performance and performance avoidance goal orientations post-MISS scores when their pre-MIIS scores are controlled?

5.1. Are there significant mean differences between the students' with mastery, performance and performance avoidance goal orientations post 'reflection and regulation, monitoring, planning, coping with distracters' and 'generating strategies' scores?

6.After controlling for the belongingness to a treatment group and pre-MIIS scores, how well do search variables (trials, duration, the number of visited links, keywords, keyword changes, copy-pastes, and added ideas) predict MS development?

7. What are the relationships between;

7.1.students' sub-metacognitive skills and search patterns?

7.2.students' search patterns and achievements?

7.3.students' sub-metacognitive skills and achievements?

7.4.students' goal orientations (GO) and search patterns?

1.3. Significance of the Study

According to Turkish Main Plan of Education (Dulger, 2002), computer literacy is one of the main requirements for new age individuals. In order to meet the needs of this new age and to become closer to developed countries' standards, Science and Technology course curriculum was designed in the light of this aim by Ministry of National Education (MoNE). In general, the design of the program seems to be integrating computers into Science and Technology lesson, however, the patterns of technology are seen especially at homework and they in majority require searching on the Internet (MEB, 2006). Only bringing the found resources without any analysis or synthesis is the most striking characteristics of the activities. At that point, the importance of metacognitive skills and Internet search skills can be taken into consideration. Metacognition is one of the important components of self-regulated learning. The Internet search process can be an example of self-regulated learning environment, because the student initiates the search due to having a goal whether assigned to the teacher or oneself. The steps followed by the searcher can all serve as self-regulated strategies. Throughout that process student also needs online reading and comprehension skills besides metacognitive skills. These are different in an online environment than off-line. This study is significant in terms of its unique features

providing one-to-one scaffolds online. There are tools in the literature providing such scaffolds online, but this tool is in Turkish and designed according to the feedback received from the primary users. The motivation of the study was the needs of students not to become lost in the huge Internet resources.

On the other hand, much more effort is needed to achieve those objectives; otherwise the students will stick to application or lower levels of Bloom's taxonomy while the aim is to achieve the higher levels in order to make learners able to process information effectively and efficiently which is an unavoidable standard of Information Age. This problem is not only related to the habits of students, but also the method of instruction. That is why; the main purpose of the study is to offer a web-based scaffolding approach for effective use of search engines by improving metacognitive skills. In Pintrich's (1999) model of self-regulated learning, certain strategies are proposed to be necessary in order to improve self-regulation. In this model, many of the strategies require the use of metacognitive skills, thus, not only inclusion of computers to the curriculum but also the constructivist approach refers to the importance of self-regulation. Metacognitive skills have importance on successful Internet searches due to requiring the complex decision makings (Stimson, 1998).

Computers can serve as effective tools for modeling metacognitive strategy uses (Lin et al., 2005). In the literature, there are many developed tools supporting the idea of using computers as metacognitive tools, but almost all of them are in English and inappropriate for the use of Turkish Science and Technology course curriculum. Therefore, this study's significance is mostly related to practice. A web-based Internet search scaffolding tool (WISST) in Turkish was prepared. This study aimed to show the applicability of it within Turkish middle school computer laboratories at a limited time (40 minutes per week) in order to improve the metacognitive skills of learners who engage in inquiry.

One of the goals of this study was also to contribute to the awareness of the use of computers as metacognitive tools in Science and Technology course. Moreover, there are many studies in the literature examining the relationship between metacognitive skill

improvement and age and intelligence, but there are fewer studies investigating the relationship between metacognitive skill improvement and goal orientation in the context of intentional information serach. Therefore, this study aimed to contribute to the literature in that respect. Inventory created for the purpose of this study might also contribute to further studies integrating metacognitive skills and the Internet search.

Nowadays, the Fatih Project is being piloted in many schools. Tablet computers will be accessible all day in the near future in Turkey. It might mean that students will be exposed to the risks on the net at maximum. Their self-regulation and thus metacognitive skills will become more important than ever before. No matter how filtered the websites, the risks of confusions and misconceptions will remain the same. Other than the perception of an authoritative figure (censorship in Turkish case), students might need to distinguish what is a trusted site, where to look, how to search, and so forth. In this study, the inclusion of metacognitive scaffolds was expected to contribute both theory and practice of self-regulation within a web search environment.

1.4. Definition of Concepts and Terms

Metacognition: It means the knowledge about own cognition (Garrett et al., 2006).

Metacognitive skills: They refer to abilities to plan, monitor, and evaluate one's own actions (Lazonder and Rouet, 2007). In this study, these will be measured by means of MIIS. Referring to Quintana et al.'s (2005) framework and the extracted and confirmed factors, we mean reflection-regulation, monitoring, planning, controlling, and strategy generation skills by metacognitive skills.

Metacognitive tool: It is any tool providing support for cognitive processes, rich cognitive experiences, and opportunities for generating and testing hypothesis, and sharing cognitive load (Azevedo, 2005b).

Computers as metacognitive tools: They are metacognitive tools using the medium of computer. In addition to above listed characteristics, they allow learners to

make instructional decisions by considering the context; they model, prompt, and support learners' self regulatory processes and engagement; provide a specific learning context in which there are external regulating agents; and require making use of metacognitive and self-regulatory skills for successful learning (Azevedo, 2005b). In this study, WISST was used as a metacognitive tool.

Mastery or task goal orientation: It exists when the learner manages the task by self-set standards and self-improvement (Pintrich, 1999).

Performance-approach or ability-approach goal orientation: It occurs when learners perform positively due to comparing themselves with others (Palmer, 2005).

Performance-avoidance or ability-avoid goal orientation: It leads to perform at a minimum rate due to not to be perceived as incompetent by others (Palmer, 2005).

Scaffolding: provided supports for learning to occur and for enabling learners become independent or self-regulated learners (Woolfolk, 2007).

Metacognitive scaffolding: The interventions to foster students' use of strategies and help them to improve and become self-regulated ultimately.

Internet search: A series of purposeful actions including keyword entry, results page exploration, visits to sites, and purposeful quit of the system.

CHAPTER 2

REVIEW OF LITERATURE

The motivations of this research was to explore the effectiveness of online scaffolding on learners', who have diverse goal orientations, metacognitive skill improvement and the relatedness of the speed of this improvement with goal orientation types. The purpose of this chapter is to provide justifications from literature related to metacognitive skills and scaffolding in computer supported courses. In the first part, an introduction to Internet search literature was presented, then metacognition theory and some of metacognitive models were introduced, and then metacognitive skill concepts were made clear. Scaffolding types were defined with some example searches. The theoretical framework, which was used in this study, and scaffolding approach were explained. Finally, goal orientation theory was explained and related with the Internet search conditions.

2.1. Internet Search

As the technologies become more mobile day by day, surfing on the web becomes a daily routine for many users. Internet is a frequently applied resource for school work. As found in the literature, web pages are the most used information source for school projects (Large & Beheshti, 2005; Aalst et al., 2007). Searching on the web can be considered as a challenging task because it requires more than one skill as Howland, Jonassen, and Marra (2012) stated. These skills are not expected to be simple because they differ from the offline skills. For example, Leu et al. (2008) made a

distinction between online and offline comprehension. According to them online comprehension is needed to be shaped or guided with the questions, and thus students' understandings are critical for online comprehension. Similarly, Howland et al. (2012) emphasized on the necessity for intentions in order to achieve meaningful search outcomes.

Leu et al. (2008) listed certain basic elements of online reading comprehension: questions or problems; locating information; critical evaluation. The assigned questions or problems lead the rest of the search process. Deciding on the keywords is critical for a successful search and the task performance (Tu, Shih, & Tsai, 2008). After understanding the questions, the next step is to locate the information. During this step, students might generate their own strategies. For example, some can first read and evaluate the relevancy of the results page, then decide on to continue with the relevant ones. On the other hand, some can just click on the first link which is considered as an immature behavior of novice searchers (Guinee et al., 2003; Quintana et al., 2005). Successful searches were observed to be the results of benefiting from the titles of hyperlinks (Bilall, 2000a). The critical evaluation skills are generally hard to achieve for young users. The lack of these skills might cause students to get lost within web. The results of a research conducted by Van Deursen (2010) found that users rarely evaluate online information because they believe in that Internet provides correct information. As Tsai's (2004) research revealed, epistemological beliefs constitute an important part of the effective use of web content. Moreover, competent searchers conduct more credible site visits (Dimopoulos & Asimakopoulos, 2010).

In students' search cases that are for homework (performance work) or projects, the objectives or tasks are generally decided by the teacher. Although the question or the problem was given to the student, shaping the frames of the task depends on the student himself/herself. The student individually selects and decides on what to use, which information should be stored or skipped, how to interpret different points of view about the same topic, what information to trust, how to use and integrate recently learned with already known, how to start the search, how to hunt the relevant information, how to

decide on the quality, and so forth. Searching the Internet might not always result in the intended outcomes (Fang & Salvendy, 2000). The student can find and report some information and this can be the exact answer of the assigned work, but the learning outcomes are critical. As Howland et al. (2012) stated browsing the Internet should not be associated with learning and the intentionality is a crucial point for Internet use in educational context. In Bilall's (2000a) research, it was found that 28 % of 7th graders in the study did not remember the used concepts. In another study, Bilall (2002) discussed that the correctly found and reported information on the web should not be viewed the only sign of success, because this might not result in meaningful learning (Howland et al., 2012).

According to Tabatabai and Shore (2005), there are some important factors for a successful web search. Users should define their criteria to evaluate the visited links, and then there should be optimum amount of navigation. Reflection on process is needed. In order to achieve intentional search, the users should have information seeking experience and a positive attitude.

Expertise is an important factor affecting the search performance. Holscher and Strube (2000) compared the combination of expertise on domain and web skills. The results indicated that being double novices, i.e. both novices on domain and web skills, causes both lots of query reformulations that are small and ineffective and many irrelevant visits. On the contrary, being double experts, i.e. both experts on domain and web skills, leads to more complex strategy uses than novices as they explore more content. Similarly, Bilall (2000a) observed that successful searchers visit more links. Those who are experts on web skills find relevant documents more successfully than web novices and spend less time. Those who are experts on domain but lack on web skills showed extensive use of terms. As Brandt (1997) stated the knowledge on subject is needed for successful search.

Although successful search characteristics were defined in different frames in the literature, the competency and some previous knowledge can be considered as the common points. There might not be a certain level of expertise or competency for the

successful search outcomes, but there is an agreement on the need for training to develop these skills (e.g. Fidel et al., 1999; Liaw & Huang, 2006).

2.2. Metacognition

This section provided information about metacognition theory in general. Well-known models of metacognition were presented, then metacognitive skills were specified. In order to have a look at the uses of metacognition in computer environments, some examples were given. Finally, the metacognitive scaffolding approaches within computer environments were explained.

2.2.1. Theory of Metacognition

The concept of metacognition is the knowledge about own cognition (Garrett et al., 2006) and the term was coined by Flavell in 1971 (Lazonder and Rouet, 2007). The word *metacognition* "refers less to thinking about what one is doing or experiencing and more to paying attention to the ways one is thinking" (Blatner, 2004, p. 4). This is actually not a new concept, i.e. it has its roots from Socrates. Martinez (2006) explains that Socrates had trained his students in order to improve their metacognition. Socratic dialogue which goes in a question-answer manner exemplifies this phenomenon. The questions are purposefully prepared in order to understand the cognitive gaps of two participants of conversation.

Bloom and Vygotsky can also be associated with the concept of metacognition (Martinez, 2006). Bloom is renowned for his taxonomy in which evaluation constitutes the highest part and it includes similar patterns with metacognition. Moreover, Flavell (1992, as cited by Veenman and Spaans, 2005) considers metacognition as parallel with formal operational stage of Piaget at which hypothetic deductive reasoning is achieved. At this stage the use of metacognitive control is needed.

Veenman et al. (2002), based on their review of literature, proposed that metacognition is one of the most important factors leading to the success in learning.

Metacognition cannot be seen or heard all the time, but can be inferred from cognitive activities and there are many ways to assess it like questionnaires, interviews, the analysis of think aloud protocols, observations, online computer log file registration, and eye movement registration (Veenman et al., 2006). The predictive value of these methods depends on their application period. It is better if these take place online rather than offline, i.e. the methods can be more successful if applied during the task, not after the task.

2.2.2. Metacognition Models

Flavell (1976) defined metacognition as "active monitoring and consequent regulation and orchestration of these processes in relation to the cognitive objects or data on which they bear, usually in the service of some concrete goal or objective" (p. 232). In his model of cognitive monitoring, Flavell (1979) defined four components including *metacognitive knowledge, metacognitive experience, goals (tasks), actions (strategies).* The model assumed that interactions among these components result in monitoring process. Metacognitive knowledge refers to knowledge about own and other's cognitive processes. It is contingent upon the interaction among characteristics of a person, the task, and his/her available strategies. Not only metacognitive strategies are stored in this factor, but also the cognitive ones. Metacognitive experience factor refers to conscious experiences during an intellectual exchange. It can vary according to duration (brief or lengthy) or content (simple or complex). These experiences can make use of strategies to achieve cognitive or metacognitive goals. According to the author, sensing and wondering are some of the examples of metacognitive experience. Goals are the objectives within cognitive context, and actions are the cognitive enterprises applied to actualize the goals. Each component includes three categories that are *person, task, and strategy.* Person in his model refers to cognitive processors. Tasks are the available information. Finally, strategies refer to the ways and conditions to achieve the goals.

Kluwe (1982) proposed 2 general attributes of metacognition. Similar to Flavell's (1979) metacognitive knowledge component, the first attribute refers to the thinking subject having knowledge about own and others' thinking. The other attribute includes monitoring and regulation components occurring throughout a cognitive enterprise. Monitoring in this model sometimes refers to simply identifying the current task. The current cognitive process can both be checked and evaluated. Another monitoring process is related with predicting the outcome of cognitive process. On the other hand, regulation component consists of strategy related items. Allocation of resources, order of the steps, decisions on the intensity and speed of the studying are some characteristics of regulation in this model.

Brown (1987) defined metacognition as the state of one's knowledge and the control of one's own cognitive system. In proposed model, there are two components that are similar to that of previous models; knowledge of cognition and regulation of cognition. These two components are contingent upon each other. The former is similar to metacognitive knowledge and refers to reflections on cognitive potentials. It is expected to develop as the person get older. The latter includes such activities as planning, monitoring, and evaluating. Unlike knowledge of cognition, regulation does not depend on the age, but it show differences across tasks and conditions.

Nelson and Narens (1990) model has three foundations. First, there are at least two interrelated levels during cognition that are meta-level and object-level. The information flows through both orientations (monitoring and control). Second, a dynamic model of object-level is available in meta-level. Third, monitoring and control are related and decided according to the directions between meta-level and object-level. In this model, what is meant by monitoring is the subjective reports of own reflections. On the other hand, control refers to modifications to initiate, continue, or terminate the actions. Certain main stages were defined within the model. Acquisition stage occurs before learning such as defining goals. Acquisition stage ongoing of learning includes such stages as feeling of knowing, judgments of learning, and so forth. Retention stage

refers to the maintenance of previous knowledge. Retrieval stage means termination. Then, retrieval of response output and retrieval of confidence judgments stages come.

The final model was proposed by Tobias and Everson (2002). Unlike other models, this one considered a hierarchical relationship among components. The components are planning, strategies, evaluating, monitoring, and control. Knowledge monitoring constitutes the basis of the model. The authors proposed that it is the knowledge monitoring that enables other components to be activated. If this component cannot be achieved, then the learning process is very unlikely to happen. Moreover, this is a prerequisite to achieve higher order metacognitive skills such as evaluating.

2.2.3. Metacognitive Skills

Lazonder and Rouet (2007) define metacognitive skills as "the ability to plan, monitor, and evaluate one's own actions" (p. 7) and these skills can be converted into the followings in the Internet environment: planning a search, monitoring the progress, and evaluating the search outcomes. These skills are similar to Quintana et al.'s (2005) categorization of metacognitive challenges faced during a web inquiry. The Greek word *meta* means *beyond*, *metacognition* means beyond cognition, and therefore metacognitive skills can be interpreted as skills beyond cognitive skills. While cognitive skills can be domain specific, metacognitive skills can be applicable within multiple domains (Schraw, 2001). Another example of this distinction can be introduced regarding the strategies. While cognitive strategies lead to cognitive process, metacognitive strategies lead to monitor it (Flavell, 1979).

Metacognitive skills are different than metacognitive knowledge. The former emphasizes on self-regulatory activities throughout problem solving process (Veenman et al., 2002), whereas the latter is contingent upon the interaction between characteristics of person and task and available strategies (Flavell, 1979). While metacognitive skills require procedural knowledge, the other deals with declarative knowledge (Veenman and Spaans, 2005). Metacognitive knowledge increases and develops after the ages of 4-

6 and when children come to the age of 11-12, metacognitive skills starts to be improved and there is enough evidence in the literature about the successful trainings of metacognitive skills (Veenman and Spaans, 2005). Individual's metacognitive skills have influences either on learning process or achievement (Sánchez-Alonso and Vovides, 2007) and they can be improved with the help of practice (Flavell, 1979).

Monitoring skills have generally the following parts (Kluwe, 1982): identifying the current task, checking and evaluating the current progress, and predicting the outcome. *Planning skills* can be assumed one of the regulatory skills. It involves a series of decisions about resources, strategies, and order of steps (Woolfolk, 2004). *Strategies* can be defined as the "cognitions or other behaviors employed to achieve them (goals)" (Flavell, 1979, p. 907). *Control skills* involves self-regulative processes that direct and modify one's behavior, such as processes that govern the selection of strategies for accomplishing tasks." (Cary & Reder, 2002, p.64). Control might be considered as the reverse actions of monitoring. In the Internet search cases, if the user gives up the search easily, it might refer to inadequate control of actions resulted from inadequate monitoring or reflection. Finally, in their metacognitive model of reflection, Mcalpine, Weston, Beauchamp, Wiseman, and Beauchamp (1999) define *reflection* as "a process of thinking about teaching and learning by monitoring cues for the extent to which they are within a corridor of tolerance and making decisions to adjust teaching as appropriate to better achieve teaching and learning goals." (p. 110).

There are many studies in the literature which seek for the relationship of metacognitive skills with intellectual ability (e. g. Veenman et al., 2005; Veenman and Spaans, 2005; Prins et al., 2006). Three models are proposed in order to understand this relationship: 1) intelligence model, 2) contrasting model, and 3) mixed model (Veenman et al., 1997). In the first model, metacognitive ability does not have any impact on learning. The contrasting model considers that metacognitive skillfulness and intellectual ability are independent predictors of learning. The third model assumes that there is a relationship between them to some extent and they have additional value for

learning in terms of guidance. As Veenman and Spaans (2005) stated, the results of research studies in the literature have a tendency towards mixed model.

Veenman et al. (2005) conducted a study with 41 secondary school students to find out the level of relationship between metacognitive skills and intelligence. The results of the study show that metacognitive skillfulness is the main predictor of initial learning. Its contributions are independent from intelligence and there is a low correlation. Another study held by Veenman et al. (2002) with 16 low and 7 high intelligent students. Participants did not receive any physics course recently. They are assigned to use Optics Lab learning environment in which they are provided to accomplish experiments. In this environment, learners are allowed to manipulate light rays and lenses. The authors concluded that there is no correlation between metacognitive skillfulness and intellectual ability. Task complexity determines the level of impact of those two factors on learning performance.

The results of the study done by Prins et al. (2006) show that learning outcomes of novice learners are determined by metacognitive skillfulness during the easy phase of Optics Lab learning environment. Veenman and Spaans (2005) approached the relationship problem in relation to age (1st and 3rd year students of a secondary school) and task difference. They found that there is no significant difference between age groups in terms of the level of metacognitive skills' influence on learning performance. Moreover, improvement of metacognitive skills repertoire can contribute to all learners regardless of their age and intellectual ability. According to Coll et al. (2005), group works or peer discussions are also crucial for the improvement and development of student's metacognitive thinking skills.

If people have high metacognitive skills, they are not only aware of the importance of ordinary thinking, but also emotional sensitivity, empathy, body-awareness, imagination, inspiration, improvisation, and intuition (Blatner, 2004). Therefore, these skills have multidimensional effects on cognitive development of learners. Metacognitive skills play an important role during the Internet search because it requires a series of decision makings (Stimson, 1998). In their meta-review, Wang,

Haertel, and Walberg (1990) found that metacognition including comprehension monitoring, use of self-regulatory, self-control strategies, and use of strategies, is one of the most important factor for good learning outcomes. Metacognitive skills can be improved with practicing. In a study done by Kelemen, Winningham, and Weaver (2007), it was found that making practice improved monitoring accuracy of students.

2.2.4. Computers as Metacognitive Tools in Science Education

Science leads people to question of their own thinking, that is why, it can be considered as a metacognitive step (Blatner, 2004). According to Flavell (1979), pre and elementary school children are limited in metacognition and they do not monitor their own cognitive processes adequately. Referring to the literature Flavell (1979) states that metacognition is critical for problem solving which constitutes the basis of science phenomenon.

Martinez describes problem solving, which involves cognition as well, as "what you do when you don't know what you are doing" (2006, p. 697). The author considers evaluation of ideas in terms of quality as complementary to problem solving. Science education is quite related with problem solving. Experiments and the interpretation of data are the backbones of science education. Metacognitive criteria are very crucial during this period (Martinez, 2006). That is why; learners need to be both informed about the importance of metacognition and provided rich practicing opportunities. This can be achieved through modeling (e.g. thinking aloud can lead to the internalization by learners) (Martinez, 2006; Garii, 2002; Mathan and Koedinger, 2005; Lin et al., 2005) and computers are especially effective in modeling metacognitive strategies (Lin et al., 2005). Moreover, the selection of problem solving tasks is critical since they should be rich in metacognitive skills as well as content (Brown, 1984). Brown (1984) focuses on the importance of metacognitive skills for the improvement of children's cognitions, so metacognition can lead success at certain points where formal disciplines fail.

Since the emergence of computers, the area of usage has always included education and with the decreased costs, infrastructure problems started to be solved gradually. Advanced computer technologies and their increased availability to public have made the integration of computers to school settings obligatory. These powerful computer technologies have given learners many opportunities for learning with and learning about technologies in science courses (Linn, 2003). However, as any other media, computers in education have both opponents and proponents. Some argues that it is a valuable medium for instruction (Kozma, 1991; Liao, 2007; Wegner et al., 1999), some questions the usage of them for educational purposes owing to limited opportunities like restricted socialization, lack of accurate integration, etc. (Clark, 1994; Chadwick, 2002), and some offers the use of them as a supplementary tool (Hargis, 2001; Ellis et al., 2006; Oliver, 2006; Moreno 2006).

In the literature, there are many computer applications used for research aims. They generally focus on problem solving and scientific inquiry method during the design of applications since both processes follow the similar steps (Newby et al., 2006). Lever-Duffy et al. (2003) stress that these steps can easily be achieved via computer software designed for problem solving, especially they are very valuable for science education. Some examples of software aiming to increase the efficiency of science education can be listed as follows: Material Science consisting of hands-on activities for middle-level science learners (Cloud et al., 2004), Spreadsheet Tutor enabling learners to perform complex calculations of scientific formulas (Mathan and Koedinger, 2005), Operation that is a biology game in action category and CART Precision Racing and Virtual Pool for physics education (Lever-Duffy et al., 2003).

Azevedo (2005b) considers computer environments as metacognitive learning tools which can be any technology-based tool such as simulations, multimedia, and so forth by referring to stated characteristics stated by Lajoie, Pea, Perkins, and many other authors. In Azevedo's (2005b) article, the main characteristics of computers as metacognitive tools are listed as follows (the last five was added by the author for computer environments):

- Supporting cognitive processes,
- Sharing cognitive load,
- Providing rich cognitive experiences,
- Providing opportunities for generating and testing hypothesis during problem solving,
- Requiring learners to make instructional decisions,
- Enabling learners to make decisions for successful learning with respect to context,
- Modeling, prompting, and supporting learners' self regulatory processes and engagement in using task, domain, and activity specific learning skills,
- Providing a specific learning context in which there are peers, tutors, humans or artificial acting as external regulating agents,
- Providing an environment where metacognitive and self-regulatory processes are critical for successful learning.

Concept maps are the most frequently used metacognitive tools in science education in order to let learners to understand what they know by externalizing knowledge (Riley & Ahlberg, 2004) and offer flexible frameworks with varying graphical representations aiming the facilitation of metacognition. Some examples include semantic networks, mind maps, knowledge maps, and node-link maps. On the other hand, there is a growing area of research about scaffolding of users through scaffolding (Hanley, 1995; Bogdan, 2000; Driscoll, 2000; Metcalfe, Kornell, & Son, 2007).

2.2.5. Metacognitive Scaffolding

Scaffolding can be defined as provided supports for learning to occur and for enabling learners become independent or self-regulated learners (Woolfolk, 2007). Scaffolding as a concept is closely related with *zone of proximal development* concept of Vygotsky (1978). It simply explains that an individual has certain abilities which are obvious and certain potential for further ones, but incapable of doing by oneself. The limits of the existing abilities can be enlarged with the help of certain help of more experienced agents like a peer, an adult, or even a virtual learning agent. In this way, learners can move from one zone to the next. Throughout the development, scaffolding is at the core of the whole progress. Wood, Bruner, and Ross (1976) made an explicit definition of scaffolding as follows: "adult controlling those elements of the task that are initially beyond the learner's capacity" (p. 90). As the introduction of the term, its use extended to different areas. Although the definition included the scaffolding by means of a person, electronic elements also were involved in the category as computers and hypermedia became prevalent (Cagiltay, 2006). Hypermedia environments have been used frequently by researchers as both cognitive and metacognitive tools (e.g. Azevedo, 2002; Palaigeorgiou et al., 2006; Dillon and Gabbard, 1998).

Hannafin, Land, and Oliver (1999) divided scaffolding into four: *conceptual, procedural, strategic,* and *metacognitive scaffolding.* These are all assumed to be specific to open learning environment. Metacognitive scaffolding can be defined as the interventions to foster students' use of strategies and help them to improve and become self-regulated ultimately. The aim of this type of scaffolding is to show the student the ways to monitor own cognition and learning process, to control the process, to evaluate and reflect on the process. It can be either domain-specific or general. Like other scaffolds, metacognitive scaffolds have been studied for about two decades. There are many studies concluding the positive effects of metacognitive scaffolding (e.g. Selberg, 1999; Walton & Archer, 2004; Stadtler & Bromme, 2008).

Azevedo et al. (2004) done a research using a web-based simulation named RiverWeb Water Quality Simulator with 11th and 12th grade high school students in order find out the effects of self-regulated learning of low-achievers and the scaffolding of teachers. The results indicate that low achievers gained little benefit from web-based simulation and the authors conclude that the necessary self-regulation skills to gain maximum benefit from such a rich environment does not exist in all students. Strategies and monitoring were the most frequently used variables of self-regulation during the treatment, but the quantity and quality of these metacognitive activities was not adequate to gain much from this rich environment. At this point scaffolding is crucial for successful learning (Graesser et al., 2005).

Unlike Azevedo et al.'s (2004) study, White and Frederiksen (2005) used software-based scaffolding rather than the teacher. Inquiry Island is a software designed to scaffold and support 5th graders during inquiries. Students who received the treatment show significant gain in terms of metacognition than other participants who do not received traditional treatment. Azevedo (2005a) states that challenging science topics can be learned with hypermedia if appropriate scaffolding is given by teachers. Scaffolding is important for deep inquiry and metacognitive strategies (Graesser et al., 2005).

Similar to White and Frederiksen's (2005) approach, in a study comparing the effects of computer-based versus teacher-based metacognitive scaffolding, continuous and faded options were distinguished (Wu & Pedersen, 2011). Regarding the improvement in scientific skills, those receiving both continuous computer-based procedural scaffolding and early teacher-based metacognitive scaffolding performed significantly better. On the other hand, none of the groups had significant learning results.

A research with 8th grade students investigated the effects of metacognitive scaffolding on metacognitive skill improvement (Wolf, Brush, & Saye, 2003). During the study EBIPS was used as a metacognitive scaffold. The findings showed that control group's work included irrelevant articles. They also used one-source of information

while the experiment group preferred to use various resources. Similarly, Peters and Kitsantas (2010) examined the effects of metacognitive prompts through the use of MPI-S. 162 eight grade science students were included in the study. The results suggested that students having prompts improved the content knowledge and the nature of science. An important difference on inquiry styles was that experimental group searched for evidence whereas the control group relied on the authority. The findings confirmed the previous similar studies (Davis, 1996; Vovides, 2005; Saito & Miwa, 2007).

2.3. Goal Orientation

In this section, goal orientation literature was introduced. First, its theory was explained, then some examples of goal orientation models were given, and then goal orientation types were distinguished. Finally, the relationship between goal orientations and web search was outlined.

2.3.1. Goal Orientation Theory

Motivation can be defined simply as "an internal state that initiates and maintains goal-directed behavior" (Mayer, 2007, p. 494). Goals are basically the destinations on the map and it is the motivation which brings the passengers to those destinations. Following the correct roads is the safest way to get there, thus in order to arrive the correct destination, motivation must be kept alive with the guidance of goals. Motivation is not only a prerequisite for learning but also a co-requisite (Palmer, 2005), and therefore, it plays an important role for effective Internet search process. The roots of motivation can be considered as *interest, self-efficacy, attribution, and goal orientation* (Mayer, 2007). In this study, the focus will be on goal orientation approach of motivation.

Goal orientation theory has emerged in the first half of 1980s. Unlike other motivation theories, it focused on the ways and the reasons of the motives through

achievement or failure situations. This theory has been frequently used in educational research area with a focus of school performance. Owing to being a social-cognitive theory indeed, it considers many situational or environmental factors. Woolfolk (2007) defines goal orientation as "patterns of beliefs about goals related to achievement in school" (p. 380). Although there are many other definitions in the literature, the application of the theory may vary with different definitions of goals which can also be dependent upon domains.

2.3.2. Goal Orientation Models

Goals can vary according to content, context, personality, cognitive styles, and so forth. In the literature, there are many distinctions while defining the types of goal orientations. Ames (1992) focusing on learning environments and motivational factors used the terms mastery, performance approach, and performance avoidance. Tasks assigned to students and strategies that are applied by students to accomplish the task are important in classroom settings because these let students to decide on their competence. These judgments are closely related to the patterns of orientations. The author specifically focuses on the ways to increase the number of mastery orientations within classroom settings.

In their goal orientation model, Elliot and Harackiewicz (1996) defined two basic orientations: mastery and performance. These orientations were classified as either approach or avoidance. The level of competency is related to these orientation patterns. If the student perceives herself/himself as competent enough, then s/he will be willing to show this competence to others. In a reverse situation, student will avoid to show the incompetency. In both situations, the reasons to engage in the academic work are related with performance showing no patterns of intrinsic motivation. Considered within classroom settings, the existence of other students and the teacher is assumed to be the sources of anxiety, threat, and extrinsic motivation for performance oriented students. Students with performance approach orientation are very likely to withdraw. On the

other hand, the mastery orientation leads to work engagement owing to being intrinsically motived. The aim of this orientation is not to show how competent someone is, instead, the aim is to learn or to master something.

Adding on Elliot and Harackiewicz's (1996) model, Elliot and Church (1997) defined and tested a hierarchical model of approach and avoidance by focusing on motive dispositions. In this hierarchical model, the higher level includes "achievement motivation and fear of failure", the middle level consists of "mastery, performance approach, and performance avoidance", and lastly an independent level has task-specific competence expectancies. In the model, it is assumed that motive dispositions and competence expectancies directly influence achievement goals (mastery, performance approach & avoidance), which directly influence achievement-relevant outcomes. In accordance with this hierarchy, mastery achievement goal seeks for the ways to improve competence and mastery while expecting to achieve with an intrinsic motive. Performance approach goal seeks for the ways to show the competence while expecting achievement with the fear of failure motives. Performance avoidance people seeks for the ways to avoid while expecting low competence with the fear of failure, i.e. both levels of hierarchy demonstrate a tendency towards avoidance. Hierarchical model of achievement orientation proposes that achievement goals enable individuals to meet their abstract demands (Elliot & Thrash, 2001). Such type of goals can be associated with competence. Those goals differ on two dimensions: competence and valence. The former can be judged according to the level of standard (absolute, intrapersonal, and normative). The latter refers to approach or avoidance dichotomy.

In a recent model, Dweck and Master (2007) made distinctions based on self theories of students. Students were observed showing two patterns of behaviors while performing something. These are helpless pattern and mastery patterns. While the former relates with the performance goals, the latter is associated with mastery goals. The authors define two types of self theories: entity vs. incremental. Those having entity theories believe in that the intelligent or ability is fixed and cannot be improved. Others with incremental theory beliefs know that intelligent or ability is not fixed and can be

developed. Entity self theory leads to performance orientations whereas the other brings about learning orientation. What is meant by learning orientation is similar to Elliot's mastery orientation. Two orientations attribute different meanings to the dedicated effort. Students with learning orientation perceive any effort as the ways to improve skills and to achieve desired success. Students with entity theory (performance orientation) can perceive the effort as the signs of their helplessness, as a result they spent less effort to hide their incompetence.

In addition to dichotomous (learning vs. performance) and trilogy (mastery vs. performance approach vs. performance avoidance) distinctions in the literature, there are also some studies proposing a fourth dimension that is mastery avoidance (e.g. Elliot, 1999; Countinho & Neuman, 2008), yet, this orientation type was not clearly confirmed by many researchers. On the other hand, a different perspective was based on normative goal theory (Pintrich, 2000). Instead of completely focusing on one orientation, multiple goal orientations can allow to compare and to adjust in terms of high/low dichotomy. In this model, high mastery/high performance combination show more adaptive patterns.

2.3.3. Goal Orientation Types

Mastery orientation has been associated with a series of good characteristics. First of all, they focus on to improve the possessed skills, to gain further new skills, and to learn more. They demand feedback to evaluate the current situation. Their fear of failure do not hinder their learning process, and thus are not afraid of mistakes. They are intrinsically motivated. In a recent study completed by Sideris and Kaplan (2011), college students were assigned 4 unsolvable and 1 easier tasks. It was observed that students with mastery goal orientation study longer to complete the tasks and they insisted in to finish. Mastery orientation was supposed to be related with metacognition (Schmidt & Ford, 2003). In their study, mastery oriented participants claimed that they engaged in active monitoring of learning. In a study conducted by Sungur (2007), it was found that college students' achievements were best predicted by mastery goal

orientation regardless in both consequential and non-consequential conditions. Despite being associated with success, mastery orientation might not always result on high scores. Okun et al. (2006) explored that in rote memorization situations like multiple choice tests, mastery oriented students got lower scores. This can be explained to their tendency to learn deeply.

Performance oriented students can sometimes get higher scores on such shallow tasks like rote memorization (e.g. Okun et al., 2006). They can be observed to perform better than mastery orientation (e.g. Elliot & Harackiewicz, 1996). *Performance approach* students want to achieve high performance which is an indication of high competency. They seek for positive reinforcement, which is higher scores or grades in a school setting. They do not spend too much effort if there is no positive evaluation. Their fear of failure restrains their motivation, i.e. if there is a possibility of failure, then they prefer stay outside of the task. There are many studies exemplifying the positive patterns of performance approach orientation. For example, in a study students with performance approach showed higher level of metacognitive strategy use which is a higher order skill (Wotters, Yu, & Pintrich,1996).

Performance avoidance orientations cause to be cautious about the possibility of failure. They stay away from the task if they feel they are incompetent about it. They have high levels of failure. They even do not want to be evaluated. Their performances stay at minimum. All of these worries result in the appearance of unconfidence. Performance avoidance goal orientation types are associated with low scores or performance (Tanaka, Takehara, & Yamauchi, 2006). Schmidt and Ford's (2003) study revealed that performance avoidance oriented participants engaged in lower metacognitive activity. However, there are also studies showing no effects of goal orientation on metacognition (e.g. Stavrianopoulos, 2007).

2.3.4. Goal Orientations and the Internet Search

The point where motivation, goal orientation, and the Internet search phenomena meets is the concept of self-regulation. The Internet provides limitless and ever-enhancing resources, so the learner is expected to regulate his/her own learning. Pintrich's (1999) model of self-regulated learning suggests three types of strategies: (i) cognitive learning strategies, (ii) self-regulatory strategies to control cognition, and (iii) resource management strategies. The second and the third strategies consist of certain subcomponents related with goals. For example, planning activities in the second strategy category demands certain goals or analysis of task components to go further. In the Internet search context, learners are expected to plan to achieve their goals (Lazonder, 2000). Third part of the strategies in this model serves to the adaptation process through which learners seek ways to manage resources with the guidance of goals.

Literature combining the Internet search and goal orientation can be considered as conclusive in terms of the importance of the focus of the search. When goals are set by learners, their task goal orientation (mastery) seems to increase, which in turn might increase the performance (e.g. Bilal, 2002; Thompson et al., 2002; DeVries, Meij, & Lazonder, 2008). However, because of deep levels of processing, mastery oriented individuals study longer. It is suggested that if learners generate their own tasks or goals, they can take the advantage of positive intrinsic motives due to the flexibility of goal selection. In this way, the possibility of mastery orientation can be attributed as increased, so in turn, it increases success or performance. Software and instructional designers can benefit from those findings while designing Internet-based tasks. The key point is that learners need certain level of control and flexibility in terms of goal selection and if it is provided with accordance of content and context complexity, the level of performance can be increased as the motivation increases.

In addition to those findings, Guinee et al. (2003) suggested that familiar cognitive schemata can generally guide learners about where to start during the Internet

search process. Goal orientation of learners can also be affected or even guided by those familiar cognitive schemata. That is why, while providing learners a homework requiring the web search, one might need to analyze the target's background in order to facilitate their ongoing search process. In this way, task-irrelevant behaviors on the web can be eliminated.

Literature offers that learning gains in a web environment can significantly better among those who show trends of task orientation although they can differ in terms of search strategies (Priemer and Ploog, 2007; Lin & Tsai, 2007). Those with exploration strategies can be interpreted as task oriented because there is something intrinsically motivating to search further for the sake of understanding not just for the sake of finding needed information (match approach) that is hoped to be ready to use. Decreased learning gains or poor search performance is explained with the increased number of self-intrusive thoughts (Yee et al., 2004). The reason for high numbers of such thoughts can be a result of lack of task goal orientation.

Although the goals were given within the task, because of the level of expertise, the goal orientations can differ and affect strategy selection. The literature offers three folded results. Some suggests that complex Internet search tasks can influence either experts or novices. For example, Lazonder (2000) performed a research about information search on the web to understand the differences between novices and experts. 14 fourth graders from pre-university education were categorized as novice and experts. There were three main tasks with varying difficulties. The easiest task informed participants about the exact address of the web site to be reviewed. The moderate task did not directly give the address but imply clearly. The most complex task required searching the web to find specific information. With respect to simple task, expert users did not have difficulty to select and apply certain search strategies, but as the difficulty of task increased, this difference became less obvious. In this study, goal was assumed to be inferred from task descriptions. Tabatabai and Shore (2005) concluded that being novice or expert was observed as affecting navigational patterns and the overall search performance. The level of expertise within the web search context can have a role on

goal orientation because it is related with strategies in that to decide or apply strategies, one needs to start with a goal and it is the goal orientation type which guides the rest of the search process.

On the other hand, others claim that as Gerjet and Hellenthal-Schorr (2008) stated the level of expertise and age or grade did not determine or guarantee certain level of Internet search competence or effectiveness. This interpretation can be attributed to the disoriented goals. They offered the need for training for effective information search on the web which can increase the probability of task-oriented searches. Finally, Lazonder et al. (2000) and Tu et al. (2007) showed that the level of expertise is important for the locating web site process, but not for locating specific information process. Therefore, it can be concluded that the level of expertise can influence the way to seek for information on the Internet, but there is no guarantee due to the dependence on the complexity of the task and content.

2.3.5. Goal Orientations and Scaffolding

Various examples of scaffolds or the process of scaffolding can be made use of in many fields. Despite the differences in types, content, and method, the fundamental aim of scaffolding remains the same. In other words, it aims to help and support the novice whenever needed to move the next zone. This help and support can be provided in different ways. In the literature, goal orientations were not generally directly associated with scaffolding, instead, there are many studies focusing on the motivation in general. For example, Charsky and Ressler (2011) studied the effects of conceptual scaffolds on students motivation. 9th grade students assigned to one of the conditions including expert generated concept map, their own concept map, and no concept map were included in the study. The scaffolds were provided through a computer games in the class. Interesetingly, the authors concluded that such an inclusion of scaffolds in a game playing environment caused declines in motivation.

Pittenger and Doering (2010) further explored the effects of scaffolding on motivation in a self-study environment including online pharmacy courses. The findings pointed that the extent and types of scaffolding affected the motivation. Similarly, another study done by So and Ching (2011) investigated the cases of learning with online resources. They focused on the way teachers design the science lessons. They explored that scaffolds are one of the crucial elements with regards to the design of such courses. They also concluded that a motivating learning environment is needed for successful design. Moreover, teachers' scaffolding was found important to increase motivation in science classes (Nieswandt & Shanahan, 2008). In a study conducted by Chen and Wu (2012), the relations between cognitive and motivational elements within a scaffolded environment were explored through a path model. They provided 178 10th grade students online scaffolds related with sophisticated scientific concepts. They found that students' learning goals and cognitive preferences are related with metacognitive strategy use. In turn, they also predicted their performance.

There are a few studies examining the relations between goal orientations and scaffolding. In a dissertation study, Chang (2010) examined the activity logs to explore metacognitive processes of students. The author found that mastery orientation has an effect on learning outcomes. In addition, students with high mastery orientation are associated with selective use of scaffolds. Therefore, there is a relationship between scaffolding and mastery orientation type. Similarly, a group of researchers (Sins, van Joolingen, Savelsbergh, & van Hout-Wolters, 2008) also benefitted from the log files and found that mastery approach oriented students had significantly higher achievement rates.

2.3.6. Goal Orientations and Metacognition

Since metacognition is an important part of self-regulated learning, studies addressing goal orientation indirectly focus on metacognition, instead, there are studies considering the self regulation as a whole. The research study of Ablard and Lipschultz

(1998) can be considered as an example. The participants were 222 seventh graders that are high achievers. In their results, the importance of mastery orientation was obvious especially in terms of the use strategies of self-regulated learning. On the other hand, Mastery orientation is needed for performance orientation for self-regulation. Another example also confirms that mastery and performance goals are important for self-regulated learning (Hagen & Weinstein, 1995).

There are also studies directly looking for the relations between goal orientation and metacognition, but they are relatively small in amount. Ford, Smith, Weissbein, Gully, and Salas (1998) explored a series of relationships between various variables including goal orientation and metacognition based on assigned complex decision making task. 93 undergraduate students were included in the study. The authors concluded that metacognitive activity and mastery orientation are positively related to each other. In a later study, Schmidt and Ford (2003) conducted a metacognitive intervention and tried to explore the relations in terms of goal orientations and metacognitive activities of participants. It was found that students with low performance avoidance orientation benefited the metacognitive intervention to develop their metacognitive activity. On the contrary, students with high performance avaoidance orientation benefited less regarding the metacognitive activity.

2.4. A Framework for Web-Based Internet Search Scaffolding for Metacognitive Skill Improvement

In this study, the framework of Quintana et al. (2005) will be used in order to find out the effects of scaffolding for online inquiry steps of learners with different goal orientations on their metacognitive skills' improvement. The main focus of the framework is on metacognitive challenges of online inquiry. Its target population is middle and high school students. The metacognitive challenges in the framework are categorized into three: (1) task understanding and planning, (2) monitoring and regulation, (3) reflection. Task understanding and planning consists of certain

knowledge of cognitive nature, demands, strategies related to tasks, and a serious of actions should take place. Monitoring and regulation requires the identification of the current task, evaluation of the progress, prediction of outcomes, and decisions for distribution of resources and speed and intensity of steps. Reflection includes a deliberate thinking process called reflection.

During the online search, learners engage in certain cognitive activities. A search starts with *asking questions* during which learners, especially the novice ones, can experience asking poor or inappropriate questions for the aim of the inquiry, giving up questions when needed information was not found, and having no idea about the content and the quality of questions of themselves. The next step of online inquiry is *searching* throughout which novice learners expect to find out everything in one web site and have no plan for sub-steps of search, they do not develop keywords and spend time without considering other activities, and they have no reflections about the search process. During *evaluating and reading* activities, novices do not have a clear purpose to read the resource and the process does not go beyond just skimming for the answer. While reading resources, learners can easily be distracted and fail to monitor their comprehension. In addition, they have no reflections on the quality of resource. The last cognitive activity is *synthesizing* during which novices just copy and paste from a resource, use inadequate criteria for the quality of the final product, and reflect very little on gathered (rather than synthesized) information to build the final argument.

This framework suggests certain scaffolding strategies in order to cope with the faced metacognitive challenges of novices. The authors propose that scaffolding can have many sources such as modeling, coaching, and etc. In addition, they offer certain ways to scaffold learners with the help of the software. For example, visual representations including the descriptions about online inquiry tasks in a meaningful manner can be used. The aim of the involvement of software for scaffolding process is to make implicit nature of metacognition more explicit.

In Quintana, Zhang, and Krajcik's (2005) framework, during an online search, learners face certain metacognitive challenges. For example, they generally do not know

where and how to start due to limited planning, lack of deep understanding of the task, and having no idea about key words. They aim to find everything in one, so do not plan further steps. Their purpose of reading is ambiguous; as a result, they do not go beyond copying and pasting the information. They tend to give up the search and be distracted easily. Those learners spend time inefficiently. Moreover, they have no or little criteria to eliminate the unqualified material, thus, in general they have difficulty in reflecting on material quality or the whole search process. During these processes the aim of scaffolding is to improve metacognitive skills, which are planning, understanding the task, monitoring, regulation, and reflection, and computer software can provide such a scaffolding (Quintana et al., 2005; Zion et al., 2005; White and Frederiksen, 2005).

2.5. Summary

In the literature, it was agreed that students frequently conduct Internet searches while dealing with their school assignments. Due to requirement of higher thinking skills, novice searchers can have difficulties to find relevant and needed information on the web. The skills needed for successful Internet search can be very complex in nature, and it is obvious that student should be trained to gain these complex skills.

Metacognition is hard to define since there are lots of models explaining diverse dimensions of cognitions. These models ranged from two-component models to hierarchical models including multiple elements. However, monitoring and control skills seem to be the focus of all models. The improvement of such skills is possible with practicing and computers can be the ideal media for this purpose. There are different classifications of scaffolding types. Among them, metacognitive scaffolding seems promising for further studies. The attempts to embed metacognitive scaffolds into software-based systems resulted in positive results mostly.

Goal orientation theory emerged in the early 80s in the area of social cognitive theory. Because of its situation and task specific nature, it became familiar to the field of education. Various goal orientation models were defined in the literature, but indeed,

they all have the similar dichotomies: mastery and performance. There is no consensus on the directions of those, but performance approach and performance avoidance are the most frequently used directions. In education, the management of different goal orientations, is in the hand of teachers and this can be achieved through appropriate scaffolding focusing on the improvement of metacognitive skills. Although there exist many research studies dealing with goal orientation, scaffolding, and metacognitive skill improvement seperately, there are fewer studies integrating them in instructional setting.

Considering the overall trends in the literature, some gaps were found with regards to goal orientation, metacognition, and scaffolding together. First, although it is conclusive that students should be trained to have better Internet search skills, the studies are limited to English users in general. There are a few studies exemplifying how students search and how they lack the skills while searching the web in Turkish. Similarly, despite the availability of metacognitive scaffolds in English, there are no studies making use of scaffolds in Turkish. Moreover, the scaffolds are usually content-specific, not the search specific. Goal orientation literature is extensive in educational settings, but the studies are very limited in conjunction with the metacognition and scaffolding. Motivation has been studied frequently in relation to scaffolding and metacognition, however, there are very rare research designs taking them altogether. In that sense, this study aims to fill this gap in the literature. In addition, goal orientation literature is inconclusive about the effectiveness of goal orientation types. In this study, it was also aimed to contribute the dichotomy of mastery or performance approach orientation.

CHAPTER 3

METHODOLOGY

This chapter describes the methodology to be pursued to answer the research questions. Throughout the chapter, research questions, research design, population and sampling, the web-based internet search scaffolding tool design, instruments, procedures, data collection, and data analysis are presented.

3.1. Purpose of the Study

This study aims to investigate the effects of the web-based internet search scaffolding tool on the improvement of metacognitive skills of 7th grade students associated with their goal orientations. Throughout the research, the answers of following questions were investigated:

1.What are the participants' in WISS, TS, and NS groups profiles?

1.1.What are the participants' goal orientation types?

1.2.What are the participants' metacognitive skills both at the beginning and at the end of the study?

2.What are the participants' in WISS, TS, and NS groups search patterns throughout the study in terms of:

2.1.The number of used keywords

2.2.The number of trials

2.3.Rank of the first visited link within the search result list

2.4.Total time spent for search

2.5.Frequency of copy-paste action

2.6.Frequency of added idea or interpretations

2.7.The number of visited sites?

3.How do students' in WISS, TS and NS groups metacognitive skills, search patterns (trials across tasks, use of keywords, visited links and search durations), performance works, and reflections on the topic and search processes change throughout the study?

4. Are there significant mean differences between the students' in WISS, TS and NS groups post-MISS scores when their pre-MIIS scores are controlled?

4.1.Are there are significant mean differences between the students' in WISS, TS and NS groups post 'reflection and regulation, monitoring, planning, coping with distracters' and 'generating strategies' scores?

5.Are there significant mean differences between the students' with mastery, performance and performance avoidance goal orientations post-MISS scores when their pre-MIIS scores are controlled?

5.1.Are there significant mean differences between the students' with mastery, performance and performance avoidance goal orientations post 'reflection and regulation, monitoring, planning, coping with distracters' and 'generating strategies' scores?

6.After controlling for the belongingness to a treatment group and pre-MIIS scores, how well do search variables (trials, duration, the number of visited links, keywords, keyword changes, copy-pastes, and added ideas) predict MS development?

7. What are the relationships between;

7.1.students' sub-metacognitive skills and search patterns?

7.2.students' search patterns and achievements?

7.3.students' sub-metacognitive skills and achievements?

7.4.students' goal orientations (GO) and search patterns?

3.2. Research Design

This study utilizes a static-group pretest-posttest quasi experimental design. There are two experiment groups and one control group. The intact groups, three classes in a public school, were assigned randomly one of the groups. The first experiment group received web-based internet search scaffolding tool treatment; the second experiment group received teacher scaffolding; and the control group had no scaffolding. Table 3.1 demonstrated the design of the study.

Table 3. 1

Static-Group Pretest-Posttest Design of the Study

Group	Pre-test	Tasks & Treatments	Portfolio	Post-test
WISS (web-based internet search scaffolding)	(1) Pre-MIIS (2) PALS	(1) 15-minute training for the software. (2) 5 search tasks (40 minutes for each) during 5 weeks. a. Search the Internet to find out information according to given topics from Science and Technology curriculum with the help of <u>software</u>. b. Logs (users' answers, keywords, time and number of web-site visits, number of trials, rank of visited sites, previous knowledge of users, and aim of their search) were recorded.	(1) Weekly reflective journals (2) Weekly performance works (expected to be completed within 40 minutes) (3) Logs	(1)Post-MIIS (2) Ach. test
TS (teacher scaffolding)	(1) Pre-MIIS (2) PALS	(1) 5 search tasks (40 minutes for each) during 5 weeks. a. Search the Internet to find out the information according to given topics from Science and Technology curriculum with the help of <u>teacher</u>. b. Screen shots were recorded with the help of Snagit software.	(1) Weekly reflective journals (2) Weekly performance works (expected to be completed within 40 minutes) (3) Screen recordings	(1)Post-MIIS (2) Ach. test
NS (no scaffolding)	(1) Pre-MIIS (2) PALS	(1) 5 search tasks (40 minutes for each) during 5 weeks. a. Search the Internet to find out the information according to given topics from Science and Technology curriculum <u>without any help</u>. b. Screen shots were recorded with the help of Snagit software.	(1) Weekly reflective journals (2) Weekly performance works (expected to be completed within 40 minutes) (3) Screen recordings	(1)Post-MIIS (2) Ach. test

3.3. Population and Sampling

Because of the requirements of the curriculum, almost all students of any grades frequently experience performance works that require Internet search. Depending on the subject area, students conduct web searches at least once a week. In this study, the target population of this study is all 7th grade students in Turkish public schools (approximately 1,100,000 students). Accessible population is all 7th grade students in Ankara (about 100,000 students). The reason why that grade level was chosen is that they are more experienced than 6 graders and less focused on the high school entrance exams than 8 graders, thus less excessive workload and curriculum they have. In other words, they were much more easily accessible than other grades. Another reason was that 7th graders can be considered as reached the formal operational stage of Piaget which requires the certain level of metacognition. For this study convenient sampling was used. Among 4 candidate convenient schools, two of them were randomly selected.

Y Elementary School selected for the actual study is a public school located in the central county of Ankara. It has one computer laboratory with 30 computers. There were three 7th grade classes which were randomly assigned to one of the groups. Since the interventions took place during regular class hours, participants could not be assigned randomly to one of the groups. Instead, intact groups were exposed to the treatments. There were 76 participants in total. TS group included 25 students, WISS group and the control group had 26 participants. However, in the end of the study, there were 23 valid data for TS group; 25 for WISS group; and 24 for NS group. As a result, 72 students (43 females and 29 males) participated in the study.

The majority of the students have access to computers at home (N=57). Most of them (N=55) use computers more than 6 hours a week. Only 5 students reported the minimum usage limited to just at school use between 1 and 3 hours. The rest of the students (N=12) uses computers between 4 and 6 hours a week.

Table 3. 2

Demographic Information for the Participants

	Frequency(N)	Percent(%)
Gender		
Female	43	60
Male	29	40
Computer Access		
Yes	57	80
No	15	20
Computer Use		
1-3 hours a week	5	7
4-6 hours a week	12	16
Above 6 hours	55	77

In order to examine deeply how students' performances and reflections changed over time, a smaller sample was needed. In this way individual logs and documents could be easily investigated and the weekly developments could be observed. First, a two-step cluster analysis was run both with goal orientation types and then for gained metacognition scores. All data except for 2 cases, which were outliers, were clustered in two categories. According to Hair et al. (2005), outliers in cluster analysis should be excluded unless they represent valid and relevant groups, but the outlier analysis pointed out the negative gain scores in our case. Outliers were removed because of negatively affecting the overall cluster pattern. When closely looked at those, the negative gain scores are because of some missing item fills. That's why these two students' gain scores seem below zero, however, indeed, they are not below zero. The unfilled items caused relatively low scores in post-test, hence the gain scores became negative. After the removal of outliers, 70 cases were categorized into two: those with gain scores between 0-8 and those with gain scores between 12-36. For the rest, a purposive approach was used. Cases were sorted in accordance with their belongingness to a group. Among each group, representative samples were tried to be formed. To accomplish this, one case per each goal orientation type and per each cluster were

selected within WISS, TS, and NS groups. Consequently, for qualitative analysis there were 18 cases selected. Table 3.3 summarized the selected cases.

Table 3. 3

Clustered and Purposively Selected Group of Participants

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	N_{WISS}	N_{TS}	N_{NS}	N_{WISS}	N_{TS}	N_{NS}	N_{WISS}	N_{TS}	N_{NS}
1: Gain scores between 0-8	1	1	1	1	1	1	1	1	1
2: Gain scores between 12-36	1	1	1	1	1	1	1	1	1

3.4. Instruments

In this section, used instruments in this study were presented. The first one, MIIS, was created by the authors. Its development process was explained in details. PALS for measuring the goal orientations was translated into Turkish and validated. Achievement test, computer records, performance works, and reflective journals were the other data collection instruments presented under this heading.

3.4.1. Metacognition Inventory for Internet Search (MIIS*)*

MIIS inventory (see Appendix A) aims to measure sixth, seventh and eighth grade students' metacognitive skills experienced during the Internet search. The inventory consisted of 30 items with five factors name by reflection-regulation (items 3, 4, 5, 7, 10, 12, & 18), monitoring (items 2, 6, 9, 19, 26, 27, 29, & 30), planning (items 1, 8, 16, 20, & 21), control of attention (items 14, 15, 17, 22, & 25), and strategy generation (items 11, 13, 23, 24, & 28).

In developing the inventory, three basic procedures were applied. First, 37-item MSIIS was generated based on a framework specific to the Internet search and metacognitive challenges faced during the search process, and pilot exploratory factor analysis was conducted. Second, the final version of the scale was distributed to 273 seventh grade students, and the existing constructs were extracted through exploratory factors analysis. Third, 321 seventh graders completed the revised version of MSIIS, and then the data were used for confirmatory factor analysis. As a follow-up, test-retest reliability was tested with 101 sixth graders. The subscales of the inventory found through the final analysis were named: (1) regulation and reflection, (2) monitoring, (3) planning, (4) control of attention, and (5) generating strategies.

Piloting the Inventory

In order to find out subsumption of 'metacognitive skills', the related literature (Zimmerman & Martinez-Pons, 1988; Pintrich et al., 1991; Mazzoni & Kirsch, 2002; Nelson & Naren, 1990; Butterfield, Nelson. & Peck, 1988; Lazonder & Rouet, 2007; Quintana et al., 2005) was reviewed. The result of the literature review showed that Quintana et al.'s (2005) framework included all metacognitive categories specified in the literature. Moreover, this framework was designed specifically for the Internet search process of middle and high school students, therefore the categories are more specific. In light of Quintana et al.'s (2005) framework, metacognitive skills used during the Internet search were classified into five categories: task understanding, planning, monitoring, regulation, and reflection. Based on the classified five main categories, 57 items were generated. During this process, Roedel, Schraw, and Plake's (1994) mastery goal items, Schraw and Dennison's (1994) metacognitive awareness inventory items, O'Neil and Abedi's (1996) state metacognitive inventory items, and the strategic teaching and reading project guidebook (Kujawa & Huske, 1995) were reviewed, and some of the items, especially the ones related to monitoring and control were adapted to this instrument.

The items were checked by a Turkish language expert for clarity of the language. The language expert recommended some changes on 10 items, and suggested elimination of two items from the inventory. In order to adjust the level of statements according to middle school students, the items were examined by an elementary school instructional technology teacher. Based on the feedback, 4 items were revised and 4 items 2 of which were the same ones with Turkish expert suggested were deleted. Then, two measurement and evaluation experts reviewed the items and in relation to their suggestions, 8 items were excluded, 4 items were revised, and one item with two dimensions was divided into two items. Lastly, three content area experts examined the items and recommended revisions in 7 items and elimination of 11 items. In the light of the all expert reviews, the final version became a 39-item scale piloted with one 7th grader and one 8th grader through individual cognitive interviews. During the interview, they explained their understanding of and the reason of their answers for each statement. The findings of the interviews indicated that one of the statements in the scale was difficult to understand for the 8^{th} grade students. In addition, the 7^{th} grader read the same item three times and stated that was hard to understand. Instead of removing the statement due to its importance for the theory, the item was revised and simplified. Two of the statements were eliminated since they were understood in a different way than their intended meaning. Some problematic or advanced words in 5 items were replaced with the familiar terms by interviewees. Two of the items were revised due to misunderstanding and complex sentence structure. After the necessary revisions, the scale consisted of 37 items, 6 for task understanding; 8 for planning; 8 for monitoring; 7 for regulation; and 8 for reflection. Then, the 37-item inventory was piloted with 251 (125 female and 126 male; 97 seven grader and 154 eight grader) students.

Before the delivery of the instrument, permission forms were sent to the parents. 6 teachers administered the instrument. They were trained about the instrument and the issues to be considered during the implementation process. The aim of the instrument and directions were given in written format in the beginning of the instrument. Students were asked to rate how often they experienced the statements during the search in the

Internet. It lasted about 15 minutes for eighth graders and about 25 minutes for seventh graders to complete the instrument.

The gathered data were analyzed with EFA using SPSS 11.5. The results of this pilot study implied that there exists above mentioned five basic constructs about metacognitive skills experienced during the Internet search. However, because of referring similar dimension, regulation and reflection factors were combined. As a result, four factors were named as follows: (factor 1) "critical investigation with respect to awareness and strategies", (factor 2) "level of distraction during Internet search", (factor 3) "task understanding and purpose of search", and (factor 4) "regulation and reflection on search process". 7 items were removed due to their low correlations. According to the findings, some of the items were revised to minimize close loadings and low loadings.

Exploratory Factor Analysis

Revised version of MSIIS was used to investigate the underlying pattern of 30 items reduced in the pilot study. 273 (111 female and 162 male) seventh grade randomly selected students from two urban public elementary schools participated in this study. Socio-economic-status of the two schools was very similar, and they had Internet access. Because of the requirements of the constructivist curriculum the schools follow, teachers frequently assign performance works to students that require Internet search. 47.4% of students use computers more than six hours, 26.8% of them use about 4-6 hours, and 25.8% of them use less than four hours in a week. After getting permissions from their parents, students were asked to complete the survey.

EFA was conducted by using SPSS 15.0. First, missing value analysis was performed to find the percentage of missing data. There were less than 10 %, thus no manipulation on them was performed. Second, assumptions were checked to see whether the data were appropriate for factor analysis. After deciding on sampling

adequacy, common factor analysis was conducted through principal axis factors (PAF) with oblique rotation. All analyses were performed at .05 alpha level.

Although there are no strict rules for sampling adequacy, at least 5 observations per item are acceptable according to Hair, Anderson, Tatham, and Black (2005). In this study, there were 9.1 observations per item. Kaiser-Meyer-Olkin (KMO) Measure of Sampling Adequacy equaled .85, which is above Kaiser's recommendation of .60, indicating adequate sample size to produce distinct and reliable factors. Bartlett's Test of Sphericity was found to be significant (χ^2 (435) = 2389, $p < .001$) which refers to the presence of correlations among variables. Correlation matrix coefficients were also examined because the tests mentioned above are known for their sensitivity to large sample size. Except for item 14, all items were above the cut-off level of .30.

Histograms, Q-Q plots, skewness and kurtosis values, and Kolmogorov-Smirnov normality tests were all checked for normality. All histograms and Q-Q plots were examined for each item and no violations were observed. Skewness and kurtosis values were within the range of -1.00 and +1.00, except for two items: Item 2 (Skewness=-1.37, Kurtosis=1.47) and Item 14 (Kurtosis=1.57). However, since their histograms and Q-Q plots showed normal distribution patterns, they can be assumed to be normal. According to Tabachnick and Fidell (2007), the items can be considered as normally distributed. Finally, a few outliers were detected in some of the items (items 1, 2, 6, 9, 10, 16, 24, 26, 29) but they were ignored because of not affecting the normal distribution.

EFA was performed by using PAF extraction. Because of the expected correlation among the factors, oblique rotation was chosen (Tabachnick & Fidell, 2007). This expectation was confirmed after examining the factor correlation matrix, that is, there were correlations ranging from r = -.002 to r = .43 between the five factors (see Table 3.4).

Table 3. 4

Factor Correlation Matrix

Factor	1	2	3	4
2	-.15	--	--	--
3	-.29	.18	--	--
4	-.42	-.02	.14	--
5	.43	-.002	-.21	-.42

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

For discovering the number of factors, Eigenvalues and Scree Plot were examined. As seen in table 1, eight factors fit the data well when Eigenvalues exceeding 1.00 are considered. Those eight factors explain 56.81 % of total variance which can be considered high. When the scree plot is inspected, after six factors, small declines are observed. When pattern matrix is scanned, 8 factor loadings do not make sense in addition to very small number of items per some of the factors that might decrease the reliability values of the factors. In the pilot EFA, 5 factors had been generated and two of them had been integrated. By considering all, a 5 factor extraction was performed to be consistent with the theoretical framework. It is found that these factors can explain 45.83 % of variance. The most contributing factor is the first one (see table 3.5). After the fifth factor, contributions move very slightly which can be ignored. A six factor solution was also run, but again some of the factors had such small numbers of items as 2. Since goodness of fit value is found significant (χ^2 (295) = 499, $p < .001$), it can be interpreted that the overall model fits well.

Table 3. 5

Total variance explained for EFA

Factor	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation SS Loadings(a)
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	Total
1	7.34	24.47	24.47	6.72	22.39	22.39	4.85
2	2.27	7.57	32.04	1.66	5.52	27.91	1.24
3	1.53	5.09	37.13	.89	2.98	30.89	2.14
4	1.34	4.47	41.59	.67	2.23	33.12	4.26
5	1.27	4.23	45.83	.61	2.03	35.15	4.05
6	1.14	3.81	49.64				
7	1.11	3.68	53.32				
8	1.05	3.49	56.81				
9	.99	3.33	60.14				
10	.96	3.20	63.34				
11	.91	3.03	66.37				
12	.83	2.78	69.14				
13	.81	2.69	71.84				
14	.74	2.45	74.29				
15	.72	2.39	76.69				
16	.68	2.26	78.94				
17	.65	2.16	81.11				
18	.61	2.05	83.16				
19	.58	1.94	85.09				
20	.53	1.76	86.85				
21	.52	1.72	88.57				
22	.51	1.70	90.27				
23	.48	1.59	91.86				
24	.44	1.47	93.33				
25	.40	1.34	94.67				
26	.37	1.23	95.90				
27	.34	1.14	97.04				
28	.32	1.06	98.11				
29	.29	.97	99.08				
30	.28	.92	100.00				

Table 3.6 summarizes factor loadings of the items. The findings indicate that there are no considerable close loadings, except for item 13. The range of loadings is between .38 and .85. According to Hair et al. (2005), unless the sample size and the number of variables are large, smaller loadings can be acceptable. In this case, there are 273 sample and 30 observed variables, which means that factor loadings greater than .35 are significant. There were no items below this range.

Table 3. 6

Factor loadings

	Factors				
	1	2	3	4	5
7. I deeply examine the contents of the sites that are found after Internet search.	.62	.08	.05	.02	.07
10. After completing my homework, I check for correctness of my expressions.	.57	.19	.03	-.13	.01
13. I take some notes about examined Web sites.	.52	.32	.01	-.08	.43
5. After completing the search, I think of the steps that I have followed.	.50	.05	.04	-.14	.15
18. If different Web sites include inconsistent information about the same topic, I think of its reasons.	.49	.26	.13	.22	.19
3. I complete my homework by adding reflections of my own.	.44	.10	.09	-.09	.03
12. After finishing my Internet search, I think about whether found information is adequate for my homework.	.41	.16	.16	-.11	.01
4. I know that Internet search is just a part of my homework.	.38	.06	.08	-.07	.05
9. While searching on the Internet, instead of clicking on each found site, I prefer to select the ones that make sense.	.06	.70	.05	-.13	.19
2. While examining the sites, I check for relatedness of found information with my homework.	.02	.62	.20	-.05	.11
19. The time that I spend for Internet search depends on the topic of my homework.	.07	.51	.19	.35	.03
6. While examining the sites, I easily distinguish between related and unrelated information.	.26	.50	.03	.21	.12
26. When I find important information, I start to examine more deeply and carefully.	.09	.48	.01	-.13	.06
29. While examining the sites, I realize how much I understood so far.	.05	.43	-.04	.11	.24
27. While examining the sites, I try to link the new information with my previous knowledge.	.17	.42	.05	-.16	.09
30. While examining a site, I easily distinguish the information that can be used in my homework.	.05	.39	.05	-.03	.01
21. When I did not find any related site on my first attempt, I try other key words.	.07	.10	.85	.02	.07

Table 3.6 (Continued)

Factor loadings

	Factors				
	1	2	3	4	5
20. Before starting Internet search, I generate certain questions about the topic.	.13	.04	.55	.14	.20
16. Before starting to search, I examine my homework's content.	.15	.03	.49	-.05	.09
1. Before starting the Internet search, I determine my exact goals.	.03	.07	.42	-.08	.01
8. Before starting the Internet search, I decide on basic key words.	.02	.10	.39	.06	.07
15. During the examination of sites related to my homework, I check my e-mails.	.08	.06	.07	.62	.01
22. During the examination of sites related to my homework, I chat with my friends.	.03	.06	.04	.51	.01
25. If I find the whole information in one site that I search for, I do not need further search of more sites.	.09	.09	.01	.49	.15
17. The Internet search is the most time consuming part of my homework.	.02	.02	.02	.42	.02
14. If I do not find any related site, I give up searching any more.	.09	.18	.06	.38	.16
11. I know approximately how much time to spend on Internet search.	.26	.29	.10	-.09	.66
28. While integrating different information, I generate my own strategies.	10	.06	.15	-.08	.59
24. While searching, I quickly scan the sites.	13	.03	.13	-.07	.56
23. While examining the sites, I generate special strategies to understand easily.	.19	.12	.13	.05	.48

Extraction Method: Principal Axis Factoring.

Rotation Method: Oblimin with Kaiser Normalization.

a Rotation converged in 53 iterations.

The main aim of the instrument is to explore the pattern of self-ratings of 7th graders in terms of metacognition experienced throughout an Internet search. The first dimension that included items 3, 4, 5, 7, 10, 12, 13, and 18 was entitled "reflection and regulation". The second dimension involved items 2, 6, 9, 19, 26, 27, 29, and 30, all of which related to monitoring skills. Therefore, it is entitled "monitoring". The third dimension includes items 1, 8, 16, 20, and 21 which are all representative of planning the search, thus it was named "planning". Items 14, 15, 17, 22, and 25 loaded to

"control of attention" factor. "Generating strategies" is the last factor consisting of items 11, 23, 24, and 28.

Reliability coefficients for factors were calculated. Cronbach's alpha values for the first three factors are above the lower limit that is .70 (Hair et al., 2005) ($\alpha_{factor1}$ = .78, $\alpha_{factor2}$ = .76, and $\alpha_{factor3}$ = .76). The fourth and fifth factors are below this cut-off, nevertheless, they are still within acceptable range ($\alpha_{factor4}$ = .64, and $\alpha_{factor5}$ = .62). Overall reliability of the scale was found to be .83 which is quite acceptable.

Confirmatory Factor Analysis

The purpose of this phase is to explore how the previously determined dimensions of MIIS fit the model. Data were collected from 321 7th grade students from one public and one private school in Ankara. Distribution of females (47 %) and males (53%) were very close. Almost all of the participants had computer access (99%) and most of them used computers more than 6 hours in a week (71%). About half of the students were from public school. In addition, a smaller sample including 101 6th graders was used for test-retest reliability of the instrument. They were all from a public school in Ankara. Collected data were used to understand whether previously determined constructs are consistent within MIIS. Through CFA, we aimed to support construct validity.

Confirmatory factor analysis (CFA) was conducted with the help of LISREL 8.51 (Jöreskog & Sörbom, 2001). Using maximum likelihood estimation, 30 items were examined in order to see whether they fit well the 5 latent factors which were previously determined through EFA except for item 13. It was defined under generating strategies factor because it conveys the closest meaning for that category.

The results of the analysis produced significant χ^2 value (χ^2 (df = 394) = 920. p < .001). However, due to its sensitivity to the sample size, other fit indexes were investigated to decide on goodness of fit. χ^2/ df ratio was calculated to be 2.34. According to Hair et al. (2005), when sample size is large and the number of observed

variables is equal to or greater than 30, chi square test is likely to produce significant p values. Then, exploring at least one absolute and one incremental fit index is recommended. Within absolute fit indexes, root mean square error of approximation index (RMSEA = .052, <.06) and standardized root mean square residual index (SRMR = .06, < .08) indicated satisfactory values. Although goodness of fit index is slightly below the cut-off point (GFI = .89, <.90), adjusted goodness of fit index suggested an acceptable fit (AGFI = .91, >.90). Within incremental fit indexes, normed fit index (NFI = .92, > .90) and comparative fit index (CFI = .95, >.90) confirmed the goodness of the model fit.

Standardized loadings of the latent variables range from .53 to .75 (Table 3.7). All loadings were above the suggested cutoff value that is .50. Moreover, their standardized and unstandardized loadings were found significant ($p < .001$) Internal consistencies of each dimension and the instrument were assessed by Cronbach's alpha. The values were listed in table 3.8. Overall reliability of the scale was computed .83.

Table 3. 7

Standardized loadings of each item of MIIS

Items	Loading
Reflection and Regulation	
(Item 3) I complete my homework by adding reflections of my own.	.58
(Item 4) I know that Internet search is just a part of my homework.	.53
(Item 5) After completing the search, I think of the steps that I have followed.	.75
(Item 7) I deeply examine the contents of the sites that are found after Internet search.	.62
(Item 10) After completing my homework, I check for correctness of my expressions.	.60
(Item 12) After finishing my Internet search, I think about whether found information is adequate for my homework.	.56
(Item 18) If different Web sites includes inconsistent information about the same topic, I think of its reasons.	.54
Monitoring	
(Item 2) While examining the sites, I check for relatedness of found information with my homework.	.57
(Item 6) While examining the sites, I easily distinguish between related and unrelated information.	.59
(Item 9) While searching on the Internet, instead of clicking on each found site. I prefer to select the ones that make sense.	.58
(Item 19) The time that I spend for Internet search depends on the topic of my homework.	.57
(Item 26) When I find important information, I start to examine more deeply and carefully.	.55
(Item 27) While examining the sites, I try to link the new information with my previous knowledge.	.57
(Item 29) While examining the sites, I realize how much I understood so far.	.55
(Item 30) While examining a site, I easily distinguish the information that can be used in my homework.	.57
Planning	
(Item 1) Before starting the Internet search, I determine my exact goals.	.55
(Item 8) Before starting the Internet search, I decide on basic key words.	.57
(Item 16) Before starting to search, I examine my homework's content.	.65
(Item 20) Before starting Internet search, I generate certain questions about the topic.	.53
(Item 21) When I did not find any related site on my first attempt, I try other key words.	.55
Control of Attention	
(Item 14) If I do not find any related site, I give up searching any more.	.53
(Item 15) During the examination of sites related to my homework, I check my e-mails.	.55
(Item 17) The Internet search is the most time consuming part of my homework.	.68
(Item 22) During the examination of sites related to my homework, I chat with my friends.	.56
(Item 25) If I find the whole information in one site that I search for, I do not need further search of more sites.	.51
Generating Strategies	
(Item 11) I know approximately how much time to spend on Internet search.	.57
(Item 13) I take some notes about examined Web sites.	.66
(Item 23) While examining the sites. I generate special strategies to understand easily.	.56
(Item 24) Before visiting the sites, I quickly scan the list of sites.	.69
(Item 28) While integrating different information, I generate my own strategies.	.53

In order to understand the consistency of the instrument, a 4-week interval of test-retest reliability was performed. Pearson correlation coefficient (r) was used to calculate the relations. Correlation between the results of first administration of the whole scale and the second administration, after 4 weeks, was found to be significant (r_{MIIS} = .84, p < .01). Correlation coefficients for factors were also significant. The summary of test-retest results can be examined in table 3.8.

Table 3. 8

Reliability and correlation coefficients

Factors	Cronbach α for EFA	Cronbach α for CFA	4 weeks interval Test-Retest (r)
(1)Reflection and Regulation	.76	.74	.87**
(2) Monitoring	.78	.76	.90**
(3) Planning	.76	.75	.93**
(4) Coping with Distracters	.64	.70	.89**
(5) Generating Strategies	.62	.68	.86**
Instrument	.83	.83	.84**

**Correlation is significant at the 0.01 level.

As a result of these development periods, MIIS was developed and piloted with 251 7th and 8th graders through EFA. 37 items revealed 5-factor solution. However, two factors were combined because of their similarities with respect to metacognitive skills. In that study, 7 items had been removed due to their low loadings and 4 items had been revised due to close loadings. After the revisions, the first version of the scale was administered to 273 7th graders. Again a 5-factor solution was decided as appropriate through EFA. The loadings and reliability coefficients showed that the scale seems reliable and items fit factors within an acceptable range. Finally, to prove the consistency of the constructs, MIIS was distributed to 321 7th graders. In addition, a 4-week interval test-retest reliability was also administered with 101 6th graders. The results confirmed the consistent structure of MIIS.

The nature of measured constructs is very complex because the phenomenon is completely internal. What is supposed to be achieved with MSIIS is to rely on self-ratings of individuals, which makes the measurement much complex. Literature reveals various facets of metacognitive skills. Therefore, deciding on definition and categorization of constructs is not so easy. Despite these limitations, the generated and confirmed factors were found meaningful. The contents of each factor are in line with the literature.

3.4.2. Patterns of Adaptive Learning Scales (PALS)

PALS (see Appendix B) was used in this study to measure students' goal orientation types. It had been originally developed by Midgley et al. (2000) within an eight year period. Different scales of PALS had been tested across different samples by group of researchers. Although PALS includes many different scales both for teachers and for students, in this study only personal achievement goal orientation scale was utilized. The revised version of the scale with 14 items was used (5 items for mastery, 5 items for performance-approach, and 4 items for performance-avoid). Mastery goal orientation refers to the tendency to develop abilities. Performance approach goal orientation reveals the tendency towards demonstration of abilities whereas performance avoidance goal orientation shows the patterns of avoidance of demonstration of abilities. 5 point Likert type scale was used (1 = Not at all true; 3 = Somewhat true; and 5 = Very true).

PALS was reported as a valid and reliable instrument in the literature, but all of the studies tested it in English. In this study, the sample is Turkish, thus before the administration of the PALS, it was translated into Turkish by researchers and some contents of the items made specific. For example, for one mastery goal orientation item, the course name was written specifically as Science and Technology because the content of the overall search tasks would be gathered from this course's curriculum. Then, a

bilingual Turkish teacher reviewed the scale and detected a few errors. After necessary revisions, two colleagues checked the final version of the scale. Before the real use, a seventh grader was asked to complete the scale as she thinks aloud. During the cognitive interview, no misunderstandings or unclear point were discovered. 143 students (51 sixth graders; 57 seventh graders; and 35 eighth graders) were participated in the study. They were from Z Elementary School, a public school in Ankara. The data were collected during 2008 Spring semester. Table 3.9 summarizes the comparison of reliability values of the scales with different versions. Turkish version can be concluded as reliable as the coefficients are above the cutoff point of .60.

Table 3. 9

Reliability coefficients

Scales	Cronbach α of English version	Cronbach α of Turkish version
(1) Mastery	.85	.88
(2) Performance Approach	.89	.77
(3) Performance Avoidance	.74	.77
Instrument	-	.90

Confirmatory Factor Analysis

In order to confirm the construct validity of the scale and to decide if the translated and adapted version of PALS is consistent with the original model, CFA was conducted with the utilization of LISREL 8.51 (Jöreskog & Sörbom, 2001). Maximum likelihood estimation was used to see whether 14 items fit well the 3 latent scales which are mastery, performance approach, and performance avoidance. Data analysis within LISREL revealed that chi square is not close to zero, thus the probability level is below .01 (χ^2 (df = 74) = 191, $p < .01$). It can be interpreted as an expected but undesired result. In other words, since the number of cases can be considered high, which might increase

the sensitivity of chi test. That is why, other goodness of fix indexes were explored. Absolute fit indexes (RMSEA = .013, < .06, SRMR = .10, < .80, GFI = .94, >.90, AGFI = .91, > .90) produced the goodness of fit. Besides absolute indexes, incremental fit indexes (NFI = .89, > .90 and CFI = .92, > .90) also confirmed the overall fit of the model, although normed fit index (NFI) is slightly below .90, it can be still in optimal index value (>.88) (Sivo, Fan, Wittat, & Willse, 2006). All loadings are higher than .50. Table 3.10 listed the standardized loadings of the scales ranging from .76 to .94.

Table 3. 10

Standardized loadings

Items	Loading
Mastery	
(Item 1) It's important to me that I learn a lot of new concepts this year.	.94
(Item 5) One of my goals in class is to learn as much as I can.	.91
(Item 7) One of my goals is to master a lot of new skills this year.	.92
(Item 8) It's important to me that I thoroughly understand my class work.	.84
(Item 13) It's important to me that I improve my skills this year.	.87
Performance Approach	
(Item 2) It's important to me that other students in my class think I am good at my class work.	.90
(Item 4) One of my goals is to show others that I'm good at my class work.	.88
(Item 9) One of my goals is to show others that class work is easy for me.	.87
(Item 11) One of my goals is to look smart in comparison to the other students in my class.	.87
(Item 14) It's important to me that I look smart compared to others in my class.	.76
Performance Avoid	
(Item 3) It's important to me that I don't look stupid in class.	.90
(Item 6) One of my goals is to keep others from thinking I'm not smart in class.	.84
(Item 10) It's important to me that my teacher doesn't think that I know less than others in class.	.86
(Item 12) One of my goals in class is to avoid looking like I have trouble doing the work.	.86

Statistical results confirmed that the translated version of the scale works well meaning that the model fits. As considerably high standardized loadings revealed, each

item can be considered as a good representative of each related factor. Like English version, Turkish version of PALS might be used to understand personal goal orientations of students.

3.4.3. Achievement Test

An achievement test was prepared parallel to the contents of the performance tasks to examine if the students understood what they investigated and performed throughout the interventions. The achievement test questions were prepared with the help of a Science and Technology teacher, and it consisted of 7 questions (see Appendix C). All questions were parallel to the assigned performance tasks which were designed with the help of Science and Technology teacher. 6 questions were open-ended. Among them, 4 questions requested for explanations of reasons with their own words since the aim is to measure if students learned anything from weekly Internet searches rather than copying and pasting information. Although the tasks assigned to students included in Science and Technology course curriculum, the contents of questions asked were not directly accessible in the course textbook. In addition, most of the tasks and questions in the test required some level of interpretation. 1 question required direct information and 1 needed explanation with an example. Other than these 6 questions, one additional question included 4 sub-items. It can be considered as a kind of true/false question type. It asks whether the fruits given under the sub-items are grown in Turkey, and the reasons were also requested whatever the answer (true or false) is. The points given for each answer were also included in Appendix C. The evaluation of the achievement tests was done with the help of Science and Technology teacher. The researcher and the teacher met to evaluate the answers. The open-ended answers were discussed and after the concensus, the final grades were given.

3.4.4. Computer records

Students' records (see Appendix D) were collected through two methods. For WBS group, the tool keeps logs of each search session on an online database. Students' inputs, visited websites, and spent time are all accessible via this database. For other groups, all sessions were screen-recorded with the help of Snagit screen capture software. In case of technical problems, all history files' backup was kept after each session.

3.4.5. Performance works

Students' performance works (see Appendix E) were collected during five weeks as a result of each search activity. These performance works were used to observe how students' knowledge was developed during 5 weeks. In addition, students' use of own words and interpretations were expected to give clues about their metacognitive development. They were assigned to search the web, find and write the necessary information. They were free to write with or without interpretations. In these assignments, there were two-step questions. While the first step did not necessarily require the interpretation of the found information, the second step was very hard to answer without certain amount of interpretation.

3.4.6. Weekly reflections

After finishing each search session, students wrote their reflections about what was searched (see Appendix F). They were requested to think about their search experience as well as about the searched topic and to write about it. At the end of the study, students wrote 5 reflective journals and these were used to understand and observe students' metacognitive developments.

3.5. Procedures of the Study

In this section, the pilot study conducted before the actual study was explained first. Piloting the instruments, tool, and the overall design of the study led to some changes in the actual design. The procedures of the actual study were summarized under the actual study heading.

Pilot Study

Before the actual study, a tentative study was designed to discover if there is something not working. The pilot study took place in X Elementary School in Ankara in 2008-2009 Spring semester. 25 seven grade students voluntarily participated in the pilot study. There were equal number of students in the experiment groups (N_{wiss}=8, N_{ts}=8) and 9 students in the control group. All interventions that were to be done during the actual study were done during the pilot study. The last version of WISS tool was also used. Student's logs were recorded. Performance Works were completed within 5 weeks. Reflections were collected after each search task, and revised versions of all instruments were administered.

Throughout the pilot study, some obstacles were explored:

- PCs had to be checked all the time because there was no guarantee for full-functioning. Because of that, before each session, the researcher had to come early and make sure if all computers work well.
- Schools' bandwidth is generally restricted. It was observed that students were shutting down the program if the connection was lost. In order to prevent data loss, in the actual study the students had to be trained for such emergency situations.

- In the pilot study, there were no collected data about achievement levels of students. In the real study, their GPA scores and an achievement test was included.
- Before the actual use of the tool, students were trained about how to use WISST, but some difficulties were discovered. Therefore, in the actual study, the students were allowed to practice with the tool before the study.
- While piloting, teacher scaffolding group was observed to be weakly scaffolded because the teacher did not know much about scaffolding strategies. In the real study, the teacher was trained more than two weeks about how to scaffold. Documents were provided, then individual talks occurred, and the teacher contacted either via phone or e-mail whenever she needed.

Actual Study

This study was conducted during 2009-2010 Spring semester. In the beginning of the semester, informed consent forms were delivered to parents. The treatments took place during regular class hours, 40 minutes per week. All students had an identification number and the data were brought together with the help of these numbers. This is especially crucial in order to understand the relationship between metacognitive skill development and goal orientation types.

The teacher who provided scaffolding for TS group were conducted in the beginning of the first semester. First, she led to figure out what the scaffolding is. During the semester, the teacher and the researcher met whenever the teacher had questions about the provided samples and documents. Since the teachers' English was not at an advanced level, the researcher frewuently assisted the teacher while dealing with the provided materials. At the end of the first semester, the teacher practiced the

metacognitive modeling, strategy use, and scaffolding with a few students. In the beginning of the second semester, the teacher was ready for the study, but still needed some help during the first week, because that was her first trial with a crowded group needing scaffolding. The teacher's training outline was attached in Appendix I.

In the beginning of the semester, students were given pre-metacognition inventory for internet search (pre-MIIS) and patterns of adaptive learner scales (PALS) in the first week of the semester. Those who are in the experimental group received a 15-minutes training about how to use the web site in the second week. The search tasks were assigned to learners for each week. Each task was chosen from the current unit of Science and Technology curriculum. The instructor, all contents and their orders were the same for all groups.

The first group searched the assigned topics on the web with the help of software providing scaffolding of metacognitive processes through question-answer method. The second group received traditional scaffolding, i.e. the teacher provided help to improve metacognitive processes. The last group completed the tasks as usual, i.e. without any help. The treatments took 5 weeks. Each week, students performed a different search activity. Each group completed a total of five search activities by the end of the treatment. Each search task included one fact-finding and one interpretation question. Students were requested to complete each performance work per week within approximately 30-40 minutes. They also were requested to write reflective journals on previous week's search process and gathered information for each week. For web-based scaffolding group, logs (visited sites, ranks of visited sites, time spent for the search, number of keywords, number of sessions, number of keyword changes, and copy pastes) were kept, and for teacher scaffolding and no scaffolding groups, computer screens were captured during the search activity. Then, post-MIIS and achievement tests were distributed to all participants of the study.

3.6. Web-Based Internet Search Scaffolding Tool (WISST)

WISST was designed by the researcher according to the proposed framework of Quintana et al. (2005). In this framework, there are certain offerings for effective scaffolding that are applicable for both human and software scaffolding. This tool aims to scaffold users throughout web searching by emphasizing certain metacognitive skills improvement. According to Quintana et al. (2005), through an online inquiry, children experience certain cognitive phases. The inquiry starts with asking questions, then the searching occurs, and then evaluating and reading comes. Synthesizing is the final cognitive step. Authors suggested that those steps can be scaffolded by certain approaches. Web-based scaffolding approach utilized on WISST focused on these approaches. According to suggested framework (Quintana et al., 2005, p. 237) some considered strategies applied in the WISST can be summarized as follows:

- Asking question: Provide driving questions; help to integrate results of multiple searches in one space.
- Searching: Encourage users to find rich resources; make search steps visible; help users to decide on keywords before searching; show the search history.
- Evaluating and reading: provide a prompted notepad; show users their goals; provide users with a list of evaluation criteria.
- Synthesizing: Encourage users to compare and contrast information across different resources; describe the criteria they should use; prompt users to reflect on different aspects of information.

The main components designed in WISST were '*start', 'search', 'reading*', and *'end'* modules and entrance to the tool is restricted with user name and password. Although the components were designed as separate modules, they work in a meshed

manner depending on the input of the user. The user has freedom to jump from one component to another. A small metacognitive training video providing tips for effective web search is presented to users when they first login to the system, and it is accessible whenever needed via '*help*' button. The aim of this module is to make users become aware of certain cognitive and metacognitive processes, obstacles, and challenges during an Internet search task. In this video, each step of a sample search is exemplified with the problem points and coping strategies.

In a typical search task, users are expected to start the search by entering the keywords, aim, and the previous knowledge. Then, the generated results are examined to choose what to visit next. If the user finds a relevant link, s/he visits that website. If there is nothing meaningful on the list, the user can decide either to change the keywords or to re-visit the results. Reading module starts when the user clicks on the web site's link. In this module, users can take notes by provided citation button. While leaving the page, users are encouraged to think about their reading performance through answering the presented questions about relevance and security of information. In this module, users also have to decide on what to do next. If they decide to continue the search, they go back to start module with either new or previous keywords. On the other hand, they can choose ending the whole search, and then enter needed information about their whole search. Exit button is accessible anytime and anywhere of the software. Figure 3.1 demonstrates the screenshot of the tool's last version.

Start Module: When the user login the system for the first time, a help video provides learners strategies and steps for an effective search. It also describes how to cope with the integration of results from different sites. Moreover, to initiate building right schemata of searching, the whole search strategies were exemplified starting from how to ask appropriate questions before initiation of the search.

Search Module: In order to encourage students to expand their scope of search, the search steps are made visible on a part of the screen. In this module, learners are asked to think about the aim of their search, previous knowledge about the assigned topic, and to decide on keywords. Users are not allowed to start the search without

answering these questions. Entered aim, keywords, and visited sites are visible on the screen during the whole search. Users are allowed to either change their aims or keywords completely or edit partially whenever they need. In addition, they can revisit previously visited sites by just clicking on the site listed at the bottom of the screen. Those sites are listed according to line of visit.

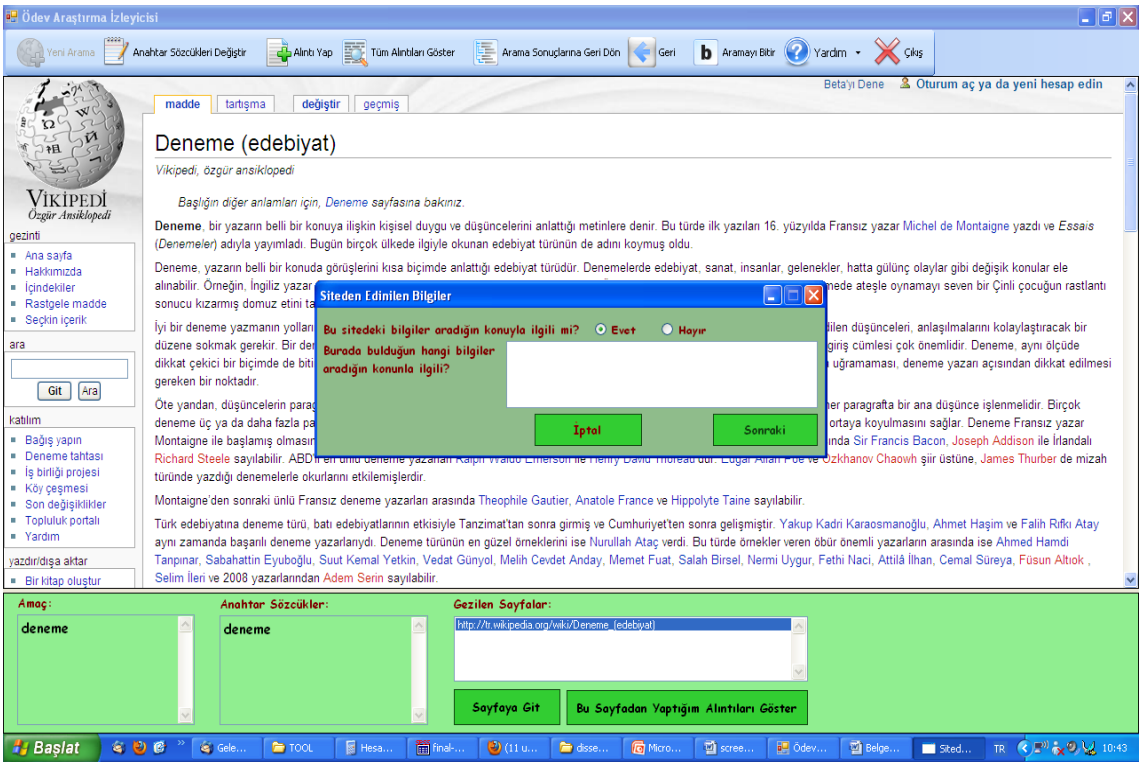


Figure 3. 1 Screenshot of WISST

Reading Module: A prompted notepad is available at the middle top of the screen. It allows users to check the copied and the pasted information. Users can edit the information or add their own interpretations. To enable the monitoring process of comprehension, after visiting the sites, following questions were asked:

1) Is that site related with your performance work topic? Why?

2) Does this site seem trustworthy? Why?

3) Do you think you have found all needed information?

4) Do you need more search?

Students were expected to answer all questions in regard to the sites they visited.

End Module: Learners faced with the following questions when they intend to terminate the session:

1) What is the topic of the search?

2) What have you learned from this search?

3) Which of the information you found was the most interesting? Why?

By answering these questions, they were expected either to think about the whole search steps or to compare information needed before the search and information gathered after the search. In this screen, cited information was also presented to the user to help them remember.

3.6.1. Usability of WISST

In this part, the development process of WISST was presented under 5 iterations. In the *first iteration*, the prototype of WISST (WISST 1.0) was designed based on the created scenario. In the *second iteration,* the tool was designed with limited funtions (WISST 2.0) and feedback from the potential users was gathered through focus group interviews in addition to experts' heuristic evaluations. In the *third iteration,* the actual tool was created (WISST 3.0). Its usability was checked with the help of eye-tracking technology. The *fourth iteration* included expert evaluations. After all necessary changes, the *fifth iteration* was the last one including the control of funtions.

In order to eliminate the errors, to test the appropriateness for the level of the users, and to adjust the functioning of the tool before using it in actual study, a user-centered iterative design approach was used throughout the design and development of the Web-Based Internet Search Scaffolding Tool (WISST). Iterative design begins with design, testing and measuring, and continues with re-design, re-test and re-measuring. These steps continue in a loop and stop when the satisfactory results are gathered (Shackel, 1991). The process was conducted with the primary users and the design of the WISST was improved on the basis of empirical data gathered from iterations as indicated by Mack & Nielsen (1994). Since the final product was supposed to be used in real educational context, primary users were included in the study. The iterative design continued until the usability evaluations results indicated satisfactory findings. The aim of the tool is to help students search purposefully in the Internet through certain scaffolding strategies implemented in the tool. The formative evaluation of WISST was completed in four basic iterations.

Iteration 1: Prototype (Version 1.0)

The purpose of WISST was to enhance and contribute the web search experience of middle school students by getting metacognitive strategies into use. The design process of the tool started with in depth literature review. Quintana et al.'s (2005) framework guided the design process. In the light of their suggestions, the interface design was storyboarded (Figure 3.2)

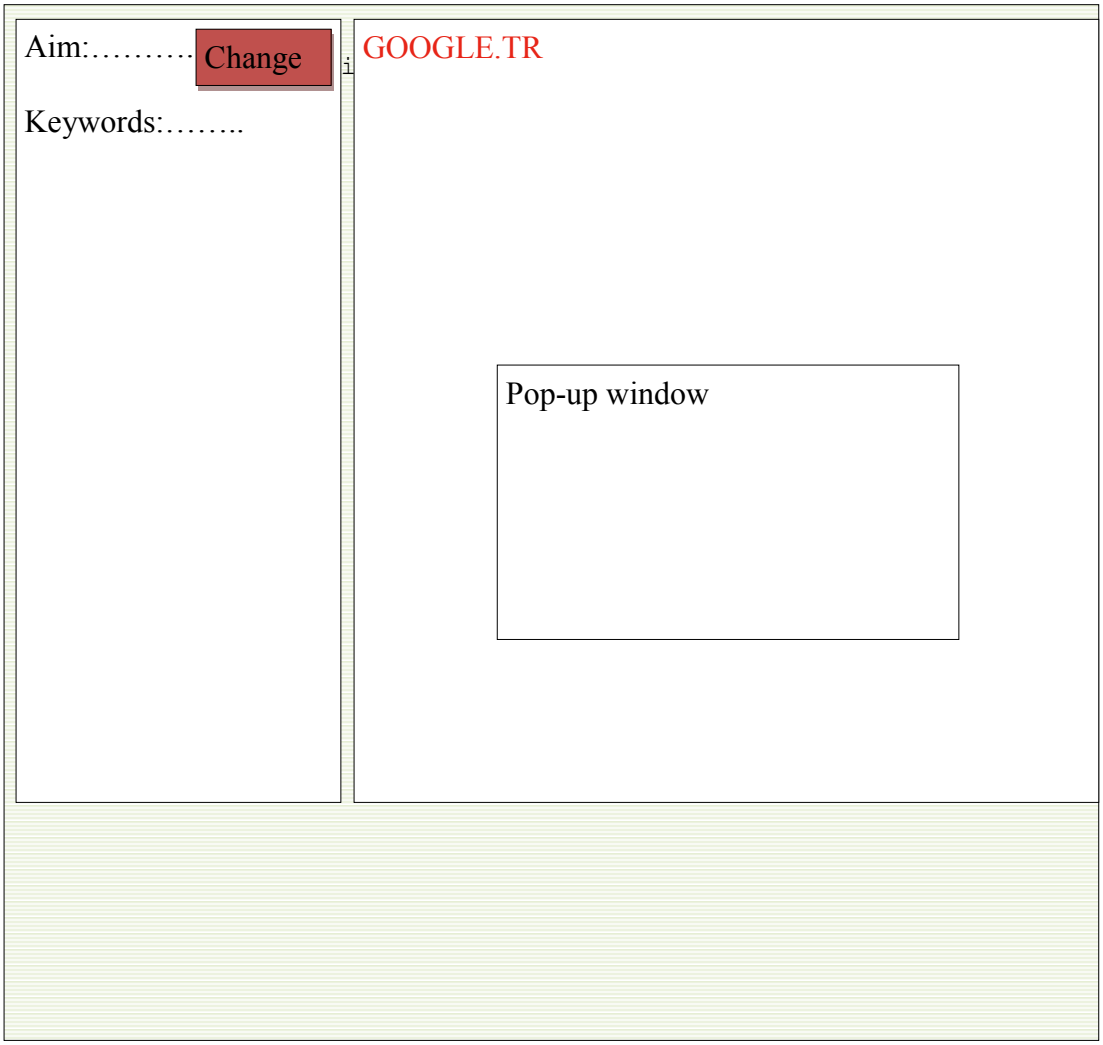


Figure 3. 2 Prototype of WISST Version 1.0

A tentative scenario was created in details (see Appendix G). The software engineers benefited from this scenario while programming WISST. During this iteration step, the researcher and the programmers frequently met and discussed about the overall functioning of the tool. At the end of this stage, a partially functioning version was created (see Figure 3.3).

Iteration 2: Interface with limited functions (Version 2.0)

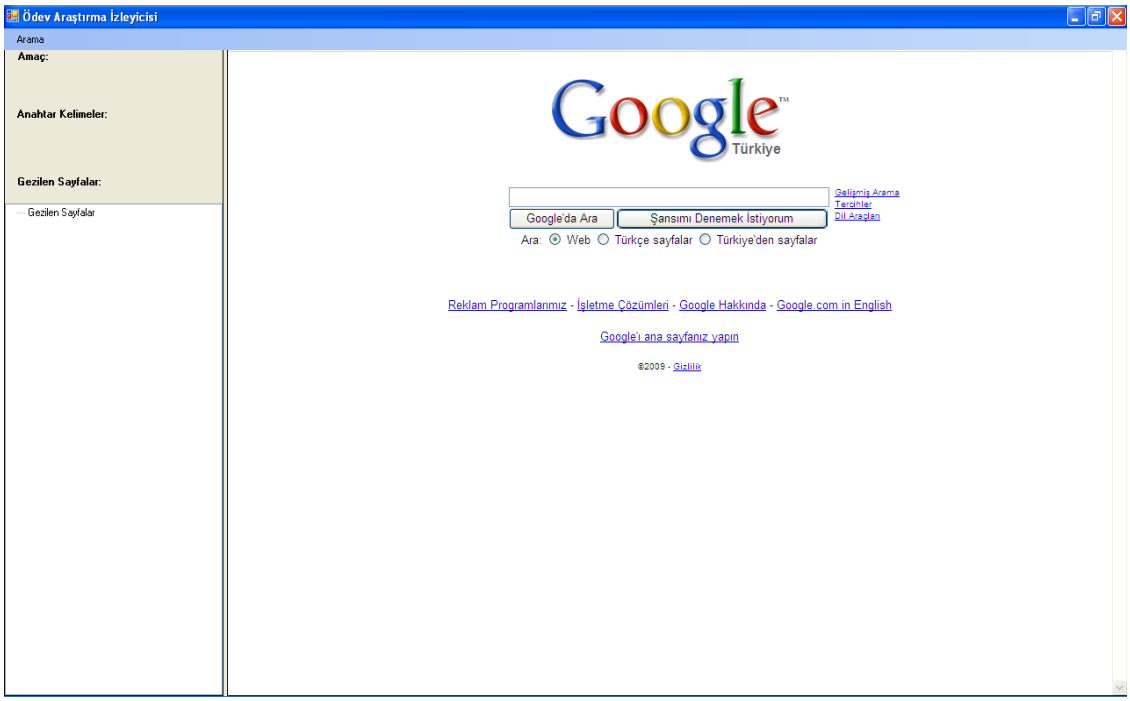


Figure 3. 3 WISST Version 2.0

The first version of the tool was only a paper-based prototype, thus programmers worked on it and produced an interface with little functions. There were all components included in the scenario. This was called WISST 2.0. There were a few changes in the design. In the paper-based version the history part was designed at the top left corner, but in the interface history part was located vertically on the left.

The second version (Figure 3.3) was not fully functioning but the available interface and simple functions were enough to get the users involved to share the impressions about the tool. In this version, there was a menu item named ‘Arama (Search)’ at the top of the page. ‘New search’, ‘quotation’, and ‘end search’ were the sub-menu items. Left side of the page consisted of search history items. On that part, the

aim of the search and keywords were listed in addition to visited web pages list. The user was allowed to change the inputs anytime s/he wants. The visited sites could be re-visited by clicking on the address listed on the left column. In this version, users were also asked to answer varieties of questions ranging from the purpose of the search to the most interesting information found. Pop-up windows emerged whenever user input is needed.

For this iteration, 45 students (15 students from each grade level; 6th, 7th, and 8th graders) participated in the study. The users were selected from a public school. Although the real users provide valuable feedback, they were not the designers (Oosterholt, Kusano, & Vries, 1996). Therefore, in addition to the real users, 4 IT experts provided feedback for the tool in the development period.

Focus Group Sessions for Version 2.0

In order to understand the target users' perspectives, the focus group interview method was used. This kind of group interview allows the researchers to discover users' needs through open-ended questions and inquiries (Barnum, 2002). It is preferred in the early iterations because of qualitative data gathered about users' habits and preferences would shape further design steps. The focus group sessions took place in a public school in Ankara, Turkey. In this school, there were two computer laboratories and focus group interview took place in one of these laboratories. Each focus group lasted two 40-minutes consecutive sessions. During the first session, the interface of WISST was projected on the screen. First, the students were asked to describe the way they would follow to complete their performance homework. Then, without explaining the overall functions and aims of the software, they were allowed to discuss and find usability issues, problems they face, and their preferences of the program with peers by facilitation of the researcher. Throughout the session, the software was only projected on a screen and the researcher explained the function of the software, provided information on the use or aim of the program, and answered students' questions. Then, students were

asked to express their first impressions and irritated items or functions. In the second session, blank cardboards were given to the students, and they were encouraged to draw or write their preferences of the software, and suggestions to solve the perceived problems. The sessions were audio recorded.

The focus group session records were transcribed, analyzed, and coded to diagnose users' Internet search habits, and perceived usability problems about WISST Version 2.0. The data gathered through group sessions were supported through analysis of drawings or essays of the students. In addition, the data were used to diagnose the solutions suggested by the target users by calculating the frequencies and determining the common concepts reported by the students. The findings from the focused group sessions emerged three main themes: (a) Internet search habits, (b) perceived usability problems, and (c) participants' recommendations.

(a) Internet Search Habits

Preferences: All participants explained that they conduct Internet search at least twice in a week to complete their performance homework. However, 3 students in sixth grade do not have a computer at home. The remaining students have computers at home, and use it actively. The most preferred search engine by the students is Google because of its ease of use and option provided for Turkish search.

Experienced Difficulties: All groups complained about broken links in the Web. Both 6th and 7th graders mentioned about the difficulty in accessing specific information due to misleading links or irrelevant list of results. In addition, 6th graders stated that they were confused easily and lost frequently within the result list.

Keywords: All participants found that deciding the keywords was easy. They generally use more than one keyword at once and just put a space between them.

Search Patterns: Without any exception, all target users stated that they start searching by extracting keywords from the performance homework question. Then, they enter those keywords in Google. When results are listed: (i) All 6th graders and 4 8th

grade students read explanations under links one by one in the given order; (ii) All 7th graders and the majority (9 students) of the 8th graders reported that they scan the titles; (iii) 2 8th grade students just click the first link. When they investigate the sites their strategies do not differ, i.e. they all benefit from titles on the pages. If the titles are appropriate, they continue to read. In addition, 7th graders use the titles as a reliability criterion. They indicate that if the site includes all the needed titles (the same with or similar to those in the homework), it can be inferred that the site is reliable. While 6th graders have no criteria for reliability of sites, 8th graders prefer to compare one site with another, and if the sites provide the same information, they mention that it is a sign for reliability of that site. Finally, all 6th graders prefer direct copying and pasting strategy to complete the work, but half of 7th and 8th graders stated that they generally feel that it is needed to add certain explanations to the copied and pasted information.

(b) Perceived Usability Problems

Almost all users' guesses about the aim of the software were to the point or close to the point. However, the menu titled "Arama" (search) revealed some problems. Five 6th graders anticipated that it was just a title. The rest of those group claimed that it allowed managing account options. Despite guessing the functions of the menu correctly, other groups pointed the visibility problem of the menu. Figure 3.4 demonstrates close and open positions of "Arama" menu.

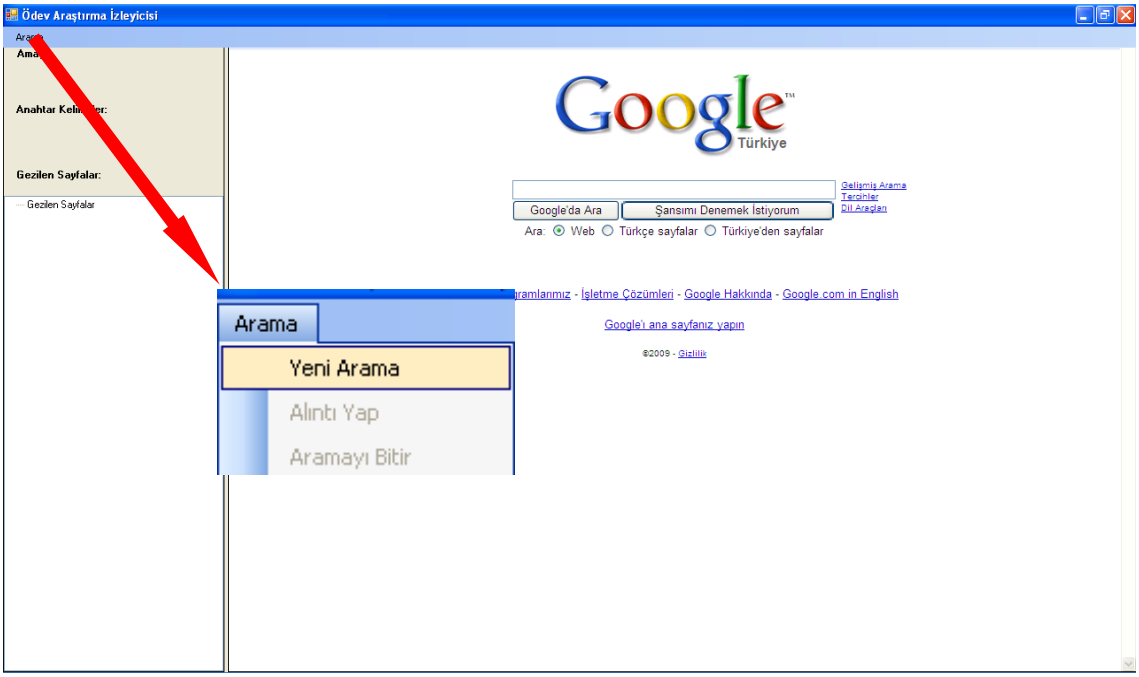


Figure 3. 4 Search Menu

Another perceived problem by the target users is related with pop-up windows requiring user input. Except for majority of 7th and 8th graders, the rest of the students found the questions posed by the tool too many and unnecessary. They stated that they did not need those questions. Indeed, 6th graders directly stated that copying and pasting do not require such questions, thus there is no need to think about the details. However, they also mentioned that it could be helpful if the sites were investigated well. Majority of all groups also stated that some questions in the termination part could help to judge the quality of the information in the site. An example of pop-up window and the questions can be seen in Figure 3.5.

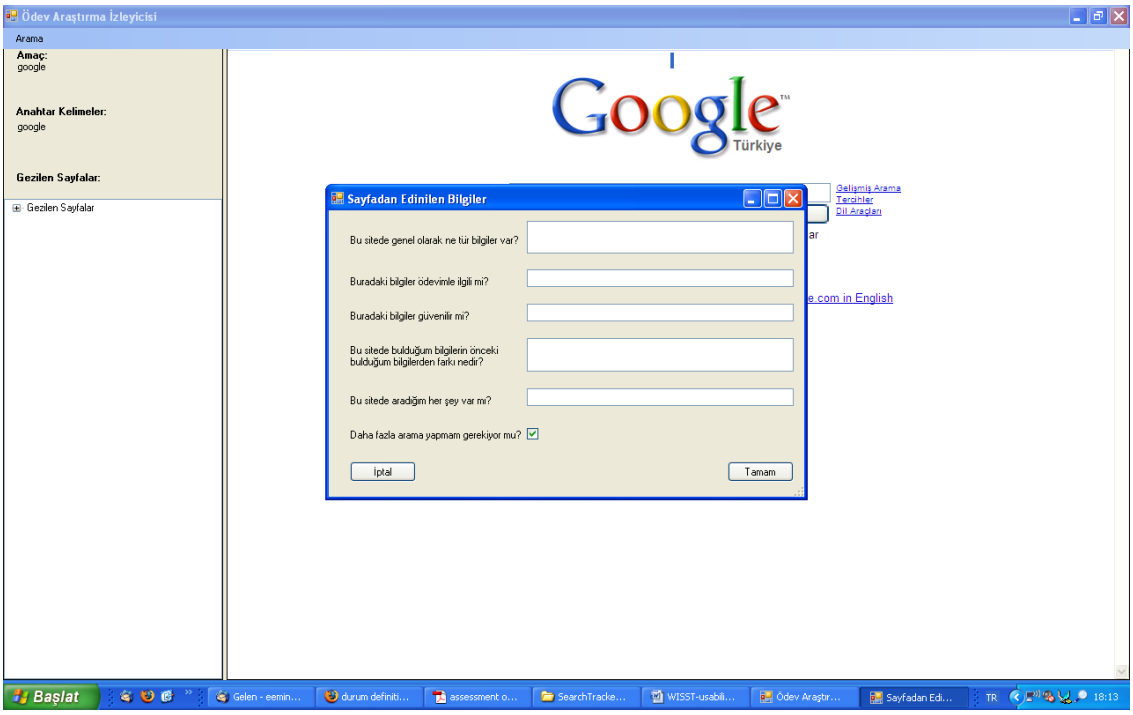


Figure 3. 5 Pop-up window including questions

"Alıntı Yap" (quotation) menu option was perceived as a problem by target users. Majority of 6th graders, two students from 7th grade and one student from 8th grade found "quotation" in this software difficult since they already do not either add any additional idea or reexamine previous quotations. Other users, on the other hand, found using "quotation" easier because they did not need to minimize the search window, and then to open or to maximize another document. In this way, time could be saved as indicated by some 8th graders.

(c) The Participants' Recommendations

The participants' recommendations were as follows:

- 34 users suggested color modifications: 14 users favored blue; 12 users green; 8 users red.
- 14 users suggested icon-based or button-based horizontal version of menu in order to make "start" and "finish" types of functions easier and visible to access.
- 12 users wanted the inclusion of some visuals like cartoon characters.
- 8 users proposed that the left panel should be moved top or bottom of the screen because of the demand for large search space.
- 7 users pointed the need for a space for note taking in addition to quotation part.
- 7 users demanded certain amount of customization of their accounts.
- 5 users wanted to change the fonts, styles, and colors of texts.
- 2 users suggested a help option.

Heuristic Evaluations of Version 2.0

Heuristic evaluation is a kind of usability inspection method (Barnum, 2002). Besides providing quick results, it is cheap and easy to use (Nielsen, 1993). In this study, Nielsen's 10 heuristics were guided for the evaluation. Four experts (3 instructional designers and 1 computer teacher) were asked to detect the usability problems. First, they were introduced the second version of WISST. Some assistance was provided them while exploring the tool. A sample task was demonstrated on the tool and any questions were answered to make sure the clarity of elements and functions.

Then, they rated the overall tool in accordance with provided heuristics. The severity ratings ranged from zero to four like in Nielsen's heuristic evaluation (0: not a usability problem; 1: cosmetic problem; 2: minor usability problem; 3: major usability problem; 4: usability catastrophe) (Nielsen, 1994). Experts were also asked for suggestions for further development.

In addition, experts evaluated the scaffolding dimension of the tool through a given checklist which was prepared by the researcher in the light of Quintana et al.'s (2005) framework. In this checklist, ratings were ranged from 1 to 5 (0: absent; 1: adapted in a wrong way…….5: adapted well). For this part, experts were also required to observe and report the places where scaffolding strategy was applied within the tool.

The collected heuristic evaluations were coded and common problems were identified. For each heuristic, total number of found problems was counted and severe problems were detected. Written suggestions of experts were also analyzed and coded. Scaffolding checklist ratings gave a total score. Finally, inter-observer reliability was calculated in order to understand how successfully the scaffolding approaches were adapted to the system.

(a) Severity of Usability Problems

Table 3.11 shows heuristics and problems found by the experts. Major usability problems column indicates the most commonly found problems. Severe usability problems column refer to serious problems rated as usability catastrophe. According to table 3.3, severe usability problems exist under 'user control and freedom', 'error prevention', and 'help and documentation' principles.

Table 3. 11

Usability problems according to experts

Nielsen's Heuristics	Major usability problems	Severe usability problems
1.Visibility of system status	-Lack of cue about system's current status. -Lack of cue about what to do next.	
2.Match between system & the real world	-"Quotation" item of menu may not be a familiar jargon for middle school children.	
3.User control & freedom	-There is no menu option to exit from the system and the only way is standard close buton on the right corner.	-The user is restricted with backspace key to return previous page and it is needed to be explored by the user.
4.Consistency & Standards	-Horizontal scrolling is not allowed. -Lack of consistency in language use (ex: target and aim were used despite referring the same things).	
5.Error Prevention	-There are no warnings to prevent further errors.	-The user can skip the input parts but the results were not listed and the system was locked.
6.Recognition rather than recall	-The user needs to recall where to start and what to do next.	
7.Flexibility & efficiency of use	-For quotation function, the use of Ctrl+C shortcut is not allowed.	
8.Aesthetic & minimalist design	-Menu cannot be distinguished from the title bar.	
9.Help users recognize, diagnose, & recover from errors	-There are no error messages.	
10.Help & documentation		-Lack of help or at least some hints. -Lack of tutorial.

Severity of found problems was listed in Table 3.12. While counting the found problems, the common ones across 4 experts were considered as a single problem. As

indicated in the Table 3.12, “visibility of system status” and “help and documentation” dimensions have the most number of problems. Secondly, “user control and freedom” part have considerable amount of problem. On the other hand, “aesthetic and minimalist design” part has the least problematic items. When ratings are considered, 27 issues were rated as cosmetic problems such as the placement of menu items. The least problems were found under usability catastrophe rating with 6 different problems diagnosed.

Table 3. 12

Severity of usability problems

	Ratings					
Heuristics	0	1	2	3	4	Total
1. Visibility of system status	3	4	7	2	0	24
2. Match between system & the real world	2	4	1	0	0	6
3. User control & freedom	2	1	1	2	2	17
4. Consistency & Standards	3	6	2	1	0	13
5. Error Prevention	0	0	2	1	1	11
6. Recognition rather than recall	4	5	1	2	0	13
7. Flexibility & efficiency of use	1	1	1	2	0	9
8. Aesthetic & minimalist design	2	2	1	0	0	4
9. Help users recognize, diagnose, & recover from errors	1	3	0	3	0	12
10. Help & documentation	1	1	1	3	3	24
Total:	**19**	**27**	**17**	**16**	**6**	**133**

(b) Suggestions of Experts

Experts’ suggestions can be summarized as below:

- In order to inform the users about the system status, a message should be made visible on the left panel.

- Cited parts during a search should be accessible in one space and the user should be allowed to edit when needed.
- Instead of citation option, more familiar terms such as copy and paste should be used.
- Input spaces on pop-up screens should be prevented to be skipped by deactivating "ok" button.
- In order to prevent further errors, error messages should be added.
- Previous inputs such as keywords, aim, and etc. should be available through an option.
- Help should be provided.
- A tutorial explaining where to start, how to continue, and how to terminate should be designed.

(c) Adaptation of Scaffolding Approaches

Scaffolding checklist (see Appendix H) was divided into 4 categories according to Quintana et al.'s (2005) framework. The mean values for each sub-item and their overall categories were listed in Table 3.13. When mean values were examined, A3 and ER6 sub-items were recorded as not adapted. Six items (SE2, SE4, ER4, SY1, SY2, SY3) out of 17 are below the average. Items above overall mean can be considered as successful adaptation. These items are A1, A2, SE1, SE3, SE5, ER1, ER2, ER3, and ER5.

Table 3. 13

Means of categories and sub_items

Scaffolding Categories	Sub-Items	Mean
Asking Questions	A1: Does the tool provide questions to the user before the search?	3.25
	A2: Does the tool enable to search more if the first trial of the user fails?	2.75
	A3: Does the tool provide a discussion platform for users to share ideas?	.00
Searching	SE1: Does the tool enable users to visit more than one website?	3.25
	SE2: Is the history of the user's actions visible?	1.75
	SE3: Does the tool enable students to decide on keywords before starting the search process?	4.75
	SE4: Does the tool define or describe the steps to be followed throughout a search process?	2.25
	SE5: Are all visited sites listed somewhere?	4.25
Evaluating& Reading	ER1: Does the tool allow the user to take notes while visiting the websites?	3.25
	ER2: Does the tool encourage the user to set specific goals before the search starts?	4.25
	ER3: Are set goals by the user visible?	3.75
	ER4: Is a help to enhance comprehension of what is read on a website provided to students?	1.75
	ER5: Is the user encouraged to reflect on the visited websites' trustworthiness, appropriateness, and relatedness?	3.25
	ER6: Does the tool provide with strategies to facilitate investigation of websites?	.00
Synthesizing	SY1: Is the user supported to compare visited websites?	.75
	SY2: Does the tool provide a list of criteria to lead reflection of what is read?	1.25
	SY3: Does the tool enable the user to evaluate or decide where and how to use the found information?	1.50
Overall Mean:		2.50

Overall mean (M=2.50) can be interpreted as 50 % adaptation. Reliability coefficient of the scale was found strong (□=.93). While evaluating each item, experts also reported where the strategy was applied within the interface. They were analyzed as wrong location (the expert location does not match with the theorized location); correct

location (the expert found the same location as theorized); and no answer. The distribution of answers among 17 items was summarized in Table 3.14.

Table 3. 14

Location diagnosis

Sub-Items	Wrong Location	Correct Location	No Answer	P_i
ASK1	0	3	1	.50
ASK2	2	2	0	.33
ASK3	0	0	4	1.00
SEARCH1	1	3	0	.50
SEARCH2	0	3	1	.50
SEARCH3	0	4	0	1.00
SEARCH4	0	3	1	.50
SEARCH5	0	4	0	1.00
EV_RE1	0	4	0	1.00
EV_RE2	0	4	0	1.00
EV_RE3	0	3	1	.50
EV_RE4	0	2	2	.33
EV_RE5	0	3	1	.50
EV_RE6	0	0	4	1.00
SYNTH1	0	1	3	.50
SYNTH2	0	2	2	.33
SYNTH3	0	2	2	.33
Total	3	43	22	
p_j	.047	.067	.344	

Fleiss' kappa (κ) enables to find out inter-observer reliability when the number of raters is more than two (Fleiss, 1971). In order to understand how successful the adaptation of scaffolding approaches implemented in the tool, this measurement was utilized. In this way the agreement between experts will be revealed. Fleiss' kappa value was calculated as $\kappa = .585$, $Var_{(\kappa)} = 6.176$, and $SE_{(\kappa)} = .025$. This κ value is in between intermediate to good strength of agreement (Fleiss, 1981 as cited by Emam, 1999). In

addition, $\kappa / SE_{(\kappa)} = 23.40$ value indicates that overall agreement between experts in terms of diagnosis of locations within the tool is significantly above chance.

Conclusion for Iteration 2

Results and findings clearly imply that the design of software is not or should not be a one-shot process. Especially, involvement of target users in the early stages of design contributes to decide on what to do next with the interface (Barnum, 2002). By considering that importance, the iteration started with analysis of users' Internet search habits. Although there are some slight differences between different grade levels, a common search pattern can be inferred. They generally do not prefer to conduct detailed search. They stop when they find all in one no matter whether it is the first site visited. However, in order to be sure whether that information is adequate or not, they visit a second site and if the titles or information included are the same with the previous one, then they decide on terminating the search process. All students face some difficulties during searching (Bar-Ilan & Belous, 2007). Findings suggested that broken links are the most common one.

Unlike other levels, 6th graders experience more confusion. This might be related with the amount of previous experience. On the other hand, they all look for ready-to-use and specific information, but this is considerably hard for especially 6th graders. This finding is consistent with previous research done regardless of age (Chau et al., 2008; Large & Beheshti, 2000). Titles and explanations serve as visual cues for the majority. In this way they decide on which site to go. For completion of performance homework, they generally prefer copy-paste strategy. Unlike 6th graders, half of other groups sometimes add their own words. In short, results generally implies that amount of previous experience affects patterns of Internet search and that might be the reason why 6th graders' answers differ from others. Tabatabai and Shore (2005) concluded that being novice or expert was observed as affecting navigational patterns and the overall search performance. On the other hand, Gerjet and Hellenthal-Schorr (2008) claim that

the level of expertise and age or grade did not determine or guarantee certain level of Internet search competence or effectiveness.

Focus group analysis revealed that the appearance and functionality of menu have certain problems. Students were irritated with the placement and background of it. In other words, they perceived it as just a title because of being located on a blue bar. Some students found questions on pop-up windows unnecessary and time consuming. This might be because they just start searching by entering keywords and continue with copy-paste. However, others who prefer to organize or add something of their own found those questions as a checklist to control. "Quotation" function of menu was also perceived as a problem by especially 6^{th} graders, but others found it easier due to elimination of a few steps.

Results of expert evaluations pointed that "visibility of system status", "help and documentation", and "user control and freedom" parts of the WISST need revisions in details. Lack of cues, hints, and help were commonly reported problems. Such common problems were also found by students. For example, quotation part was criticized by both students and experts. Experts generally focused on the functionality dimension of the system while students offered cosmetic solutions. Experts' main suggestions were related with error prevention by providing more flexibility. On the other hand, target users suggested a colorful screen with blue and green. They offered a button-based navigation rather than menu. Another important suggestion was the addition of a new feature: a space for note-taking. Actually, this could be accomplished via improving quotation options. Some of the students offered moving the left panel which can enable a totally different design.

Since WISST was built upon a theoretical framework, it is necessary to discover how well the strategies were adapted into the system. Expert evaluations showed that except for 2 strategies, all of them were adapted to an extent. However, adaptation success is not perfect as mean values indicated. Overall mean is 2.50 meaning that there is a 50 % successful adaptation. 9 items over 17 were calculated above average. In other words, there are nine strategies which were not found problematic by experts. In order to

support this finding, Fleiss' kappa value was calculated. The found value was moderate meaning that the strength of agreement between 4 experts is in between intermediate to good. Results also indicated that overall agreement is above chance. Therefore, the scaffolding part should be revised in the light of those ratings in order to improve the quality of adapted strategies.

The tested version of the tool can be thought as high-fidelity prototype. Getting feedback from the real users through such a prototype is helpful especially at the middle stage of development in order to continue to develop the tool according to the users' needs (Barnum, 2002). This iteration enabled to fix and even change the design of the tool both by emphasizing the users' point of views and by getting feedback from experts before it became too late to change.

Iteration 3: WISST Version 3.0

Collected data in the second iteration was considered to revise the third version of the tool. The findings were shared and discussed with the software engineers. All suggestions of users and experts were taken into account and tried to be achieved in line with the framework. The following basic changes were done for WISST 3.0:

- The second version of the tool was not very colorful. In version 3.0, different tons of green and blue were used.
- The overall layout was found ineffective by some users because the vertical bar presenting the user actions and history was occupying a considerable amount of search space. That is why, the whole design of the interface was decided to be changed completely. Instead of vertical space, the history and action elements were moved bottom of the screen horizontally.

- Menu was perceived as problematic by the users. In order to make it catchy, menu items were spread horizontally at the top of the interface. In this version, menu items were converted into icons.
- Quotation menu item was limited in the previous version. Moreover, users demanded a place to take notes. The two options were combined under one icon named 'note taking.' Whatever written or copy-pasted by the user made accessible through this icon. In addition to this feature, 'show quotations' and 'go to this site' buttons were added to the history section. In this way, users were allowed to see what was copied from which site. Ctrl+C and Ctrl+V shortcuts were enabled.
- The questions were found unnecessary by users, but they have theoretical values to achieve scaffolding. According to expert evaluations of 'Evaluating and Reading' and 'Synthesizing' adaptations, the presentation of questions was either weak or unsatisfactory. That is why, the questions were revised and made simpler and more focused. Especially, the questions were added to help users decide on what to o next and why. For example, they were asked to reflect on what is found on the web site and what should be done for further process.
- Experts rated two of the search items as low. Visibility of actions' history was reported inadequate. To make it clearer, input page included more than one option referring either what is done before or what will be done next. For example, if the user chooses to end the search, s/he is presented her/his list of copy-pastes or notes and required to answer a couple of questions. Then, s/he has options either to continue without saving or continue to save the data to a preferred storage space.

Figure 3.6 shows the third version of the tool after necessary revisions. The aim of this iteration was to collect quantitative data to see whether users' needs were met

after revisions in terms of design issues. The following issues were considered to evaluate the usability of WISST 3.0:

(1) If users had difficulties while locating key navigation elements (new search, end search, and change keyword icons).

(2) If there were any biasing navigational elements on the screen.

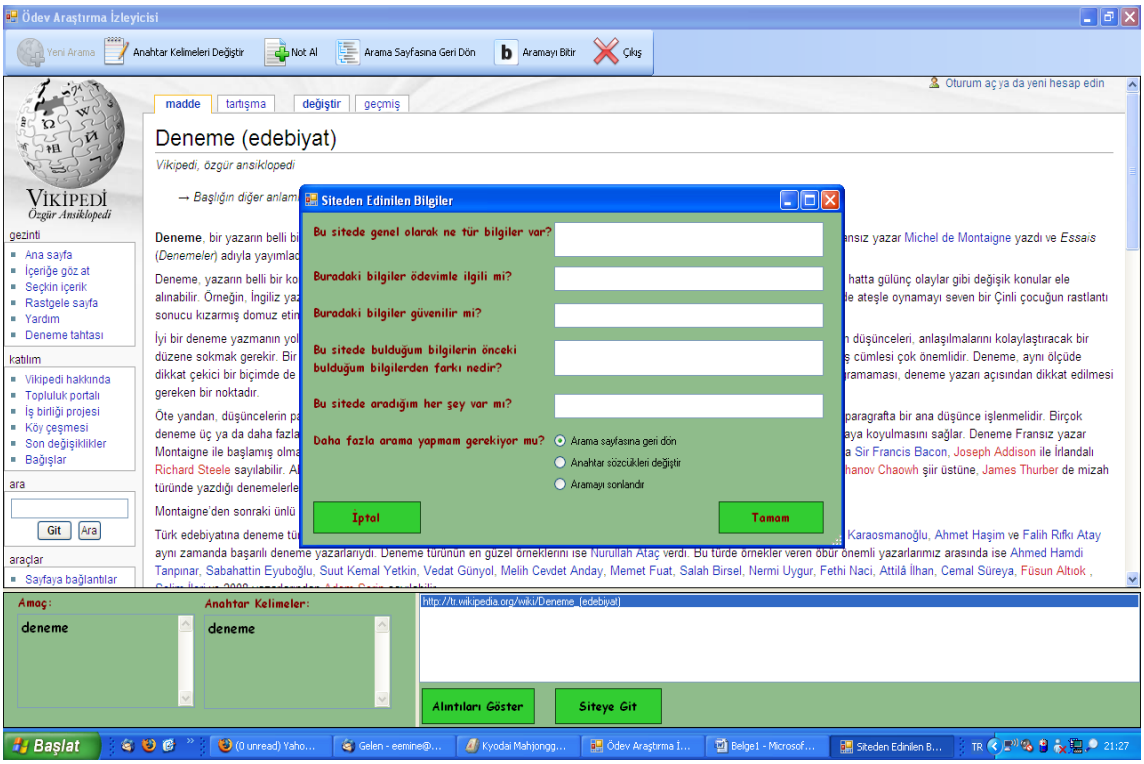


Figure 3. 6 WISST Version 3.0

To test the usability of the new design, volunteer users from the target group participated in this observational study. Participants are used to searching the web for performance homework of their regular classes. 11 seventh graders from 3 different public schools in Ankara used the WISST 2.0 in the Human Computer Interaction

laboratory located at Middle East Technical University. In the testing room, there was a PC with 17 inches monitor set at 1024x768 resolutions. There was also an adjustable chair for the user and a chair and a small table for the observer. All sessions were also video recorded. Tobii 1750 Eye Tracker (Tobii Technology AB, 2008) with 50 Hz sampling rate was utilized to record eye-movements while the user interacting with WISST 2.0. The eye tracker has 0.5^{o} accuracy and $.25^{o}$ spatial resolution. Its freedom of head movement is about 30x16x20 cm (WxHxD) at 60 cm away from the tracker. Camera field of view is 21x16x20 cm at 60 cm distance. The Tobii 1750 allows binocular tracking.

After completing necessary permissions, each student was scheduled to come to the lab. Since the aim of the observation is to discover if the tool work well, no software training was presented to the participant. Three tasks were given and expected to be completed without any time limit. Students were required to write the answers on papers including the explanations of each task. ClearView software (Tobii, 2008) enabled to adjust fine calibration.

All tasks were given one at a time in an order. Students were assigned to complete three tasks ranking from easy to hard. Users were free to try however they needed, i.e. there were no limit for trials. The tasks were:

Task 1 (Ready-to-use): Search the Internet and find the name of native Australians.

Task 2 (Easy-to-interpret): Search the Internet and find the differences between aerobic and anaerobic respiration.

Task 3 (Hard-to-interpret): Search the Internet and find how does steam affect global warming.

Each search session was recorded and gathered data were visualized with the help of Tobii Studio software. While seeking for the answers of research questions, the researchers first decided and defined the appropriate areas of interest (AOI). Figure 3.7

includes the AOIs defined for WISST by the researcher. The upper part consisting of menu elements were labeled TOOLBAR. The center of the interface was named MAIN because this is the main part of the software where they search and read. The bottom part was divided into two: DISPLAYBAR; HISTORYBAR. The former shows user inputs including goal of the search and keywords. The latter includes visited sites and related buttons.

Eye-tracking data was divided into segments manually. New search (NS), end search (ES), and keyword change (KW) segments were defined within separate intervals where the user starts seeking for NS, ES, and KW buttons and it ends when the user clicks the buttons. The commonality of these buttons is that they all located within TOOLBAR AOI. In order to generate specific metrics sometimes scenes were generated from appropriate segments.

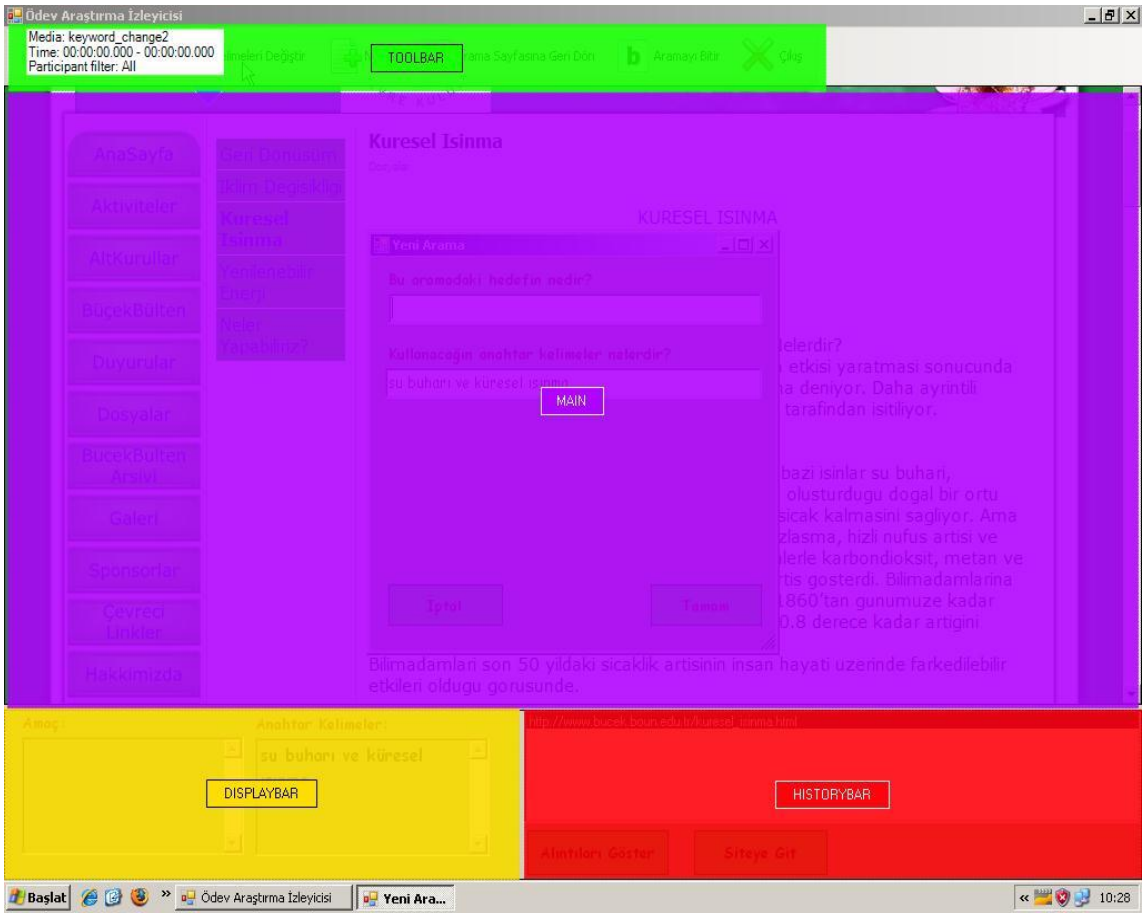
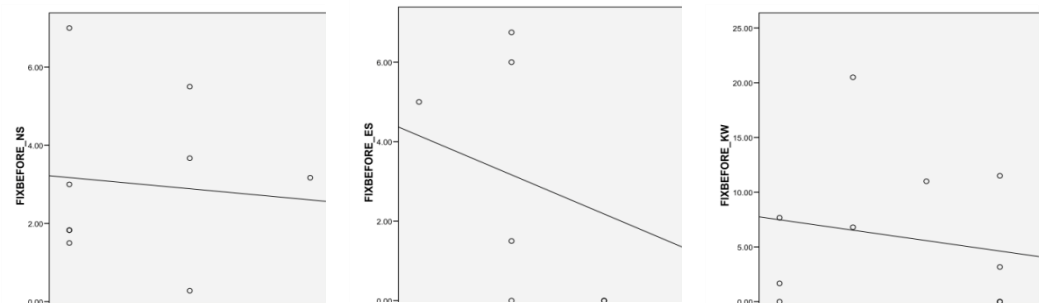


Figure 3. 7 Defined Areas of Interest (AOI)

To find out whether users had difficulties while locating key navigational elements (NS, ES, KW), such objective metrics as fixations before, visit durations, and total visit durations were used. The metric called 'fixations before' allows detecting number of fixations before the first fixation on a target AOI (TOOLBAR in this case). It was expected that fixations before decreases across attempts. Since each user had different number of trials for tasks, each case was evaluated separately. In other words, individual total number of fixations was divided by number of attempts, and then overall tendency of mean values were compared across attempts. This procedure was conducted separately for each navigational element. As figures 3.8(a, b, c) indicated, the number

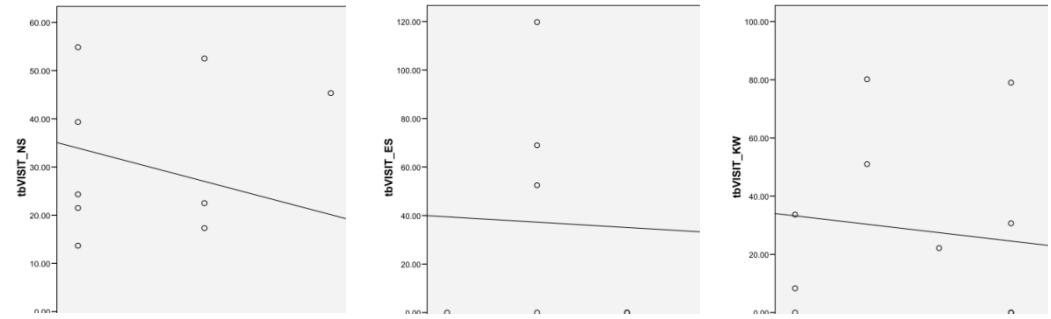
of fixations before the first fixation of toolbar for any of the three navigational element decreases across attempts. It means that after the first exposure of the interface, users became familiar to the interface.



(a) (b) (c)

Figure 3. 8 Fixations before across trials (a. for NS; b. for ES; c. for KW)

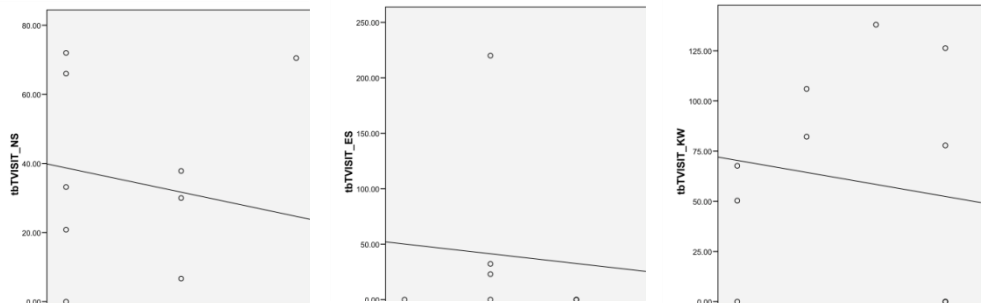
'Visit duration' is a metric to measure separate individual time intervals starting with the first fixation on a target AOI and ends with the next fixation outside the AOI. The durations were generated in seconds. It was expected that visit durations within TOOLBAR would decrease across attempts because it might show that the navigation element on the toolbar can easily be located as the user gets familiar with the interface. Figures 3.9(a, b, c) shows that mean of individual visit durations decreased across trials.



(a) (b) (c)

Figure 3. 9 Visit durations across trials (a. for NS; b. for ES; c. for KW)

Unlike visit duration, 'total visit duration' metrics measure all visits within the target AOI. It was also expected to decrease across trials. Figures 3.10(a, b, c) indicates the decline in total visit duration as expected.



(a) (b) (c)

Figure 3. 10 Total visit durations across trials (a. for NS; b. for ES; c. for KW)

In order to discover if there was any biasing element on the screen, the following metrics were used: time to first fixation, fixation count, and total fixation duration. The first metric is useful when a specific search target exists (Jacob & Karn, 2003). It

measures time interval starting with the exposure of the stimuli and ending with the fixation on the target AOI for the first time. Table 3.15 indicates the statistics for each subtask. When comparing the three subtasks, the mean for keyword change subtask was the highest (M = 7.32, SD =8.48) and the mean for end search subtask was the lowest (M = 4.32, SD =4.28). On the other hand, the mean for new search subtask was found very close to end search subtask's mean but with a lower standard deviation (M = 4.53, SD =2.78).

Table 3. 15

Time to First Fixation

	NS (sec.)	KW (sec.)	ES (sec.)
Min	1.25	2.72	3.00
Max	10.04	25.21	12.75
Mean	4.53	7.32	4.32
SD	2.78	8.48	4.28

Fixation count other than target AIO (Toolbar in this case) metric was used to see if there is any element on the interface that occupies the user and makes it harder to achieve locating on the toolbar. This metric counts the number of times when fixations occur within an AOI. Therefore, it was expected that number of fixations of toolbar should be more than the ones on other AOIs. Table 3.16 includes average fixation counts within each AOI for each subtask. The average number of fixations of Toolbar AOI is more than the ones on Displaybar and Historybar, but the Main AOI has the highest fixation count.

Table 3. 16

Fixation Counts

	ToolBar	DisplayBar	HistoryBar	Main
New Search	2.29	2.16	1.98	9.87
Keyword Change	6.82	3.46	1.53	14.78
End Search	4.54	1	1	6.34

Total fixation duration metric reveals how long all fixations occur within an AOI in total. In this case, sum of duration within toolbar AOI is expected to be more than the others. For all subtasks, total fixation durations of toolbar were found higher than displaybar and history bar. However, the main AOI has the highest duration. Table 3.17 summarizes the total fixation durations for each subtask and AOIs.

Table 3. 17

Total Fixation Durations

	ToolBar (sec.)	DisplayBar (sec.)	HistoryBar (sec.)	Main (sec.)
New Search	1.08	.55	.53	3.77
Keyword Change	2.46	1.12	.36	5.06
End Search	1.67	.30	.28	1.92

Conclusions for Iteration 3

WISST 3.0 was explored to find out how effective the overall interface elements and what to be changed for further development. In order to discover usability issues of the interface, an eye tracking study was designed and 11 seventh graders participated in

the study. Many metrics were used while analyzing the recordings. These analyses were based basically on fixations. “Fixations are eye movements that stabilize the retina over a stationary object of interest” (Duchowski, 2007, p.46). This measurement provides clues about visual attention, hence, the distracting elements and any other problems about the interface usability were expected to be found.

Three important basic subtasks were used with three Internet search main tasks. Data collected through different measures indicated that after first exposure of the interface, users easily adapted to the placements of the key elements such as new search button. After each trial, users located the elements faster than before. Toolbar AOI data indicated that users associated any navigational task, such as finding end search icon, with toolbar. It is valuable in terms of design of the interface since the intended aim of this bar is to include any basic subtask element. By combining the results including fixations before, visit duration, and total visit duration data, it can be inferred that users did not have severe difficulties while locating key navigational elements. There is considerable gradual declines of fixations and durations across trials. It means that as the user becomes familiar with the interface, it become easier and faster to locate any navigational element on the WISST 3.0 interface.

While detecting the biasing elements, the metrics including time to first fixation, fixation count, and total fixation duration were analyzed. Instead of trials, subtasks were taken as a reference point to decide on biasing elements. A gradual decrease from NS to ES was expected due to their chronological order. However, the decline was not gradual, but at least the durations were decreased across subtasks. The most time consuming subtask can be considered as keyword change subtask. This might be because of another enabled option serving the same purpose which is on the display bar. While displaying the entered user input such as aim of the search and used keywords, this space also provide the opportunity for users to change the entries by simply clicking the input. Unlike other AOIs, Main AOI was detected as a attention striking part of the interface. Although this might mean that Main AOI has some biasing elements, it might be because of its location. It is at the center of the interface and even after deciding to

change keyword for example, the user can think of what to write before locating and clicking the keyword change icon, thus fixations can occur naturally on the Main part of the interface because it is almost always the latest place to be engaged before moving to one of the three subtasks (NS, KW, and ES). Moreover, this part also includes pop-up questions of the tool and content of the websites which can include advertisements, visuals, and varieties of distracters. Therefore, the biasing nature of the main AOI can be acceptable. At least, it can inferred that toolbar seems to be associated with navigational elements when results were compared across other AOI except for main AOI.

Iteration 4: WISST Version 4.0

After three iterations, the analyzed data and gained observations led the following changes:

- In order to eliminate the time to decide on where to change keyword, only the keyword change icon was made active and the editing was disabled on the display part of the tool. Aim and the used keywords were only listed there, not to be edited.
- Since the introduction of pop-up questions were found boring to answer by users, the designers decided to split them into meaningful parts. As well as open-ended questions, yes-no questions were also scattered among screens. In this way, users were expected not to feel overwhelmed. Therefore, in the last version, each question is introduced one by one.
- Certain language defects were fixed. For example, ‘back to search page’ label was turned into ‘back to search results’ label.
- In the previous version the ‘quotation’ label was changed into ‘note taking’, but during user tests, it was observed that the label is misleading. That is why, the icon was again labeled ‘quotation’ either to add content and to take

notes. Another button was added to direct access to view the whole copied and pasted content as well as taken notes.

- It was also observed the tool failed to go back within website navigation. Therefore, an extra ‘back’ button was needed. In this way going back to results page or the previous page was distinguished.
- A help option was lack as detected in expert reviews. Two different helps were added: one for tool use and one for web searching.
- During user tests, an inconvenience about scrolling was detected. There was no scroll bar on history part listing visited sites.

The necessary revisions were completed. The final look of the interface was shown in figure 3.11. For WISST 4.0, 2 experts were asked to evaluate the tool. One of the experts was an educational software designer and the other expert was a computer teacher.

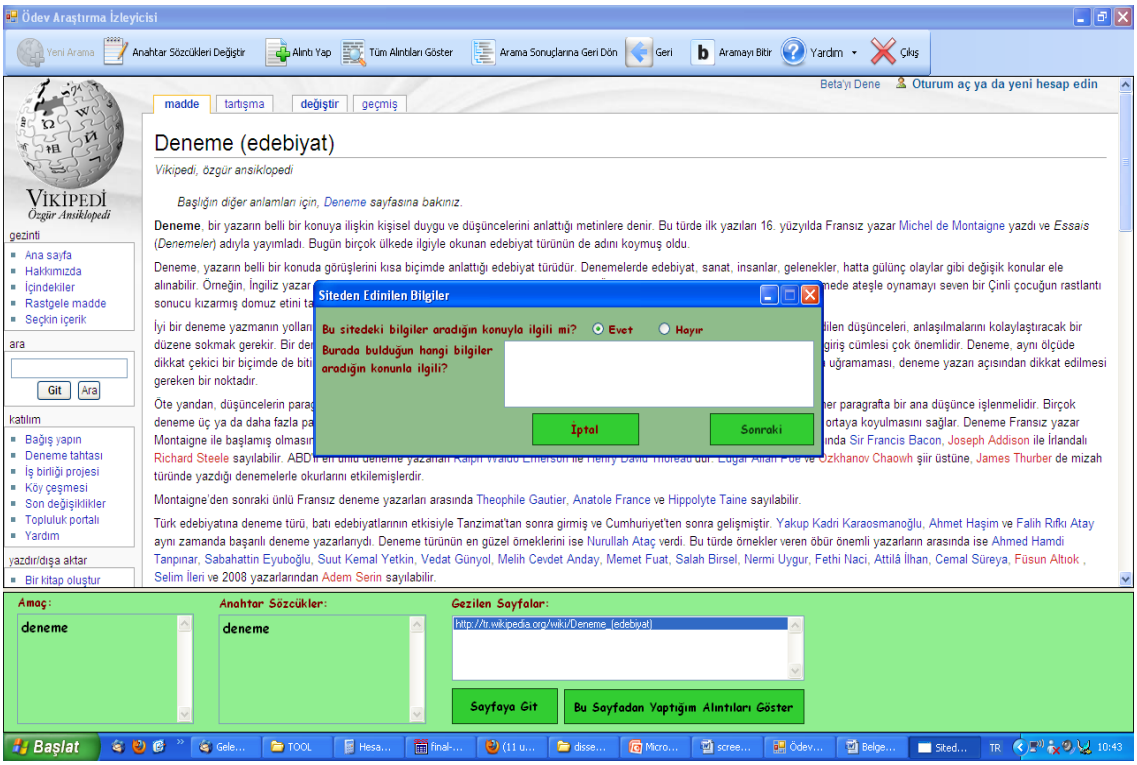


Figure 3. 11 WISST Version 4.0

(a) Expert Evaluations

The experts were familiar with Nielsen's heuristics, so they were first allowed to explore the tool, and then any question about the tool or the framework adaptation was welcomed. The severity ratings for Nielsen's heuristic evaluation were ranging from 0 to 4 (0: not a usability problem; 1: cosmetic problem; 2: minor usability problem; 3: major usability problem; 4: usability catastrophe) (Nielsen, 1994). The ratings for the adaptation success of the tool for utilized framework ranged from 1 to 5 (0: absent; 1: adapted in a wrong way…….5: adapted well). For both evaluations, experts were asked to add some open-ended observations or suggestions.

Severity of Usability Problems

Unlike previous expert evaluations, this time very small number of problems was found and none of them were rated as severe. Table 3.18 consists of reported major problems. Version 4.0 still has some problems under 'visibility of system status', 'error prevention', and 'help users recognize, diagnose, and recover from errors' principles, but they were considered as non-catastrophic.

Table 3. 18

Major usability problems according to experts

Nielsen's Heuristics	Major usability problems
1.Visibility of system status	Lack of cue or the reason why the search was failed.
2.Match between system & the real world	
3.User control & freedom	
4.Consistency & Standards	
5.Error Prevention	There is no 'are you sure?' question while leaving the tool.
6.Recognition rather than recall	
7.Flexibility & efficiency of use	
8.Aesthetic & minimalist design	
9.Help users recognize, diagnose, & recover from errors	There are no warnings when meaningless keywords were entered.
10.Help & documentation	

Table 3.19 listed the severity ratings of the two experts. In this version of the tool, most of the problems were reported as minor usability problem. There is no usability catastrophe, but only three major usability problems were listed. 'Help users recognize, diagnose, and recover from errors' heuristic has the highest number of usability problems. Total score for heuristic evaluation was calculated 33 in total. This is far less than the previous evaluations.

Table 3. 19

Severity of usability problems

Heuristics	Ratings					
	0	1	2	3	4	Total
1. Visibility of system status	1	1	1	1	0	6
2. Match between system & the real world	0	1	0	0	0	1
3. User control & freedom	0	2	0	0	0	2
4. Consistency & Standards	0	0	1	0	0	2
5. Error Prevention	0	0	2	1	0	7
6. Recognition rather than recall	2	0	1	0	0	2
7. Flexibility & efficiency of use	0	0	2	0	0	4
8. Aesthetic & minimalist design	0	0	0	0	0	0
9. Help users recognize, diagnose, & recover from errors	0	0	3	1	0	9
10. Help & documentation	0	0	0	0	0	0
Total:	3	4	9	3	0	33

Adaptation of Scaffolding Approaches

After reviewing previous expert evaluations for adaptation success, many items were changed throughout the iterations. WISST 4.0 was evaluated by two experts and the means were shown in Table 3.20. Overall mean is very near to well adaptation rating (5.0). Majority of the items (N=10) were rated as well-adapted. 85% of the items is above mean value. Except for one item, all others were adapted to some extent. Reliability coefficient of the scale was almost perfect (□=.95).

Table 3. 20

Means of categories and sub-items

Scaffolding Categories	Sub-Items	Mean
Asking Questions	A1: Does the tool provide questions to the user before the search?	5.0
	A2: Does the tool enable to search more if the first trial of the user fails?	5.0
	A3: Does the tool provide a discussion platform for users to share ideas?	.00
Searching	SE1: Does the tool enable users to visit more than one website?	5.0
	SE2: Is the history of the user's actions visible?	3.5
	SE3: Does the tool enable students to decide on keywords before starting the search process?	5.0
	SE4: Does the tool define or describe the steps to be followed throughout a search process?	4.0
	SE5: Are all visited sites listed somewhere?	5.0
Evaluating& Reading	ER1: Does the tool allow the user to take notes while visiting the websites?	5.0
	ER2: Does the tool encourage the user to set specific goals before the search starts?	5.0
	ER3: Are set goals by the user visible?	5.0
	ER4: Is a help to enhance comprehension of what is read on a website provided to students?	3.0
	ER5: Is the user encouraged to reflect on the visited websites' trustworthiness, appropriateness, and relatedness?	5.0
	ER6: Does the tool provide with strategies to facilitate investigation of websites?	4.5
Synthesizing	SY1: Is the user supported to compare visited websites?	4.0
	SY2: Does the tool provide a list of criteria to lead reflection of what is read?	5.0
	SY3: Does the tool enable the user to evaluate or decide where and how to use the found information?	3.0
Overall Mean:		4.24

Besides rating the items, the experts were also asked to find and report where these items were specifically exist within the tool. The two experts almost located correctly the elements. Cohen's kappa coefficient (κ=.92) shows almost perfect inter-rater reliability with respect to finding correct locations within the tool.

Conclusions for iteration 4

When compared with the other versions, the expert evaluations showed that many problems were fixed successfully. As heuristic evaluation results indicated, there are no severe usability problems in version 4.0, but some major problems. Overall heuristic total decreased comparing the previous total. Moreover, majority of the adaptation scale seems to be covered by the last version of the tool. IT can be considered that the framework was adapted and the principles were embedded into WISST 4.0 to great extent. However, there is only one item that is not exist. A discussion platform was not provided with the tool because the tool was supposed to be used in computer laboratory environment in the school. There is neither necessity nor enough time to use this principle in WISST 4.0. Experts located elements of the tool for each adaptation item successfully. This might be considered as a proof for successful integration of the framework into the software.

Iteration 5: WISST Version 5.0

Before actual use of the tool, small changes were done. From the last iteration, there were a few problems about error prevention. For example, if the user enters wrong or misspelled keywords the generated results are not relevant. Increasing the awareness of what should be done next is one of the key metacognitive skills, thus, it is not fatal not to provide error prevention in this tool. On the other hand, to prevent data loss, while leaving the tool, the user is asked to be sure. The final tool was reviewed by three colleagues at different times and locations. Since no malfunctioning was detected, WISST was ready to be used by primary users.

3.7. Data Analysis

In order to understand the effects of WISS on 7th grade learners' metacognitive skill development, a series of quantitative analysis was conducted. SPSS 15.0 software was used to make necessary statistical analysis. After collection and entry of data, data cleaning was performed. There were less than 3 % of missing data, so no interventions were done to deal with the missing ones.

The first main research question was answered with the help of descriptive statistics. Students' PALS scores were used to define their GO types. To describe students' beginning and final MS types pre-MIIS and post-MIIS scores were used. The second research question was answered through a series of counting. These counts were gathered from either computer logs or students' performance works. Their frequencies were compared with the help of descriptive statistics and graphics.

The third and fourth research questions were answered through one-way analysis of covariance. In this way, the effects of scaffolding were explored both across groups and across GO types. In these cases, the effects of pre-MIIS scores were controlled.

Finally, a series of relationships were examined with the help of multiple regression and canonical correlation analyses. As a main question, the predictors of MS development of students were tried to be discovered. Certain search variables were the candidates of contributors and 4 variables were decided to be included in the hierarchical regression. This was hierarchical because grouping variables were needed to be controlled. For the rest of the relations, canonical correlation was run because the relations between the two varying group of variables were the concern of the study.

After completing the quantitative analyses, some of the cases were analyzed qualitatively. The aim of this in depth look was to focus on students' search patterns. To accomplish this, the logs or screen recordings, weekly performance works, and weekly reflections of students with different goal orientations were explored through content analysis and coding.

3.8. Threats to Internal Validity

According to Fraenkel and Wallen (2005), static group research design has certain potential for the following threats: subject characteristics, mortality, location, data collector characteristics, data collector bias, attitude of subjects, regression, and implementation. In order to control differences in subject characteristics, detailed demographic data were collected like the frequency of computer usage, computer access, the amount of experience on the Internet search, and goal orientation type.

Mortality was one of the biggest threats in this study due to taking place at regular class hours, thus absents were unavoidable. This threat was reduced as much as possible by giving ID numbers to individuals. In this way, the whole data of each individual was eliminated. The same computer laboratory was used to deal with the location threat. Moreover, the same person (computer teacher) collected data from all groups to control data collector characteristics. The data collector was trained about how to collect data and not be informed about specific hypothesis of the study. In order to prevent such threats related to attitude of subjects, the interventions were treated as the regular parts of the curriculum.

In order to control regression threat, qualitative data including reflection reports, performance works, logs, and interviews were also analyzed. Moreover, goal orientations and pre-MIIS scores were controlled statistically. In addition, while WISS group were provided one-to-one scaffolding, TS group's one-to-one scaffoldings might not be equal to that of WISS group due to the number of students. In other words, teacher had to deal with more than one student at a time, but this threat was tried to be reduced by training the teacher to provide one-to-one scaffolds whenever the student needs. Finally, implementation threat was tried to be eliminated by using the same teacher for all groups in the same laboratory with the same contents.

3.9. Assumptions

- Items in the inventories were assumed to be answered honestly.
- Inventories were assumed to measure goal orientations and metacognitive skills accurately.
- WISST was assumed to serve as metacognitive scaffolding tool.
- Metacognitive skills were assumed to be developed with the help of external interventions (like scaffolding).

3.10. Limitations of the Study

The study was carried out in real school settings, which results in many limitations:

- Students in groups could not have assigned randomly.
- 72 students participated to the study and this number might not be enough to generalize the results.
- The participants were limited to 7th graders and the results might differ across other grades.
- The search tasks were limited to Science and Technology course contents, so the results might differ if the subject or tasks change.
- The technical infrastructure of the school is another limitation because computers and the Internet sometimes were too slow which might have influenced the search time. In addition to that, short Internet outages occurred.
- The teacher who gave scaffolding to students was trained for this experiment, but the overall skills and background of the teacher might have affected the whole procedure, thus the results might have differed if another teacher with different skills and background had carried out the sessions.

- The study duration was limited to 5 weeks, so for further studies a longitudinal approach could be used.
- Measurement of metacognition was based on self-reports and external observations of student products, therefore an internal phenomenon was observed externally which is another limitation.
- Technical features of computers are the most significant limitation of this study since in one laboratory there are computers differing in the type of processor, size of HDD, speed of RAM, and etc.

CHAPTER 4

RESULTS

In this chapter, descriptive and inferential statistics are introduced. In order to deeply understand the quantitative results, qualitative data is also analyzed. In the end, the summary integrating all results were presented.

Three basic scores (pre- & post-MIIS, and PALS) of seventh graders among three groups were presented descriptively in Table 4.1. The mean scores for pre-MIIS as well as median values are very close across groups. Post-MIIS scores indicate an increase within 5 weeks interval, but the amount of increase varied across groups. While gained MIIS score for NS group within 5 weeks is 2.75, it is considerably higher for WISS and TS groups respectively; 9.4 and 8.3. PALS scores are a little bit diverse. PALS mean score of TS is higher than that of the other groups. Reported minimum scores for all variables are more than the expected minimum which is 30 for MIIS and 14 for PALS. On the other hand, maximum PALS scores were observed to be reached within WISS and TS groups. NS group is also very close to the maximum. However, neither pre- nor post-MIIS mean scores of the groups reached the maximum score.

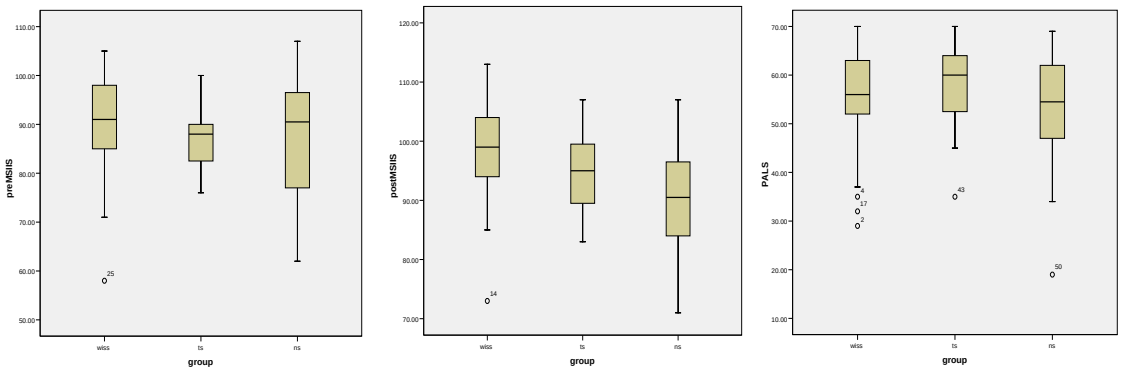
Table 4. 1

Participants' Goal Orientations, Pre- & Post-Metacognitive Skills

	WISS			TS			NS		
	Pre-MIIS	Post-MIIS	PALS	Pre-MIIS	Post-MIIS	PALS	Pre-MIIS	Post-MIIS	PALS
N	25	25	25	23	23	23	24	24	24
Mean	88.8	98.2	54.72	86.83	95.13	58.39	87.67	90.42	53.58
Median	91	99	56	88	95	60	90.5	90.5	54.5
Min	58	73	29	76	83	35	62	71	19
Max	105	113	70	100	107	70	107	107	69
SD	11.24	8.46	11.61	6.42	6.88	9.14	11.41	9.66	11.97
Skew	-.93	-.88	-1.00	.13	.05	-.71	-.36	-.25	-1.15
Kurt	.92	1.14	-.02	-.33	-.90	.37	-.50	-.56	1.66

120 is the maximum and 30 is the minimum scores for pre & postMIIS. 70 is the maximum and 14 is the minimum scores for PALS.

Skewness and Kurtosis values provide clues about the distribution of the scores. The majority of the values fall into the acceptable range that is -1.0 and +1.0. NS group's skewness and kurtosis values for PALS are above the range. On the other hand, these values do not exceed -2.0 and +2.0 when divided by standard error. Therefore, despite its extending tail to the left and many peaks, PALS distribution for NS can be considered as normally distributed. In addition, boxplot with a few outliers also confirms the normality of the distribution (see Figure 4.1.(c)). Kurtosis value for post-MIIS scores of WISS refers to a little bit pointy distribution, but when it is divided by standard error, it does not exceed 2.



(a) (b) (c)

Figure 4. 1 Boxplots for (a)preMIIS, (b)postMIIS, and (c)PALS

Boxplots in Figure 4.1 summarize the main characteristics of distributions. Pre-MIIS scores' midpoints are very close for WISS and NS groups and higher than that of TS group. Midpoints of WISS and TS groups increased from pre-MIIS to post-MIIS while NS midpoint remains almost the same. On the other hand, the middle 50% of TS increased from pre to post, but that of NS group decreased. In the pre-MIIS scores, the middle 50% of NS was greater than WISS group and TS group which is the narrowest one. In the post-MIIS scores, the middle 50% ranges were very close across groups. There was an increase for the upper 75% of scores of all groups from pre to post. Midpoint of PALS scores of TS is higher than WISS which is higher than NS. Middle 50% of NS is larger than the others. The lower 25% of TS is approximately half of the others. The upper 75% of both WISS and NS are very close to each other, but that of TS is a little less.

A few univariate outliers can be observed in Figure 4.1. Case 25 in WISS group is an outlier with regards to pre-MIIS scores. In the same expreriment group, case 14 does not fall into the normal range for post-MIIS scores. Cases 2, 4, 17, 43, and 50 can be considered as outliers for PALS scores.

4.1. Profiles of Participants (Research Question 1)

72 seven grade students (25 for WISS; 23 for TS; and 24 for NS groups) participated in this study. Their goal orientation types were measured with the help of PALS (Midgley et al., 2000). In order to decide the goal orientation types for three groups of individuals, the highest score among three subscales was explored. In table 4.2, goal orientation types are summarized. Mastery orientation is the most frequent goal orientation type and interestingly, each group has equal number of mastery orientation count. Unlike TS group, there are more performance approach oriented students than performance avoidance orientations in WISS and NS groups. It is vice versa for TS group.

Table 4. 2

Descriptives of Goal Orientations by groups

	WISS			TS			NS		
	N	*M*	*SD*	N	*M*	*SD*	N	*M*	*SD*
GO									
Mastery	12	4.25	1.20	12	4.09	.82	12	4.21	.89
PerfApp	8	4.10	.74	4	3.58	.90	7	3.81	1.05
PerfAvoid	5	4.05	.98	7	4.10	.85	5	3.79	1.04

Metacognitive skills of the students were measured with the help of MIIS that constitutes 5 subscales before and after the study. Table 4.3 shows the details of mean scores and standard deviations of each subscale across groups. WISS group had the highest monitoring, planning, and control of attention mean scores in the pre measurements, but it had the highest mean scores in the post measurements. TS group has the highest reflection-regulation scores in the pre-test but it was not very high in

post-test despite the increase in the scores. NS group had the lowest pre-MIIS scores for reflection-regulation and monitoring skills, while TS group had the lowest pre-MIIS scores for control of attention and strategy generation subscales. For planning skill, both TS and NS groups had the lowest mean score for pre-MIIS. The lowest post-scores of all skills belong to NS group.

Table 4. 3

Descriptives of Pre and Post Metacognitive Skills by groups

	WISS		TS		NS	
	M	*SD*	*M*	*SD*	*M*	*SD*
Pre-MIIS						
Reflection-Regulation	2.78	.55	2.80	.47	2.77	.44
Monitoring	3.30	.52	3.27	.31	3.15	.49
Planning	3.02	.57	2.92	.53	2.92	.65
Control of Attention	2.47	.66	2.45	.61	2.46	.66
Strategy Generation	2.77	.66	2.79	.54	2.83	.58
Post-MIIS						
Reflection-Regulation	3.34	.51	3.23	.49	3.00	.52
Monitoring	3.62	.38	3.51	.36	3.28	.41
Planning	3.60	.40	3.23	.61	3.04	.58
Control of Attention	2.97	.49	2.47	.78	2.43	.55
Strategy Generation	3.33	.64	3.18	.40	2.79	.49

4.2. Participants' Search Patterns (Research Question 2)

72 seven grade students' whole search steps were recorded either through WISST or Snagit software. Among these search steps, some common variables (duration, copy-paste, rank, idea, keyword, keyword change, and trials) were considered to compare the search patterns across groups. Variables for each week's search were

summarized in Table 4.4. Overall mean scores indicated that NS group both spent the most time to search and performed the most frequent copy-paste actions. WISS group has the highest overall scores for all variables other than time spent and copy-paste.

Table 4. 4

Logs of students

	Week 1		Week 2		Week 3		Week 4		Week 5	
	M	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
Time spent (min.)										
WISS	6.57	3.78	13.22	4.80	10.15	4.24	8.98	2.80	11.40	5.61
TS	12.85	5.91	9.30	4.28	9.62	3.03	9.56	4.28	8.80	2.48
NS	9.98	5.67	10.60	8.59	12.20	5.89	10.58	6.01	8.73	5.02
Number of copy-pastes										
WISS	.80	.41	.92	.28	1.00	.20	.80	.41	.60	.50
TS	.78	.42	.83	.39	.91	.19	.74	.29	1.00	.45
NS	.83	.38	.50	.51	.88	.34	.92	.28	1.00	.18
Rank of first visited link										
WISS	1.76	1.17	2.44	1.83	1.92	1.75	2.08	1.80	3.00	1.63
TS	2.00	1.09	3.22	2.04	2.17	1.85	2.13	2.12	1.52	1.16
NS	1.5	1.02	2.04	1.83	1.71	1.08	1.42	1.32	1.96	1.16
Number of added idea										
WISS	.56	.82	1.00	.50	.56	.65	.84	.69	1.84	.37
TS	.39	.72	.70	.56	.26	.54	1.00	.74	.87	.34
NS	.00	.00	.58	.72	.25	.61	.71	.62	.42	.50
Number of keywords										
WISS	1.64	1.19	3.04	1.24	1.48	.65	1.68	.95	2.00	1.66
TS	1.74	1.32	2.70	.93	1.30	.47	1.22	.42	2.35	1.19
NS	1.38	.58	2.50	1.50	1.58	.72	1.63	.92	1.67	1.00
Number of keyword changes										
WISS	.64	1.38	1.64	1.15	.60	.91	.56	.65	1.00	1.89
TS	.65	.98	1.61	.89	.39	.58	.22	.42	1.26	1.18
NS	.21	.51	1.54	1.79	.88	1.42	.63	1.06	.67	1.13
Number of trials										
WISS	1.88	1.30	2.64	1.15	1.64	.91	1.56	.65	2.24	1.98
TS	1.70	1.11	2.61	.89	1.39	.58	1.22	.42	2.35	1.15
NS	1.33	.57	2.54	1.79	1.88	1.42	1.63	1.06	1.67	1.13

Figure 4.2 shows the search trends of groups within 5 weeks interval. The first variable is *time spent* to complete the search task. Groups' peak points differ across weeks. WISS group spent the most time for task 2; TS group spent the most time for task 1, and NS group spent the most time for task 3. WISS and TS groups have reverse trends as indicated in figure 4.2(a). From time 1 to time 2 there are sharp changes in different directions for these two groups. While WISS group has fluctuations in terms of time spent for tasks during 5 weeks, its last value is higher than the beginning. Unlike WISS group, TS and NS groups spent more time first week than the last week. Although NS group had the highest overall time scores (10.43), the difference between the minimum and maximum time values is the largest for WISS group with 6.65 and the lowest for NS group with 3.47. None of the groups had consistent overall decline or incline trend. It can be concluded that although time did not increase as weeks passed, the beginning and ending time durations decreased from week 1 through week 5 for TS and NS. On the other hand, WISS group's last week's duration was quite higher than the first week.

The second search variable is number of *copy-pastes* for each task. Figure 4.2(b) shows that the peak points are the same for TS and NS groups which occurred in the last week. WISS has its peak in the third week and after that week there is a gradual decline in copy-paste actions. WISS and TS have similar trends till the fourth week, but number of copy-pastes reached the peak for TS group and the bottom for WISS during the last week. The number of copy-pastes in the beginning is lower than in the ending for TS and NS and it is vice versa for WISS group. It can be concluded that the fifth week is critical in terms of copy-paste actions when scaffolding conditions were taken into account.

Rank of the first link is another search variable to be considered. During the first three weeks, all groups show a similar pattern (Figure 4.2(c)), but their trends vary after that week. For first link visited, peak points for TS and NS groups were at the second week, but it was at the fifth week for WISS. The ending points of WISS and NS groups

were higher than the beginning, but it is vice versa for TS group. To sum up, all groups have similar trends, but the fourth and the fifth weeks caused distortions among groups. One part of the search process was to add some ideas from the resources they read or visited instead of copy-pastes, but not all of the students preferred this method. As indicated in Figure 4.2(d), NS groups' average is .00 for the first week. All groups have similar patterns over 4 weeks, but WISS group differed after the fourth week, i.e. it reached its peak whereas the others peak points were at week 4. When beginning and ending scores were compared, it can be concluded that all of them showed different amounts of increase. The highest difference between minimum and maximum scores belongs to WISS group with 1.28, then TS with .74, and then NS with .25.

Number of used *keywords* variable's graph demonstrates an interesting pattern. The numbers are considerably close and WISS and NS groups showed similar trends. Actually, all groups have similar patterns for the first three weeks, but TS groupdiffers after that week (see Figure 4.2.(e)). All reached their peak values at the second week. Moreover, their beginning values are lower than the ending values over 5 weeks. In conclusion, since all reached the peak values at the second week, it is critical to focus on the second task.

While students search on the web, they tried different keywords and whenever they changed the existing keyword with or without visits, it was counted as a *keyword change*. Figure 4.2(f) indicates that all groups have the similar fluctuations, but different values. Like number of keywords, keyword changes reached the peak at the second week for all groups. Their beginning and ending point showed an increase over 5 weeks. The difference between minimum and maximum scores is the highest for TS group with 1.39, then NS group with 1.33, and then WISS with 1.08.

Finally, Figure 4.2(g) demonstrates the number of *sessions* or number of trials. Like keyword change, trials variable has similar trends over 5 weeks with respect to experimental groups. All groups' peak points were at the second week and values were very close to each other. Although all beginning values are lower than ending values, the

highest difference between minimum and maximum values belong to TS group with 1.39, then NS group with 1.21, and then WISS group with 1.08.

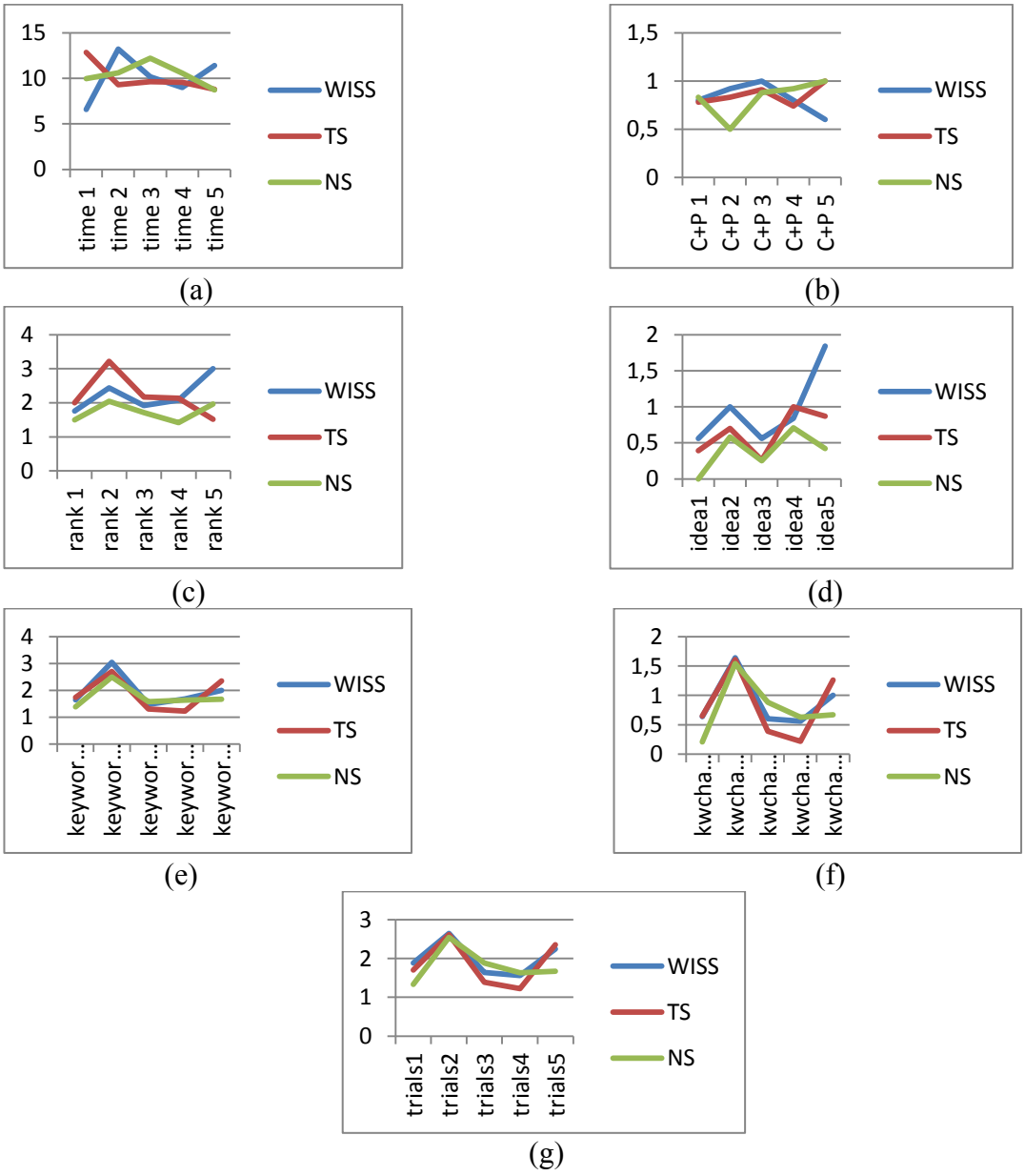


Figure 4. 2 Multiple line graphs of groups for (a) time, (b) copy-paste, (c) rank of first visited link, (d) added idea, (e) used keywords, (f) keyword changes, and (g) trials.

Characteristics of visited sites

Each week's task was selected from the Science and Technology curriculum with the help of Science and Technology teacher, and consisted of two parts. In the first part, the question required direct information which can be easily accessed online with the help of simple keywords online. In the second part, the question did not have direct answer, and the students had to interpret the found information. That's why, the second part of the tasks included "according to you" or "in your opinion" statements.

In order to investigate how students in different groups searched and reported the results of the search, three sources of data were used. First, students' logs on search tracker or screen recorder were analyzed. Second, students' performance works that were completed spontaneously throughout the search process were explored to find out copy-pastes, interpretations, related-unrelated information, correct-incorrect answers, and so on. Third, students' weekly reflections were examined to understand how their metacognition changed over time.

Week 1

The topic of the first week was *global warming.* The reason to include this topic was because of being a current issue. It is relatively an easy topic, so for the first week, it was appropriate to warm-up the students. The task included two questions:

1. What is global warming?
2. In your opinion, what might be the negative effects of global warming on human life?

The teacher's original proposal for this question was different for the second part. It was as follows: "what had been done so far to prevent the global warming by

governments?" In this study, the researchers preferred topics requiring critical thinking, that's why the second part was formed in a different way with the help of the teacher. The first question can be easily found on the web as ready-to-use format whereas the second question requires interpretation skills because there is no ready-to-use information on the web. Students are required to search first and then add some interpretations to them.

29 various websites were visited by 72 students. Among these, 57 students visited www.kureselisinma.org link which was at the top of the list that was produced as a result of entered related keywords. 25 students preferred visiting only this link, and then ended the search process. Others visited more than one website and the rank of visiting that site changed across students. 8 students visiting that link in WISS group added their own ideas while completing their performance work, but 15 students also performed copy-pastes. 5 students in TS group added ideas whereas none of 17 students added idea in NS group. In both TS and NS groups, 17 students preferred copy-pastes.

The second most visited link is tr.wikipedia.org website. It was located at top three of the generated search results page. 27 students clicked this link and among them 6 students preferred only to visit that site and others visited more than one websites. 2 students in TS group added their own ideas, but 10 students of this group performed copy-pastes. None of the students visiting that link in WISS group added their own ideas, neither did students in NS group. Moreover, 5 students visiting wikipedia.org in WISS group did copy-paste and 8 students in NS group did copy-pastes. Those not performed copy-pastes failed to complete the performance work of the first week.

Those who clicked the mostly visited two links in the list used very similar keywords such as "global warming", "what is global warming", "global warming, its negative effects", "sun, earth, warming". There were also many unrelated or distracting websites within 29 different visited links. Students who generally visited these kind of sites showed a trend to use different keywords. For example, a few students directly entered the second question as a keyword. "damages of global warming", "ecosystem", "disaster", "warming", "earth". Visits to at least one irrelevant link were mostly a result

of searches for the second question. Duration passed till the realizing the irrelevant content of the irrelevant website ranged between 5"-1'44" for WISS, 1'41"-3'20" for TS, and 5"-5' for NS group.

Week 2

The topic of the second week was *tropical fruits.* This topic was included since the teacher persisted in that his experiences so far have indicated that students really have difficulties because of being a vague topic. They aren't given a strict list, instead they are required to explore themselves. According to the teacher, the results of the performance works are generally full of irrelevant information. This topic seems easy but since there was no specific one answer, it can turn into a hard topic as well. The task included two questions:

1. Find information about a fruit that does not grow in Turkey but somewhere in the world?
2. In your opinion, why doesn't that fruit grow in Turkey?

Although for the first part there was ready-to-use information on the web, it might be harder if students do not know the name. In that case, a pre-search might be needed. The second part is completely open to interpretations. Some students might not even feel the need for the search. No changes were done for this task, it was the teacher's original research questions.

83 different websites were visited by 72 students. The most visited link was tr.wikipedia.org with 47 visits. Other visited links had 1-4 visits in average. The Wikipedia links were generally located at the top three of the results page generated in accordance with students' keywords. 16 students visited only this site and the rest visited more than one link including Wikipedia. The rank to visit the site showed variance across students. 11 students visited Wikipedia in WISS added their own ideas

while completing the performance work, but 11 students also performed copy-pastes. 10 out of 14 students in TS group added their ideas and the same number of students also copy-pasted some information. 9 NS students added their own ideas and majority (16 students) of them preferred copy-pastes.

Within 83 different links, there were many irrelevant sites. Students visiting relevant sites generally used exact keywords such as "pineapple" and those visiting irrelevant sites used such keywords as "the fruit that doesn't grow in Turkey", "turkey, fruit", and "fruit unknown". Moreover, most of the failed searches were the consequence of entry of the whole question. It took different durations for students to recognize the irrelevant links. It lasted between 10"-1' for WISS group, 10"-1'55" for TS group, and 40"-3' for NS group.

Week 3

The topic of the third week was *noise pollution.* The topic was originally about environmental pollution issues, but for the search task it was simplified and reduced to only noise pollution. The format of the question remained the same. According to the teacher, it can be considered as a medium difficulty task. It included two questions:

1. What are the reasons of noise pollution?
2. In your opinion, what can be the ways to reduce or eliminate the noise pollution?

The first part of the task is relatively easy because if appropriate keywords are entered, then the results can guide the student. For the second part, the found information in the first part can guide students to generate their own solutions to noise pollution. Besides, reflection of found information, and a little creativity can also help students.

39 different websites were visited by students. Among them, www.cevreorman.gov.tr was the most frequently visited site with 38 counts and it was listed at the top for many keywords related with noise pollution. 16 of these students did not visit any more links. Half of 20 WISS students visited that site added their own ideas to their performance work, and 16 of them performed copy-pastes. Among 7 TS students visited that site, only one added his/her own ideas, but all of them performed copy-pastes. 3 NS students added ideas their own ideas, but 10 students within that group copied and pasted some information.

The second most visited link in the third week was www.msxlabs.org with 31 counts. Students visiting that site also visited more than one sites. 4 out 6 WISS students added their own ideas to the performance work, but 5 students also made copy-pastes. In TS group, 3 students added their own ideas whereas 12 of them also copied and pasted some information. In NS group, 3 students added ideas in addition to 10 copy-pastes.

There were irrelevant link visits for the third search task. Students who visited unrelated links showed a tendency to use the second search question as a whole keyword. However, in this task there were not many unrelated keywords, instead some students used only "pollution" which led them to click on unfocused websites. It took about 25"-1'30" for WISS group, 20"-2'44" for TS group, and 40"-3'32" for NS group to realize the irrelevancy of the visited link.

Week 4

The topic of the fourth week was *soil types.* It was originally about soil types and the structure of the earth, but in order to simplify, the teacher and the researchers decided to limit the topic with only soil types. The format of the question was changed because the original one required only collection of information, but due to the purposes of this study, it was turned into a combination of data collection and synthesizing. It included two questions:

1. What are the differences between mold and clayey soil types?
2. In your opinion, which one might be more appropriate for agriculture? Explain your reasoning.

Unlike previous tasks, this task can be referred to as a little bit sophisticated because in the first part, students needed to compare and contrast the found information. Moreover, they had to focus more than one aspect of different types of soil. In the second part, students were required to think critically to decide on the efficiency of soil types. The previously collected information were expected to help them. They had to give reasons for their choice of efficient soil type.

33 different types of websites were clicked by 72 students. The most frequently visited page was www.ebilge.com with 49 counts. This site was listed at the top of the list as a result of many specific keywords of this topic. 18 of these students did not visit any more website, but the rest also visited other pages. 15 WISS students added their ideas to their work and also majority of them also had 17 copy-pastes. 6 TS students added their own words, but 5 of them also preferred copy-pastes. In NS group, a great majority of students preferred to copy-pastes while 13 students also added ideas.

The second most visited page was tr.wikipedia.org with 31 clicks. 13 of these students did not feel a need to visit more sites. This link was generally listed at the top three of results list generated after the entry of such keywords as “mold soil, clayey soil”. 3 WISS students visiting that link also added their ideas to their performance works, but majority (8 students) also preferred copy-pastes besides their own ideas. 8 TS students added their ideas and there were also 11 copy-pastes. Finally, 4 NS students added ideas, but 8 of them had copy-pastes as well.

Like previous tasks, the unrelated links were generated as a result of treating the whole question as keywords without any changes. In addition, many typing errors also brought about misleading links. For example, there were a few students written “kirli (dirty)” instead of “killi (clayey)”. It lasted 20”-1’12” for WISS, 15”-1’ for TS, and 25”-2’19” for NS groups to realize if it was the relevant page.

Week 5

The topic of the fifth week was *respiratory system.* This task was originally included detailed data collection about both circulatory and respiratory systems, but the topic was limited to only respiratory system in this study. Moreover, instead of the teacher's original question form and its general content, the researchers decided to reduce the topic to specific illnesses of respiratory system. It included two questions:

1. Find information about 3 respiratory system illnesses.
2. In your opinion, which of these illnesses might be the most dangerous one? Explain your reasoning.

This task can be denominated as hard-to-interpret. Although there are ready-to-use information for the first part of the task, the rest of the task required a series of abilities such as decision making, comparison, contrast, synthesizing, and reflection. In addition, for the second part, the correct or acceptable answer totally depended on previously gathered information and the student's ability to interpret.

40 different websites were visited. The most visited website was tr.wikipedia.org with 34 counts among which 10 students stopped to visit more pages. Like other top visited links, it was at the top three of the results list generated with many keywords about respiratory system. "Respiratory system" and "respiratory system illnesses" were examples of that. All of 16 WISS students added their ideas, but 13 of them had also copy-pastes. In addition to their own ideas, 5 students in TS group added ideas but all of them also performed copy-pastes. 3 NS students added ideas whereas all of them copied and pasted among 12 NS students.

www.fenokulu.net with 28 counts was the secondly visited page. Many keywords about respiratory system generally resulted in a list including this webpage at the top or at the top three locations. 5 students stopped searching after visiting that page. All of 9 WISS students added ideas, but 7 of them also performed copy-pastes. 12 out of

14 TS students added ideas while 8 of them preferred copy-pastes besides. In NS group, 2 students of 5 added ideas and 3 students had copy-pastes.

In addition to related links, a few unrelated links were also detected. Such keywords as "illnesses" or mistyping of the keywords or entry of the questions as keywords caused to the list of results. It took about 15"-1'18" for WISS, 50"-1'10" for TS, and 50"-5'56" for NS students to realize the irrelevancy of the visited links.

4.3. Performance & Reflection Changes over Weeks (Research Question 3)

In order to understand how students' performances and reflections had changed during the intervention, the selected cases were examined deeply. The clustered sample was summarized in table 4.5. Individual logs, performance work sheets, reflections of search topic and the search process were the data sources for these analyses. First, content analysis and coding were done, and then the themes were generated. Lastly, the patterns of the students with the same goal orientation (mastery, performance approach and performance avoidance) and with similar levels of metacognitive skill (reflection-regulation, monitoring, planning, control of attention, and strategy generation) development were examined.

Table 4. 5

Clustered and Purposively Selected Sample for Qualitative Analysis

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	N_{WISS}	N_{TS}	N_{NS}	N_{WISS}	N_{TS}	N_{NS}	N_{WISS}	N_{TS}	N_{NS}
1: Gain scores between 0-8	1	1	1	1	1	1	1	1	1
2: Gain scores between 12-36	1	1	1	1	1	1	1	1	1

During the intervention, the data were collected from 72 students in total in three groups. Since having a deeper look would be difficult with 72 students, the researchers decided to reduce the data without losing the overall pattern. Therefore, a cluster analysis was done, and it resulted in two types of metacognitive gains that were below 8 gain scores and above 12 gain scores. Then, within available clusters students were selected in a purposive way. That is, within two clusters students with different goal orientations in each group were selected. As a result, for qualitative analysis, there were 18 students available. Considering the goal orientation types, there were 6 cases per each goal orientation (6 for mastery; 6 for performance approach; 6 for performance avoidance). Considering the gain scores, there were 9 cases per each gain cluster (9 for lower gain cluster; 9 for higher gain cluster).

4.3.1. Developed Metacognitive Skills

Before the interventions, students' metacognitive skills were measured with the help of MIIS test. It included items related to reflection-regulation, monitoring, planning, control of attention, and strategy generation. The same MIIS test was implemented at the end of the study again. Improvement in students' metacognitive skills were determined according to the gained score between pre and post MIIS.

MIIS Development for Mastery Goal Orientation Students

Students having *mastery* goal orientation showed different levels of increase in MIIS scores, but half of them showed a common pattern in terms of the most developed skill (*planning* skill). In other words, it was observed that students whose gain scores were within the range of 0-8 (cluster 1) developed their planning skills from the beginning to the end of the study.

Besides planning, the mastery oriented student in WISS group showed a development in *control of attention* skills. On the other hand, while mastery oriented

students in both TS and NS groups in the higher gain cluster (gains between 12-36) showed the development in *monitoring* skill. Mastery oriented student in WISS group in the higher gain cluster showed skill development in *strategy generation*.

MIIS Development for Performance Approach Goal Orientation Students

Students having *performance approach* goal orientation had various developed metacognitive skills. For example, 1 WISS student and 1 TS student in the lower gain cluster showed an increase in *planning*, but at the same time the WISS student's *strategy generation* skill was developed. NS student in that cluster had development on *control of attention*. In higher gain cluster, while TS and NS students' *strategy generation* skills were developed over five weeks, WISS students' *reflection-regulation* skills increased in that cluster.

MIIS Development for Performance Avoidance Goal Orientation Students

Students having *performance avoidance* goal orientation had increased scores, except for one NS student in lower gain cluster, i.e. her all scores remained the same. Others in the lower gain cluster showed no common patterns. WISS student's *control of attention* skill and TS student's *monitoring* skill were developed over five weeks.

In higher gain cluster, WISS and NS students' *reflection-regulation* scores increased. Besides,WISS student's *planning* skills also raised. The TS student in this cluster showed a development in *monitoring* skills. The overall pattern was summarized in Table 4.6.

Table 4. 6

Developed Metacognitive Skills

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster	Plan+Cont	Plan	Plan	Plan+Str	Plan	Cont	Cont	Mon	--
Higher gain cluster	Str	Mon	Mon	Ref-reg	Str	Str	Ref-reg+Plan	Mon	Ref-reg

4.3.2. Trials across Tasks

Each week, students were assigned to one search task including two sub-questions. In the first question, students can easily find ready-to-use information online, but for the second question they were required to interpret the ready-to-use information. While students engaging in the Internet search, their logs or screen recordings were kept. Therefore, the data to analyze the trials across tasks were taken from these logs or records. In this study, a *trial* (or session) was defined as "the process starting with the entry of a new keyword and ending with another entry of keyword or quit from the search". It is not parallel with number of keywords because the learner can give more than one keyword at once which might mean one trial but not one keyword.

Students in the *lower gain cluster* were observed to try at least once or at most twice. Although, the number of trials varies across weeks, the number of trials for the second week (task) interestingly was the same for all students in the lower gain cluster regardless of their goal orientation type or their groups. On the other hand, selected performance approach oriented students of both WISS and TS groups in the lower gain cluster had more than one trial for tasks 2 and 4. Moreover, selected performance avoidance oriented students in TS and NS groups had the same number of trials for the tasks 2 and 5.

Mastery orientation students in the *higher gain cluster* had at least one and at most three trials each week. TS and NS students had the highest number of trials in weeks 3 and 4, but WISS student's hughest number of trials were in weeks 2 and 3, thus

the third task had the common number of trials for this goal orientation type. Performance approach students in this cluster showed different patterns. TS and NS students had one shot trials for the majority of the weeks and tried twice for only one week whereas WISS student had three trials for week 2 and two trials for weeks 3 and 5. Performance avoidance students with high gain scores tried at least once at most three times. WISS and TS students had the samenumber of trials for the same tasks (tasks 2, 3, & 5), but NS student had more than one trials for the first and the second weeks. Table 4.7 briefly includes the main parts of the analysis.

Table 4. 7

Trials for 5 Tasks

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster									
Min Trials	1	1	1	1	1	1	1	1	1
Max Trials	2	2	2	2	2	2	2	2	2
Common Trials	Task 2	Task 2	Task 2	Task 2&4	Task 2&4	Task 2	Task 2	Task 2&5	Task2&5
Higher gain cluster									
Min Trials	1	1	1	1	1	1	1	1	1
Max Trials	3	3	3	3	2	2	3	3	3
Common Trials	Task3	Task 3&4	Task 3&4	--	--	--	Task 2 & 3 & 5		Task 2

4.3.3. Use of Keywords

In order to perform an ordinary Internet search, at least one keyword is needed. For each week's task, students in this study used various types of keywords. Their use of keywords can be classified into four: (i) entry of a meaningful set of keywords; (ii) entry of keywords from general to specific or in way of hypothesis testing; (iii) entry of the question as it was; (iv) entry of unfocused or irrelevant keywords.

In the first approach, students picked the word string(s) within the available question. These keywords were generally focused and related. Almost all of the students

followed this approach at least once. This kind of use was observed most commonly in WISS and TS students. However, NS students with either performance approach oriented or performance avoidance oriented in the higher gain cluster also used this approach. “Global warming” and “respiratory system diseases” were the most common keyword set.

In the second approach, some of the students preferred to use more than one keyword at a certain sequence. In other words, the first entry was more general than the following entries and it was getting more specific and focused through the search topic. These students were in the higher gain cluster and two of them (one with mastery and one with performance approach orientation) were in WISS group and the other two (one with performance approach and one with performance avoidance orientation) were in the TS group. For example, for the second week the WISS student with mastery orientation first entered “imported fruits”, then he visited one link, and then entered “papaya”. The other WISS student followed “fruits that are not grown in Turkey” and “pineapple” keyword sequence. On the other, in the lower gain cluster, there was a mastery oriented WISS student who also used this approach; “fruits that are not found in Turkey” and then “avocado”. Similarly the TS student with performance approach orientation applied this approach in the same week as follows: “tropic fruits”, “pineapple”. Another pattern was the vice versa, i.e. one WISS student with performance avoidance orientation in the higher gain cluster tried to start with hypothesis testing and then moved forward as she visited links. In the second week, she first typed “banana” keyword, then she clicked on a website, and then she entered a totally different keyword that was “where is coconut grown”. Without visiting any link, she then decided to move on with “coconut” keyword only. In the fifth week, she tried first “asthma” and visited a website, then entered “respiratory system diseases” keywords, and then move on with other specific keywords like “bronchitis”.

In the third approach, students did not make any changes on the given tasks. They directly entered the question included in the tasks. Instead of focusing on the mainly searched topic, they preferred to find the whole answer as a ready-to-use format.

Interestingly, students following this approach belonged to the lower gain cluster which refers to low MIIS gain scores. One TS student and one NS student with performance approach goal orientation showed this pattern and their common task for this were obvious in the third task.

The last style of keyword use was the entry of unfocused or irrelevant keywords. This use was observed commonly among NS students. Two NS students (one with mastery and one with performance avoidance) in the lower gain cluster and two NS students (one with mastery and one with performance approach) in the higher gain cluster used this approach. "Fruit", "ecosystem", "Turkey fruit", "pollution", "warming", and "soil" were the commonly observed keywords of these students. The summary of findings is presented in Table 4.8.

Table 4. 8

Use of keywords

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster									
Relevant keywords	√	√	--	√	√	--	√	√	--
Hypothesis testing	--	--	--	--	--	--	--	--	--
Question as keyword	--	--	--	--	√	√	--	--	--
Irrelevant keywords	--	--	√	--	--	--	--	--	√
Higher gain cluster									
Relevant keywords	√	√	--	√	√	√	√	√	√
Hypothesis testing	√	--	--	√	√	--	--	√	--
Question as keyword	--	--	--	--	--	--	--	--	--
Irrelevant keywords	--	--	√	--	--	√	--	--	--

4.3.4. Visited Links

Assigned tasks were required to series of web page visits, however, it was observed that the number of visits exerted a large variance. The types of visits can be elaborated in five themes; (i) visits with at least one tr.wikipedia.org, (ii) visits starting

with the first link, (iii) visits to irrelevant links, (iv) visits to relevant links that are not in a sequence in the list, (v) one shot visits.

As previously stated, tr.wikipedia.org was one of the most frequently visited website by our sample and there were even such keywords as “soil types Wikipedia”. In this smaller sample, the pattern was found the same and there were students who specifically searched for Wikipedia. 2 TS students (two with performance avoidance belonged to both clusters) and 4 NS students (one with performance avoidance student in the first cluster and all of second cluster students) were categorized into that way. These students had always visited Wikipedia even if they also visited other links. The rank of clicks varies, but the number of Wikipedia visits ranged from 1 to 3. The rank of Wikipedia within the result list was generally at the top three.

Some students insisted on visiting the first link in the list as the first visit. This trend was observed in two WISS student (ones with mastery orientation in different clusters). They clicked on the first link in the list whenever they entered really specific keywords such as “pineapple”. There was a commonality among this use which was their use of this approach both in the second and the fifth week. 3 NS students (one with performance approach and one with performance avoidance in the lower gain cluster, and one with performance approach in the higher gain cluster) were observed to enter the first link throughout the study.

Although there were many visits, not all of them were to the point. This pattern was observed among all sample, but it was very intense in NS group. All NS students in the first cluster clicked at least two irrelevant links. These were observed to be resulted in irrelevant or unfocused keyword entries. Another observed thing was that these irrelevant links were also generated as a result of searches for the second parts of the tasks. For example, “why do not dates grow in Turkey?” keyword led one of the students to enter an alternative medicine website that was away from the focus of the actual search.

Performance approach and performance avoidance students in the WISS group in both clusters had a tendency to visit more than one websites during at least 3 tasks. In

addition, one TS student with mastery orientation in the higher gain cluster also showed this kind of a trend. While engaging in these tasks, students' first click on a link seemed to be purposeful and these websites were generally to the point. Instead of clicking on the link in the result list, the sequence varied according to the students' purposes. The rank of visited links was not limited to the first three, but the rank even reached to the 12th link. Students' visits showing this trend also had almost no unrelated clicks.

One-shot visit was another search style among students. Most of the students had that kind of visits at least during one week, however the frequency was higher in NS and TS groups. Two TS students with performance approach in both clusters and two NS students (one with mastery and one with performance approach in the higher gain cluster) demonstrated that approach at more than 2 weeks. Except for the first or the second task, they all had one-shot visits. Table 4.9 consists of the summary.

Table 4. 9

Visited Links

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster									
Wikipedia	--	--	--	--	--	--	--	√	√
Rank 1	√	--	--	--	--	√	--	--	√
Irrelevant links	--	--	√	--	--	√	--	--	√
Relevant links	--	--	--	√	--	--	√	--	--
One-shot	--	--	--	--	√	--	--	--	--
Higher gain cluster									
Wikipedia	--	--	√	--	--	√	--	√	√
Rank 1	√	--	--	--	--	√	--	--	--
Irrelevant links	--	--	--	--	--	--	--	--	--
Relevant links	--	√	--	√	--	--	√	--	--
One-shot	--	--	√	--	√	√	--	--	--

4.3.5. Duration

The duration spent for each website visit was recorded during Internet searches. It was observed that this duration depended on two factors that were *performing copy-pastes* or *relevance of the content.* Students showed different tendencies at conditions of copy-paste and at conditions of reading. On the other hand, students' duration of visits varied across conditions of relevant websites and conditions of irrelevant websites.

Students showing the first mentioned tendency had mastery goal or performance approach orientations. 1 WISS and 1 NS student with mastery orientation in the first cluster and 1 TS student in the second cluster spent less time whenever they performed copy-pastes, but spent longer times for reading the content. On the contrary to this trend, 2 students (one TS student with mastery and one TS student with performance approach orientation) in the first cluster and 3 students (one TS student with performance approach, one NS student with mastery and one NS student with performance approach) in the second cluster followed the reverse pattern, i.e. they spent longer time whenever they performed copy-pastes.

In the second pattern, students' visit duration depended on the relevance of the opened page's content. For these students performing copy-pastes did not affect the duration. 4 WISS students fell into this category. Among these, there were 3 WISS students in the second cluster and 1 WISS student with performance approach orientation in the first cluster. Among TS group, performance avoidance students in both clusters demonstrated this pattern. These students spent less time whenever they realized that the content was irrelevant. The results were summed up in Table 4.10.

Table 4. 10

Duration

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster									
Shorter visits	CP	NCP	CP	IR	NCP	--	--	IR	--
Longer visits	NCP	CP	NCP	R	CP	--	--	R	--
Higher gain cluster									
Shorter visits	R	CP	NCP	--	NCP	NCP	--	IR	--
Longer visits	IR	NCP	CP	--	CP	CP	--	R	--

CP=copy-paste condition; NCP=no copy-paste condition; R=relevant content; IR=irrelevant content

4.3.6. Performance Works

For each week, students were required to complete an Internet search to answer questions given to them in the beginning of the lesson. Each performance work consisted of two types of questions first of which can be found on the web as ready-to-use form. The second part of the tasks was challenging due to requiring critical thinking. Among examined performance work sheets, three trends were observed: (i) full of copy-pastes; (ii) use of own sentences or additional ideas; (iii) incomplete parts.

Copy-pastes for both questions of tasks were observed commonly in especially for the first three weeks. Except for four students (2 WISS students with mastery orientation in both clusters, 1 performance avoidance orientation in the lower gain cluster, and 1 TS student with mastery orientation in the firlower gain cluster), the rest of the sample included at least one performance work sheet consisting of full copied and pasted information. WISS and TS students in the second cluster had such a performance work only for the first week. Moreover, WISS and TS students in the first cluster had copied and pasted performance work for both the first and the third tasks. NS students of both clusters did not have a common pattern, but they had at least 3 performance works including all copy-paste information. There is a difference between NS group and the others in terms of characteristics of copied-pasted information. For example, some of the

copy-pastes of NS students were either really irrelevant or unfocused. The following excerpt was an extreme example of such an irrelevant copy-paste:

> In the avocado eating guide, there are 5 different ways for the consumption of avocado. A shopping center in Konya gives its customers a manual describing how to eat and use avocado in order to increase the amount of sales of this not much known fruit.
>
> Avokado yeme kılavuzunda, tüketim konusunda 5 farklı yol ele alınıyor. Konya'da bir alışveriş merkezi, çok fazla bilinmeyen avokadonun satışını artırmak amacıyla, avokado satın alanlara, bu meyvenin nasıl yeneceğine ilişkin bilgiler içeren kılavuz veriyor.

Copy-pastes also led to misconceptions, and therefore wrong answers. For example, students having full copy-pastes for the third week showed the same pattern, that is, they reported results of noise pollution. However, the cause of noise pollution was the original question. Another example was about the fifth week. Three of the respiratory system diseases were asked, but copy-pastes were explaining the aspiration (exhale and inhale). In addition, none of the copy-pasted information for the second parts of the tasks was correct because of the lack of interpretations or student's additional thoughts.

The second approach can be observed in two ways within available data. In one way, students insisted on copy-pastes, but also make some editing or paraphrasing the copy-pastes information. Students who preferred this approach all used copy-paste information for the first questions of the given tasks. For the second questions, they also used copy-pastes but with small or big change such as paraphrasing. This trend was observed among students who had lower gain scores in TS and who had higher gain scores in NS group almost throughout the whole study. Performance avoidance student in WISS lower gain cluster also showed this trend twice (tasks 1 and 4). When these performance works were closely examined, the copy-pasted parts were almost

untouched. For example, in the fourth week's task, the WISS student with performance avoidance in the lower gain cluster just copied and pasted the definitions of soil types respectively instead of comparing and contrasting them together. The second parts including editing or paraphrasing were frequently observed in TS and NS lower gain students, but there was a difference between them in terms of either the quality of editing or the correctness of written information. That is, the second questions of NS students' performance works were observed to be inappropriate or incorrect or very shallow in content. The following excerpts exemplified how shallow the answers were. Despite the correctness of the answers, they lacked of justification.

> I think, mold soil is better than clay soil because it is the most suitable soil type for agriculture.
>
> Humuslu toprak bence daha iyi çünkü tarım için daha uygun.

> I believe that pneumonitis is the most dangerous respiratory system disease because it is a kind of deadly disease.
>
> Bana göre zatüre en tehlikeli hastalık. Çünkü insanların ölmesine sebep oluyor.

Unlike NS students of the second cluster, TS students in the lower gain cluster found the correct answers for the second questions of the tasks and they included some rationale as following excerpts indicated.

> If the cars are used less, there will be less noise pollution. In addition, something can be installed into the exhaust of trucks. People should not shout out on the street.
>
> İnsanlar arabalar daha az kullanırsa gürültü kirliliği azalır. Kamyonların egsozuna bir şey takılabilir. İnsanlar sokaklarda yüksek sesle konuşmamalı.

> The mold soil is a fertile soil type because it allows to grow food, however, clay soil does not enable to grow something. The mold soil can be processed, but clay soil can't be processed. That's why the mold soil is more appropriate for agriculture.
>
> Humuslu toprak verimlidir çünkü üzerinde besin yetişir. Killi toprakta hiçbir şey yetişmez. Humuslu toprak işlenmeye elverişlidir ama killi toprak işlenemez. Bunlardan dolayı da humuslu toprak bana göre tarıma daha elverişli topraktır.

In another way, students benefitted from the found ready-to-use information but shaped them according to their needs, i.e. they used their own words instead of small editing or paraphrasing. It was common in WISS students with both high and low gains and TS students with high gains. The trend became evident towards the fourth and fifth tasks, but performance approach students of WISS in both gain levels and that of TS in low gain level tended to add their own words earlier than the others, i.e. after the first week. When compared their use of words or the content, there was not clear distinctions between WISS and TS students or between goal orientation types. The closely examined performance work sheets showed that students' answers were very similar in the second task, very creative both in the first and the third task, and very diverse in the fifth task. The following excerpts were from the second week.

> Since there is neither much humidity nor very high temperatures in Turkey, this fruit does not grow here. There should be 90%-95% humidity to keep this fruit fresh. (WISS student with performance approach in the lower gain cluster)
>
> Ülkemiz çok nemli ve sıcak olmadığından dolayı bu meyve yetişmez. Bu meyve için % 90-95 nem oranı gerekir.
> One of the reasons why not this fruit grow in Turkey is climate conditions. The climate of Turkey is different than India. That enables papaya to grow. India is a hot country. There are four seasons in Turkey. Since papaya needs hot weather, it does not grow in Turkey. (WISS student with mastery in higher gain cluster)

> Bu meyvenin Türkiye'de yetişmeme sebeplerinden biri iklim koşullarıdır. Türkiye'nin iklimi Hindistan'in ikliminden farklıdır. Papayanın yetişmesini sağlar. Hindistan sıcak bir ülke. Turkiye'de 4 mevsim yaşanır. Papaya sıcak havaya ihtiyaç duyduğu için Turkiye'de yetişmeyen bir meyve.
>
> Since Turkey does not have a tropical climate and since there is not appropriate climate conditions, this fruit does not grow in Turkey. (TS student with performance approach in higher gain cluster)
>
> Türkiye'de tropik iklim olmadığından ve uygun iklim koşulları olmadığından bu meyve burda yetişmez.

The above excerpts directly or indirectly referred to the absence of appropriate climate conditions to grow the mentioned fruits. Although the answers of the first questions of the first task varied, it can be inferred from the answers that above students grasped the main point of the topic. The following quotes were selected both from the first and the third tasks and they exemplified how students can create original solutions. For instance, packaged water became a part of our lives or unexpectedly changing weather events emerged recently, thus these inferences seem really creative. In the third task, charging people if they cause too much noise or installation of noise isolation or reducer tools were also original ways of coping with noise pollution.

> Global warming caused aridity. It brought about money loss. People had to start buying packaged water. (WISS student with mastery in lower gain cluster)
>
> Küresel ısınma kuraklığa sebep oldu. İnsanlar para kaybetti. Damacana su almaya başladık.
>
> Global warming caused many negative results. It is responsible for the increase in skin cancer. It caused people to be afraid of disasters because of the unexpected weather conditions. (TS student with mastery in higher gain cluster)

Küresel ısınma bir sürü kotü sonuç getirdi. Deri kanserinin artmasına yol açtı. İnsanlar ani hava değişimleri yüzünden felaketlerden korkar oldu.

We can turn down the volume while listening to the music or watching TV…..certain rules can be enacted and the policemen can charge the violators. Apart from that the most important thing is to help people to become conscious. (WISS student with performance approach in higher gain cluster)

Müzik dinlerken ve televizyon izlerken müziğin sesini kısabiliriz……kurallar konabilir. Polis ceza yazabilir. Bunlardan daha da önemlisi insanların bilinç sahibi olmasını saglamak.

I think sound isolation can reduce the noise pollution. It should be also used in factories. Houses, cars, and apartments should use this, but it must be used in factories because they caused 80% of the noise pollution. (WISS student with performance avoidance in higher gain cluster)

Bana gore ses yalıtımı gürültü kirliliğini azaltır. Fabrikalar kullanmalı. Evlerde, arabalarda, binalarda ses yalıtımı olmalı ama fabrikalarda da kullanılması gerekir çünkü gürültü kirliliğinin % 80'ini onlar yapıyor.

The number of road constructions can be reduced. We should not listen to high volume music. Noise reducers should be installed to cars and planes. People should speak softly. (TS student with performance avoidance in higher gain cluster)

Yol yapım calışmaları azaltılmalı. Çok yüksek sesli müzik dinlememeliyiz. Araba ve uçaklara susturucular takılmalı. İnsanlar yavaş konusmalı.

The answers of the fifth task were very diverse, especially the second answers of that task. The following quotes showed how students' perceptions and justifications varied across students.

In my opinion, asthma is the most dangerous respiratory system disease. ….inappropriate environmental conditions can make it worse. (WISS student with performance avoidance in higher gain cluster)

Astım bence en tehlikeli hastalık….bazı cevresel durumlar astımı kötüleştirebilir.

Lung cancer can be the most dangerous disease because it can result in death. It causes loss of hair. (TS student with mastery in lower gain cluster)

Akciğer kanseri en tehlikeli hastalıktır çünkü öldürür. Kanserli insanların saçı dökülür.

I think tuberculosis is very dangerous. It was responsible for many deaths in the past, but today we get vaccinations to prevent it. It is still dangerous when the effects of vaccines diminish. (TS student with performance avoidance in higher gain cluster)

Bence en tehlikeli hastalık veremdir. Eskiden bir sürü insan öldürmüş ama simdi aşı yapılıyor. Aşının etkisi gidince yine insanı öldürebilir.

Other than these trends, there was another trend observed in performance work sheets. Some students returned their work sheets as either totally or partially incomplete. These failures were observed widely among NS students in the lower gain cluster regardless of their goal orientation types. NS student with performance avoidance in lower gain cluster failed to complete the second task although she entered many keywords but visited only one website. Performance approach student in the same category failed to complete the first parts of the first two tasks although she visited many websites which were not very related with the main topic of the search. The same student failed to answer the second part of the third task. Mastery oriented NS student in this category also failed in the second task that was searched through one keyword resulting in only one link visit. Overall findings were outlined in Table 4.11.

Table 4. 11
Performance Works

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster									
Copy-paste	--	--	√	√	√	√	--	√	√
Added ideas	√	√	√	√	√	√	√	√	√
Incomplete parts	--	--	√	--	--	√	--	--	√
Higher gain cluster									
Copy-paste	--	√	√	√	√	√	√	√	√
Added ideas	√	√	√	√	√	√	√	√	√
Incomplete parts	--	--	--	--	--	--	--	--	--

4.3.7. Reflections of Topics

Students in all groups wrote their reflections about previous week's searched topic on a piece of paper before starting the new week's task. They were requested to write about what they remember about the topic. The examined reflections can be shaped in three forms: (i) remembering only interpretations; (ii) remembering both interpretations and found information; (iii) confusions or misconceptions. These trends were not strictly separated across groups or goal orientation types, but there were some common patterns as well as merged ones.

The first theme inferred from the reflection papers was that students who did not write anything about ready-to-use information, but remember *interpretation* generally in the second part of the tasks. TS students in this sample did not show a common trend. In the lower gain cluster, TS students with performance approach and avoidance orientations demonstrated a straight pattern which was remembering very general information starting from the second week, however, they were all lack of details of the topic. Nonetheless, TS students with performance approach and performance avoidance orientations in the higher gain cluster seemed to remember the second part of tasks 2, 3, and 4, but varied in the first and the fifth weeks. NS students in the second cluster also tended to remember the second parts of at least two tasks, but these varied across

students. WISS students in the lower gain cluster seemed to remember mainly the second parts of tasks. Their first two week reflections are more general than the rest. Towards the end of the study, they tended to remember more details. The following quotes were taken from mastery oriented WISS student in lower gain cluster.

> Global warming has been threatening our lives and our health. (Week 1)
>
> Küresel ısınma insan hayatını ve sağlığımızı tehdit ediyor.
>
> Tropic fruits do not grow in Turkey because of inconvenient climatic conditions. (Week 2)
>
> Tropikal meyveler Türkiye'de olmaz çünkü iklim koşulları uygun değil.
>
> Automobile horns, planes, and exhaust of trucks are the main causes of noise pollution. It can be reduced in a variety of ways. For example, we can make people aware of this issue. Noise reducers can be installed into exhausts. (Week 3)
>
> Araba kornası, uçaklar ve kamyonların egsozları gürültü kirliğinin sebepleridir. Azaltmanın bir çok yolu var. İnsanları bilinçlendirebiliriz mesela. Kamyonlara susturucu takılabilir.
>
> Many things can be grown on mold soil because it is very appropriate for agriculture. Clay soil keeps too much water, but the mold soil does not. That's why, it is easier to use mold soil. (Week 4)
>
> Tarıma elverişli olduğundan humuslu toprakta bir çok şey yetiştirebiliriz. Killi toprak çok su tutar ama humuslu toprak çok su tutmaz. Bunlardan dolayı da humusluyu kullanmak daha iyidir.
>
> I could not remember the names of all respiratory system diseases but I remember that lung cancer is really dangerous. It kills people who smoke too much. (Week 5)
>
> Bütün solunum hastalıklarını hatırlayamıyorum ama akciğer kanserinin çok tehlikeli olduğunu biliyorum. Çok sigara içenler bu hastalığa yakalanıp ölüyor.

The second theme referred to reflections about both *previously found information and interpretations*. The number of students who exhibited that tendency was 4. 1 WISS student with performance approach in higher gain cluster and 1 TS student with mastery orientation in higher gain cluster showed this trend only for the third task. In addition, 1 WISS student with mastery orientation in higher gain cluster mentioned about both parts of tasks during three weeks (tasks 3, 4, & 5). Apart from these students, 1 WISS student with performance avoidance orientation in higher gain cluster all wrote about both questions of all tasks from the beginning till the end of the study. It can be observed from the reflection papers that the remembered things about the second parts were deeper than the first parts of tasks. The below quotes are some examples of students showing this trend.

> Papaya is found in warmer countries. For example, India has a warm climate which enables papaya to be grown there. This fruit has seeds inside. Its color is orange. It does not grow in Turkey because of having four seasons. (WISS student with mastery in higher gain cluster)
>
> Papaya sıcak ülkelerde yetişir. Hindistan'da sıcak iklim görülür. Bu papayanin yetişmesi için uygundur. Papayanın çekirdekleri vardir. Turuncu bir meyvedir. Türkiye'de yetişmeme sebebi de burda 4 mevsim yaşanmasıdır.
>
> Motor vehicles are primarily responsible for noise pollution. It can be reduced with less use of cars. If unnecessary uses of horns are prevented, the noise pollution can also be reduced. There are many other ways to reduce it, but I think it is impossible to completely remove it. (WISS student with performance approach in higher gain cluster)
>
> Gürültü kirliliğinin sebebi motorlu araçlardır. Araçları daha az kullanırsak daha az kirlilik olur. İnsanlar gereksiz yere korna çalmazsa da azalır. Bence bir çok başka yol vardır ama tamamen yok etmek çok zor.

The clay soil is different than the mold soil. The latter is darker than the former. Since the latter consists of varieties of minerals, it is more efficient than other soil types. (TS student with mastery orientation in higher gain cluster)

Killi toprak humusludan farklıdır. Humuslu daha koyu renktedir. Içinde çok mineral olduğu için humuslu toprak daha verimlidir.

Flue, asthma, and lung cancer are some of the respiratory system diseases. All of them are very dangerous, especially the lung cancer because it leads to death. (WISS student with performance avoidance in higher cluster)

Grip, astım, akciğer kanseri solunum hastalıklarıdır. Hepsi çok tehlikeli bana göre ama en çok akciğer kanseri öldürür.

The last theme observed within reflection papers showed *certain misconceptions or confusions*. These were prevalent within NS students as well as TS students. There was a distinction between these two groups. 3 TS students (one with mastery in lower gain cluster, one with performance approach and one with performance avoidance in higher gain cluster) have at least one reflection indicating some confusion about the content. For example, one student defined the process of aspiration rather than diseases. Another student claimed that mold soil consisted of clay soil. On the other hand, 4 NS students (all in lower gain cluster and one with mastery orientation in higher gain cluster) illustrated at least one misconception within the reflections. Table 4.12 summarized the findings. The following excerpts were some examples of misconceptions.

The sun heats the Earth too much and it causes global warming.

Güneşin dünyayı çok ısıtması küresel ısınmaya yol açar.

The clay soil is a kind of clean soil. That is why it allows cultivations.

Killi toprak temiz topraktır. Bu yüzden tarım yapılabilir.

Table 4. 12

Topic Reflections

Cluster	*Mastery*			*Performance Approach*			*Performance Avoidance*		
	WISS	TS	NS	WISS	TS	NS	WISS	TS	NS
Lower gain cluster									
Interpretations	√	--	--	√	√	--	√	√	--
Information&Interpretations	--	--	--	--	--	--	--	--	--
Confusions&Misconceptions	--	√	√	--	--	√	--	--	√
Higher gain cluster									
Interpretations	--	--	√	--	√	√	--	√	√
Information&Interpretations	√	√	--	√	--	--	√	--	--
Confusions&Misconceptions	--	--	√	--	√	--	--	√	--

4.3.8. Reflections of Search Process

Each week, students were requested to write their reflections about their previous Internet search process. These reflections were written before the new week's search task start. Unlike topic reflections, process reflections of students were clearly categorized into 3: (i) perceived challenges; (ii) descriptions; (iii) advantages.

Students' *perceived challenges* about Internet search process differed between groups. The mastery oriented TS students in both clusters mentioned about the importance of choosing the appropriate keywords. Because of being experienced in different Internet search environments, WISS students' perceived challenges were very different and detailed than others. During the early weeks, they stated how hard to distinguish *aim* from *keyword.* A WISS student with performance avoidance orientation in lower gain cluster explained how he realized the difference in the third week.

> When I first met the program, I was thinking why this program wants me to type the same things respectively. I did not even think about what my aim is and what keywords I will use. I automatically typed the keywords for both spaces. Later, I realized that in the end of the search the program shows me the reports of what I have done. It says your aim is noise pollution and you used noise pollution keyword. It seems to me still they refer the same things, but I think I should add "to learn" for the aim space.

> Bu programı ilk kullandığımda neden benden sürekli aynı şeyleri yazmamı istediğini anlamadım. Her arama yapmak istediğimde soruyordu. Amacın ne, hangi kelimeleri kullanacaksın diye iki tane boşluk var. Ben bunları dusunmeden yazıyordum zaten. Programı kapatırken neler yaptığımı gösteren bir dosya göründü. Ondan sonra gördüm amacımın kelimelerimle aynı olduğunu. Hem gürültü kirliliği amacım hem de anahtar kelimem. Bence ikisi de aynı şey aslında ama amacım gürültü kirliliğini öğrenmek olduğu için bunu eklemem gerekirdi.

WISS students also claimed that the questions asked by the program as soon as they visited a link were really hard. Those in the lower gain cluster mentioned more than the other cluster. Higher gain cluster WISS students seemed to have got used to answer them after a few weeks later since they did not mention about questions after the third week. Performance approach WISS student in higher gain cluster outlined her perceptions about questions in the second week as follows:

> ….the questions are boring indeed. However, they help me to have an idea about the visited pages. If I enter a page that I do not know anything about it, I explore it, and then I make up my mind. I detect the harmful pages with the help of questions.
>
> ….soruları çok sıkıcı gerçekten. Ama baktığım sayfalar hakkında düşünmemi sağliyor. Hakkında hiçbir şey bilmediğim bir sayfaya girdiğimde önce bir göz atıyorum sonra da devam edip etmeyeceğime karar veriyorum. Zaten kötü bir siteyse sorular bana yardım ediyor.

TS students were also exposed to these questions with the guidance of the teacher. They did not directly mention about the questions, instead they described how to detect useless links. Unlike WISS students, TS students were observed to have noticed this point towards the end of the study. The following quote from week 4 is an

example from a TS student with performance approach orientation in higher gain cluster.

> Our teacher taught us how to investigate the websites. I learnt about the existing risks of the Internet. I do not click everything that I see on the net and I recognize if I come across an unusual website.
>
> Öğretmenimiz bize sitelerde nelere bakmamiz gerektiğini öğretti. İnternetteki tehlikeleri de biliyorum. Her gördüğüm şeye tıklamıyorum. Kötü bir siteye girdiğimde hemen anlıyorum.

Unlike WISS and TS students, none of the NS students wrote about anything about challenges of searching. Instead, they generally remained at the *description* level which was the second theme. NS students in the lower gain cluster used such words as finding "new information", "interesting information", "lots of information", "what s/he do not know" while reflecting on their search processes throughout the study. Beside these expressions, NS students in the higher gain cluster also referred frequently to the "search" and "homework" words. A performance approach NS student in higher gain cluster explained his third week search process as follows:

> I did my homework. I found much important information about noise pollution. I searched the Internet to complete my homework.
>
> Ödevimi yaptım. Gürültü kirliliğiyle ilgili önemli bilgi buldum. Ödevimi yapmak için İnternette araştırma yaptım.

WISS and TS students' *descriptions* included references to either teacher or the program. For instance, one WISS student with performance approach orientation in lower gain cluster claimed that he learnt new information with the help of the program. The same student also emphasized on his extra attention to complete inputs of the

program. Another WISS student with mastery orientation in higher gain cluster stated that he learnt things in detail with the help of program. WISS students also used such words as “reading deeply”, “finding extensive information”, “detailed search”, “easy search” to define their search. TS students attributed their search process to their teacher and frequently used the following descriptions: “detailed search”, “helpful search”, “easy search”. Two students (one WISS and one TS student with mastery orientation in higher gain cluster) also defined how they applied strategies although they did not directly use the word strategy.

> In order to save time I started to first examine the Google results page before clicking a page. I read the explanation. I click the page if it appeals to me. Otherwise I get lost. Moreover, to me, it is hard to answer questions (that comes after a visit) when I enter a weird page. (WISS student with mastery orientation in higher gain cluster)
>
> Bir sayfaya tıklamadan önce Google sonuçlarına baktım. Böylece çok zaman kaybetmedim. Açıklamalara baktım ve bana göre uygun olan sayfalara tıkladım. Böyle yapmadığımda sayfalar arasında kayboluyordum. Ayrıca böyle yapmazsam ve kötü bir siteye girersem soruları cevaplamak cok zor geliyor bana.
>
> The last week was hard for me, that’s why I will read more this time. I will try to find more information. Our teacher warned us about not to enter unrelated links. He listed the things that we need to be careful. (TS student with mastery information in higher gain cluster)
>
> Geçenki ödevde çok zorlandığım için bu haftakinde daha çok okuyacağım. Daha çok bilgi bulmaya çalişacağım. Öğretmenimiz ilgisiz sitelere girmemizi istemiyor. Öğretmenimiz dikkatli olmamız gereken şeyleri tahtaya yazdı.

The last theme was about *advantages of Internet search*. NS students’ explained advantages were very shallow. They were limited to “learning through Internet” or “finding new information. On the other hand WISS and TS students listed a series of

advantages including time, speed, easiness, fun, and help. Almost all of the WISS and TS students in the sample mentioned one of these advantages. The following excerpts are some examples.

> It is fun to do homework here in this program…..It saves time. (WISS student with performance avoidance orientation in lower gain cluster)
>
> Bu programda araştırmak çok zevkli……..Zamanım arttı.
>
> This program provided with many advantages like saving time. I searched faster and finished in advance, so that I had time to do something else. (WISS student with mastery orientation in higher gain cluster)
>
> Bu program bana bir çok şey sağladı. Kendime zaman kaldı. Daha hızlı araştırdım ve daha çabuk bitirdim. Ödevimi erken bitirince başka şey yapacak zamanım kaldı.
>
> It allowed me to learn clearly…..I read more……It enabled me to remember my previous knowledge related with the topic…...I read faster and search easily. (WISS student with performance approach orientation in higher gain cluster)
>
> Program sayesinde daha iyi şeyler öğrendim…..daha çok okudum……Daha önceden bildiğim şeyleri hatırlattı……Daha hızlı okudum, daha kolay araştırdım.
>
> While searching on this program, I realized what I have learnt or I have not about respiratory system. (WISS student with performance avoidance in higher gain cluster)
>
> Programda arama yaparken solunum sistemiyle ilgili neler öğrenip öğrenmedigimi fark ettim.
>
> I learnt how to find appropriate keywords….I read more in details….The teacher taught us how to do effective searches. I think it becomes easier with the help of our teacher. (TS student with performance avoidance in lower gain cluster)
>
> Nasıl anahtar kelime bulunduğunu öğrendim…..Daha detaylı okudum…..Öğretmenimiz İnternette nasıl iyi araştırma yapılacağını öğretti. Bence öğretmenimizin yardım etmesi ödevleri daha kolay yapmamı sağladı.

Searching the Google is not very hard but a little bit complicated….Our teacher demonstrated us how to easily search. I learnt many helpful ways….(TS student with mastery orientation in higher gain cluster)

Google'da arama yapmak zor değil ama bazen karışık oluyor….Öğretmenimiz bize arama yapmanın kolaylıklarını gösterdi. Bir sürü yol öğrendim….
Our teacher taught us how to search the Internet. It is more enjoyable to search here. (TS student with performance avoidance in lower gain cluster)

Öğretmenimiz İnternette nasıl arama yapmamız gerektiğini anlattı. Burda İnternet ödevi yapmak çok zevkli.

Table 4.13 includes the summary of search process reflection findings.

Table 4. 13

Process Reflections

Cluster	*WISS*	*TS*	*NS*
Challenges	Questions of the program	Detection of useless links	--
Descriptions	Program-focused Used words: *help, details, attention, easy, strategy*	Teacher-focused Used words: *help, details, easy, strategy*	Search-focused Used words: *homework, searching, new information*
Advantages	Time Speed Easiness Fun Helpful	Time Speed Easiness Fun Helpful	Learning Finding new information

4.4. Post-MIIS Score Differences between Groups (Research Question 4)

There are 72 participants divided in 3 groups having different pre-MIIS scores in this study. After receiving different interventions, students took the post-MIIS test. Since the study took place within regular school settings, the group structures were

intact. There was no control of their prior characteristics. Therefore, students' pre-MIIS scores were controlled in the following analyses. Before the main analysis, a series of assumptions were checked.

Independence of observation assumption was met through the standardized context. Post-MIIS scores can be assumed normally distributed because its skewness and kurtosis values are within the acceptable ranges. Boxplot on figure 4.1(b) shows only one outlier that is case 14. On figure 4.1(a), pre-MIIS scores have one outlier, case 25, but when Cook's D was calculated, there were no values exceeding the critical value which was calculated d = .067. Leverage values were also less than 1. The variances of post-MIIS scores are the same across groups as Levene's test indicated ($F(2, 69) = 1.58$, $p>.05$). MIIS scores are calculated along with the ratio scale. Slopes on the scatterplot (Figure 4.3) indicate the linear relationship between pre-MIIS and post-MIIS scores. Finally, homogeneity of regression coefficient assumption was investigated. Relationship between pre-MIIS and post-MIIS do not differ significantly ($F(2,66)=.81$, $p>.05$). It can be concluded that no violations of assumptions exist.

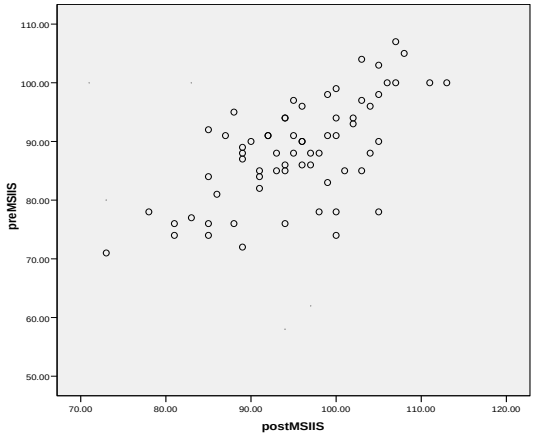


Figure 4. 3 Linear relationship between DV (post-MIIS) and CV (pre-MIIS)

Results of the analysis show that pre-MIIS scores ($F(1,68) = 19.08$, $p<.05$, $\eta^2 = .22$) have significant effects on post-MIIS scores of students. Similarly, belonging to one of the experiment groups ($F(2,68) = 6.03$, $p<.05$, $\eta^2 = .15$) have also significant effects on post scores. Moreover, their effect sizes can be considered as moderate for covariate and small for independent variable. Pre-scores of students explains 22% of variance while belonging to one of the groups explains only 15% of variance. Table 4.14 summarizes the results of ANCOVA.

Table 4. 14

ANCOVA results with dependent variable post-MIIS scores by group with confounding variable pre-MIIS scores

	SS	*df*	*MS*	*F*	η^2
Covariate	1074.30	1	1074.30	19.08*	.22
Between	678.62	2	339.31	6.03*	.15
Within(Error)	3829.51	68	56.32		
Total	5647.11	71			

η^2 *=effect size,* * $p < .05$

In order to compare groups, contrast results and follow-up comparisons were used. Alpha was adjusted to α=.025 due to having two comparisons. Table 4.15 summarized the results of Bonferroni test. After adjusting alpha, only the second comparison was found significant ($p<.025$).

Table 4. 15

Contrast Results

IV:Group Simple Contrast[a]			Dependent Variable: Post-MIIS
Level 2 vs. Level 1	Contrast Estimate		-2.25
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-2.25
	Std. Error		2.18
	Sig.		.30
	95% Confidence Interval for Difference	Lower Bound	-6.60
		Upper Bound	2.09
Level 3 vs. Level 1	Contrast Estimate		-7.30
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		-7.30
	Std. Error		2.15
	Sig.		.001
	95% Confidence Interval for Difference	Lower Bound	-11.58
		Upper Bound	-3.01

a Reference category = 1

Confidence interval adjustment was completed with Bonferonni correction (Table 4.16). The pairwise comparisons indicated that there is a significant mean difference between WISS and NS at .05 alpha level. Students in WISS group ($t(68)=3.40$, $p<.05$, $r=.15$) had significantly higher post-MIIS scores with small effect sizes than the ones in NS group. As a result of contrast and comparison tests, it can be concluded that there are either significant or insignificant mean differences on post-MIIS scores of students across group. While WISS group's post-MIIS score was significantly higher than that of NS group. It was not significantly higher than TS group's post-MIIS score. In addition, there was not significant difference between TS and NS groups' post-MIIS scores. The findings also indicated no significant post-MIIS score differences between WISS and TS group.

Table 4. 16

Pairwise Comparisons

(I) group	(J) group	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a] Upper Bound	Lower Bound
wiss	ts	2.25	2.18	.91	-3.09	7.59
	ns	7.30*	2.15	.003	2.03	12.57
ts	wiss	-2.25	2.18	.91	-7.59	3.09
	ns	5.05	2.19	.07	-.33	10.42
ns	wiss	-7.30*	2.15	.003	-12.57	-2.03
	ts	-5.05	2.19	.07	-10.42	.33

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

4.4.1. Specific Metacognitive Skill Improvements across Groups (Research Question 4.1)

ANCOVA results indicated that there are differences on the post-test scores of students attending different groups, therefore digging into post-MIIS dimensions might be helpful in order to understand which sub-scores were varying across groups. 5 independent variables (post-MIIS scores for reflection-regulation, monitoring, planning, control of attention, and strategy generation) and 1 independent variable with three levels (groups; level 1: WISS, level 2: TS, level 3: NS) were included in the analysis. One way multivariate analysis of variance (MANOVA) was conducted to understand if there are significant mean differences of sub metacognitive skills across groups.

Before starting the main analysis, certain assumptions were evaluated. Although the main analysis was run at .05 alpha level, it was adjusted to .01 ($\alpha/5$) to evaluate univariate analysis. Moreover, the alpha was adjusted to .025 ($\alpha/2$) for planned comparisons; however, this adjustment is not needed for pairwise comparisons.

Independence of observation assumption was met through random sampling. All dependent variables (5 subscales of MIIS) were continuous variables which met the assumption of at least interval/ratio scale usage. Another assumption is that there should not be any outliers. Skewness-Kurtosis values were explored to check univariate outliers. Moroever, multivariate outliers were investigated with the help of Cook's D. For each dependent variable, Cook's D was calculated and no outliers were detected.

Normality is one of the assumptions as it is in other variance analysis, but for MANOVA multivariate normality should be checked. First of all, each DV should be normally distributed within groups. Skewness-Kurtosis values did not exceed the range of -1, +1, and Shapiro-Wilk test generated insignificant results for each cell. Then, bivariate normality was tested with scatterplot of pairs of variables and no violations were observed. As a last step, Mardia's test was performed to ensure multivariate normality and the test indicated that data has a multivariate distribution ($p>.05$).

Linearity is another assumption referring to the relationships among dependent variables within each group. Matrix scatterplot produced linear lines, but there were a few lines that were not straight. On the other hand, when bivariate correlations were examined, it was found that each dependent variable is related to some extent with others within groups at .01 and .05 alpha levels (Table 4.17).

Homogeneity of population covariance matrix assumption refers to both variances for each dependent variable and covariance among dependent variables. Levene's tests of homogeneity indicated that variances for each DV are similar across groups. Box's M test, which is very sensitive to sample size, generated a significant value ($F(30,14945)=1.74$, $p<.05$). In other words, covariances among dependent variables are not the same or similar. Instead of Wilk's Lambda, Pillai's trace was preferred to use for further interpretations of MANOVA results because it is robust to such violations.

Table 4. 17

Correlations within Groups

	Reflection-Regulation	Monitoring	Planning	Control of Attention
Monitoring				
WISS	.62**	--	--	--
TS	.43*	--	--	--
NS	.39	--	--	--
Planning				
WISS	.63**	.72**	--	--
TS	-.03	-.16	--	--
NS	.68**	.50*	--	--
Control of Attention				
WISS	-.09	-.11	.04	--
TS	-.18	-.03	-.27	--
NS	-.12	.25	-.18	--
Strategy Generation				
WISS	.86**	.77**	.66**	-.10
TS	.33	.51*	-.02	-.29
NS	.72**	.56**	.69**	-.10

** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed).

MANOVA results indicated significant differences among groups on metacognitive skills, Pillai's V=.39, $F(10,132)=3.20$, $p<.05$, $\eta^2=.20$. In other words, belonging to one of the three groups has effects on metacognitive skills with moderate effect sizes. The overall results of the analysis were summarized in Table 4.18.

Table 4. 18

Multivariate and Univariate Analysis of Variance F ratios for groups with three levels (WISS, TS, NS) on students' metacognitive skills.

		ANOVA				
Variable	MANOVA $F(10, 132)$	Reflection-Regulation $F(2,69)$	Monitoring $F(2,69)$	Planning $F(2,69)$	Control $F(2,69)$	Strategy $F(2,69)$
Groups (IV)	3.20^{*}	3.09	4.90^{**}	6.91^{**}	5.94^{**}	6.74^{**}

Note. *F* ratios are Pillai's approximation of *F*s. MANOVA = Multivariate analysis of variance; ANOVA=Analysis of variance

$^{*}p < .05$. $^{**}p < .01$

For follow-up analysis, Bonferonni method was used to adjust for Type I error in addition to alpha adjustment ($\alpha/5=.01$). Investigating the univariate analysis, monitoring, planning, control of attention, and strategy generation skills were found significant with small effect sizes [$F_{monitoring}(2,69)=4.90$, $p<.01$, $\eta^2=.12$; $F_{plan}(2,69)=6.91$, $p<.01$, $\eta^2=.17$; $F_{control}(2,69)=5.94$, $p<.01$, $\eta^2=.15$; $F_{strategy}(2,69)=6.74$, $p<.01$, $\eta^2=.16$]. Only reflection-regulation skills were not found significant (see Table 4.18).

Since the results of ANOVAs showed significant effects for all variables except for reflection-regulation, post-hoc analysis was run for each DV in order to examine which group performed better with regards to four different metacognitive skills as a follow-up with Scheffe test. The results pointed to many significant mean score differences. Students in WISS condition had significantly higher scores of monitoring, planning, control, and strategy than those in NS condition ($p<.05$). Control scores of students in WISS group were also significantly higher than those in TS condition ($p<.05$). Students in TS group performed significantly higher only at strategy generation scores ($p<.05$) than those in NS group.

4.5. Post-MIIS Differences across Goal Orientation Types (Research Question 5)

In this study, PALS instrument was used to define goal orientations of participants. The scale refers to three dimensions of orientations: mastery, performance approach, and performance avoidance. In MIIS scale, there are 5 factors that are reflection-regulation, monitoring, planning, controlling, and strategy generation. In order to detect any post-MIIS score differences among three goal orientation (GO) types, ANCOVA was run after checking assumptions. Pre-MIIS score was again chosen as covariate. Independence of observation and normality assumptions were confirmed. As figures 4.1(a) and (b) show, dependent variable (DV) and confounding variable (CV) have two outliers in total, but these were assumed not to affect normality. The variances of post-MIIS scores are the same across GO types as Levene's test indicated (F (2, 69) = 1.37, p>.05). Figure 4.4 shows the linear relationship between pre-MIIS and post-MIIS scores considering GO types. While investigating the homogeneity of regression coefficient assumption, it was found that the relationship between pre-MIIS and post-MIIS do not differ significantly (F(2,66)=.80, p>.05). Therefore, none of the assumptions of ANCOVA was violated.

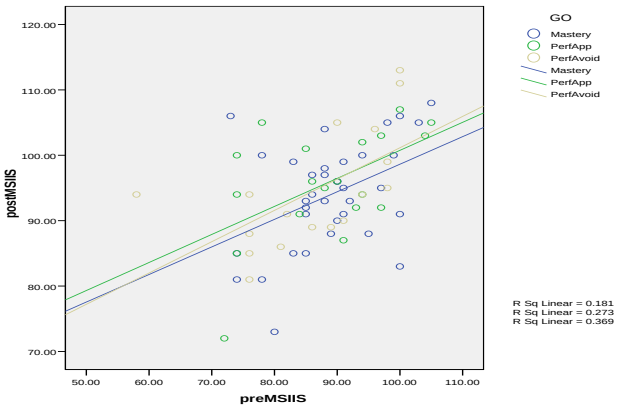


Figure 4. 4 Linear relationship between dependent variable and confounding variable

The results of ANCOVA indicated that both pre-MIIS scores ($F(1,68) = 21.35$, $p<.05$, $\eta^2 = .24$) and goal orientation types ($F(2,68) = 3.47$, $p<.05$, $\eta^2 = .09$) have significant effects on post-MIIS scores of students. Pre-MIIS scores of students explain 24% of variance which can be considered as moderate. Goal orientation types explain only 9% percent which is a very small effect size. Table 4.19 summarized the results of ANCOVA. Since the GO types were found significant, post-hoc analysis is needed.

Table 4. 19

ANCOVA results with dependent variable post-MIIS scores by GO types with confounding variable pre-MIIS scores

	SS	*Df*	*MS*	*F*	η^2
Covariate	1284.41	1	1284.41	21.35*	.24
Between	417.39	2	208.69	3.47*	.09
Within(Error)	4090.74	68	60.16		
Total	5647.11	71			

η^2 *=effect size,* * $p < .05$

Contrasts and pairwise comparisons were used as follow-up analysis. Alpha was adjusted to α=.025 due to having two comparisons. The results of simple contrasts with mastery orientation reference category were summarized in Table 4.20. Only the first contrast was found significant at the level of .025 meaning that there is a significant mean difference between post-MIIS scores of students with mastery goal orientation and those with performance approach orientation.

Table 4. 20
Contrast Results

GO Simple Contrast[a]			Dependent Variable: postMSIIS
Level 2 vs. Level 1	Contrast Estimate		5.54
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		5.54
	Std. Error		2.21
	Sig.		.01
	95% Confidence Interval for Difference	Lower Bound	1.13
		Upper Bound	9.94
Level 3 vs. Level 1	Contrast Estimate		3.73
	Hypothesized Value		0
	Difference (Estimate - Hypothesized)		3.73
	Std. Error		2.31
	Sig.		.11
	95% Confidence Interval for Difference	Lower Bound	-.89
		Upper Bound	8.34

a Reference category = 1

Bonferroni correction was used for confidence interval adjustment (Table 4.21). The results of the correction showed that students with performance approach goal orientation had significantly ($t(68)=.97$, $p<.05$, $r=.01$) higher post-MIIS scores than students with mastery goal orientation, however, the effect size is really small.

Table 4. 21

Pairwise Comparisons

(I) GO	(J) GO	Mean Difference (I-J)	Std. Error	Sig.[a]	95% Confidence Interval for Difference[a]	
					Upper Bound	Lower Bound
Mastery	PerfApp	-5.54*	2.21	.04	-10.96	-.12
	PerfAvoid	-3.73	2.31	.34	-9.41	1.96
PerfApp	Mastery	5.54*	2.21	.04	.12	10.96
	PerfAvoid	1.81	2.60	1.00	-4.56	8.19
PerfAvoid	Mastery	3.73	2.31	.34	-1.96	9.41
	PerfApp	-1.81	2.60	1.00	-8.19	4.56

Based on estimated marginal means

* The mean difference is significant at the .05 level.

a Adjustment for multiple comparisons: Bonferroni.

4.5.1. Specific Metacognitive Skills Development across GO Types (Research Question 5.1)

Since the results of ANCOVA showed significant effects of GO types on post-MIIS scores, specific developments were explored within sub-metacognitive skills. 5 independent variables (post scores of reflection-regulation, monitoring, planning, control of attention, and strategy generation) and 1 independent variable with three levels (GO types; level 1: mastery, level 2: performance approach, level 3: performance avoidance) were included in the analysis. One way multivariate analysis of variance (MANOVA) was conducted to understand if there are significant mean differences of sub metacognitive skills across GO types.

All assumptions of MANOVA were checked and no violations were detected. Alpha was adjusted to .01 ($\alpha/5$) for univariate analysis and .025 ($\alpha/2$) for planned comparisons. For other evaluations, the alpha was adjusted to .05. Independence of observation and interval/ratio scale assumptions were met. Skewness-Kurtosis values and Cook's D were investigated and no outliers were detected. The univariate, bivariate,

and multivariate normalities were controlled. Skewness-Kurtosis values were found within the acceptable range (-1,+1). Each pair of variables was examined on scatterplots for bivariate normality. Mardia's test was run for multivariate normality and found that the distribution can be assumed as a multivariate distribution (p>.05). In order to ensure linearity of dependent variables within each group, a matrix scatterplot was examined. Except for a few lines, majority of the lines were quite straight. Bivariate correlations indicated that each DV is related to some extent with others within groups at .01 and .05 alpha levels (Table 4.22). For homogeneity of variance assumption, Levene's tests were checked. None of the DVs violated the assumption across GO types. To check the homogeneity of covariances among DVs, Box's M test was evaluated and it ensured the assumption (F(30, 8130)=1.40, p>.05). Since this assumption was met, for the overall evaluation, Wilk's Lambda was used. It was found insignificant, Wilk's L=.95, F(10,130)=.35, p>.05, η^2=.03, i.e. having a different type of goal orientation has no effects on specific metacognitive skills development. Since there isn't any significant result, there is no need for planned comparisons.

Table 4. 22

Correlations within Groups

	Reflection-Regulation	Monitoring	Planning	Control of Attention
Monitoring				
Mastery	.50**	--	--	--
PerfApp	.54*	--	--	--
PerfAvoid	.69**	--	--	--
Planning				
Mastery	.35*	.30	--	--
PerfApp	.37	.62**	--	--
PerfAvoid	.83**	.58*	--	--
Control of Attention				
Mastery	-.15	.07	-.08	--
PerfApp	-.13	.08	.14	--
PerfAvoid	.32	.39	.11	--
Strategy Generation				
Mastery	.75**	.70**	.34*	-.05
PerfApp	.60**	.66**	.75**	-.29
PerfAvoid	.78**	.66**	.79**	.44

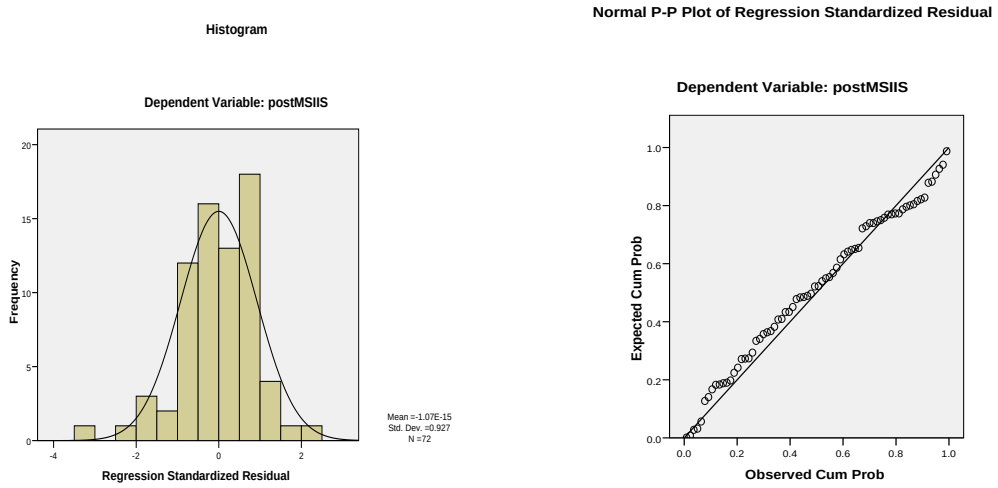
** Correlation is significant at the 0.01 level (2-tailed).* Correlation is significant at the 0.05 level (2-tailed).

4.6. Potential Predictors of Metacognitive Skills (Research Question 6)

Throughout students' Internet searches, many variables were recorded during 5 weeks interval. These variables were used in this analysis to investigate how they contribute metacognitive skill development of students. Number of trials, number of visited links, number of used keywords, number of keyword changes, time to finish the search, number of copy-pastes, and number of added ideas were one set of independent variables. Average of 5-week data was taken for each variable. While exploring the predictions, students' belongings to one of the groups and their pre-scores were also controlled. Grouping variable having three subsets was recoded into 2 different variables

because it is a categorical variable and dummy coding is one of the ways to prevent Type II error in multiple regression analysis. In order to control the belongingness to one of the groups and different pre-scores and to see the individual contributions to metacognitive skill development, a hierarchical regression with direct entry method was run.

Before the main analysis, assumptions of hierarchical regression were checked. According to Hair et al. (2005), the minimum observation per variable should be 5 in regression analysis. In this study, there are 10 independent variables including 2 dummy variables. There are 7.2 variables per each IV which is above the minimum, so the sample size is adequate for the analysis. It can be inferred from P-P plot and histogram of residuals that residuals in the model were distributed normally and randomly because Figure 4.5(a) shows that the curve is skewed neither left nor right. Similarly, Figure 4.5(b) indicates a linear line.



(a) (b)

Figure 4. 5 (a)Histogram and (b)P-P plot of post-MIIS

The result of Durbin-Watson test proves the independence of observation with a value (d=1.99) within the range of 1.50-2.50. Figure 4.6 shows the scatterplot of the predicted value and the residual. No pattern was observed, therefore it can be concluded that the variance of residuals remain the same across varying predictor values, i.e. homoscedasticity assumption was met.

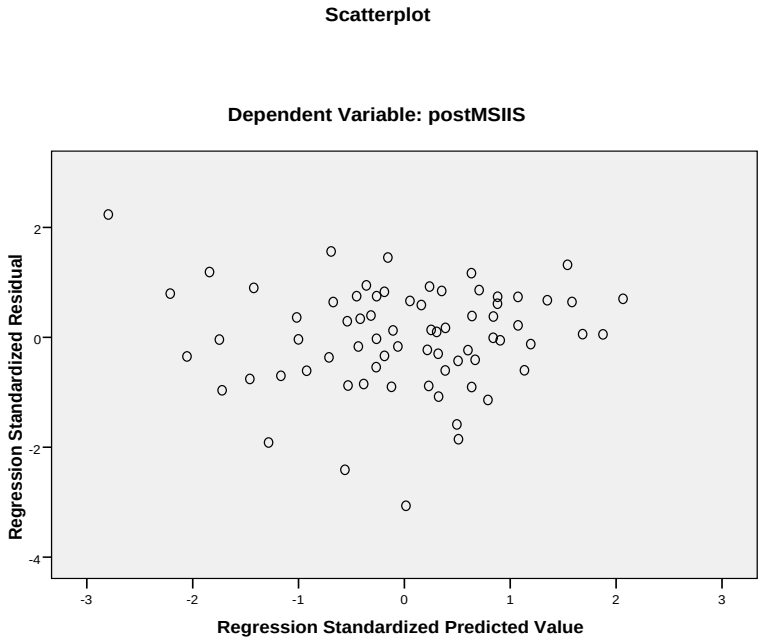


Figure 4. 6 Scatter plot of predicted value and residual with the dependent variable post-MIIS

Multicollinearity assumption was checked to detect if there were any high correlations between predictors. On correlation matrix, there were no values larger than .90. Variance inflation factors (VIF) were less than the critical value which is 4. In

addition, Tolerance values were all greater than .20. These together ensure that there are no unacceptable correlations among predictors.

The final assumption of multiple regression is the influential observations. Outliers and residuals were investigated through Mahalonobis distance, Cook's distance, and Leverage statistics. All Mahalonobis distance values were less than the Chi square critical value with 10 predictors (λ^2=29.59) at α=.001. There were no cases greater than calculated Cook's distances ($d_{ref\text{-}reg}$=.50, d_{mon}=.06, d_{plan}=.06, d_{cont}=.05, d_{st}=.06). All Leverage values were within the range of 0-1. That's why, all cases can be assumed to be normal during multiple regression analysis.

In the hierarchical regression analysis, three models were entered hierarchically to control the grouping variables. The first model included only pre-MIIS scores. The second model consisted of dummy grouping variables that are WISS and TS besides pre-scores, so the NS group was the uncoded dummy variable. Search performance variables (number of trials, number of visited links, number of used keywords, number of keyword changes, time to finish the search, number of copy-pastes, and number of added ideas) were added to the third model. Number of trials means that a session starts with a keyword and then ends with either entering another keyword or quit from the search process. In other words, if the student enters a keyword, a new session begins and it does not necessary to visit one or more than one website. A session might mean that the student enters keyword, examines the search results, but might not visit any websites. The number of visited links refers to how many web sites were clicked. If the user entered the same link twice it was counted as two. The number of keywords refers to the used keywords for a search task in total. The keyword changes across sessions were counted. If the student visited websites within the results generated from a keyword entry, this means there is zero keyword change. Total time of the search variable refers to the duration start with entry of the first keyword, and end with quiting the overall search. The number of copy-pastes indicates how many copy-paste actions were performed during a search task. The number of added idea shows the frequency of students' own original sentences or ideas rather than the copy-pastes.

The results of hierarchical regression produced significant models. The first model was found significant ($F(1, 70) = 17.69$, $p < .05$), and students' pre-MIIS scores explained 20% of the outcome variance (R^2=.20).The second model was also significant ($F(3,68) = 10.76$, $p < .05$) with 12% of explained variance (R^2 *change*=.12). The third defined model was found significant ($F(10, 61) = 3.36$, $p < .05$). All independent variables predicted 36% of metacognitive skills (R^2=.36). The search related variables contributed with only 3% (R^2 *change*= .03) to the explanation of the model. In this model, pre-MIIS scores contributes significantly (B= .42, t (61) = 4.29, $p < .05$) as it does in the first and second models. Unlike the second model, being in one of the groups has no significant contributions to the third model. Search related variables were found as little predictors since none of them was found significant. In the third model the unique contribution belongs to pre-MIIS scores ($sr_{(pre\_MIIS)}^2$=.23). Belonging to WISS group and TS group contributes 3% for each ($sr_{(WISS)}^2$=.03; $sr_{(TS)}^2$=.03). Among search variables, number of trials contributes the prediction with 2% ($sr_{(trials)}^2$=.02) and number of copy-pastes predicts only 3% ($sr_{(copy\text{-}paste)}^2$=.03). Others' contributions were all below 1%. The results were summarized in table 4.23.

Table 4. 23

Hierarchical Regression Analysis Predicting post-MS with Pre-MIIS, Grouping and Search Variables

Models and predictors	R^2	ΔR^2	ΔF	sr^2	B	β
Model 1	.20	.20	17.69			
Pre-MIIS				.20	.40	.45**
Model 2	.32	.12	6.03			
Pre-MIIS				.22	.39	.44**
WISS				.15	7.30	.39**
TS				.07	5.05	.27*
Model 3	.36	.03	.45			
Pre-MIIS				.23	.42	.47**
WISS				.03	5.38	.29
TS				.03	3.83	.20
Trials				.02	2.05	.18
Visited links				.002	-.38	-.05
Keywords				.00002	.07	.01
Keyword change				.00004	-.07	-.01
Time				.0002	-.05	-.01
Copy-Pastes				.03	3.19	.15
Added ideas				.0004	.48	.03

*p< .05, **p< .001)

4.7. Relations Among Group of Variables (Sub-MS, Search variables, Achievement variables, and GO) (Research Question 7)

In this section, groups of variables were analyzed to find if there exist any relations between these sets of variables. Canonical correlations were run to examine the relationships between two sets. In the first run, MS and search variables; in the second run, achievement and search variables; in the third run, MS and achievement variables; and in the fourth run, GO and search variables were examined.

4.7.1. Relationship between MS variables and Search variables (Research Question 7.1)

Hierarchical multiple regression analysis showed that search variables contributed to metacognitive development, but the amounts of contributions are not significant. Despite this result, three of search variables (number of trials, number of copy-pastes, and number of visited links) that are relatively contributes to an extent were included in canonical correlation analyses. In the first set, all specific metacognitive skills were included (reflection and regulation, monitoring, planning, control, and strategy generation). The second set consisted of search variables that are trials, copy-pastes, and visited links. The reason for inclusion of only three search variables is because of the sample size issue. In canonical correlation, there should be at least 10 cases per variable (Tabachnick and Fidell, 2007). There are 72 observations and maximum 7 or 8 variables can be included.

Before the main analysis, assumptions of canonical correlation were controlled. The first assumption is that all variables and their linear combinations are normally distributed. Mardia's test was run. It was insignificant which is the sign of multivariate normality. To be safe, either univariate or bivariate normality was also checked. Histograms and Skewness-Kurtosis values showed that all can be assumed to be normally distributed. In addition, linear combinations of variables were examined and found normal. Multicollinearity in either each set or across sets should not exist, which is another assumption. That is why, correlations were examined. Most of the variables are correlated significantly, but they do not exceed .90 (Table 4.24).

Table 4. 24

Correlations between each set of variables and across sets

Measure	1	2	3	4	5	6	7
1. Reflection and Regulation	--	--	--	--	--	--	--
2. Monitoring	.54**	--	--	--	--	--	--
3. Planning	.46**	.41**	--	--	--	--	--
4. Control of Attention	-.03	.14	.003	--	--	--	--
5. Strategy Generation	.71**	.68**	.51**	-.01	--	--	--
6. Number of Trials	.25*	.28*	.25*	.24*	.35**	--	--
7. Number of Copy-Pastes	-.06	.02	-.02	.07	-.16	-.29*	--
8. Number of Visited Links	-.01	.02	-.13	.20	.09	.31**	-.03

**p<.01 ,*p<.05

Linearity assumption requires the existence of linear relations for all variables within the set and between sets. A matrix scatterplot was created to see if there are any violations of linearity, but no violations were detected. These plots also do not represent any patterns which ensured the homoscedasticity assumption. The absence of outliers is another assumption. To detect within set outliers, Leverage statistics were used and no values greater than .50 were found.

The results of the analysis generated 3 canonical variate pairs, however only one of them was significant (Wilks' $\lambda_1 = .69$, $p < .05$). The canonical correlation for the significant pair was moderate ($r_{c1} = .44$) explaining 19 % of variance. Table 4.25 summarizes the correlations between variables and canonical variates, canonical correlations, standardized canonical variate coefficients, percent of variance, and redundancies. Correlations above .30 were taken as the cut-off point. As a result, all metacognitive skills within the first set and number of trials and number of visited links within the second set were found correlated with the first canonical variate. It might mean that students who have less developed metacognitive skills are associated with performing less trials for search tasks and visiting less number of web sites.

Table 4. 25

Correlations, Standardized Canonical Coefficiencts, Canonical Correlations, Percents of Variance, and Redundancies between MS and Search and Their Canonical Covariates

	First Canonical Variate	
	Correlation	*Coefficient*
Metacognitive Skills		
Reflection & Regulation	-.57*	-.02
Monitoring	-.66*	-.08
Planning	-.58*	-.24
Control of Attention	-.60*	-.59
Strategy Generation	-.77*	-.58
Percent of Variance	.41	
Redundancy	.08	
Search Variables		
Number of Trials	-.98*	-1.04
Number of Copy-Pastes	.12	-.18
Number of Visited Sites	-.32*	-.003
Percent of Variance	.36	
Redundancy	.07	
Canonical correlation	.44	

*correlations above .30

4.7.2. Relationship between Achievement variables and Search variables (Research Question 7.2)

In order to understand the relations between achievements of students and their search patterns, canonical correlation analysis was performed. The first set included achievement related variables that are achievement test scores, performance work scores, and course grades. In the second set, the search variables included number of trials, number of copy-pastes, and number of visited links.

Multivariate normality is the first assumption. The result of Mardia's test indicated insignificant value ensuring the existence of multivariate normality. Moreoever, histograms and Skewness-Kurtosis values were all pointed normal distributions. Table 4.26 shows the correlations. The highest correlation is .43, so there is no

multicollinearity. In order to check linearity assumption within and between sets, a matrix scatterplot was created. There were no violations of linearity. In addition, homoscedasticity assumption was met dues to absence of patterns on scatterplots. Finally, by investigation of Leverage statistics, no outliers were detected.

Table 4. 26

Correlations between achievement set of variables and search patterns sets of variables

Measure	1	2	3	4	5	6
1. Achievement Test	--	--	--	--	--	--
2. Course Grade	.09	--	--	--	--	--
3. Performance Work	.36**	.03	--	--	--	--
4. Number of Trials	.07	.06	.43**	--	--	--
5. Number of Copy-Pastes	-.21	-.16	-.17	-.29*	--	--
6. Number of visited links	.04	-.03	.25*	.31*	-.03	--

**p<.01, *p<.05

Canonical correlation results showed that there is one significant canonical variate pairs (Wilks' $\lambda_1 = .74$, $p < .05$) among 3 pairs. The canonical correlation for the significant pair was found $r_{c1} = .46$ which is moderate enough. It explains 21% of variance. There are correlations between variables and canonical variates, canonical correlations, standardized canonical variate coefficients, percent of variance, and redundancies on table 4.27. Canonical loadings greater than .30 were considered as significant. In accordance with this cutoff point, it can be inferred that students with low performance work scores are more tended to perform copy-pastes. These students are also associated with less trials and less number of visits.

Table 4. 27
Correlations, Standardized Canonical Coefficiencts, Canonical Correlations, Percents of Variance, and Redundancies between Achievement and Search Variables and Their Canonical Covariates

	First Canonical Variate	
	Correlation	*Coefficient*
Achievement Variables		
Achievement Test	-.19	.19
Course Grade	-.13	-.11
Performance Works	-.97*	-1.04
Percent of Variance	.34	
Redundancy	.07	
Search Variables		
Number of Trials	-.96*	-.85
Number of Copy-Pastes	.33*	.08
Number of Visited Links	-.55*	-.28
Percent of Variance	.44	
Redundancy	.09	
Canonical correlation	.46	

4.7.3. Relationship between Metacognitive Skill Variables and Achievement Variables (Research Question 7.3)

Metacognitive skills might be associated with certain achievement variables. In order to examine the relations between MS and achievement related variables, canonical correlation analysis was run. All 5 sub-skills and 3 achievement variables (achievement test, student course grade, and performance work score) were included in the analysis. A series of assumptions were checked. Leverage statistics indicated absence of outliers. The multivariate normality was checked through Mardia's test. In addition to that, histograms and Skewness-Kurtosis values were also examined to ensure normality. There were no violations. In order to detect multicollinearity, the correlation matrix was produced and the maximum correlation was .71 which is below .90 (Table 4.28). The linearity assumption was checked with the production of a matrix scatterplot. No

violations were detected with regards to linearity. Moreover, homoscedasticity assumption was met having no obvious patterns within scatterplots.

Table 4. 28

Correlations between each meta-cognitive skill set of variables and achievement set of variables

Measure	1	2	3	4	5	6	7
1. Reflection and Regulation	--	--	--	--	--	--	--
2. Monitoring	.54**	--	--	--	--	--	--
3. Planning	.46**	.4**	--	--	--	--	--
4. Control of Attention	-.03	.14	.003	--	--	--	--
5. Strategy Generation	.71**	.68**	.51**	-.01	--	--	--
6. Achievement Test	.12	.14	.24*	-.02	.27*	--	--
7. Performance Work	.10	.24*	.16	.24*	.26*	.36**	--
8. Course Grade	-.08	-.06	-.20	-.04	-.04	.09	.03

*p<.05, **p<.01

Although, the correlation matrix showed some significant correlations within and between sets, the run of canonical correlation syntax resulted insignificant canonical variate pairs. Therefore, it might be concluded that there are no relationships between MS and achievement variables.

4.7.4. Relationship between GO variables and Search variables (Research Question 7.4)

In this study, three goal orientation types were distributed similarly across three intervention groups. The relationship between GO scores and search related variables were explored through canonical correlation analysis. In the first set, mastery, performance approach, and performance avoidance scores were included. The second set consisted of number of trials, number of copy-pastes, and number of visited sites.

Before the analysis, assumptions of canonical correlation were checked. No outliers were found with the help of Leverage statistics. The normality assumption was checked with Mardia's test, Skewness-Kurtosis values, and histograms. None of them pointed violations of both multivariate and bi- or uni-variate normality. The correlation matrix in Table 4.29 demonstrates that there are some correlations, but none of them is above .90, thus it can be concluded that multicollinearity assumption was met. Within and between set linearity were detected through matrix scatterplot. There were no violations. Homoscedasticity assumption was ensured with regards to scatterplot.

Table 4. 29

Correlations Between Goal Orientation Set of Variables and Search Pattern Set of Variables

Measure	1	2	3	4	5
1. Mastery	--	--	--	--	--
2. Performance Approach	.48**	--	--	--	--
3. Performance Avoidance	.63**	.68**	--	--	--
4. Number of Trials	.03	.14	.19	--	--
5. Number of Copy-Pastes	.10	.11	.11	-.29*	--
6. Number of Visited Links	-.06	-.14	-.04	.31**	-.03

**p<.01, *p<.05

After running canonical correlation, no significant canonical variate pairs were detected. It means that the scores of different goal orientation types are not associated with the search variables.

4.8. Summary of Results

The results of different analyses showed the following major results:

- Number of keywords increased from beginning to the end for all groups. Subtle tasks led to increase in the amount of keyword. Content of the keywords and the style of keywords entry were observed as crucial parts of search patterns.
- All groups showed similar trends in terms of number of trials with an increase in subtle tasks.
- Number of visits demonstrated differences across tasks. Wikipedia was found one of the most frequently visited link.
- Time spent for the total task showed no common patterns. Time spent for a visit depends both on the copy-paste actions and relevancy of the visited link.
- Copy-paste actions followed similar trends during four weeks, but WISS group differed from others at the fifth task. Similarly, own idea additions of WISS group also increased at the fifth task while that of other groups decreased.
- Reflections of students revealed that WISS group students were likely to remember both parts of the tasks. NS group students showed excessive patterns of misconceptions and confusions.
- Statistical analysis showed that WISS group had significantly higher scores in monitoring, planning, controlling, and strategy generation skills in comparison to others.
- Results indicated that although performance approach oriented students had higher scores of post-MIIS scores, there was not significant mean differences on specific metacognitive skills across different goal orientation types.

- The defined hierarchical regression model showed no significant contributions of search patterns, and demographics, except for the pre-MIIS scores to the prediction of post-MIIS scores.
- Students with less improved metacognitive skills are associated with less trials and less number of visits.
- Students with low performance work scores are tended to more copy-paste actions, less trials, and less visits.
- No significant relations were found between metacognitive skill variables and achievement variables.
- No significant relations were found between goal orientation variables and search variables.

CHAPTER 5

CONCLUSION, DISCUSSION, & IMPLICATIONS

In this chapter, the whole study was summarized first, and then the results were discussed and some conclusions were made with respect to proposed research questions. Finally, implications of the study and possible future research suggestions were presented.

The purpose of this study was to find out the effects of web-based metacognitive scaffolding on metacognitive skill improvements of 7th grade students with different goal orientations. A web-based internet search scaffolding tool (WISST) was designed with the intention of providing metacognitive scaffolding through the online search. This condition was assigned to the first experiment group. Another condition in the study was metacognitive scaffolding provided by the teacher. All scaffolding techniques and other conditions were standardized between two conditions; the only difference was the scaffolding agent. There was also a control condition with no scaffolding. Students' logs were recorded while they were searching the web either through the tool or Google. All students completed 5 search tasks accompanied by completion of performance work sheets. After each search task, students wrote their reflections of previous weeks' topic and the search process. Students also took some tests including MIIS for metacognitive skills, PALS for goal orientations, and achievement test. Gathered data were analyzed using either quantitative or qualitative methods.

5.1. Participants' Profiles (Research Question 1)

72 students from a public school in Ankara were the participants of this study. Three intact classes were randomly assigned to one of the interventions. There were 25 students in WISS class, 23 students in TS class, and 24 students in NS class. All students received the same instruments that were PALS measuring goal orientation type and pre- and post-MIIS measuring metacognitive skills.

PALS is an instrument originally developed by Midgley et al. (1997). It is based on goal orientation theory and includes 94 items, however, in their manual, authors suggest the individual use of subscales whenever needed (Midgley et al., 2000). In this study, personal achievement goal orientations part of the PALS was distributed to the students. Revised versions of mastery (5 items), performance approach (5 items), and performance avoid (4 items) goal orientation items were included. As a result of these scales, students were labeled as more or less oriented to a certain approach. In short, a student with mastery goal orientation has a tendency to reach a competency and advance it further by focusing on the task itself. These students are generally intrinsically motivated to study. Performance approach students are tended to seek for the ways to show their competencies to other by focusing on themselves. Performance avoid students try to avoid situations comparing them with others and this is especially obvious when they believe they are less competent than others. These students are generally focused on themselves. As the literature suggested mastery orientations are associated with adaptive learning whereas performance avoidance orientations are associated with maladaptive patterns of learning (Ames, 1990; Park, Pintrich, & Midgley, 1992). Moreover, performance approach students can be associated with either adaptive or maladaptive patterns.

There were the same number of students with mastery goal orientations in the groups and the number of these students was higher than the other students with either performance approach or performance avoidance in the groups. The distribution of goal orientation types is not surprising because it was claimed that there can be a decline in

personal ability goals (performance approach or performance avoidance) from sixth grade to seventh grade (Anderman & Midgley, 1996) although it might change across subjects. Student profiles for both WISS and NS groups were very similar with regards to distributions of goal orientations. There were more students with mastery orientations than these of with performance approach orientation. The number of students with performance avoidance orientations was the least. In TS group, performance avoidance orientations were more than performance approach orientations.

MIIS includes five metacognitive skills expected to be activated throughout an Internet search process. These skills are reflection-regulation, monitoring, planning, control of attention, and strategy generation. Students were given the same test both in the beginning and in the end of the study. It was observed that students in all groups showed different amounts of increase from pre to post MIIS test. It can be concluded that the increase in MIIS scores for NS group was less than the others, i.e. both WISS and TS group showed an amount of increase approximately three times more than NS group. Certain level of development in control group was an expected result since metacognition develops over time owing to its nature. People have metacognition early in their lives and they became more conscious and skillful as they reach adulthood (Flavell, 1979; Kuhn, 2000). Our participants were early adolescents, which can be considered as an early stage for metacognitive skill development (Veenman, Kok, Blote, 2005). Throughout the study period, their metacognitive skills were developed since they performed activities.

Reflection skill refers to both conscious thoughts about the learning process as a result of monitoring process and decisions to accomplish goals (Mcalpine, Weston, Beauchamp, Wiseman, & Beauchamp, 1999). Regulation skills also refer to allocation of resources, ordering the steps, deciding on the intensity, and speed of the studying (Kluwe, 1982). Monitoring can be defined as series of information about the individual's own introspections whereas controlling can be defined as the skill that modifies the object level through certain actions (Nelson & Narens, 1990). In this study, control actions were limited to Internet search environment. For example, online

chatting with friends while conducting a web search task might be a sign of lack of attention control. Planning skill is similar to regulation due to involving a series of decisions about resources, strategies, and order of steps (Woolfolk, 2004). Strategy generation skills refer to adjustments made to achieve goals (Flavell, 1979). When pre and post scores for 5 metacognitive skills were considered, it can be observed that in the beginning the highest scores were distributed between groups. While WISS group had the highest three skills including monitoring, planning, and controlling, TS (reflection-regulation) and NS (strategy generation) groups had one highest score in the beginning. It is noteworthy to remind that the score differences in the beginning were very small ranging from .02 to .10, i.e. the gap was not even a half point, however, this gap was around .50 in post-test scores. In the end of the study, the results changed and WISS group had all the highest post scores of MIIS. At that point, it might be risky to attribute the increased scores to WISS, but at least it was seen that it resulted with greater amount of improvement in MIIS scores than TS or NS groups did. Moreover, TS group's scores were all higher than NS group. This descriptive picture could be assumed as a sign of effectiveness of scaffolding approach that were served in two different forms.

There are many studies examined the effects of different scaffolding types including metacognitive scaffolding in different formations applied in varies of domains and aiming to measure diverse parameters such as metacognitive knowledge, success, and scientific skills (e.g. Wolf, Brush, & Saye, 2003; Walton & Archer, 2004; White & Frederiksen, 2005; Saito & Miwa, 2007; Stadtler & Bromme, 2008; Bulu, 2008; Peters & Kitsantas, 2010; Wu & Pedersen, 2011; Molenaar, Van Boxtel, & Sleegers, 2011). Among these studies, the general tendency is in favor of scaffolding. For example, in their research Walton and Archer (2004) provided scaffolds during web search of university students. The results revealed significant increase in searching skills of students. In Wolf, Brush and Saye's (2003) research, the positive effects of metacognitive scaffolds on metacognitive skill improvement were observed. These results are all parallel to our preliminary picture of increase in metacognitive skills, even though it is early to mention about the significance of this increase.

5.2. Search Pattern Changes Over Weeks (Research Questions 2 & 3)

In the second and the third research questions, students' search patterns both in relation to the interventions received and their goal orientations were examined. Furthermore, the changes in their search and reflection patterns from the first through the fifth week were investigated. Students' computer logs were recorded during 5 weeks. In line with the aim of this research, certain parameters were taken into account specifically. Keywords, trials, visited links and their characteristics, durations, copy-pastes, and quality of tasks (performance work sheets) were the sources for outlining the overall search patterns of participants. Students generally initiate a regular Internet search with the entry of keywords which can vary with regards to content, number, entry style, and so forth. Sometimes, students also search the Internet without using keywords, instead, they might just enter a previously known web page into the address bar. Nonetheless, in this study students were required to search through the same search engine which was Google. In WISS condition, it was embedded into the software providing scaffolding. In TS condition, students used directly the search engine and the scaffolding agent was the teacher. In NS condition, the same search engine was used without any scaffolding.

Keyword Usage

It was observed that all groups had the same fluctuations during the first three weeks and their average for number of used keywords were very close to each other when students' average number of used keywords for each week's task was taken into consideration. After the third week, while both WISS and NS groups' number of keywords continued to increase gradually, TS group's number of keywords dropped from week 3 to week 4 and then increased towards week 5. They all reached the maximum numbers in the second week. All groups' ending keyword average values were more than the beginning values. This portrait might indicate that the impacts of

scaffolding were not obvious in terms of students' selection of keyword usage on the contrary to the studies concluded the significant effects causing a change from single term queries to complex queries (Walton & Archer, 2004). The peak number was reached while engaging in the second task and the number of used keywords in the fifth task was very close to that of second week. This situation might be explained with the characteristics of the assigned tasks (Zhang, 2008), because both tasks (2nd & 5th) were a little bit subtle compared to others, that is, both had no cues such as phrases "global warming" within task statements. It can be concluded that the amount of used keywords might not be a critical parameter in terms of scaffolding but for the nature of the task. Therefore, closely examining the nature of the task, the content of keywords and the style of keyword entry might help to understand the existing differences.

Overall weekly Internet search logs showed that students' keyword usage were classified into four including "meaningful set of keywords", "general to specific or hypothesis testing", "question as keywords", and "irrelevant keywords". Students following the first two strategies to decide on the keywords generally visited relevant websites. There were students implementing the first approach from all groups, but the second strategy was observed in WISS and TS groups, which is in line with the findings of Walton and Archer (2004). In their research, they observed that students demonstrated more specific strategies, they became more focused, and used more than one keyword set when they were scaffolded appropriately. In depth examination of the search files of the smaller sample selected purposively shed light on these results, that kind of metacognitive strategy uses were salient especially in the second and the fifth tasks. This might be the result of such vague tasks despite they still requested a close-ended answer for the first part. The common point of these two tasks was that both of them required first to find out close-ended (ready-to-use) answers such as a tropical fruit or a kind of respiratory disease but unlike other tasks, there was no focused beginning point of the task, i.e. other tasks comprised of such statements as "noise pollution" and "mold soil". This finding is in line with the study conducted by Tsai, Tsai, and Hwang (2011). In their research, they found a positive correlation between keyword adaptation

strategies and information finding types of questions. Similarly, Tu, Shih, and Tsai (2008) also claimed that keyword formulation is an important factor on web search performance. The use of these strategies in WISS and TS groups might point the effectiveness of scaffolding since no such strategies were observed in NS group. While scaffolding students, before the selection of the appropriate keyword, they were oriented to think about the aim of the research, then enter the keywords simultaneously with the prior knowledge entry on the same prompt. In short, they forced to think about their aim, possible keywords, and the recall of the previous knowledge together. In this way, they might distinguish between the aim and the keyword, so that they might have become aware of not to use the given question as a keyword. By recalling the previous knowledge, they might have remembered something related to the content, so that it helped to shape the keyword about the current task. This method followed similarly in TS group. They followed the same steps with the guidance of the teacher instead of the tool.

Benefitting directly from the questions included in the tasks was another type of keyword usage. Such uses were observed in either TS or NS groups. This usage generally occurred during the search for the second parts of the tasks which required certain level of interpretation. Students find it hard to search for such types of tasks (Bilal, 2000b). This finding can be supported with the findings of studies referring the specific answer seeking for research tasks with the use of less number of keywords (Wallace & Kupperman, 1997; Bilal, 2000b). On the contrary to our findings, in a research conducted by Marchionini (1989) revealed that younger searchers like 3rd or 4th graders were tended to use sentences as direct inputs of queries. On the other hand, 6th graders did not show that pattern of use. The participants of this study included 7th graders who might be considered having similar characteristics with 6th graders. The findings in terms of question entry as a keyword is not similar to Marchionini's (1989) results. Following this strategy resulted in many irrelevant website visits. In smaller sample, this pattern was obvious among lower gain performance approach students. Their little amount of skill gain might be attributed to trials and errors (Bilal, 2000b)

because most of the time they first tried the whole question as the keyword, then with one or two visits or without any visits they tried another keyword which was in general the question with the exclusion of such words as “what”. In WISS group, the reason of the absence of this pattern might be because of simultaneous entry of aim and the keyword, i.e. aim, keyword, and previous knowledge entries were requested entry on the same prompt. There is a parallel approach in TS group, but the teacher might not have requested such entry perfectly whenever needed. The WISS condition had the advantage of one-to-one intervention.

Although many students used a few irrelevant or unfocused keywords, within the smaller sample, the excessive use of them belonged to NS group. This finding might be the result of initiating the search process without any planning. In both WISS and TS groups, students were encouraged to define their specific aims of search and to think about their previous knowledge about that topic, so that they were expected to distinguish aims from keywords and to shape the potential keywords with the help of previous knowledge. Nevertheless, none of these scaffolds was served to NS group. A common trend demonstrated the use of too general keywords such as “fruit” to find specific information. This trend was also explored in Walton and Archer’s (2004) study. The use of such irrelevant or unfocused keywords were observed in all tasks, therefore it could be the matter of scaffolding rather than the task itself. There may be students having difficulties in where to start to find the best keyword.

In terms of goal orientation types, the smaller sample whose search patterns examined qualitatively demonstrated that students with performance approach goal orientation are tended to find relevant keywords as well as applying certain strategies for keyword adaptation more than the other goal orientation types, but this is especially evident within higher metacognitive skill gain cluster. This finding might refer to a relationship between performance approach goal orientation and the search performance. Studies favoring performance approach goal orientation exist in the literature (Elliot & Harackiewicz, 1996; Elliot et al., 1999; Elliot & McGregor, 1999; 2001), but there are also studies favoring mastery goal orientation (Miller et al., 1996;

Yildirim & Somuncuoglu, 1999; Schmidt & Ford, 2003). One explanation why performance approach students were tended to make use of keyword adaptation strategies besides appropriate keyword selection could be related to their desire to prove others how competent they are and to outperform others. It is typical for them seeking for positive evaluations. In this study, students received weekly grades which might have served as a positive reinforcement for students with this orientation. The teacher and the researcher together graded students' performance works and the teacher announced the grades each week, thus for the sake of being appreciated by peers and by teacher, these students might have paid extra attention to their works.

Trials (Sessions)

A session (or trial) was defined in this study as a set of actions starting with the entry of a keyword(s) and ending either with another keyword or quit. The user can give more than one keyword at a time or might not visit any link after a keyword entry, in these cases each period was still counted as a new session. The results indicated that students in all groups showed similar fluctuations with a peak of the second task. Despite the higher number of trials in the fifth week, the amount of increase of WISS and TS groups was sharper than NS group's increase and the numbers were very close to the peak point. The peak points could be related with task types, because both the second and the fifth tasks were less precise and open-ended than others, which obviously resulted in more trials to refine the possible answers among a huge amount of information. As Marchionini (1989) concluded, open-ended tasks bring about more moves. Similarly, Bilal (2000a) found that successful search results were generally required high number of navigations and visits. What revealed the higher number of increase in WISS and TS groups' trials might be attributed to scaffolding, but not the type of scaffolding. In NS group, students freely searched the web without any interventions except for the physical existence of the teacher who did not guide students. Therefore, this setting might be the closest one to the home settings of children in which

they surf randomly and experience with the help of trials and errors (Kuiper, Volman, & Terwel, 2008). In short, students in either WISS or TS condition might have felt restricted with the flow of scaffolds, which in turn might have kept their attention on the task to try more. Another reason of this difference could be the emergence of positive effects of scaffolding. Provided scaffolds might have had students think about what to do next or to judge the adequacies of found information so far.

Having a closer look to the findings of smaller sample might help to understand the overall tendency of trials with regards to goal orientation and metacognitive skill gains. Not surprisingly, students in the higher metacognitive skill gain cluster tried more than the students in lower gain cluster. This relationship can be found in the literature focusing on the metacognitive skills and web search performance (Tsai, 2004; Tu, Shih, & Hwang, 2011). In higher gain cluster, performance approach student in WISS group performed more trials than the others. Other than this point, there is no difference between trials. This might be related with the features of WISST. When the user decides to quit the system or just terminate the search process, WISST reports what s/he has done so far, what are copy-pasted, what notes are taken, what aims were stated, what was known, etc. Facing with the summary of the actions could have been served as a triger for these with performance approach orientation. In this way, these students might have perceived themselves as evaluated by an external source to get higher grades, which is a desired condition for this goal orientation type.

It can be concluded that increase in number of trials can be results of open-ended and less precise types of tasks. In addition to the task type, receiving scaffoldings can lead to an increase in number of trials.

Visited Links

Students' number of visits changed depending on the tasks. There were 29 different web site visits during one week, but this number had reached to 83 in another week, so the huge variance can be the consequences of vagueness of the beginning point

of the second task as well as the fifth one. The indepth content analysis of the logs of smaller sample provided an outline of five types of visits that were “wikipedia visits”, “first link visits”, “irrelevant visits”, “relevant visits”, and “one-shot visits”. Although these categories were generated from the smaller data, the clues of these patterns can also be observed within the overall data.

It seems that tr.wikipedia.org website earned the trust of the students. In our sample, there were students who visited that site consistently throughout the all tasks. There were even students who add “Wikipedia” to the entry of specified keywords. This does not mean that these students did not visit any website but Wikipedia, instead, they insisted on taking a look at wikipedia link besides others. There were also a few students who only visited that link. Since Wikipedia was listed as the most frequently searched link in our study, all students from all groups visited that link at least once during the completion of various search tasks, however, the smaller sample revealed that the visits was excessive in NS group in higher gain cluster. This can be explained by the structured organization of information on Wikipedia website. This quality of that page might have satisfied the needs of NS group’s students due to having no scaffolds to guide them through the building process of the search. These students might have seen that site as an authority because of its encyclopedia-like organization. A study done by Van Deursen (2010) found that many students had an orientation to believe the correctness of everything on the net. The study conducted by Peters and Kitsantas (2010) is similar to our findings. In their study, eighth graders received metacognitive prompts and the results showed that experiment group’s decisions depended on evidences while the control group’s decisions were dependent on authority. In our study, the frequent visits to Wikipedia among NS group might point the importance of decisions through the search process. One of the focuses in metacognitive scaffolding provided in this study was to increase and shape the consciousness to suspect the reliability and validity of the found information on the net. This could have been achieved through scaffolding since very small number of students’ visits to only Wikipedia was reduced towards the end of the study in both TS and WISS groups. It is

noteworthy to point this tendency was common in NS group in higher gain cluster. Although these students' metacognitive skills in that group were relatively high, this did not guarantee the high Internet search skills in action. In conclusion, these searching skills might need training (Fidel et al., 1999; Liaw & Huang, 2006) no matter how competent metacognitively they are. This study was administered within a small sample, so the overall results might not sense, but these findings about Wikipedia might refer to the different levels of epistemological beliefs, that is students with advanced epistemological beliefs can manage their way on the web while searching (Tu, Shih, & Tsai, 2008; Tsai, 2004).

One of the frequently applied strategy of student in our study was to start the first link click and then continue respectively. Such a tendency was also explored in other studies (e.g. Guinee, Eagleton, & Hall, 2003). During the first three weeks, groups showed the similar trends in terms of the visiting first links, but interestingly, after that point, TS group showed a different trend. In other words, the rank of visiting first sites decreased in TS group while increasing in others, however, this could not mean anything since the ranks were around 2. In spite of this drop rate, in the smaller sample the TS group showed no patterns of the click on the first link primarily. Although there were students in WISS group who started with the first link, there were some NS students who demonstrated the same pattern throughout the whole study. Again, this can be explained with the absence of any kind of scaffold whether metacognitive or not. It seems that WISS students applied to this strategy whenever they were not totally sure about where to start since this pattern was prevalent among the second and the fifth tasks. On the other hand, TS students did not refer to this strategy, thus the scaffolding approach in WISS group might not be as effective as that of in TS group. It's the student's choice how to continue after the entry of keywords in WISST. It provides scaffolds depending on the decisions of the clicks, but has no scaffolds during the selection within the results list. This can be a weakness of WISST. On the other hand, teacher does not have to wait till the clicks, he could frequently remind students what strategies should be followed in the meanwhile.

For students at seventh grade, it might be hard to distinguish between relevant and irrelevant links. Irrelevant visits were generally results of irrelevant keywords. Moreover, these happened frequently while searching for the second parts of the tasks that are open-ended in nature because they tried to find direct answer as they did in the same way for the fact-finding parts of the task, this trend of the students is in line with the literature (Wallace & Kupperman, 1997; Bilall, 2000a). In the smaller sample, it was observed that NS students in the lower gain cluster visited irrelevant links more than the others. This might be because of two reasons. One reason could be the lack of scaffolding since others' irrelevant visits were less frequent. After visit of a link, WISST asks if that page was related to the topic searched, if the found information seemed reliable, etc. Similarly, the teacher requested the students to think about those criteria, but NS group students had no such scaffolds to think about their visits, so it was an expected result. Another reason might be the inadequate prior knowledge of students who visited irrelevant links about the content. As stated by Brandt (1997) relevant information finding is related to the domain knowledge. However, when students' course grades and achievement scores were considered, this possibility seemed unlikely, i.e. there were no commonalities of these students with regards to success variables.

Another observed strategy among students was detected as one-shot searches. Majority of the students of any group sometimes turned to this strategy but the smaller sample (clustered sample) revealed that TS and NS group students applied more frequently than the WISS group. This is partially supported and partially not supported by the literature because studies claimed that students are tended to use one source when not scaffolded metacognitively (Wolf, Brush, & Saye, 2003; Tsai, 2004) which explains the less frequent one-shot visits of WISS condition, though, TS group was scaffolded but one-shot visits were as frequent as NS group's visits. In this case, it would be wise to look at these students' motivations. For example, TS students who performed frequent one-shot visits belonged to performance approach orientation which is famous for the desire to show possessed talents through emphasizing the outcome rather than the learning itself (Westen, 1999). On the contrary, performance avoidance oriented

students in any group did not show such a tendency as far as the smaller sample's records revealed. In fact, the overall picture was the opposite to the expected because performance avoidance students might visit as less as possible to avoid making mistakes, yet in contrast, performance approach students were expected to visit as much as possible to show how they manage to deal with such a huge data source. The literature is inconclusive while defining the competency of the successful web search. According to Dimopoulos and Asimakopoulos (2010), a competent searcher visit less number of websites but the visited sites were high in credibility which was consistent with our result revealing the one-shot visits of performance approach orientations. Oppositely, Quintana et al. (2005) defined the incompetent searcher behavior as expecting to find all in one web site which could be an explanation of why performance avoidance students performed more than one visits, i.e. they might have avoided to be incompetent by visiting only one website.

Durations

All students were given the same tasks to be completed within approximately 40 minutes. Time spent to search the Internet and durations for each website visit were recorded for all tasks. Overall picture neither produced a gradual change nor a common trend across groups. The most change was observed in WISS group. WISS and TS groups showed reverse trends, that is, while time spent for the task increased in one group whereas it decreased in the other group. In general, WISS group's average time spent for the whole search task was tended to increase while TS and NS groups' average decreasing. The closer look to the records of smaller sample made clear the time spent for web sites and it was found that two conditions were decisive for durations that were "performing copy-pastes" and "relevance of the content".

Copy-paste strategy influenced the duration of visits in two ways: shorter visits in the presence of copy-paste or shorter visits in the absence of copy-paste. This strategy was prevalent within mastery oriented students. More than half of this category within

the selected sample stayed longer if there were no copy-pastes and the absence of copy-pastes were generally the sessions for the second part (open-ended) of the tasks. This was supported by Sideris and Kaplan's (2011) work proving how insistent the mastery oriented students when the task was hard and took long to deal with. In an earlier study, Borgman et al. (1995) also concluded that students spend more time to complete such open-ended tasks. The results of a study conducted by Somuncuoglu and Yildirim (1999) also confirmed that students with mastery orientation use deeper metacognitive strategies than other types. In our findings, this might be exemplified with spending more time to deeper comprehension of the content when no copy-paste actions were done. The reverse condition was prevalent within performance approach orientation. Majority of the students stayed longer if they performed copy-pastes. This might have been considered as a way to show how they engage in the tasks even if they performed the copy-pastes by these students. Another reason might be related to spend time to copy-paste precise information for the sake of outperforming others. Since close-ended tasks were the ones having the most copy-paste rates, spending more time on such tasks were consistent with the results of Bilall (2000b).

In the purposively selected sample, there were students applying relevancy strategy to decide on how long to stay. Even though others made use of this strategy, it was prevalent in performance avoidance orientation students in TS group. They stayed longer if the pages were relevant. The tendency to stay shorter whenever any irrelevant content was detected was parallel to the characteristics of performance avoidance oriented students, but the emergence of it within TS condition is interesting. It can be attributed to the fear of failure either in front of an authority (teacher) or others (peers in the class), so that avoiding the situations that are potential to failures is inevitable for these students.

Copy-Paste Actions, Added Ideas, and Quality of Performance Works

As a result of their web search, students were required to assign a paper answering two types of questions every week. The quality of these performance works were decided mainly with respect to how they used the information found. If there were little or no copy-pastes, more paraphrasing, more interpretations, and more relevant and focused information, then this performance work can be marked as high in quality. Therefore, copy-paste actions and added ideas are at the heart of the overall performance.

The weekly averages of copy-paste actions of groups demonstrated very diverse trends between NS group and others. WISS and TS groups showed similar fluctuations till the fourth week and WISS group's copy-pastes decreased at the last task whereas TS group's average copy-paste amount increased and reached its peak which was the same peak point with NS group. Similarly, the weekly averages of added own idea trends were very likely during the first four weeks, but WISS group reached its peak while demonstrating a sharp increase. TS and NS groups showed a decline between weeks 4 and 5. Their peak points were the same which was the fourth week. To sum up, the first four weeks did not make any difference across groups and this might be because the effects of web-based metacognitive scaffolding started to show up after four weeks or the effects of teacher-based metacognitive scaffolding started to disappear. At that point closely looking at the fourth and the fifth weeks and examining some patterns in the smaller sample can help to explain the difference. The findings in the smaller sample indicated that students followed three ways to complete their tasks: "copy-pastes for both (close and open-ended parts) questions", "use their own words", "incomplete parts (give-ups)".

When fourth and fifth weeks were compared in terms of copy-pastes and added ideas, no gradual change was observed. During the fourth week, all students visiting Wikipedia performed copy-paste actions more than idea addition actions, however, during the fifth week, WISS students' visiting Wikipedia performed idea additions more

than copy-paste actions. Although the visited web site did not change, the decreased number of copy-pastes and increased number of idea additions could refer to the success of web-based scaffolding. Unlike teacher-based scaffolding, web-based scaffolding directly served as one-to-one scaffolds. To interpret this difference, a closer look at performance works can shed light on the explanation with regards to metacognitive skills and goal orientations.

The smaller sample's performance works showed that all students performed either copy-paste action or idea addition at different tasks, but both WISS and TS groups' copy-paste rate started declining after the second week. Since the intensity remained the same for NS group, which might mean that students were not aware of what was expected from them or they did not know how to shape and interpret the found information on the web. The reason can be the result of unaddressed or not embedded technical skills within the curriculum of courses (Walton & Archer, 2004). In other words, ICT courses in Turkey are not a compulsory part of the programs, so students are left to learn through trial and errors. That might be the reason for the intensity of copy-pasted and untouched information on performance sheets of NS group was already an expected result. On the other hand, all students added their own ideas to some extent, but those in NS group frequently missed the main parts. In addition, the smaller sample revealed that these additions of NS group were either quite shallow or wrong. The give-up rate of this group was also higher than others and this was observed especially in the second part of tasks. It is in line with the literature denoting that children have difficulties in searching when faced with these types of search tasks (Schacter et al., 1998; Bilall, 2000b). Since students in scaffolded conditions outlined a more optimistic view, this might be due to the scaffolding itself (Lim, 2004; Bulu, 2008). WISST provided users a space for taking notes which might have encouraged them to think about what was read on pages. Similarly, the teacher encouraged students to take notes whenever and wherever they needed. In NS condition, students continued to use their own strategies to complete the performance work and it was observed generally as copy-paste actions with or without any changes. The frequency of irrelevant answers and "as-

it-is" information in NS group were parallel to the findings of Wolf et al. (2003). It might be considered as the representations of the need for scaffolding.

Although there were no striking pattern regarding the goal orientation types, it can be concluded that students with performance approach orientation in WISS and TS group especially in the lower gain cluster showed early adaptations to shape their copy-pasted information and to add their own words. This is supported by Bulu's (2008) work concluding the efficiency of scaffold especially for those having lower prior knowledge and lower metacognitive skills. In our case, this early adaptation appeared earlier among lower gain cluster WISS and TS group students. Furthermore, this pattern was clearer among performance approach goal orientation type than other orientations, which was an expected result because these students might have wanted to show how well they performed the task. Scaffolding might have accelerated these students' adaptation to write qualified answers.

Quality of Reflections on Topic and Search Process

Reflections or evaluations on own processes are the ways to support metacognitive development (Former, 2004; Kuhn & Dean, 2004). In this study, students were required to reflect on their previous processes and topic of the search. Due to relatively large amount of data, reflection reports of purposively selected sample were taken into account. The findings showed that students were tended to remember much about the second parts of the tasks rather than the first parts. However, there were students remembering the both parts of the task and these students belonged to mainly WISS group in higher gain cluster which might be a sign for the effectiveness of web-based scaffolding. It might have enabled the users to think about the found information much more than the teacher scaffolding, because WISST made students think about what was found in the website, whether there was any relevant or interesting information, whether the found information was adequate to answer the questions. These

were achieved through prompts appeared as a visit happened. Thinking and justifying the found information might have facilitated students' higher gains in metacognitive skills. As a result, such an increase in skills as well as high quality of reflections owing to the metacognitive scaffolding is also evident in the literature (Davis, 1996; Boulware-Gooden et al., 2007; Peters & Kitsantas, 2010).

Some reflections on the topic included examples of confusions or misconceptions of students. As Vosniadou (2001) stated misconceptions can be seen in science learning. Especially TS and NS groups showed such patterns. This might be related to these students' lower levels of comprehension. Students had to face with online texts requiring different skills for online comprehension (Leu et al., 2008). In addition, students' lack of prior knowledge might also have led them to get confused. Another reason might be the unfamiliar structure of confronted content since it might hinder the comprehension (Coiro, 2003). Although both web-based and teacher-based scaffolding aimed to eliminate misconceptions through modeling with sample search strategies, it seemed that this intervention did not work in TS group. The reason for that could be again the one-to-one fashion of WISST.

Students were asked to reflect on the previous week's search process. As Tabatabai and Shore (2005) found, successful searchers reflect both on strategy and monitoring progress. In this study, students' reflections were "on time" instead of "in time", i.e. they reflected on their search process one week after the search performed due to time restrictions. Those reflections revealed that NS group did not perceived any challenge. On the other hand, WISS group perceived scaffolding questions embedded in the software as challenges and TS group perceived eliminating the irrelevant links as the most challenging point in their search process. Students got used to these challenges towards the end of the study. These perceptions of challenge might have increased students' motivation to deal with the tasks. Such an arousal in motivation can explain why WISS and TS students differed from NS students in terms of many search parameters as indicated by Liaw and Huang (2006). They stated that motivation is a desired crucial state for successful searches. Otherwise metacognitive strategy use does

not work efficiently (Sungur, 2007a). On the other hand, the perception of challenge might have caused some students to paying full attention to the search performance, which is very typical for performance avoidance students.

WISS students seemed to associate their search processes with the program whereas TS students associated it with the teacher. They were all aware of scaffolding though they did not use the word exactly. Instead, they mentioned about the help provided. Such an awareness might have influenced students' attention, which in turn might have biased the performance during early weeks. Students in scaffolded conditions mentioned about strategy uses as well as many advantages like easiness, fun, speed, and so forth, which were not mentioned by NS group. This might mean that students in scaffolded conditions monitored their own process, evaluated, and reflected on their own process. NS group's reflections were very shallow and too general. Besides, it seemed that they focused only on finding new information, searching, or doing homework. On the contrary to NS group, others seemed to have been benefitted the advantages of scaffolding. For example, some students wrote about how they saved time by searching on WISST. In conclusion, apart from the scaffolding itself, students' perceptions about making use of it could also be an important factor contributing to the effective web searches.

5.3. Effects of Web-based Metacognitive Scaffolding on Metacognitive Skills Development (Research Question 4)

In the third research question, the effects of web-based metacognitive scaffolding on the improvement of metacognitive skills was tried to be explored. The results of analysis indicated that receiving web-based metacognitive scaffolds during an Internet search had a significant effect on the improvement of metacognitive skills when compared with no scaffolding condition, however, it was not significant when compared with teacher-based metacognitive scaffolding condition. Further analysis revealed a moderate effect of either scaffolding conditions in terms of specific metacognitive skills.

While WISS group's scores in monitoring, planning, control, and strategy improved significantly compared to NS group's scores, TS group's strategy generation scores were significantly higher than that of NS group. Comparing the WISS and TS groups showed that WISS group's control of attention scores were significantly higher than TS group's.

Considering the results, students in WISS group seemed to be benefitted the most from metacognitive scaffolding. The only difference between WISS and TS group was the scaffolding medium (computer vs. teacher). Both groups had higher strategy generation skills in the end of the study which can be attributed to the success of metacognitive scaffolding. Modeling students how to apply these strategies and allowing them to practice are important parts of metacognitive scaffolding. In this way, regardless of the medium, students' strategy generation skills might have developed during the study. WISS group's improvement in control of attention was greater than that of TS. This can be the result of deficiencies in teacher scaffolding, i.e. the teacher had to deal with 23 students at the same time although their needs for scaffolding varied regarding the time and intensity, thus students might have got distracted while waiting for scaffolds. To sum up, metacognitive scaffolding can help learners develop their strategy generation skills especially while facilitating other skill improvement, except for reflection-regulation skill. The medium via which metacognitive scaffolding was provided can be taken into consideration when the control of attention was the skill to be improved. The findings about metacognitive scaffolding are supported by available literature (Selberg, 1999; Walton & Archer, 2004, Lazonder & Rouet, 2008).

5.4. Effects of Goal Orientation Types on Metacognitive Skills Development (Research Question 5)

In this study, three types of goal orientations were measured; mastery, performance approach, and performance avoidance. As expected, it was found that goal orientation types had an effect that was very small on development of metacognitive

skills. Although there are studies claiming that some metacognitive skills are not influenced by goal orientation types (e.g. Stavrianopoulos, 2007), there are also examples that show relations between them (e.g. Schmidt & Ford, 2003). Results indicated that performance approach oriented students showed more significant skill improvements than mastery oriented students. Although mastery oriented students seek for individual satisfaction for learning, performance approach students constantly seek for the approval by others as a result of his/her competency demonstrations, yet, in this research question, the learning of students was out of concern. Instead, students' skillfulness was the focus. In the literature, there are many studies focusing on the relationship between goal orientations and learning outcomes reporting positive effects of mastery orientation on learning (Priemer and Ploog, 2007; Lin & Tsai, 2007), but there are also studies showing the positive effects of performance approach orientation (Skaalvik, 1997; Elliot et al., 1999; Wolters, 2004). Metacognitive skillfulness is a strong predictor of learning (Veenman et al., 2005), so the relationship between metacognitive skills and the learning can be parallel to the relationship between metacognitive skills and goal orientation. A few studies tried to find the relations between goal orientations and metacognitive skills, but they are inconclusive. The finding in this study is similar to studies supporting the hypothesis stating the higher skills of students with performance approach orientation .

The results indicated the significant differences across goal orientation types in terms of general metacognitive skill improvement over weeks. In order to explore if the same effects exist for sub-metacognitive skills, further analysis was run. No significant effect of goal orientation type on sub-metacognitive skill improvement was found, which means that there were significant differences of different goal orientationtypes on overall metacognitive skill development. Nevertheless, these effects were not significant when sub-metacognitive skill development were considered. This is expected due to the very small effect size of the overall significance.

5.5. Potential Predictors of Metacognitive Skill Improvement (Research Question 6)

The possible contributing factors were detected with the help of the sixth research question. The potential predictors were assumed as number of trials, duration, visited links, keywords, keyword changes, copy-pastes, and added ideas. In addition to these variables, pre-MIIS scores and intervention types were also controlled. In the final model, the only significant predictor was pre-MIIS scores. All other variables were very weak predictors of post-MIIS scores. Despite being very small and insignificant, intervention types, number of trials, and number of copy-pastes contributed to the explanation of post-MIIS scores similarly. Receiving one of the intervention types predicted metacognitive skill improvement when search variables were ignored, but with the inclusion of them to the model, their predictive power disappeared.

The results were on the contrary to the expectations. The reason for this insignificant model might be due to the characteristics of measured variables which were all quantitative forms of qualitative parameters. For instance, number of keywords only refers to the total keywords used regardless of their form, entry style, sequence, and so forth. Based on the content analysis of students'logs for further research showed very different dimensions of keyword usage. Therefore, relying on only numbers of search variables might have covered the prediction power of variables. Another reason for the insignificant contributions might be the inclusion of average values of 5 weeks' values since each task outlined diverse views. For example, the second and the fifth tasks were very subtle tasks leading to more number of trials than other weeks, hence, these weeks might have distorted the overall average values. Instead, examining the log itself could help to understand the relations.

5.6. Existing Relationships between Search Patterns, Goal Orientation Types, Metacognitive Skills, and Achievement (Research Question 7)

In order to understand the associations between groups of variables, a series of canonical correlations was conducted. First, the relations between metacognitive skills and search variables were examined. It was found that students having less improved metacognitive skills were associated with performing less number of trials for search tasks and visiting less number of web sites. Students with high metacognitive skills are expected to find more sources. These findings together can refer to successful search performances which are more likely to occur with better metacognitive skills (Tu, Shih, & Tsai, 2008).

Second, the relations between achievement variables and search variables were investigated. The results indicated that students with low performance work scores were more tended to perform copy-paste actions, try less, and visit less number of web sites. Copying and pasting the information and using it without changing it either in terms of content or formation are the examples of shallow processing which in turn might have influenced the search outcomes of the students. Less number of trials and less number of visits might refer two things. On the one hand, it could refer to the different goal orientations of the students since in the literature it was seen that students with mastery orientation are more demanding than other goal orientation types. On the other hand, it could also be explained with the characteristics of visited sites, because some students insisted on visiting Wikipedia for instance which generally resulted in copy-pastes. Such web sites provide the information similar to encyclopedias do; therefore, students might have highly satisfied with the found content. If the student has less improved metacognitive skills, it might become likely not to reflect on the quality of the content. The student might fail to monitor his/her understanding. As a result, all these actions can end in low quality search outcomes, which results in low scores of performance works.

Third, the relationship between metacognitive skills and achievement variables were explored, however, no meaningful associations were found. The literature is

inconclusive in that sense. There are studies claiming the relatedness of metacognitive skills with success (Desoete et al., 2006). There are also studies claiming the contrary which is parallel to our findings in this study (e.g. Countinho & Newman, 2008). The insignificant relations might be the results of the relatively short time interval of the study. 5 weeks might not be long enough to develop the metacognitive skills. Another reason might be the nature of metacognition, that is, it is not isolated from the social and physical environment (Schraw, 2001). It might have influenced from many other variables. For example, the student can apply the metacognitive strategies learned in a lesson to another domain which could allow students practice more and such kinds of effects were not measured in this study.

Fourth, the relations between goal orientation variables and search variables were tried to be detected, but no significant pattern was found. In other words, according to the results of this analysis, students' goal orientation types are not associated with their number of trials, copy-pastes, and visited sites. While investigating the qualitative data gathered from computer logs, no common trends regarding the goal orientation types were found. In the literature, there are no specific studies connecting such specific search patterns, but there are studies showing the relations between performance and goal orientation types (e.g. Middleton & Midgley, 1997). Nonetheless, the found results were on the contrary to the expectations because mastery oriented students are tended to be more persistent on the completion of tasks (Sideris & Kaplan, 2011) which might result in more number of visits or trials. The absence of the relations between any type of goal orientation and search patterns might be explained by the closer analysis of features of these search patterns. The bare numbers might have distorted the overall connections. Moreover, unique attributes of the tasks could also have influence the search patterns regarding the goal orientations. Difficult tasks might have caused different outcomes in different perceptions. For example, the numbers can increase due to getting confused or they can decline due to perceiving the task as challenging. These perceptions can also lead to different actions. While a performance approach oriented student can associate the more number of visits with being perceived as a competent

searcher, a mastery oriented student can associate this situation with the ways to learn more. That is why, the numbers might not have provided a clear pattern, so the relations were not found significant.

5.6. Conclusion

From the introduction of the scaffolding to the literature, various types of it have been tried to be integrated into instructional cases. The effects of scaffolding were represented in many contexts. This study is an example showing positive effects of scaffolding within school settings with regular search tasks. Comparison of two scaffolding conditions revealed important findings. When students received web-based metacognitive scaffolds, they improved their monitoring, planning, controlling, and strategy generation skills significantly. Content analysis indicated that WISS students applied certain strategies while dealing with the selection of appropriate keywords.

Compared to the teacher-based metacognitive scaffolding, web-based scaffolding was found especially successful for control of attention skill improvement. These students' reflections on the searched topic exemplified that they remembered larger portions of information including both fact-finding questions and interpretation questions, which might mean that there was something to support students' comprehension of online reading because the fact-finding facts were only clear among WISS group. Although this tendency was observed in the small sample, to generalize results, more detailed observations and larger sample are needed. It is noteworthy to remind that the WISST introduce lots of scaffolds including question prompts and these all support the before and after the reading process, which might have affected the comprehension levels as opposed to others.

Decreasing trend of the frequency of copy-pastes in WISS group can be a valuable finding despite its insignificant contribution in statistical analysis. 5-week interval might not be enough to reveal the significance of the decline, but the content analysis indicated that the fifth week made difference in terms of copy-paste frequency.

Moreover, the frequency of own idea additions increased after the fourth week. WISST enabled students to copy-paste, edit, and take notes on a space accessible via a button whenever needed. In the end of the search, the outline of student's process and these notes are made visible for students through a report page. This feature of the tool might be responsible for the increase in idea additions. A longer study period can shed light on the relations between web-based metacognitive scaffolding and the amount of copy-pastes and original idea additions. Content analysis also showed that, unlike others, WISS group did not indicate inappropriate or irrelevant keyword usage examples. As a result, the visited links were quite relevant to the searched topic. This could be the consequences of metacognitive scaffolds prompted while deciding on the keywords. The prompts to help deciding on the quality of the visited links might also have prevented students from future unwanted links.

Metacognitive scaffolding regardless of the scaffolding agent contributed to strategy generation skills. Since this skill was not developed significantly among non-scaffolded group, it can be inferred that modeling with the help of metacognitive scaffolds has the potential to encourage students to make use of strategies. Such metacognitive skills can be improved with practice (Flavell, 1979). Regular classroom practices as well as outside classroom activities can allow students to practice with real tasks. When compared to the web-based scaffolding, teacher-based scaffolding was found weaker especially in terms of control of attention skills improvement. This is very hard to accomplish for teachers within crowded classrooms. Such scaffolds as modeling might be easier for teachers to apply, but detecting and providing support in time might be harder. This latency can cause some gaps in attention.

Content analysis showed that like WISS group, TS group applied strategies like hypothesis testing during the keyword elimination. Nevertheless, there were also students using the whole question as keywords and performing one-shot visits, which are the examples of lack of strategies and plans although the statistical analysis revealed the improvement in strategy generation when compared to NS group. These findings should be investigated in the future studies. In addition, teacher-based scaffolding seems

to be inadequate to decrease the copy-paste frequency as well as to increase the idea additions. Further research is needed to make implicit the deficiencies in teacher-based metacognitive scaffolding.

This study enables us to compare the Internet search situations in scaffolded and non-scaffolded environments. As found by many other studies, scaffolding can help students to improve their skills (e.g. Stadtler & Bromme, 2008). Students having less improved metacognitive skills were found trying less and visiting less pages. This might refer the relations between internet search competency and metacognitive skills. The content analysis revealed that student, whose metacognitive skills are highly developed throughout the study, frequently used meaningful keywords and applied to certain strategies to eliminate keywords. Our study confirmed the previous studies in terms of skill improvement, but our results were not supportive in terms of learning gains. In our study, no relations were found between metacognitive skills and achievement related variables directly, but low scores in performance works were found related with copy-pastes, trials, and visits. This might be an example of indirect relation between metacognitive skills and achievement because appropriate use of search patterns were associated with improved metacognitive skills. If these skills used appropriately, the performance scores will increase which can be considered as a sign of learning gain.

NS group's logs exposed many deficiencies of search patterns. Unlike scaffolded ones, students in NS group entered many irrelevant keywords that were resulted in irrelevant visits. This usage appeared especially during the search for open-ended tasks. All students were observed to have difficulties in such tasks, but others generated certain strategies to deal with the subtleness. Due to the lack of scaffolds, NS group showed this pattern for many times for many tasks. Their performance work statements were very shallow in content and their interpretations were low in quality. These students gave up the tasks easier than others. These students' search processes were not interrupted by anyone or by any digital agent, which might have led them feel free to quit. Like in TS group, there were examples of misconceptions of confusions in NS group. Although all these deficiencies can be attributed to the lack of scaffoldings, the data is small to

generalize the findings, and furthermore, such an attribution requires different types of analysis.

Goal orientation types of students showed differences in terms of general metacognitive skill improvement, but only performance approach orientation was more significant than mastery orientation. This finding contributes a line of research studies concluding similarly (Elliot & Harackiewicz, 1996; Wotters, Yu, & Pintrich,1996), however, none of these goal orientations were associated with any search variables. On the other hand, content analysis revealed some important findings despite the small number of sample. For example, meaningful set of keywords were entered frequently by performance approach students. An interesting finding was that performance approach students stayed longer on a page when they performed copy-pastes. They also tried more than the others. They were the ones who got used to add their own words to the performance works earlier than others. These all can be interpreted as the ways to prove how competent they are to others. On the other hand, performance avoidance students showed no examples of one-shot visits. They stayed longer when the content was relevant to the searched topic. These might be the ways to avoid being perceived as incompetent by others. Considering the findings, it seems that scaffolding might not have influenced the search behaviors of students with different goal orientations types. More research and more scaffolds should be necessary to consider the goal orientation types. Since the aim of this study was to improve students' metacognitive skills, no interventions were taken into consideration to change students' goal orientations. Further studies can contribute the findings with different focus.

The effects of task difficulties were not one of the concerns of this study, but content analysis demonstrated some obvious patterns regarding the different task types. Each task included two parts; one was more close-ended (fact-finding) and the other was more open-ended (argument). It was observed that, some search patterns changed as the task types changed. Open-ended questions resulted in inappropriate keyword usages. Irrelevant visits also occurred during the searches for open-ended tasks. Such types of tasks sometimes resulted in incomplete performance works. Finally, as the tasks become

subtle, the number of keywords and trials increased. Students applied strategies for subtle tasks. These findings deserve attention to be investigated because the task difficulty or type could have led to increases or decreases in motivations.

The final interesting finding in the content analysis was the prevalent use of Wikipedia. Although its use was excessive among NS group, others also visited this site most of the time. It was listed at the top three in frequently visited links during task searches in this study. It seems that students trusted that site. Its structure and wide content repertoire might have caused students frequently go to that site. It was interesting to find some students specifically search for this site with the inclusion of "wikipedia" word as a keyword. Regardless of neither metacognitive skills nor goal orientation types, many students visited it, therefore it deserves a specific attention for further studies.

5.7. Implications for Practice

Like many other examples in the literature (Selberg, 1999; Walton & Archer, 2004; Vovides, 2005; White & Frederiksen, 2005; Stadtler & Bromme, 2008), this study also confirmed the effective use of metacognitive scaffolding when embedded into computers. In practice, these scaffolds can be embedded into different technologies. As students become familiar with tablet computers, the importance of such scaffolding approaches may become crucial to shape students' interactions with the Internet and guide them to improve their online skills and metacognitive skills. This is necessary because, although students can be considered as digital natives, this might not mean the overall appropriate uses of computers. This might not mean they all have needed skills or make use of skills. That is why these skills including reflection-regulation, monitoring, planning, control of attention, and strategy generation skills should be taken into account by educators who should pay attention to make explicit the skills. Internet search skills should be integrated to the lessons rather than giving as separate instructions. In this way, students can develop their skills while engaging in the real

tasks. Web-based metacognitive scaffolds may make a difference if used in a structured way.

Policy makers can benefit from the positive contributions of metacognitive scaffolding. This kind of scaffolds can be embedded into the curriculum of different domains. It does not needed to be web-based. As the results of this study indicated teacher-based scaffolds also made difference, thus teachers can be trained to use this kind of scaffolds related to their domain. Teacher education programs and in-service training programs can benefit from the metacognitive scaffolding technique. As well as teachers and students, the parents can benefit from metacognitive scaffolding tools while helping children at home. The scaffolding tools can be shaped according to the needs of the domain and the users.

The designed tool provided audio-video instruction, question prompts, clear view of followed steps, and so forth. The reflections of students showed that question prompts were the most challenging part of the tool. In the earlier weeks, they complained about those, but later their perceptions changed because they became aware of how helpful these questions were. For example, they benefitted from them as a checklist to decide on the relevancy of the visited web page. Questions embedded into the tool seemed to be effective. Such scaffolds might be crucial in the beginning of trainings, then they can be faded gradually as students become experienced in time. Some scaffolds should be embedded into the program to facilitate and guide students how to manage the results page. Indeed, the help video provided demonstrations about how to distinguish relevant links from irrelevant ones, but it was not simultaneous. After the entry of the keywords, students should be guided through scaffolds helping students to decide on what and why to click. The tool can either be used either with or without the exıstence of a teacher or an adult. This does not mean that the tool can replace with the teacher, but it can serve as a support tool rather than an instructor.

Metacognitive skills and Internet search skills should be considered as the ways to improve the quality of performance works. In this study, students with lower metacognitive skills were associated with less trials and less visits. Moreover, students

having low performance grades were more tended to copy-pastes, less trials, and less visits. The performance works of students should not be associated with the final products submitted to the teachers. In addition to the product, the process should also be taken into account. Teachers can teach students and make them practice how to reflect on the quality of the outcomes. Reflective journals can help at this point. Reflections on the process as well as the content learning should be taken into account by teachers since they can uncover the existing patterns of knowledge. Besides, students can learn to think about their own actions. In this study, misconceptions and confusions appeared on reflective journals. Confusions and misconceptions can be observed any in domain in learning and it is hard for teachers to observe and fix them. Teachers can benefit from the reflections through integrating them different settings. Students can be assigned to write reflective journals after working on a project.

Finally, teachers can apply the following practical strategies within the classes through integration of Internet and any electronic information source. In order to achieve this, the teacher should model students how to start a search. In that way, the distinctions between keyword and aim should be emphasized. An important point with regards to keyword selection or entry is not to enter the task or question statement as the whole keyword. The teacher should help students to extract the meaningful keywords from the question statement. Students should be given some strategies about how to evaluate the search engine results page. For example, they can be encouraged first to read the titles of links or the short explanations, and then click if related. Once the students enter the web pages, the teacher can model where to start first, how to read, and the ways to enhance online comprehension. In addition, students should be made aware of the threats for misleading links, confusions, and so forth. They should be encouraged to think what has been found, what has been understood, and etc. as soon as a visit happens. The teacher should be clear about what s/he wants from the students' products and s/he should clearly state the importance of showing references whenever a copy-paste information is used. On the other hand, copy-paste actions should be minimized by students and the teacher should have a rubric showing the penalties if there are too much copy-pastes.

Another important point is that the teacher should help and model students to reflect on what is being searched, the steps followed during the search, and the final product. Other than those, these are all possible with meaningful tasks. That is, the teacher should assign open-ended tasks requiring critical thinking and interpretation of the found ready-to-use information. In this way, the students can get used to thinking about the found information before totally copying and pasting.

5.8. Implications for Research

This study was conducted in regular school settings and included only one subject area. Different domains can be included in the study to compare the effects of web-based or teacher-based metacognitive scaffolding. The tasks were all under the curriculum of Science and Technology course. The results might be very different if the tasks are selected from Mathematics or other subjects curriculum. Further research is needed in different subject areas. The tasks used in the study were selected with the help of Science and Technology teacher. In spite of varying difficulties, they were not given in a purposeful sequence. Future studies can also design the study in accordance with such sequences as simple to complex or vice versa. Besides the difficulties, the tasks can also be differentiated as open-ended and close-ended. In our study, this classification was done within each main task, i.e. each task was the mixture of both types. The tasks for each task can be fully open-ended or fully close-ended rather than mixture of both.

Embedding metacognitive scaffolds into computer environment has been studied by many researchers. This study's results were in favor of web-based metacognitive scaffolding compared to the teacher-based one in Internet search task. For further implications, different types of scaffoldings can be compared with web-based scaffolding which might lead deeper understandings of the impact. As students are being exposed to various types of media, there is a need for adaptation of this tool to different devices. Especially nowadays in Turkey, the government has been equipping schools with tablet computers. Unlike PCs, tablets require entry with touches, which can bring

about ease of use. At that point, students' search habits and patterns or even their styles of reading and comprehension can change. These situations may need to be explored in Internet search context or any other interaction cases. Metacognitive scaffolding can earn new implications in such mobile interactions.

The study took place in a 5-week period which can be a short period, but still many impacts were detected. The results can be different if applied within longer time periods. The effects can either become weaker or stronger. Considering the developmental periods of students, the longitudinal studies can make more sense. If this is the case, the scaffolding approaches should be adjusted according to the developmental stages of learners. The participants of this study were seventh graders and the assignments were in the format they used to. School context might have influenced the way students perceived and acted, but future research can be designed in different contexts and with different participants. The results can differ with different grade levels. The data gathered in this study included 72 students and there is a gap in the literature focusing on cases individually. Since metacognition is a hard phenomenon to explore, smaller samples and closer observations should be included in future studies. Especially, TS condition should be examined within smaller samples.

This study focused on individual work to monitor metacognitive skill gains. Further studies can integrate metacognitive scaffolds to group works. Dynamics between peers and metacognitive scaffolds can be observed. The WISST tool can be adapted according to the needs of group dynamics. Even this version of the tool can be compared with the previous tool designed for individual scaffolding. In this way, the researcher might be able to examine the effects either on metacognitive skillfulness or performance. In this study, both qualitative and quantitative data were collected and analyzed. It was observed that qualitative data provide many insights about the search patterns of students. For further studies, more qualitative approaches such as think aloud protocols can help to understand the purposes of actions.

Finally, in this study, a dimension of motivation was taken into consideration and some significant results were observed. Students with performance approach goal

orientations were appeared to improve metacognitive skills better than mastery orientations. The literature is inconclusive, but somehow oriented to the mastery orientation's tendency to higher performance. In order to make clear the results of both this study and similar studies, more research is needed. In addition to goal orientation types, other motivational elements should be considered while designing and applying the future studies.

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APPENDIX A

METACOGNITION INVENTORY FOR INTERNET SEARCH

İNTERNET'TE ARAŞTIRMA YAPMA BECERİLERİ ANKETİ

Sınıf: ☐ 7. Sınıf ☐ 8. Sınıf

Cinsiyet: ☐ Kız ☐ Erkek

☐ **Evde kullandığım bir bilgisayarım VAR.**

☐ **Evde kullandığım bir bilgisayarım YOK.**

Haftalık bilgisayar kullanım süresi: ☐1-3 saat ☐4-5 saat ☐6 saat ve üzeri

1. Aşağıdaki ifadelerin doğru veya yanlış cevabı yoktur. Tamamen sizin yaşadıklarınızı saptamak amaçlıdır, bu nedenle lütfen samimi cevaplar verin.
2. Eğer ifade sizin **HİÇ** yaşamadığınız bir durumu belirtiyorsa **"1"** i; **BAZEN** yaşadığınız bir durumu belirtiyorsa **"2"** yi; **SIK SIK** yaşadığınız bir durumu belirtiyorsa **"3"** ü; **HER ZAMAN** yaşadığınız bir durumu belirtiyorsa **"4"** ü yuvarlak içine alın.
3. Yardımcı olduğunuz için teşekkürler☺

		HİÇ	**BAZEN**	**SIK SIK**	**HER ZAMAN**
1)	İnternet'te araştırma yapmaya başlamadan önce, araştırmam gereken noktaları belirlerim.	1	2	3	4
2)	İnternet'te araştırma yaparken incelediğim sitelerdeki bilgilerin ödevimle ne kadar ilgili olduğunu kontrol ederim.	1	2	3	4
3)	İnternet'ten araştırdığım bilgilere kendi yorumlarımı ekleyip ödevimi tamamlarım.	1	2	3	4
4)	İnternet'te araştırma yapmanın ödevimin sadece bir aşamasını oluşturduğunu bilirim.	1	2	3	4
5)	İnternet'te araştırmamı tamamladıktan sonra izlediğim aşamalar hakkında düşünürüm.	1	2	3	4
6)	İncelediğim sitelerde ödevimle ilgisi olan bilgileri kolayca ayırt ederim.	1	2	3	4

		HİÇ	BAZEN	SIK SIK	HER ZAMAN
7)	İnternet'te yaptığım araştırma sonunda bulduğum sitelerin içeriğini derinlemesine anlamaya çalışırım.				
8)	İnternet'te araştırma yapmaya başlamadan önce, kullanacağım **anahtar sözcükleri** belirlerim.				
9)	İnternet'te araştırma yaparken bulduğum bütün sitelere girmek yerine aralarından ödevimle doğrudan ilgili olanları seçerim.				
10)	İnternet'ten bulduğum bilgileri ödev haline getirdikten sonra düşüncelerimi doğru ifade edip etmediğimi kontrol ederim.				
11)	İnternet'te araştırmamı tamamlamak için yaklaşık ne kadar zamana ihtiyacım olduğunu bilirim.	1	2	3	4
12)	İnternet'te araştırmamı tamamladıktan sonra, bulduğum bilgilerin ödevim için yeterli olup olmadığını düşünürüm.	1	2	3	4
13)	Ödevim için incelediğim siteler hakkında hatırlatıcı kısa notlar alırım.	1	2	3	4
14)	İnternet'te ödevimle ilgili site bulamazsam daha fazla araştırma yapmaktan vazgeçerim.	1	2	3	4
15)	Ödevimle ilgili sitelerdeki bilgileri incelerken aynı zamanda elektronik postalarıma bakarım.	1	2	3	4
16)	İnternet'te araştırma yapmadan önce ödevimi incelerim.	1	2	3	4
17)	Ödev yaparken İnternet'te araştırma yapmak en çok zaman harcadığım şeydir.	1	2	3	4
18)	Bulduğum sitelerdeki bilgiler aynı konu hakkında farklı şeyler yazıyorsa nedenini araştırırım.	1	2	3	4
19)	İnternet'te araştırma yapma sürem ödevimin konusuna göre değişir.	1	2	3	4
20)	İnternet'te araştırma yapmaya başlamadan önce, kafamda oluşan soruları belirlerim.	1	2	3	4
21)	Eğer ilk araştırmada ödevimle ilgili site bulamazsam farklı **anahtar sözcükler** belirlerim.	1	2	3	4
22)	Ödevimle ilgili sitelerdeki bilgileri incelerken aynı zamanda arkadaşlarımla sohbet ederim.	1	2	3	4
23)	Sitelerin içeriğini okurken anlamamı kolaylaştıracak kendime göre yöntemler geliştiririm.	1	2	3	4
24)	Araştırma sırasında karşıma çıkan siteleri kısaca gözden geçiririm.	1	2	3	4
25)	Aradığım tüm bilgiyi tek bir sitede bulursam daha fazla araştırmam.	1	2	3	4
26)	Önemli bilgilerle karşılaştığımda daha dikkatli ve derinlemesine inceleme yaparım.	1	2	3	4
27)	İncelediğim sitelerdeki bilgilerle kendi bildiklerim arasında bağlantı kurmaya çalışırım.	1	2	3	4
28)	İnternet'ten bulduğum bilgileri bir araya getirirken kendime göre yöntemlerim vardır.	1	2	3	4
29)	Sitelerdeki bilgileri okurken neleri anlamadığımı fark ederim.	1	2	3	4
30)	İncelediğim sitede, ödevimde kullanabileceğim bilgileri kolayca ayırt ederim.	1	2	3	4

AP

APPENDIX B

PATTERNS OF ADAPTIVE LEARNING SCALE

Öğrenci No:…….Sınıf:……

		Kesinlikle Katılmıyorum	Katılmıyorum	Kararsizim	Katiliyorum	Kesinlikle Katiliyorum
1.	Bu sene birçok yeni kavram öğrenmek benim için önemli.					
2.	Bu dersteki hedeflerimden biri öğrenebildiğim kadar çok şey öğrenmek.					
3.	Bu seneki hedeflerimden biri yeni beceriler edinmek.					
4.	Derste yapılanları iyice anlamak benim için önemlidir.					
5.	Bu sene, becerilerimi geliştirmek benim için önemli.					
6.	Sınıf arkadaşlarımın dersle ilgili çalışmalarımda iyi olduğumu düşünmeleri benim için önemlidir.					
7.	Dersle ilgili çalışmalarımda ne kadar iyi olduğumu başkalarına göstermek hedeflerimden biridir.					
8.	Dersle ilgili çalışmaların benim için ne kadar kolay olduğunu göstermek hedeflerimden biridir.					
9.	Hedeflerimden biri sınıftaki diğer öğrencilere göre daha zeki görünmektir.					
10.	Sınıftaki diğer öğrencilere göre daha zeki görünmek benim için önemli.					
11.	Sınıfta aptal gibi görünmemek benim için önemli.					
12.	Derslerde diğerlerinin zeki olmadığımı düşünmelerini engellemek hedeflerimden biridir.					
13.	Öğretmenimin diğerlerinden daha az şey bildiğimi düşünmemesi benim için önemli.					
14.	Hedeflerimden biri yaptığım çalışmalarda sıkıntı çektiğimi göstermemektir.					

APPENDIX C

ACHIEVEMENT TEST

Sınıf:……No:……..

1. Küresel ısınmanın hızla artmasının nedenleri nelerdir? *(1 puan)*

……

……

2. Küresel ısınma daha da arttığında ne gibi olaylarla karşı karşıya kalabiliriz, neden? *(1 puan)*……

…….

3. Gürültü kirliliğini bir örnek vererek açıklayınız? *(1 puan)*

……

……

4. En verimli toprak çeşidi ……. *(0.25 puan)* topraktır, çünkü……

……*(0.75 puan)*

5. Killi toprağın özellikleri nelerdir? *(1 puan)*

……

……

6. Aşağıdakilerden hangileri Türkiye'de yetişmez? Nedenlerini belirtiniz.

a. Elma, Türkiye'de…… *(0.5 puan)*Çünkü…… .*(0.5 puan)*

b. Mango, Türkiye'de ……. *(0.5 puan)*Çünkü…….. *(0.5 puan)*

c. Ananas, Türkiye'de ……. *(0.5 puan)*Çünkü…… *(0.5 puan)*

d. Karpuz, Türkiye'de ……. *(0.5 puan)* Çünkü…… *(0.5 puan)*

7. En tehlikeli solunum sistemi hastalığı ……dır *(0.25 puan)*, çünkü……*(0.75 puan)*

APPENDIX D

SAMPLE STUDENT RECORD

Öğrenci Geçmişi

Öğrenci					
Adı	: 325	Sınıf:	325	Okul:	325

Aramalar:

Session 1

Amaç	: küresel ısınma
Anahtar Kelimeler	: Küresel ısınmanın insan hayatına etkileri
Konuyla ilgili bildikleri	: Güneşin zararlı ışınlarından dolayı oluyor.
Ödev	: İndir

Gezilen Sayfa 1 - http://tr.wikipedia.org/wiki/Küresel_ısınma 1

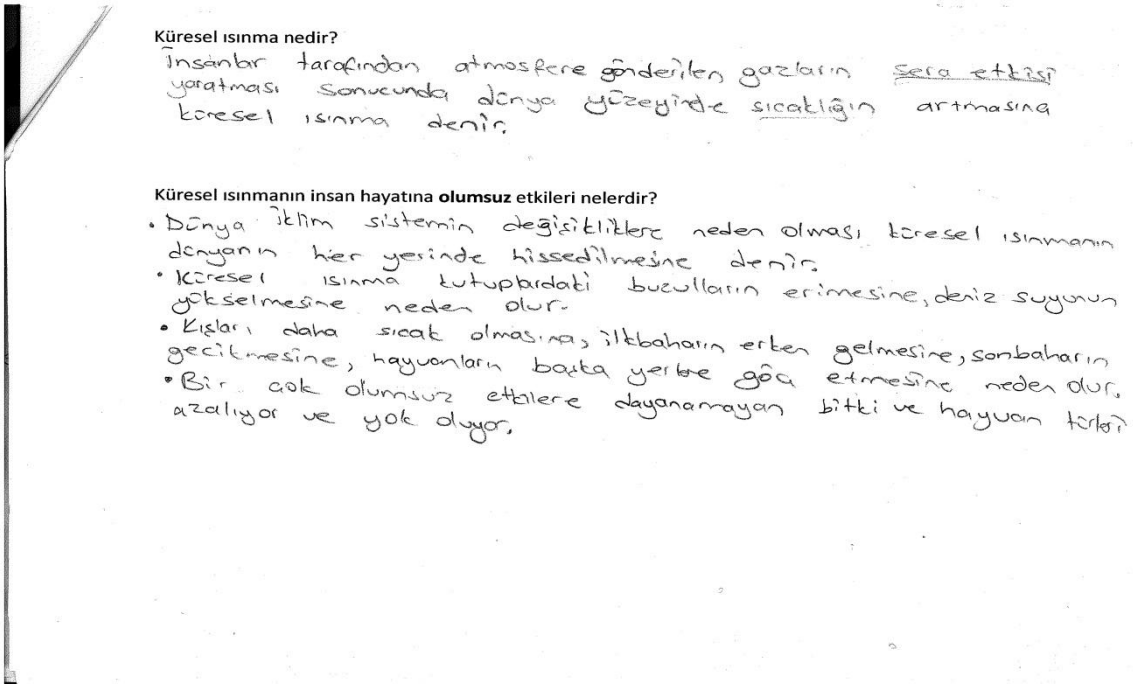
URL	: http://tr.wikipedia.org/wiki/Küresel_ısınma
Kaçıncı Sırada	: 1
Anahtar Kelimeler	: Küresel ısınma
Süre	: 0 saat 5 dk. 48 sn.
Ödev ile ilgili mi?	: Evet - Küresel ısınmayı anlatıyor.
Güvenilir mi?	: Evet - Çünkü ben bu siteye evde de giriyorum. Ödev yaparken her şeyi bulabiliyorum.
Aranılan herşey var mı?	: Evet
Alıntılar:	: Küresel ısınma, atmosfere verilen gazların sera etkisi yaratması sonucunda, dünya atmosferi ve okyanuslarının ortalama sıcaklıklarında belirlenen artışa verilen isimdir.
Daha fazla arama gerekiyor mu?	: true

Gezilen Sayfa 2 - http://tr.wikipedia.org/wiki/Küresel_ısınma 1

Figure D.1 Track of a student

APPENDIX E

SAMPLE PERFORMANCE WORK



Küresel ısınma nedir?

İnsanlar tarafından atmosfere gönderilen gazların sera etkisi yaratması sonucunda dünya yüzeyinde sıcaklığın artmasına küresel ısınma denir.

Küresel ısınmanın insan hayatına olumsuz etkileri nelerdir?

- Dünya iklim sistemin değişikliklere neden olması küresel ısınmanın dünyanın her yerinde hissedilmesine denir.
- Küresel ısınma kutuplardaki buzulların erimesine, deniz suyunun yükselmesine neden olur.
- Kışları daha sıcak olmasına, ilkbaharın erken gelmesine, sonbaharın geciktmesine, hayvanların başka yerlere göç etmesine neden olur.
- Bir çok olumsuz etkilere dayanamayan bitki ve hayvan türleri azalıyor ve yok oluyor.

Türkiye'de yetişmeyen ancak Dünya'nın farklı bölgelerinde yetişen meyvelerden bir tanesi hakkında bilgi toplayınız.

Hindistan cevizi palmiyegiller familyasında tropik bölgelerde yetişen meyvesi yenen bir palmiye türüdür. Tropikal bölgelerde yetişir. Meyvesi yenir. Hindistan cevizi lifi elde edilir. Ayrıca beyaz renkler halinde kek ve pastayı süslemek veteottetmek amacıyla kullanılır. Boyu 20 myi aşan Hindistan cevizinin özsuyu mayalanarak bir tür palmiye sorbe üretir. Meyvesinden elde edilen sıvıdo tıpta kullanılmaktadır. 60 yıl kadar ürün verir. 90-100 yıl yaşar. Beraberlikte toz halinde alır. Kurutulmuş Hindistan cevizinin enerji değeri yüksektir. Hindistan cevizinin özü sindirim sistemi rahatsızlıklarının tedavisinde etkilidir. Kuşmayı yatıştırmak için kullanılır.

Sizce bu meyvenin Türkiye'de yetişmeme sebebi nedir?

Türkiye Tropikal bir bölge olmadığı için ayrıca ülkemiz in iklim şartları uygun olmadığı için

Solunum sistemi hastalıklarından 3 tanesi hakkında bilgi toplayın.

Verem= Verem diğer adıyla "TÜBERKÜLOZ" solunum havası ile akciğerlere verem bakterisinin (mikrobunun) yol açtığı bulaşıcı bir hastalıktır.

Zatürre= Halk arasında "ZATÜRRE" olarak bilinen "pnömoni" enfeksiyonları, özellikle risk grubu hastalarda ölümle sonuçlanabilecek ciddi bir akciğer hastalığıdır.

Akciğer kanseri I Akciğer kanseri ilk önce akciğerde başlar. Küçük hücreli akciğer dokularında kanser (kötü, kötü huylu) hücrelerinin bulunduğu bir hastalıktır.

Bu hastalıklar içinde sizce en tehlikelisi hangisidir? Neden?

Bu hastalıklar içinde bence en tehlikelisi akciğer kanseridir. Çünkü; Günümüzde, tedavisi zor bulunan ve çok dirençli gerçekleşen bir hastalıktır. Bu hastalığa yakalanan son insanlar güçsüz olabiliyor. Onun için de ölümle sonuçlanıyor.

Gürültü kirliliğinin sebepleri nelerdir?

Gürültü kirliliğinin başında trafik yoğun olması, sürücülerin gereksiz ve zamansız klakson çalmaları, geniş belediye hudutları içerisinde bulunan endüstrinin bölgelerinden gürültüler gelmektedir. Meskenlerde ise televizyon ve müzik aletlerinden çıkan yüksek sesler, zamansız yapılan bakım ve onarımlar, ilaç başı işlerden kaynaklardan gürültüler insanların işitme sağlığını ve algılamasını dumsuz yönden etkilemesi

Sizce gürültü kirliliğini yok etmenin veya azaltmanın yolları nelerdir?

gereksiz korna çalınmama. toplu taşıma araçlarını kullanma. Kişisel - televizyon ve müzik setini yüksek sesle dinlememe. Bitkilere ses yalıtımı yapılması.

fizyolojik ve psikolojik dengesini bozmakta, iş verimini azaltmaktadır.

Örnek

Geçici veya sürekli işitme bozuklukları. Kan basıncının artması dolaşım bozuklukları, savunmada hızlanma, kalp atışlarında yavaşlama, ani refleks. Davranış bozuklukların artırı sınırlılık.

Humuslu toprak ve killi toprak arasında ne gibi farklar vardır?

Humuslu toprak, Bitki ve hayvan kalıntılarının çürümesiyle oluşuyor, koyu renkli, yumuşak ve su tutabilen verimli topraktır. Bu tür topraklar kavrulduğunda içinde canlı kalıntılar oluşur. Onun yüzeinden yanık kokusu verir.

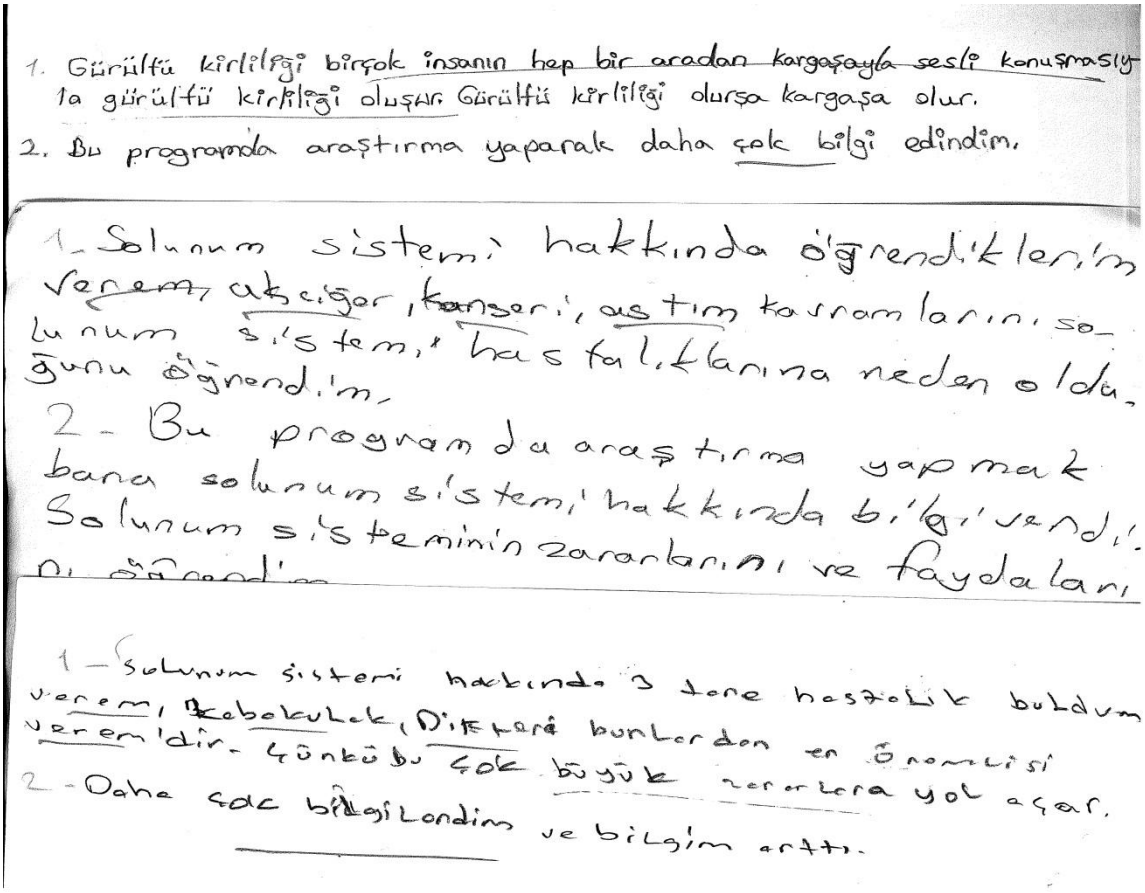
Killi Toprak; Ağır, su tutabilen, zor işlenen, kil bakımından zengin, asitlerden etkilenmeyen ve ısıya dayanıklı toprak çeşitine killi toprak denir. Killi topraklar ise kavrulduklarında sertleşirler ve camı çizebilecek hale gelirler.

Sizce hangisinin olduğu yerde daha verimli tarım yapılır? Neden?

Humuslu toprak. Çünkü bitki ve hayvan kalıntılarından oluşmuştur. Su tutabilen bir topraktır. Killi toprak su tutmadığı için.

APPENDIX F

SAMPLE REFLECTIVE JOURNAL



1. Gürültü kirliliği birçok insanın hep bir aradan kargaşayla sesli konuşmasıy la gürültü kirliliği oluşur. Gürültü kirliliği olursa kargaşa olur.
2. Bu programda araştırma yaparak daha çok bilgi edindim.

1- Solunum sistemi hakkında öğrendiklerim verem, akciğer, kanser, astım tavramlarını, solunum sistemi hastalıklarına neden olduğunu öğrendim.
2- Bu programda araştırma yapmak bana solunum sistemi hakkında bilgi verdi. Solunum sisteminin zararlarını ve faydalarını öğrendim

1- Solunum sistemi hakkında 3 tane hastalık buldum verem, kabakulak, Difteri bunlardan en önemlisi verem'dir. Çünkü bu çok büyük zararlara yol açar.
2- Daha çok bilgi Londim ve bilgim arttı.

APPENDIX G

SCENARIO OF THE TOOL

1. Öğrenci sisteme girerken bir ID ve şifre sorulacak.
2. Ekranın açılışında kısa bir tutorial olacak. Bu tutorialda, iyi bir İnternet araştırmasında dikkat edilmesi gereken noktalara değinilecek: (İlk login oluşta bu kısım zorunlu olacak ama sonraki loginlerde isteğe bağlı olarak atlanabilecek)
    a. Bir aramada gerekli olan basamaklar şema şeklinde gösterilecek.
        i. Amaç belirleme
        ii. Planlama
        iii. Arama
        iv. İnceleme
        v. Özetleme
    b. Daha sonra her birine tek tek örnekler verilecek ve stratejiler önerilecek.
3. Öğrenci tutorialı bitirdikten veya atladıktan sonra karşısına pop-up pencere şeklinde "bu aramadaki hedefin nedir?" sorusu çıkacak ve öğrencinin cevabı ekranın sol üst köşesinde logout olana kadar kalacak ama istediği zaman bu hedefi değiştirebilecek (buton aracılığıyla olabilir).
4. Yine aynı şekilde "kullanacağın anahtar kelimeler nelerdir?" sorusu sorulacak.
5. Yine aynı şekilde "bu konuyla ilgili neler biliyorsun?" sorusu sorulacak ama sol tarafta görünmesine gerek yok sadece kaydedilmesi yeterli.
6. Google.tr varsayılan arama motoru olacak ve değiştirme şansı verilmeyecek öğrencilere.
7. Öğrencilerin arama esnasında
    a. kullandığı anahtar kelimeler,
    b. çıkan sonuçlarda kaçıncı siteye girdiği,
    c. girdiği sitelerde ne kadar süre geçirdiği bilgileri veritabanında tutulacak.
8. Öğrenci her incelediği site için şu bilgileri girecek ve bu aşamayı geçmeden ilerleyemeyecek:

a. Bu sitede genel olarak ne tür bilgiler var?
b. Buradaki bilgiler ödevimle ilgili mi?
c. Buradaki bilgiler güvenilir mi?
d. Bu sitede ödevimde kullanabileceğim bilgiler nelerdir? (bu kısım yukarıda tarif edildiği şekilde sol tarafta listelenecek veya ayrı bir word dosyasına referansıyla birlikte kaydedilecek daha sonra öğrenci ödevini son haline getirmek için kullabilecek şekilde erişilir olacak)
e. Bu sitede bulduğum bilgilerin önceki bulduğum bilgilerden farkı nedir? (sadece ilk girdiği site için bu soru olmayacak)
f. Bu sitede aradığım her şey var mı?
g. Daha fazla arama yapmam gerekiyor mu? (Cevabı evetse aynı prosedür diğer arama oturumları için de devam edecek ama cevap hayırsa 8)

9. Google ın yerine boş bir word dosyası açılacak. Bu dosya şu başlıkları içerecek:
    a. Ödevin konusu
    b. İncelediğim sitelerden bu konuyla ilgili öğrendiklerim
    c. İnternette arama yaparken bir dahaki sefere dikkat etmem gereken noktalar
10. Bu dosya oluşturulduktan sonra oturum sona erecek.

APPENDIX H

EXPERT CHECKLIST

Öğrenciyi Destekleme Süreci
Not: Lütfen aşağıdaki ifadelerde yer alan ölçütlere, "bir" den "beş"e kadar bir değer veriniz. Ölçütün uygulamaya çok iyi entegre edildiğini düşünüyorsanız 5, çok kötü entegre edildiğini düşünüyorsanız 1 puan veriniz. Eğer kararınız en uçlarda değilse 2, 3, veya 4 gibi puanlar da verebilirsiniz. Eğer değerlendirdiğiniz sistemle ilgisi olmadığını düşündüğünüz bir madde varsa "sıfır" yazabilirsiniz. Puanlamanızı yaptıktan sonra, ölçütte *programdaki hangi öğe veya öğeleri* göz önüne aldığınızı belirtiniz. Gerekli gördüğünüz yerde lütfen düşüncelerinizi yazınız. Zaman ayırdığınız için şimdiden teşekkürler.
(0=İlgili değil, 1=Çok iyi <u>uygulanmadığını</u> düşünüyorum ⟷ 5=Çok iyi <u>uygulandığını</u> düşünüyorum)

SORU SORMA		Puan	Programdaki hangi kısım?*
1.	Öğrencinin arama yapmaya başlamadan önce soru sorması sağlanıyor mu?		
2.	Öğrenci ilk aramada istediğini bulamazsa daha fazla arama yapmasına imkan veriliyor mu?		
3.	Öğrencinin sorularını arkadaşlarıyla tartışabileceği bir ortam sağlanmış mı?		
Açıklama:			

ARAMA		Puan	Programdaki hangi kısım?
1.	Öğrencinin birden fazla web sitesine bakması destekleniyor mu?		
2.	Öğrencinin geçtiği aşamalar görünür halde mi?		
3.	Öğrencinin arama yapmaya başlamadan önce arama sırasında kullanması gereken anahtar kelimelere karar vermesi sağlanıyor mu?		

4.	Öğrencinin arama süresince izleyeceği bütün aşamalar tanımlı mı?		
5.	Öğrencinin arama süresince gezdiği siteler listeleniyor mu?		

Açıklama:
.....
.....
.....

OKUMA ve DEĞERLENDİRME		Puan	Programdaki hangi kısım?
1.	Öğrencinin arama esnasında ziyaret ettiği sitelerle ilgili not almasına izin veriliyor mu?		
2.	Öğrencinin ziyaret ettiği sitelerde incelemesi gereken bilgilere odaklanması için arama öncesinde hedeflerini belirlemesi sağlanıyor mu?		
3.	Öğrencinin belirlediği hedefler ekranda görünüyor mu?		
4.	Öğrencinin ziyaret ettiği sitelerde bulduğu bilgileri kavraması için yardım sağlanıyor mu?		
5.	Öğrencinin ziyaret ettiği sitenin içeriğinin güvenilirliği, uygunluğu, vs. hakkında düşünmesi sağlanıyor mu?		
6.	Öğrencinin siteleri kolayca incelemesi için stratejiler belirlenmiş mi?		

Açıklama:
.....
.....
.....

SENTEZLEME		Puan	Programdaki hangi kısım?
1.	Öğrencinin ziyaret ettiği farklı siteleri karşılaştırması destekleniyor mu?		
2.	Öğrencinin okuduklarından çıkardığı sonuçları kendi kendine değerlendirmesi için ölçütler belirtilmiş mi?		
3.	Öğrencinin bulduğu bilgileri nerede ve nasıl kullanacağı hakkında değerlendirme yapması sağlanmış mı?		

Açıklama:
.....
.....
.....

APPENDIX I

TEACHER TRAINING OUTLINE

İnternet Kullanımı ve Çocuklar

- İnternette güvenli arama için gerekenler.
- İnternette öğrencilerin karşılaşabileceği olası tehlikeli durumlar.
- İnternette arama yaparken öğrencilerin karşılaştıkları problemler.
- İnternette arama yaparken öğrencilerin geçirdiği bilişsel süreçler.

Üstbilişsel Destek

- Üstbilişsel destekleme nedir?
- Üstbilişsel destekleme ile İnternet aramalarının ilişkisi nedir:
- Üstbilişsel destekleme örnekleri.

Derste İzlenecek Strajiler

- Ders başladığında öğrencilere görev dağılımı yapılmadan önce nasıl doğru bir İnternet araması yapılması gerektiği model olarak gösterilmeliç
- Hangi aşamalardan geçeceği tek tek anlatılmalı.
- Öğrencilere bu aşamalardan geçerken ne tür stratejilere başvurması gerektiği anlatılmalı.
- Gerekli görüldüğü her zamanda örneklerle detaylı bir şekilde öğrencilere yardımcı olunmalı.
- Arama hedefi ve kullanılacak anahtar kelime arasındaki fark öğrenciye anlatılmalı.
- Konuyla ilgili önceki bilgilerinden yararlanmaları sağlanmalı.

- Arama motorunun sonuçlarının nasıl değerlendirilmesi gerektiği ve rastgele ziyaretlerin yapılmaması gerektiği örneklerle ve model olarak açıklanmalı.
- Ziyaret edilen her site için öğrecilerin şu sorulara dikkat etmeleri sağlanmalı ve gerektiğinde birebir kontroller yapılmalı:
    - Bu sitede genel olarak ne tür bilgiler var?
    - Buradaki bilgiler ödevimle ilgili mi?
    - Buradaki bilgiler güvenilir mi?
    - Bu sitede ödevimde kullanabileceğim bilgiler nelerdir?
    - Bu sitede bulduğum bilgilerin önceki bulduğum bilgilerden farkı nedir?
    - Bu sitede aradığım her şey var mı?
    - Daha fazla arama yapmam gerekiyor mu?
- Öğrenciler arama sürecini bitirince geçirdikleri aşamalar hakkında düşünmeleri sağlanmalı.
- Son olarak da ödevlerini tamamlarken dikkat etmeleri gereken noktalar vurgulanacak.

CURRICULUM VITAE

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Visiting Scholar	2010-2011	Purdue University- Department of Curriculum and Instruction
Minor	2002-2005	METU-Department of Psychology
BS	2000-2005	METU, Computers Education & Instructional Technologies

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