Abstract

Twelve participants completed over 140 concurrent verbal protocols (Think Alouds) as they searched for information using two CD-ROM encyclopedias. The ability to generate Think Alouds varied among the participants. The 2,200 statements were coded as defining, planning, monitoring, or evaluating. All participants made a majority of defining statements, but the number of planning and monitoring statements varied among participants. It was found that some participants were in the acquisition phase, a phase where people are less likely to be able to do the task and think about the task at the same time. Other participants were able to plan and ask questions, characteristic of the consolidation phase. In a few searches, some participants seemed to be in the consultation phase. This was characterized by the ability to perform skills, plan an approach, and discuss difficulties and problems with themselves. Researchers need to be conscious of levels of self-direction so that the most complete Think Aloud data can be gathered from participants. © 2001 Elsevier Science Inc. All rights reserved.

1. Introduction

Concurrent verbal protocols are increasingly used as a source of data for process inquiry tasks such as reading, writing, and problem solving (Stratman & Hamp-Lyons, 1994, p. 89). The verbal protocol analysis method is now accepted by a large part of the psychology and education communities and is being used in a variety of research areas. Hayes and Flower (1983) and Ransdell (1995) have used this research method in the area of writing. Whitney and Budd (1996) used the method to study text comprehension, and other researchers have used the method to study reading comprehension strategies. Murtaugh (1984) used verbal
protocol analysis to study the grocery shopping decision-making process. Sullivan and Seiden (1995) assessed online catalog users’ education needs using the method. Verbal protocol analysis has been used to look at chemistry, physics, math problem solving, and the development of expert systems, and it can provide diagnostic information for teachers. Cacioppo, von Hippel, and Ernst (1997) cited the many uses of verbal protocol research in clinical and counseling psychology (e.g., social phobia, snake phobia, test anxiety, social anxiety, romantic relationships, and group therapy).

Concurrent verbal protocols should provide a “dramatic increase in the amount of behavior that can be observed when a subject is performing a task while thinking aloud compared to the same subject working under silent conditions” (Ericsson & Simon, 1993, p. xiii). A study by Branch (2000) explored the use of verbal protocol analysis (Think Alouds and Think Afters) to gain the most complete data in a qualitative study. Yet, in this study, some of the participants had difficulty with Think Alouds. Stratman and Hamp-Lyons (1994) call it the “reactivity problem” (p. 90). This is the notion that something can happen when participants are required to do Think Alouds while carrying out a task. They suggest there are five factors that may cause reactivity in concurrent verbal protocols:

- Experimental task directions to subjects that elicit an inappropriate level of verbalization;
- Limited short-term memory capacity for talking and attending at the same time;
- Hearing one’s own voice;
- Learning that occurs because thinking out loud increases subjects’ critical attention to their activities; and
- Direct or indirect experimenter influence through verbal or nonverbal cues (Stratman & Hamp-Lyons, 1994, p. 95).

The second point was the most applicable to this study. This article focuses on the work of Biemiller and Meichenbaum (Biemiller & Meichenbaum, 1992; Meichenbaum & Biemiller, 1992, 1998). Using part of the coding scheme of Biemiller and Meichenbaum (1992), Think Aloud data from the 144 protocols were coded.

In the appendix of Ericsson and Simon’s (1993) book, *Protocol Analysis: Verbal Reports as Data*, the authors presented practical advice on how to do Think Alouds with subjects. For Ericsson and Simon, “apart from the instruction to verbalize and the production of the verbalization, the only differences are the presence of the monitoring experimenters and of the tape recorder” (p. 375). Ericsson and Simon suggested that if subjects do not appear to “verbalize as much as normal subjects, one can give them more practice problems” (p. 377). However, it is difficult to determine how many more practice problems to give. It is of concern that Ericsson and Simon use the terms subject, experimenter, variables, traditional experiment, reliability, validity, generalizability, and hypotheses. These are not terms used in qualitative research.

Ericsson and Simon’s verbal protocol analysis is firmly set within the positivist paradigm, as they are concerned with reliability, validity, and generalizability. In the naturalistic paradigm, “realities are multiple, constructed, and holistic” (Lincoln & Guba, 1985, p. 37).
The researcher and the object of the research—in this case, the participants—interact to influence one another and the inquiry is value-bound. For Lincoln and Guba, “the aim of the inquiry is to develop an idiographic body of knowledge in the form of ‘working hypotheses’ that describe the individual case” (p. 38).

2. Literature review

This literature review will explore the three main areas of this study. First, an overview of concurrent verbal protocols and Ericsson and Simon’s theory of information processing will be discussed. A brief presentation of recent information-seeking research using the Think Aloud method follows. The major part of the literature review will describe the work of Biemiller and Meichenbaum.

2.1. Verbal protocol analysis

For qualitative researchers seeking a rich source of data, the verbal protocol analysis method is an excellent choice. Wilson (1994) emphasized that inspiration can be gained from people's conscious thoughts. Pressley and Afflerbach (1995) expanded the idea by noting that “spoken language is the data used in protocol analysis and the richness and variability of language are the greatest assets and liabilities of the verbal reporting methodology” (p. 2). Verbal protocol analysis is a way to gain information about a participant’s cognitive processes by using verbal reports. Verbal reporting is bringing thoughts into consciousness, making the ideas verbal if needed, and then verbalizing them (Ericsson & Simon, 1984). Concurrent verbal reports are also referred to as Talk Aloud, Think Aloud, or thought-listing techniques. For this study, the concurrent verbal protocols are referred to as Think Alouds. Data gathered by Think Alouds can provide information to test hypotheses and models of behavior (Ransdell, 1995). Protocols done properly, according to Russo, Johnson, and Stephens (1989), report the thoughts of participants but do not explain them.

Ericsson and Simon (1984) based their study of verbal protocol analysis of the constructs of short-term and long-term memory on information-processing theory. They hypothesized that all human cognition is information processing and stated “that a cognitive process can be seen as a sequence of internal states successively transformed by a series of information processes” (p. 11). Long-term memory contains a vast amount of knowledge, both procedural and factual, that can be accessed. The way that this information is organized is highly individual. Short-term memory, on the other hand, is extremely limited if the information is not acted upon. External stimulation and associations from long-term memory are the basis of short-term memory. According to Pressley and Afflerbach (1995), short-term memory can be quickly accessed and the contents reported. It is this short-term memory that verbal reports tap. Ericsson and Simon (1984) used this conclusion to validate the Think Aloud data that were gathered earlier in the century and to promote their continued use today.
2.2. Information-seeking research

Researchers interested in information-seeking behavior have used verbal protocol analysis as a method to gather data. Kuhlthau (1983) used the method in her work with high school students. McGregor (1993) used the Think Aloud method and thinking process logs to gather information about high school seniors as they completed research-paper assignments. Yang (1997) used verbal protocol analysis and observation to study six cases of information-seeking behavior in university students as they accessed information in the Perseus hypertext system. She had her participants practice thinking aloud and then asked them to think aloud while working on the problem.

Hughes, Packard, and Pearson (1998) also used the Think Aloud method in looking at reading in a hypertext environment. They introduced the method to the participants using a video of other computer tasks so that the method was demonstrated without “suggesting strategies for using the intended target of research” (p. 5). Xie and Cool (1998) used Think Aloud to study end-user online searching. They found, through the use of this method, “much insight is gained into the problems encountered by searchers and the adaptive strategies they employ in such situations” (p. 329). Hirsh (1999) used the Think Aloud method to study elementary students’ relevance criteria and search strategies during a school project. Her results have implications for how we teach students about information literacy and for the design of systems (p. 1265). All of these researchers used the Think Aloud method for data collection, yet none discuss reactivity or any difficulties with the method in generating their data.

2.3. Work of Meichenbaum and Biemiller

Biemiller and Meichenbaum’s interest in the self-directed learner seems, at first, totally incongruous with this work on information-seeking processes and verbal protocol analysis. Yet, on closer study, the researchers were interested in the very same thing—the nature of thinking out loud as one does a task. Their research, conducted over the past 15 years, involved studying the most and least self-directed students in elementary schools as identified by their teachers and peers. In a study involving 70 high- and 70 low-self-directed learners, the researchers recorded what the students did and what the students said. This involved recording the students’ self-talk, their talk to peers, and their talk to teachers. As a result of this work, Biemiller and Meichenbaum (1992) developed a coding system to analyze the “children’s discourse about tasks” (p. 76).

This coding system enabled the researchers to compare high- and low-self-directed learners and to “infer the nature of their cognitive and metacognitive self-regulatory activities” (Biemiller & Meichenbaum, 1992, p. 76). This task-related speech, or Think Alouds, provided a way of accessing the cognitive processes of a learner. Biemiller and Meichenbaum determined that “children whose level of cognitive development exceeds the complexity of tasks they are being taught have ‘surplus mental capacity’ permitting them to ‘think’ (self-dialog) about what they are doing” (p. 76). On the other hand, children who are
less cognitively advanced approached a task with fewer skills. As a result, they encountered an overload or, at the very least, needed their full attention to complete the task. These low-self-directed learners had “little or no capacity left for verbal thought processes while conducting the task” (p. 76).

Specifically, Biemiller and Meichenbaum (1992) found that highly self-directed learners generated more than twice as many statements as less self-directed learners. The statements were coded as defining, planning, conditional planning, monitoring, or evaluating. The following is an explanation of the coding categories:

**Defining:** A statement or question that labels and notes features of tasks, procedures, and objects (e.g., “It’s John’s game” or “That’s red paint”).

**Planning:** A statement or question about what will or should happen next (e.g., “Can I do X?”; “Mix some soap in the paint”; “Where are the sparkles?”; or “I need . . . ”).

**Conditional planning:** A statement or question that relates a plan to a condition or specifies the basis for choosing between alternative plans (e.g., “If we make noise, then we won’t have recess”).

**Monitoring (ongoing task):** A statement or question that notes progress, or lack thereof, on the task (e.g., “You’re going too fast” or “Slow down”).

**Evaluating (completed or aborted task):** A statement or question about conclusions on ending the task with regard to the product, the child’s ability, or the experience of doing the task (e.g., “This is my best one so far,” “I can’t do it,” or “The math squares are fun”) (Biemiller & Meichenbaum, 1992, p. 78).

Both groups had similar rates of defining and evaluating statements, but highly self-directed learners had more planning and monitoring statements. The authors suggested “spontaneous planning and monitoring statements are crucial indicators of the degree to which a child is functioning with expertise in a specific situation” (Biemiller & Meichenbaum, 1992, p. 76). Seventeen task-directive statements per hour were received by less self-directed learners from their teachers. Highly self-directed students received only two statements per hour from their teachers. Teachers were “thinking for” the less self-directed learners by giving them planning and monitoring statements (Biemiller & Meichenbaum, 1992).

Meichenbaum and Biemiller (1998), in their book, *Nurturing Independent Learners: Helping Students Take Charge of Their Learning*, presented a three-dimensional theory of mastery. Based on the constructivist model, this theory consists of the Skill and Vocabulary Dimension, the Planning/Application Complexity Dimension, and the Self-Direction Dimension. The Skill and Vocabulary Dimension “refers to the level of difficulty or complexity of the skills and concepts required for successful accomplishment of the task” (p. 70). Although one goal of instruction is to teach students to perform more difficult tasks, another goal is “to teach students to transfer skills and strategies they have learned to analogous tasks in new situations” (p. 72). The Planning/Application Complexity Dimension refers to this second goal. The third dimension, the Self-Direction Dimension, refers to the range of tasks that a learner encounters. These tasks can “range from being other-
directed (others guide the learner through the performance of the task on a step-by-step basis), to being self-directed (the learner is responsible for all aspects of accomplishing the task)” (p. 75).

Meichenbaum and Biemiller (1998) identified “three phases of self-direction: acquisition, consolidation, and consultation” (p. 75). In the acquisition role, the learner “observes, imitates and acts under the guidance of the instructor” (p. 75). In this role, learners are less likely to be able to do the task and talk about it at the same time. In the consolidation role, the task begins to become more automatic. This automaticity “reduces the attentional and memory load associated with the skill, freeing up cognitive capacity to attend to other features of the task or to talk or think about the task while doing it” (p. 76). In the consolidation role, the learner becomes more able to plan and ask questions and, as a result, becomes more efficient. Learners who have reached the consultation role “can perform requisite skills and plan specified applications, provide assistance to others as needed, collaborate effectively with others in planning large tasks, and consult with themselves when they encounter difficulties or problems in accomplishing tasks” (p. 77).

Biemiller and Meichenbaum’s work is interesting, especially when considering the problems that some of the participants in this study encountered when doing Think Alouds while searching CD-ROM encyclopedias. Stratman and Hamp-Lyons (1994) list of reactivity factors included “limited short-term memory capacity for talking and attending at the same time” (p. 95). To determine if the acquisition, consolidation, and consultation roles could be applied to junior high information-seeking processes, the coding scheme developed by Biemiller and Meichenbaum (1992) was used.

2.4. The study

This study looked at the information-seeking processes of junior high students as they accessed information using CD-ROM encyclopedias. The study took place in Inuvik, Northwest Territories, Canada, in the fall of 1999. This research was conducted within the qualitative paradigm as it involved both process and meaning. A qualitative researcher stresses “the socially constructed nature of reality, the intimate relationship between the researcher and what is studied and the situational constraints that shape inquiry” (Denzin & Lincoln, 1998, p. 8). As a result, the qualitative researcher is the primary instrument for data collection, analysis, and interpretation (Creswell, 1994).

In this study, participants were asked to think aloud while searching, and this talk was recorded. After the search, participants watched a videotape of their search and were encouraged to add any comments about their information-seeking processes at that time. These Think Alouds and Think Afters were recorded using audiotapes. Two tape recorders were set up to record the voices of the researcher and the participant. The researcher used the audiotapes and the videotapes to create the most complete written transcript possible. The transcripts were used as the primary source of data. The Think Alouds and Think Afters were transcribed verbatim from the participants. Additions to the transcripts were made from the videotapes. Anything written in brackets explains what the participant was doing. This included what search term was being typed in, and what the students were looking at or
clicking on when making a statement. Participants had the opportunity to review the written transcript and add, delete, or comment on any aspect of the discussion.

Videotaping the computer screen was felt to be effective, based on previous work with another researcher, and because it provided a simple way to replay the search for participants so that they and the researcher could discuss their information-seeking processes. The video camera was positioned behind the participant’s left shoulder and only videotaped the screen during searches. The video camera was attached to a large television so that the participant and the researcher could watch a replay of the search during the Think Afters. Each student’s search sessions were recorded on videotape. The videotapes were used to add detail to the transcripts.

The research setting was a small classroom located at a quiet end of the school, where there would be few disruptions. A computer workstation on a movable cart, a television, and a tripod with the video camera were added to the room. The participants were seated at the computer workstation during the searches. The computer had a Pentium processor, with a $12 \times \text{CD-ROM}$ drive, a color monitor, and speakers.

Twelve participants, recommended by their teachers, participated in the study. The teachers worked together to select 12 students with a diversity of backgrounds, ethnicities, and experiences. The participants ranged in age from 11 to 15 years. Six participants were boys and six participants were girls. The participants varied in their levels of school achievement; several were at the top of the class and several were identified with special needs. Eight of the participants were Aboriginal: one was Cree, two were Gwich’In, and five were Inuvialuit. This was fairly representative of the Inuvik population. Six participants were born in the Northwest Territories, four were born in other parts of Canada, and two were born in other countries (South Africa and the United States). Pseudonyms are used for the participants.

The researcher had spent 6 years as a teacher and teacher-librarian in the school in Inuvik between 1991 to 1995 and 1996 to 1998. The research was carried out in the fall of 1999. The researcher was no longer living in the community or teaching at the school when the research was carried out.

Each participant completed 12 searches so that, at the end of the study, there were 144 Think Aloud protocols. The participants searched the encyclopedia for answers to four researcher-generated questions, four teacher-generated questions, and four self-generated questions.

While transcribing the 144 Think Aloud protocols, it was noticed that some participants had incomplete Think Alouds, that is, very brief Think Alouds or very procedural Think Alouds. Some of the participants were not able to generate complete Think Alouds while performing the task. There has been much written about why this can happen. Stratman and Hamp-Lyons’ (1994) list of factors is a good one. These included poor Think Aloud directions, limited capacity in short-term memory to do both the task and Think Aloud, hearing the sound of one’s own voice, increases in learning due to Think Alouds, and the influence of researchers’ verbal and nonverbal cues (Stratman & Hamp-Lyons, 1994). It is important to remember that some participants may have been unable to do a task and Think Aloud at the same time.

The work of Meichenbaum and Biemiller (1998) provided one way of looking at the participants in this study and their ability to generate Think Alouds. Using Biemiller and
Meichenbaum’s (1992) coding scheme for task directive speech, the 144 Think Aloud protocols were analyzed. This involved coding each statement as defining, planning, monitoring, or evaluating. For this study, planning and conditional planning were combined under the planning task function because only two examples of conditional planning were found after coding all of the Think Alouds. Search Session 1 required all of the participants to search for the answers to four researcher-generated questions. The questions were as follows:

1. Who was the first woman in space?
2. Describe the cardinal, a bird.
3. Who was the first man in space?
4. Describe the boxer, a dog.

Search Session 2 had four teacher-generated questions based on the social studies curriculum for each grade (i.e., Alaska for Grade 7, Egypt for Grade 8, and inland Canadian Waterways, Latitude and Longitude, for Grade 9). The final search session required participants to search for the answers to four self-generated questions. These questions included topics on sports (hockey, soccer, and rugby), Halloween (scary stories, trick or treat, pumpkins, black cats, and witches), Northern topics (Fort McPherson, Inuvik, snowmobiles, and the Northwest Territories), popular culture (Pokemon, Blair Witch Project, and horror movies), *Anne of Green Gables*, world countries, and major cities.

3. Results

The data were coded using colored stickers to represent each of the five coding categories. A total of 2,221 statements were coded from the 144 Think Alouds. This section reports the overall results of the coding for the three search sessions as well as comparisons of all the participants’ Think Alouds during Search Session 1. Questions 1 and 3 required quite complex searching, that is, more than two search terms. Questions 2 and 4 were simpler searches. It is interesting to look at the differences between participants’ Think Alouds in simple and complex searches.

3.1. Overall results

Table 1 shows the range in the number of Think Aloud statements in each search session. In Search Sessions 1, 2, and 3, there were a total of 1,037, 583, and 601 statements, respectively. In Search Session 1, Fran had 278 statements, while Sue had only 27, a difference of 251. In Search Sessions 2 and 3, the range was smaller, 82 and 124, respectively. The first session had many more statements because students had a more difficult time finding the answers to the questions. With practice, students became more efficient searchers. The mean number of statements decreased from 86.4 in Search Session 1 to 58.6 in Search Session 2 to 50.1 in Search Session 3. Table 1 shows the results of the coding.
Table 2 shows the statements as a percentage of the total number of statements for each of the search sessions.

Carol had no planning, monitoring, or evaluation statements in her first session, but planning and monitoring statements did increase over time. Fran, Chris, and Bob had planning and monitoring statements in each of the search sessions. Fran and Sue were the only participants with evaluating statements in each search session. Several of the participants had few planning or monitoring statements during all three of the search sessions.

Figure 1 shows the differences in the number of statements by each participant. The average number of statements was 181. Chris, Paul, and Fran generated a lot of Think Aloud data. Other participants, such as Sue, Mary, Ken, and Eric, generated fewer statements than the average. Biemiller and Meichenbaum (1992) noted in their research

<table>
<thead>
<tr>
<th>Name</th>
<th>Search Session 1</th>
<th>Search Session 2</th>
<th>Search Session 3</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>D</td>
<td>P</td>
<td>M</td>
</tr>
<tr>
<td>Eric</td>
<td>40</td>
<td>10</td>
<td>2</td>
</tr>
<tr>
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<td>16</td>
<td>10</td>
</tr>
<tr>
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<td>42</td>
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<td>0</td>
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<tr>
<td>Dave</td>
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</tr>
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<td>Ken</td>
<td>37</td>
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<td>1</td>
</tr>
<tr>
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</tr>
<tr>
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<td>31</td>
</tr>
<tr>
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<td>8</td>
</tr>
<tr>
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<td>0</td>
</tr>
<tr>
<td>Sue</td>
<td>20</td>
<td>3</td>
<td>3</td>
</tr>
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</table>

Table 2 shows the statements as a percentage of the total number of statements for each of the search sessions.

<table>
<thead>
<tr>
<th>Name</th>
<th>Search Session 1</th>
<th>Search Session 2</th>
<th>Search Session 3</th>
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</thead>
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<td>M</td>
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<td>77</td>
<td>19</td>
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<td>3</td>
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<td>0</td>
</tr>
<tr>
<td>Dave</td>
<td>94</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>Ken</td>
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</tr>
<tr>
<td>Sue</td>
<td>74</td>
<td>11</td>
<td>11</td>
</tr>
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</table>
that highly self-directed learners generated more than twice as many statements as less self-directed learners.

3.1.1. Results of Search Session 1

It is impossible to compare between the participants for Search Session 2 because different questions were asked for each grade. Search Session 3 also cannot be compared as each participant generated search questions of his or her own. However, it is interesting to look at Search Session 1. Participants had two different types of questions. The answers to Questions 1 and 3 were quite difficult to find. These questions were chosen because they were quite complex. The results are shown in Table 3.

Four of the participants—Carol, Lynn, Mary, and Sue—did not have any planning or monitoring statements in the first search. However, the searchers were very different. Carol and Mary were novice searchers and admitted in the initial interview that they did not know

Table 3
Number of Statements in Search Session 1 (Questions 1 and 3)

<table>
<thead>
<tr>
<th>Name</th>
<th>D</th>
<th>P</th>
<th>M</th>
<th>E</th>
<th>T</th>
<th>First Man in Space</th>
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<tbody>
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</tr>
<tr>
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<td>88</td>
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<td>3</td>
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<td>8</td>
</tr>
<tr>
<td>Fran</td>
<td>57</td>
<td>5</td>
<td>3</td>
<td>1</td>
<td>66</td>
<td>102</td>
</tr>
<tr>
<td>Carol</td>
<td>12</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>12</td>
<td>15</td>
</tr>
<tr>
<td>Dave</td>
<td>21</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>24</td>
<td>12</td>
</tr>
<tr>
<td>Ken</td>
<td>20</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>22</td>
<td>7</td>
</tr>
<tr>
<td>Lynn</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>14</td>
</tr>
<tr>
<td>Abby</td>
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<td>1</td>
<td>0</td>
<td>1</td>
<td>25</td>
<td>9</td>
</tr>
<tr>
<td>Chris</td>
<td>43</td>
<td>12</td>
<td>9</td>
<td>1</td>
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<td>Bob</td>
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<td>1</td>
<td>0</td>
<td>12</td>
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</tr>
<tr>
<td>Mary</td>
<td>6</td>
<td>0</td>
<td>0</td>
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<td>0</td>
<td>0</td>
<td>3</td>
<td>11</td>
</tr>
</tbody>
</table>
anything about computers. Lynn and Sue, on the other hand, were experienced searchers and found the answers quickly and easily. Explanations for the few planning and monitoring statements can be explained by the work of Biemiller and Meichenbaum (1992). When learners in the acquisition role are faced with a new task it “creates ‘overload,’ or at least occupies the student’s full attention” (p. 76). Mary and Carol were unable to do the task and also think about it at the same time.

A few participants had a high number of planning and monitoring statements. These participants—Chris, Bob, and Eric—were likely in the consolidation or consultation role. Eric monitored and planned his search when looking for the first woman in space. In the following transcript excerpt, “D” indicates defining statements, “M” indicates monitoring statements, and “P” indicates planning statements;

Eric: That there’s not that much coming up. (M) Try this. (P) Some of the same ones came up. (M) I am going to go see this one. (P) She was one of the first six . . . . (M) And I’m going to go to the next one. (P) She was a member of the first group of astronauts. (D) One of the first six women. (D) I am going to go back again. (P)

Chris, Bob, and Eric felt comfortable doing the Think Alouds and generated more planning statements than the group as a whole. They were all familiar with computers, had one at home, and spent time searching on the Internet. When searching for the answer to Question 3, a few more of the participants had planning statements. It may not be surprising that the boys tended to be more familiar with computers and talked about some planning and/or monitoring in each search.

Two of the participants had no planning or monitoring statements in either search. Mary and Carol were both novice users and were quiet during their searches. Mary continued to be quiet during her searches. Part of her transcript is as follows:

Mary: I am just putting first man in space. (D) (No topics found)I clicked okay. (D) I clicked okay again. (D) I am clicking articles. (D) I am clicking go. (D) I am clicking okay. (D) Clicking okay. (D) I’m looking at the picture of the article. (D)

Carol actually began to use more planning and monitoring statements as she progressed through the searches. This may indicate a movement from the acquisition role to the consolidation role.

Questions 2 and 4 were much easier for most participants (see Table 4). Most of the participants typed in the word cardinal or boxer and immediately found the answer. It is interesting how much Think Aloud data Fran generated even in these very simple searches. She was very talkative throughout the study and had more evaluating statements than any other participant.

Even though finding the answer to these two questions was easy, Bob, Paul and Chris still did some planning and/or monitoring in each search. Bob was a very interesting participant. He had just moved to Inuvik from California about a month before the study began. Bob expected he would be living in an igloo. He spontaneously used language to solve the task and also to relate this search to his own background knowledge and experiences. The following is an excerpt from his Question 1 transcript.
Researcher: Who was the first woman in space?

Bob: I’m thinking about the space shuttle crash back in 1985. (D)

Researcher: Okay.

Bob: Um. So I am going to type in space then space shuttle (types space s). (P)
Just scrolling down. (M) I am also looking for the name of the spacecraft.
(M) Pioneer. (D) No. (D) (scrolling down article list) Freedom 7. (D)
There was a woman on it — she was a teacher or something. (D) First
woman in space. (D) I guess it would have been easier to type in that. (M).

The following is an excerpt from his Question 2 transcript.

Bob: I am going to click “find.” (D) I’m not that good at spelling but . . . . (M) Cardinal
bird. (D) (clicks on image). Give you some sound with the picture. (D) Uh, I knew
that would take too long. (M)

Meichenbaum and Biemiller (1998) proposed that students like Bob are in the consultation
role and “they come to understand the task, and to be able to call upon the associated skills
(in a literal, verbal sense) when new situations occur in which the skills are relevant” (p. 77).

4. Discussion

Learners are unique and bring to a task their own skills, experience, and vocabulary. The researcher has to keep this in mind when using concurrent verbal protocols as a way of gathering data. The work of Biemiller and Meichenbaum may help to explain why some searchers experienced difficulty generating complete Think Alouds. Those students who are not in the consolidation or consultation role in the given task may have difficulty generating Think Alouds. To get the best and most complete data, researchers must ensure...
that learners are given time to become familiar enough with the task so that they can speak about what they are doing. However, learners must not be so familiar with the task that it becomes automatic.

It is a delicate balance that must be reached by a researcher and, obviously, one that is difficult with a group of junior high students. Biemiller and Meichenbaum (1992) suggested that “teachers and more advanced peers sometimes 'think for’ less self-directed children” (p. 77). It may be unreasonable to expect those students to generate complete Think Alouds. Some students have spent 7 or more years in school becoming other-directed. These learners come to depend on others to act as their support systems. Others in the classroom end up doing the defining, planning, and monitoring activities for the less self-directed learner. As a result, this becomes a “self-maintaining cycle” (Biemiller & Meichenbaum, 1992, p. 77).

One example of this can be seen in the following transcript excerpt:

Researcher: Alrighty, so now who was the first man in space? So you’ve had some experience with this. What are you going to type in?
Dave: I am typing in the first man in space. There’s no topics found.
Researcher: Okay, so now what are you going to try?
Dave: Who was the first person in space?
Researcher: What else do you know? What other topics might it be under? Try search by word rather than go. So no matches found. Okay. So close that with the x and find to search again. Try something else. Delete that and try something else.
Dave: (types in who was the first man in space)
Researcher: Okay, what other words can you try? So, who was the first man in space isn’t working. Where else might you try? Any ideas? What’s going through your head? What other words are you thinking about? Or are you thinking about other words you can try? Do you know the names of any astronauts?
Dave: Neil Armstrong
Researcher: Why don’t you give it a try? He may not be the first but he may be a place to start, eh?
Dave: (types in Neal Armstrong)
Researcher: Just try Armstrong or maybe you spelled Neil wrong.
Dave: Neil A. Armstrong.
Researcher: Try that. Okay, that’s his picture. Go back and see if there’s an article or you can see. What does this say? So who was he?
Dave: He was man on the moon.

This learner was experiencing difficulty with the search. Dave was a less self-directed learner. Without knowing anything about the work of Biemiller and Meichenbaum, the researcher began to act as a “mental crutch” for Dave as he searched.

Lynn’s transcript reveals another pattern. This exchange was quite different from Dave’s. Lynn was highly self-directed and quite familiar with the task.
Researcher: I want to know what the cardinal looks like, the bird looks like.
Lynn: A cardinal?
Researcher: Umm.
Lynn: I don’t know if this is going to work but I will try it again (types in bird, cardinal). So just the appearance?
Researcher: Um hum.
Lynn: Okay.
Researcher: Just the appearance.
Lynn: Is this a picture?
Researcher: I think so. Then you can click on cardinal, I think.
Lynn: It gives the sound or something.
Researcher: Yeah, I think it does.
Lynn: Cool.
Researcher: Um hm.
Lynn: So is that all you need?
Researcher: Yup.

Biemiller and Meichenbaum (1992) suggested that “teachers should strive to systematically monitor their students’ social and self-discourse in order to infer the children’s level of knowledge, strategies, and motivation” (p. 77). These are important clues to each student’s level of competence and expertise. A researcher should do the same thing. Time should be spent observing and listening to the self-talk of each student as they search so as to infer what stage they are in. Those students who were in the consolidation or consultation role would then be ready to generate Think Alouds. However, those students in the acquisition role should be allowed more time to become familiar with the task before being asked to do Think Alouds.

5. Conclusion

Biemiller and Meichenbaum (1992) suggested that “students who are more expert have the ability to nurture their own self-regulatory skills” (p. 77). Because teachers often provide planning and monitoring information, they may not “provide the less competent child with the same opportunities or tasks to practice to develop his or her self-regulatory competence” (p. 77). There is no way to know whether the ability to generate Think Alouds in this study can be attributed only to the role the learner was in (i.e., acquisition, consolidation, or consultation). Many other factors including age, gender, computer experience, ethnicity, background, and ability may have also contributed to the difficulty with generating Think Alouds.

Stratman and Hamp-Lyons (1994) suggested that there are several other factors that may have influenced the Think Alouds. There could have been confusion as to what the researcher wanted when asking for the participant to think aloud. There was a cultural difference between the researcher and some of the participants that may have influenced the Think
Alouds. There may have been gender issues or learning-style issues that influenced the Think Alouds. Any or all of these may have contributed to incomplete Think Alouds.

Think Alouds are a wonderful way of gathering information-seeking data. The method should be used to explore other topics in library and information science. Of particular importance now is how people find information on the Internet and how they use online public access catalogs in libraries to locate materials. These topics are well suited to verbal protocol analysis.

The work of Biemiller and Meichenbaum presents an interesting theory that informs this research situation. They offer good suggestions for helping all learners become more self-directed. Teachers and researchers will have difficulties because students “vary in the areas in which they have expertise” (Biemiller & Meichenbaum, 1992, p. 77). Researchers need to be aware that differences exist and help learners move from the acquisition role through the consolidation role to the consultation role. Not only will this benefit the learner, it may also help to generate the best Think Alouds possible.

References


