The Big Six Information Skills As a Metacognitive Scaffold: A Case Study

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Several information problem-solving models exist for teaching and reinforcing the research, problem-solving, and writing processes. The Big Six information skills model (Big6) is one that is primarily aimed at kindergarten through twelfth-grade students. This model is intended to foster the acquisition of research, problem-solving, and metacognitive skills through the cooperation of both school library media specialists and classroom teachers. While a strong anecdotal record exists supporting the use of Big6, empirical research support is less evident in library and education literature. This study examines the effect of Big6 on a class of eighth-grade students asked to research and write about events surrounding the African-American Civil Rights movement. This study describes the context of the task students were asked to complete, student's experiences and reactions, and some conclusions that might be drawn from their experiences. It is a study based on a very small and homogenous set of students, but it tends to show the value of concise models that illustrate the full problem-solving process in order for young "researchers" to perhaps more fully grasp the extent of the task facing them. Such models, maps, and organizers should continue to be tested among many groups of learners to determine the full range of their value for giving the student greater confidence and understanding of the complexities involved in information problem-solving.

In an effort to create authentic experiences for students in schools, teachers, and school library media specialists infuse information-literacy skills into the curriculum. Activities utilizing information-literacy skills are varied, from creating pamphlets on drugs in health class, to researching and recommending vacation trips in social studies class, to writing newspaper articles in journalism, English, or history classes. These authentic tasks often require an increased amount of metacognitive attention on the part of the students, as they are generally not addressed in the kindergarten through twelfth-grade curricula. Through the use of a specific information skills model like Big6 these skills can be developed in students of all ages (Eisenberg and Berkowitz 1990).

A review of the current literature reveals a strong anecdotal record supporting the use of the Big Six information skills model (Big6) in kindergarten through twelfth-grade curricula. The model is recommended for use as a programmatic change agent (Eisenberg and Berkowitz 1988), the basis for interdisciplinary evaluation of student work (Grover et al.1999), a method for parents to use while assisting students with homework (Berkowitz 1998; Eisenberg and Berkowitz 1995), and the foundation of several specific projects developed by teachers (e.g. Callison 1998; Jansen

1997; Jansen and Culpepper 1996; Johnson 1992; Roblyer 1998; and Spitzer 2000). However, empirical studies dealing with Big6 in a kindergarten through twelfth-grade setting are not similarly represented in the literature. Therefore, the authors sought to discover what effects Big6 might have on the metacognitive skills of eighth-grade students in order to begin building a body of research to support the continued implementation of this model throughout the kindergarten through twelfth-grade curricula.

Information Problem Solving

Information problem solving is a concept that combines the skills needed to access and use information, and those needed to apply and solve an information problem (American Association of School Librarians 1998; Eisenberg and Berkowitz 1990). In other words, whenever a student encounters a problem that requires information in order to be solved, she is encountering an information-based problem, also termed an information problem (Eisenberg and Berkowitz 1990). Several researchers have examined behaviors and skills associated with information use (Kuhlthau 1993; Marchionini 1989; Oliver and Perzylo 1994; Perzylo and Oliver 1992; Small and Ferreira 1994; Stripling and Pitts 1988; Yang 1997). From this rich empirical and rational-empirical (Burisch 1984) body of knowledge, three prominent models of the research process have been developed. These include the search process model (Kuhlthau 1993), the research process model (Stripling and Pitts 1988), and Big6 (Eisenberg and Berkowitz 1990).

In an effort to better understand the research process or the information problem-solving process, Kuhlthau (1993) examined the thoughts, feelings, and actions associated with various activities within this complex process. Her search process model details the changes that occur for searchers as they move from a generally unfocused to a focused state of mind while progressing from seeking relevant to pertinent information. This shift also describes feelings that ebb and flow between more negative emotions such as uncertainty, confusion, frustration, and doubt, to more positive emotions such as optimism, clarity, confidence and relief.

While Kuhlthau examined searchers as they sought information in a variety of situations, other authors focused on research paper writing in order to better understand the information search process. For example, Stripling and Pitts describe their model as a "thinking frame" (Stripling and Pitts 1988, 19) for research. This ten-step process emphasizes a thinking framework that can be adapted for any age level and any curricular subject. The authors maintain that, unless they are instructed to do so, most students do not automatically think about research in an explicit manner. Therefore, by prescribing the method in which to write research papers, the authors hope to improve student thought about the research process. The ten steps of the search process model (Stripling and Pitts 1988) are organized around the major activities performed in writing a coherent research paper: topic selection, planning the information search, locating and accessing materials, and creating a final product. Throughout the model, students have several reflection points that allow them to make judgments about their progress.

Both Kuhlthau (1993) and Stripling and Pitts (1988) examined the search process from the point of view of the searchers. Others have examined the search process and found that a more generalized view of the information problem-solving process was warranted. By formulating a model that can be used by students to guide their thinking and research activities and by teachers to guide their planning and implementation of classroom instructional activities, Eisenberg and Berkowitz (1990) provided school library media specialists, students, and classroom teachers

with a model that could be used in a variety of settings for a variety of activities. Big6 (Eisenberg and Berkowitz 1990) is a six-step process that provides support in the activities required to solve information-based problems: task definition, information seeking strategies, location and access, use of information, synthesis, and evaluation (see figure 1).

Figure 1. The Big Six Information Skills (Eisenberg & Berkowitz, 1990)
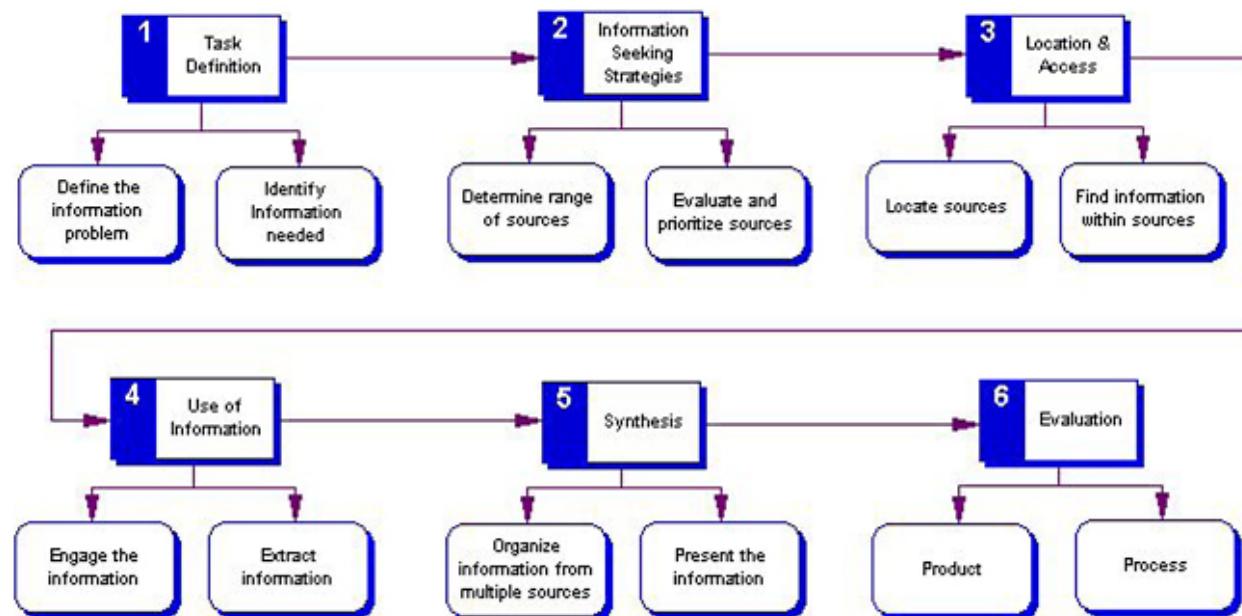
Each of the six steps has two subskills. *Task definition* requires students to identify the exact information problem presented to them. They must also identify the types of information needed in order to solve the problem. They must have a clear hypothesis, a specific question, and a clear understanding of what is needed in order to answer that question. The *information seeking strategies* stage requires students first to identify all the possible sources of information, and then to evaluate each source to determine which are best for them to use. For instance, while one possible source of information about the planet Mars is to go to Mars, a more feasible and higher quality source would be a detailed Web site created by NASA, based on the Mars exploration expeditions.

The next two steps, *location and access* and *use of information,* are comprised of traditional bibliographic skills. Students must not only find individual resources such as books, magazines, reference materials, and Web sites, but also find the information within each source through the use of tables of contents, indexes, and other resource-specific tools. Next, they must engage each source (read, view or listen) and extract specific information from it through the application of note taking, highlighting, and summarizing.

Synthesis requires students to make a decision, create a product, or formulate an answer. Synthesis is linked to task definition in that students are expected to answer the specific question they created when initially engaging in the problem-solving process. Finally, *evaluation* requires

students to evaluate not only their final product (whether it is a decision, paper, etc.), but also to evaluate how well they performed the information problem-solving task.

Metacognition

Metacognition has been described as thinking about thinking. More specific definitions include references to knowledge and control of factors that affect learning, such as knowledge of self, the task at hand, and the strategies to be employed (Baker and Brown 1984; Palincsar and Brown 1981). In order to perform metacognitively, learners must be aware of their own cognitive activities, and be able to control and monitor those activities.

Evaluating cognitive activities in students is confounded by the hidden nature of cognition. It is difficult to see whether a student is engaging in metacognitive behaviors. Therefore, researchers have operationally defined metacognition in terms of various behaviors that can be observed in students. Markman (1977) considered children to be exhibiting metacognitive activity when they verbally indicated that they did not understand a task or were not given enough information to complete a task. Other researchers considered an ability to alter strategy use based on an awareness of task and personal characteristics (Palincsar and Ransom 1988) as well as the "process of reflecting on, or monitoring the effectiveness of, the search process and then refining the process when necessary" (Land and Greene 2000, 57). Several techniques have also been used to ascertain metacognitive awareness in study participants including think-aloud protocols (Hill 1995; Land and Greene 2000) and journaling activities (Brush and Saye 2000; Harada 2001).

A number of research studies have been conducted with regard to metacognition. For example, McGregor (1993) examined the thinking processes that students engaged in while writing research papers. Her finding that students' thinking was found to be carried out on an intuitive level by students (129) "support[s] the claim that students do not instinctively operate in a metacognitive manner" (131). Other researchers have found that student success in a learning environment was negatively impacted by the lack of metacognitive ability of the students (Hill 1995; Land and Hannafin 1997). This lack of metacognitive skill and awareness supports the need for instruction that teaches learners to "plan, implement, and evaluate" strategies for learning and problem solving (Palincsar 1986, 123).

A major issue in relation to metacognitive strategy instruction is that many students use a strategy when required, but fail to use it when the requirement is removed (Cavanaugh and Perlmutter 1982). This suggests that a model other than direct instruction would be beneficial to students. Costa (1984) and Brown et al. (1984) advocated for the infusion of strategy instruction throughout the curriculum. Palincsar (1986) recommended that strategy instruction be gradually transferred from teacher to student in order for the strategy to be fully integrated. This transfer or gradual fading of support for the student is a central element of scaffolding.

Scaffolding

Teachers and designers can develop and support strong metacognitive skills in students by incorporating the use of metacognitive scaffolds (Hannafin, Land, and Oliver 1999) into the

curriculum. Scaffolding has been defined as a support structure for learners engaged in activities just beyond their independent abilities (Hannafin, Land, and Oliver 1999; Vygotsky 1978).

Research indicates that the different uses of scaffolds in various learning situations have impacted student achievement and attitudes (Saye and Brush 1999; Hill 1995; Krajcik et al. 1998). For example, both Hill (1995) and Land and Hannafin (1997) have found that metacognitive skills affect student success in a learning environment and suggest that deficiencies found in these skills could be mitigated through the use of strong metacognitive scaffolds. In addition, the school library community has recognized the need for students to possess strong metacognitive skills (Eisenberg and Berkowitz 1990; Marchionini 1989). Studies suggest that information-seeking behaviors yield more positive results when the students performing them possess strong metacognitive skills (Hill 1995).

The link between metacognitive skills and the use of scaffolds has also been explored (Hannafin, Land, and Oliver 1999; Hill and Hannafin 1997). One common assumption associated with the design, development, and implementation of student-centered learning environments (particularly environments that are technology-enhanced) is that "learners must take more responsibility for monitoring, and reflecting upon, the learning process" (Hill and Hannafin 1997, 170). Further, student effectiveness within student-centered environments is attributed to an ability to monitor thoughts and actions; locating, selecting, organizing, integrating, and using *relevant* information to generate products; and evaluating the efficiency and effectiveness of personal approaches during open-ended learning (Hill and Land 1997; Land and Greene 2000).

Hill (1995) suggests that information-seeking behaviors yield more positive results when students possess strong metacognitive skills. Recommendations for scaffolding metacognitive development in students have been identified. Students can be taught to generate questions, make conscious choices regarding information for problem solutions, evaluate information in relation to multiple criteria, summarize information, and keep a thinking log or journal (Bondy 1984; Costa 1984). Teachers can provide specific support and scaffolding for desired metacognitive skills by labeling student behaviors as metacognitive behaviors, modeling specific metacognitive activities (e.g. self-questioning, reflection, strategy revision), providing opportunities for feedback to the students, and by adopting a specific learning or studying model for use within the classroom (Bondy 1984; Costa 1984).

Big6 As a Metacognitive Scaffold

As noted previously, Big6 defines information problem solving in terms of a research process. Palinscar's (1986) definition of metacognition as the ability to plan, implement, and evaluate strategic approaches to learning and problem solving is supported by the six steps of Big6. Students who engage in *task definition* and *information-seeking strategies* are formulating a plan in order to complete an assignment or solve a problem. Engaging in *location and access, use of information,* and *synthesis* is the implementation of that plan. *Evaluating* the process and product resulting from the synthesis activity is the final step.

Big6 may serve as an effective metacognitive scaffold for a variety of reasons. Within the task-definition stage, students are generating questions and making conscious choices regarding relevant information (Costa 1984). There also exists an element of analysis and evaluation in this stage to make links between required information and the questions generated by students. The

information-seeking strategies stage requires that students make evaluative and conscious decisions (Costa 1984) about which specific information sources to use for a problem. Location and access is a part of the implementation process, yet consists mainly of seeking and finding types of behaviors. Students must determine only whether a particular source contains information that they might need, not the value or use of that information. However, once students engage the use of the information step, they employ a variety of summarizing skills in the form of note taking, highlighting, paraphrasing, and other methods of engaging and extracting specific information from each resource (Bondy 1984). The synthesis stage involves the use of summarizing techniques, as well as additional analysis and evaluation of information in relation to the questions generated in the task definition stage. Finally, students must not only evaluate whether their product meets the criteria initially set forth, but they must also evaluate the process they took in order to finish the project and make decisions about their strengths and weaknesses of their problem-solving strategies (Costa 1984).

Research Questions

The researchers' review of the literature spanning scaffolding (e.g., Brush and Saye 2000; Graves and Avery 1997; Hill 1995; Land and Hannafin 1997; Yang 1997) and information problem solving (e.g., Marchionini 1989; Dreher and Sammons 1994; Eisenberg and Berkowitz 1990; Kuhlthau 1983; Oliver and Perzylo 1994; Stripling and Pitts 1988) revealed a common theme among these areas. A need exists to increase the metacognitive skills of students (Hill 1995; Land and Hannafin 1997; Yang 1997). Most of the scaffolds discussed in the literature are designed to support one portion of the metacognitive spectrum of skills. However, a general metacognitive scaffold is needed so that students do not have to rely on situation-specific scaffolds each time they encounter a problem. We chose to examine Big6 as a general, nonsubject-specific, metacognitive scaffold for students to use when solving information-based problems.

Big6 was chosen for study for two reasons. First, while there is a strong body of anecdotal research that highlights recommendations for practice and successes resulting from implementation of Big6 (e.g., Jansen and Culpepper 1996; Eisenberg 1997, 1999; Eisenberg and Berkowitz 1998) the literature does not report a strong empirical study of the model. Second, the complex nature of the information search process coupled with the influence of metacognitive skills provides an intriguing arena to explore in a detailed manner. In this light, the key question in this study was, How does Big6 support metacognitive strategies and knowledge management in students?

Method

Participants and Setting

Participants

Eighteen eighth-grade students participated in the study. The students came from primarily upper middle class socio-economic strata, with none of the students eligible to receive free or reduced lunches. The ethnic distribution of the class was 94 percent white/Caucasian (N=17) and 6

percent East Indian/Hindu (N=1). None of the students had been identified as being gifted or possessing a learning disability.

One of the researchers acted as participant and observer during the course of study. She was the instructional leader for the students while they completed study activities. She had eight years of teaching experience in grades four through eight as well as at the college level. Her educational training in school library media provided a unique perspective during this study. The classroom teacher remained in the room throughout the study and provided technical and logistical support for noninstructional issues as they arose during the study. The content being explored, the African-American Civil Rights movement, had not previously been addressed in the students' curriculum. Also, the journalistic style of writing was not a format for projects previously assigned by the classroom teacher.

Setting

The study was conducted in a private school serving kindergarten through twelfth grade in a major southwestern city. The enrollment in the school was approximately five-hundred students with a student to teacher ratio of 15:1. The curriculum of the school stressed the importance of integrating critical-thinking skills and technology throughout the curriculum. A paraprofessional staff member acted as the librarian on a part-time basis only. Students participating in the study had spent approximately three years together as a cohort group within their school.

Due to the limited collection of the school library, as well as the nonprofessional status of the individual acting as the school librarian, the study was conducted within the students' regular classroom. Each student was provided with their own computer or laptop computer to use while completing the study activities. Students were also provided with the multimedia CD-ROM database Decision Point! (DP) in order to complete the research activities related to the study.

Instructional Context

The researchers and the classroom teacher collaborated in developing the task for students to complete. The classroom teacher communicated that studying the African-American Civil Rights movement would be beneficial and appropriate for his students and suggested the use of a news article writing project as the culminating project for the unit. After this consultation, the researchers developed a student-centered activity that asked students to assume the role of reporters for their school newspaper. The thirty-fifth anniversary of the Selma March was approaching, and they were to write newspaper articles that reported on this historic event.

The teacher reported that his primary pedagogical technique prior to the study consisted of asking students to relate their understanding of individual historical events in terms of their causes and effects. That is, he did not teach historical events in isolation. Instead, he emphasized the connections between events that tied them together. In addition to regular classroom activities and discussions, the classroom teacher frequently assigned projects to his students. These projects included models, skits, debates, oral presentations, and reports. However, he had not previously had these students complete a newspaper-style writing activity.

Additionally, neither the teacher nor the students had prior experience using a specific information-skills model to solve information-based problems. The students had little prior

exposure to the events of the African-American Civil Rights movement. Both the activity and the content of the unit were unfamiliar to the students prior to the start of the study. Due to the limited library collection on the topic and the complexity of the content surrounding the Selma March, the researcher provided tools and resources for students to use while completing their project activity. These included Big6 training materials as well as the multimedia CD-ROM database DP and are described in the following paragraphs.

Big6 Training Materials and Activity

The students were provided an introduction to the Big6 processes in a workshop format. They were provided a packet that described in detail each step of Big6. Additionally, students were given a content-neutral information problem to solve utilizing the steps of Big6. Each student was also provided a packet of materials that was designed to guide them through the steps of Big6 as they related to the news article writing activity. This packet included the detailed assignment the students were to complete as well as milestones for each step toward completion of the activity.

DP

Subject matter content was delivered via DP, a multimedia database of content and other resources relating to the African-American Civil Rights Movement (Brush and Saye 2000; Saye and Brush 1999). Twenty-six separate events relating to the African-American Civil Rights Movement are documented through historical photographs, video clips, audio clips, and newspaper artifacts on the DP CD-ROM. The events are organized into three strands: Black Power, Nonviolent Strategies, and the Legal System. For the purposes of this study, students primarily utilized the resources associated with the Selma March (see figure 2).

Figure 2. *Decision Point!* **Selma March resource menu**

Metacognitive Scaffolds

Students used the Big6 packet in conjunction with specific metacognitive scaffolds that were embedded within the DP database to provide guidance concerning work they were to complete each day. Student guides embedded in the database were designed to act as metacognitive scaffolds for students (Hannafin et al. 1999). Students were directed to use the prompts in the guides when determining which information to focus on during their research activities (see figure 3). The prompts were designed to support students in their discovery of the information needed for newspaper articles: people involved, goals of the people involved, causes of this event, description of what happened, opinions and quotes in favor of and opposed to this event.

Figure 3. *Decision Point!* **Guides scaffold**
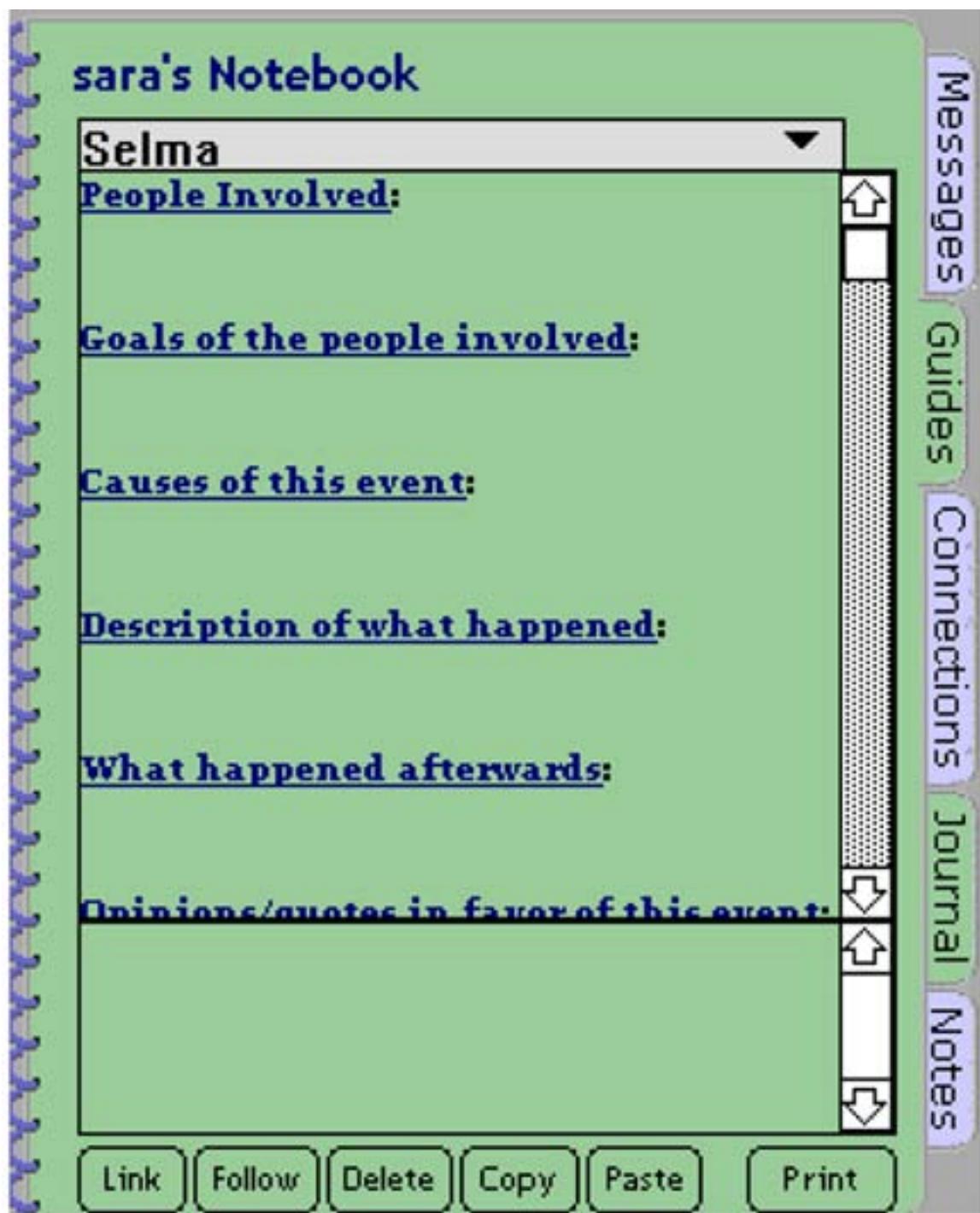
A journal tool within the DP environment also provided a metacognitive scaffold for students. This tool supported self-regulatory activities such as reflection on work completed and planning future research activities (Hannafin, Land, and Oliver 1999). Each journal entry had specific sections that prompted students to summarize their progress, describe any problems or successes they might have had, and describe their plan for research activities they would need to complete during the next class session (see figure 4).

Figure 4. *Decision Point!* **Journal scaffold**
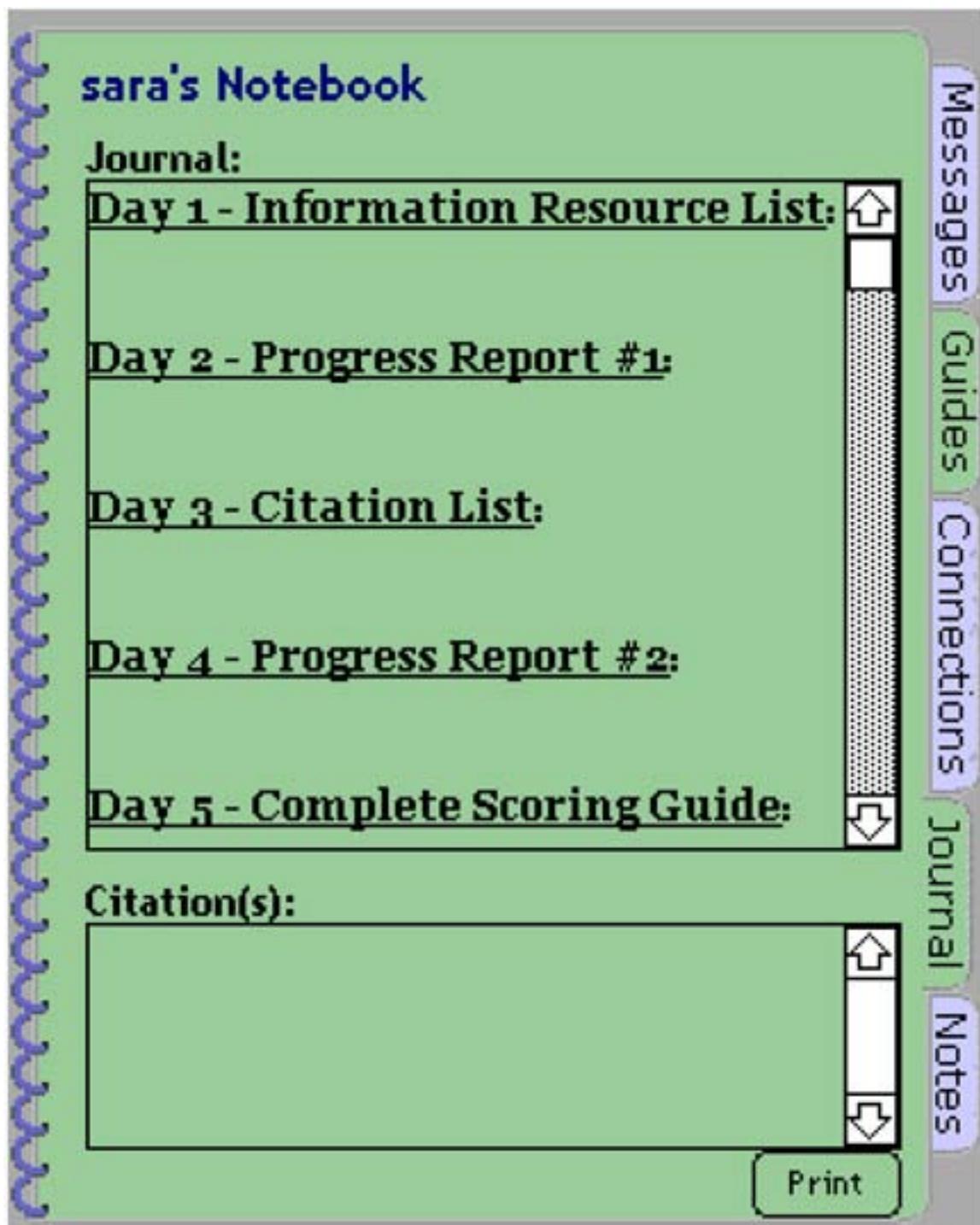
Procedures

The study was conducted over twelve eighty-five-minute class sessions. To acclimate herself, one of the researchers sat in on regular classroom activities for one week prior to the beginning of the study. During this week the researcher administered a simple fifteen-item multiple-choice pretest to the students. Analysis of the pretest scores revealed that the students had virtually no

prior knowledge of events related to the Selma March. Upon completion of the pretest, an introductory activity was conducted in order to orient students to the DP database. The activity consisted of a short scavenger hunt using the DP software that asked students to locate a variety of different types of information sources as well as to make entries in to the electronic log.

During the first class session, students received content-neutral training on information problem solving following Big6 as well as on newspaper writing. After the first class session, students were given three class days to conduct research and collect information from the DP database relevant to the Selma March. Students were required to use the metacognitive scaffolds (the guides and journal) embedded within the DP database to assist them with following the steps of Big6 as they gathered and evaluated information.

After the information gathering activities were complete, students were given two days to complete rough drafts of their newspaper articles related to the Selma March. They were once again guided to use Big6 to assist them with synthesizing the data they had gathered into a coherent article. For example, they were advised to use the questions in the guides scaffold of the DP notebook to focus their research. Once they had completed their guide questions, they could use the information to structure a rough draft of the article easily.

After completing rough drafts, students were provided with opportunities to receive feedback and given an additional two class periods to revise their articles and submit their final versions to the researcher. Students used an evaluation scaffold provided through Big6 to review one of their peers' drafts and provide feedback. Students then used the feedback they received from their peers to revise their articles and submit a final version.

Data Sources

In order to better understand the experiences students had while solving information-based problems, several data sources were collected. The use of multiple data sources and methods of analysis "contributes to the trustworthiness of the data" (Glesne and Peshkin 1992, 24) and assists in "increasing the strength and rigor of an evaluation" (Patton 1987, 60). These methods included student logs and journals, recorded teacher and student interactions, student articles, and post-activity interviews.

Student Logs and Journals

The DP database contained a tracking feature that recorded the path students took as they navigated throughout the database. These tracking files were printed out and examined to locate patterns among the students. The logs recorded the date the student accessed the database, time-stamped activities such as accessing artifacts, adding bookmarks within the database, using navigational features such as Forward and Back buttons and menus, and the time each student logged out of the database. The researcher transcribed this data into a spreadsheet that computed the elapsed time spent on each artifact, average time spent on artifacts within a single searching session, and total time spent in each searching session. Additionally, the computer logs recorded the bookmarks (bookmark title, DP section, file name, and title name within DP) each student created during their information gathering processes. These files were also transcribed and coded according to the type of artifact used.

Student journals from within the DP database were also collected. Students were directed to complete a journal entry at the end of each class period in response to specific prompts provided within their project information packets. These journal entries consisted of free-form responses to open-ended prompts as well as more structured responses to the prompts within the guides section of the DP database (electronic notebooks). Journal entries were examined for patterns among the students, insight into their experiences and feelings, and indications of metacognitive thought processes.

Teacher and Student Interactions

Throughout the study, the researcher (in her role as teacher for the class) wore a microphone in order to capture interactions with students as they completed their tasks. These interactions were transcribed and analyzed for evidence of metacognitive activity in students, as well as instances of teacher-provided scaffolding of metacognitive processes.

Student Articles

Each student completed a newspaper article that was submitted to the researcher for analysis. The articles were photocopied and the originals returned to the classroom teacher. Each article was examined using a detailed evaluation rubric (see figure 5). The rubric was developed in consultation with the classroom teacher and focused on analyzing the steps needed to complete the article (task analysis), locating and obtaining appropriate information from the database (location and access), applying information to appropriate sections of the article (use of information), and synthesizing the information into a coherent final product (synthesis). Two neutral scorers assessed each newspaper article using the scoring rubric. At the conclusion of this procedure the correlation between the two scorers was .91.

Figure 5. Article scoring rubric

Competency Type	Not Yet 1	Adequate 2	Competent 3	Highly Competent 4
Task Analysis	1 out of 3 (picture, body, headline) and 1-2 paragraphs included; less than 1/2 page in length	2 out of 3 (picture, body, headline) and 3-4 paragraphs included; 1/2 – 3/4 page in length	Picture, body, headline, and 5 paragraphs included; 3/4 - 1 page in length	Picture, body, headline and 6 paragraphs included; 1 page in length
Location and Access	List of only one type of information	List of types, no priorities; 1 or 2 types of information	List of types of information is prioritized with who, what, where, when, why; items from only 3 or 4 types	Items include range of types (who, where, why, what, when) 5-6 types are listed
Use of	Less than 3 paragraphs; inaccurate and/or	3-6 moderately developed paragraphs;	6 paragraphs with accurate information;	6 well developed paragraphs including focus on who, what,

Information	conflicting information	information is not accurate and/or conflicting with other internal information in the story	paragraph focuses are not definite and are moderately developed	where, when why; accurate information in each paragraph
Synthesis	Picture, headline, and body do not match and are not interesting or engaging; paragraphs do not have topic sentences, are collections of details; Many spelling and/or grammar errors	Picture doesn't match body, headline not engaging; paragraphs have topic sentence and some have no supporting details; Some spelling and/or grammar errors.	Picture and body match; headline isn't engaging; Body is interesting; each paragraph has a topic, but less than 2 supporting details; Few spelling and/or grammar errors.	Picture, headline and content "match" and are engaging/interesting; each paragraph has a topic sentence and 2 or 3 supporting details; No spelling and/or grammar errors.

Post-activity Interviews

At the conclusion of the study, three of the eighteen students were purposively selected based on the recommendation of the classroom teacher to participate in an exit interview. The researcher interviewed the students as a triad to help alleviate any anxiety associated with the interview process as well as to gain a more complete understanding of what the students knew regarding the research study (Graue and Walsh 1998). Interview questions were generally based on observations from class sessions and transcripts of interactions with the researcher. Students were asked to explain and expand on comments made in class, verify assertions made during classroom observations, and give their opinions about the study activities. The interview was recorded and lasted approximately fifty to sixty minutes.

Additionally, after each class period the teacher and researcher conferred for a short debriefing session. During this time the teacher had the opportunity to discuss any significant occurrences that the researcher may have missed during the class session and share his impressions of student attitudes and progress. All interviews were transcribed after they were completed.

Post-activity Surveys

At the completion of the study, students were asked to complete a two page survey about their experiences. Students responded using a four-point Likert-type scale to seventeen statements about their perceptions and feelings concerning the research and writing process. The second page consisted of several open-ended questions that asked students to respond about their likes and dislikes as well as ways to improve the unit for future students.

Results and Discussion

Assertions and Evidence

After analysis of the data sources, the researchers formulated several assertions related to the research questions that framed the study. The researchers were interested in discovering how Big6 supported metacognitive strategies and knowledge management in students. Two assertions grew from the data that may provide insight into metacognitive management. First, when students are provided metacognitive support during information problem-solving activities, they may be able manage complex tasks and subject matter content. Managing the content included writing in an unfamiliar format and understanding complex subject matter related to African-American Civil Rights. In this study, the management of this process was implemented through the use of Big6. Second, the students relied heavily on the model in order to make decisions about current and future activities. Students utilized the scaffolding provided to them in order to manage time, the project (of writing the news articles), and the resources used within the DP database in an efficient manner. The researchers found that Big6 provided a focus to student research and writing activities that appeared to enhance the level of engagement the students had with both the content and their writing activities. Each assertion is discussed in more detail in the following paragraphs.

A metacognitive support system allows students to manage complex cognitive tasks and processes. Students managed the complex task of writing a newspaper-style article by utilizing the metacognitive structure provided to them in the form of the Big6 packets. Analysis of their journals revealed that several students planned ahead for the next day's activities in response to the journal prompts provided. For example, one student reported his plan for subsequent work sessions as, "I am pretty sure what I'm going to start with at the next class. My conclusion is what I'm going to start with." Additionally, several students utilized the journal to record their progress on their article during nonclass periods such as lunch or study hall. Students also told the researcher that the process they used for the news article writing would be helpful in other subject areas having complex activities involved in the curriculum:

> Researcher: Do you think that the steps to the process if you had to, would be useful to you elsewhere?
>
> Student: Definitely.
>
> Researcher: Definitely? Where?
>
> Student: English.
>
> Researcher: Really. Could you use it on your own if you had your—if you had these sheets you could do it? As an example of how you would use the process?
>
> Student: Right.

Students also recorded a variety of sources in their bookmark lists while researching their articles. They identified that factual information would most likely be found in specific types of resources within the DP database. One student wrote in his journal, "the ones I will probably visit first are newspaper articles and personal accounts (videos) because they have the most factual information." The students appeared to recognize the value of primary documents and resources for the completion of their articles. One student during the exit interview

communicated an especially cognizant understanding of the difference between these types of sources and the information found in her textbook:

> Researcher: So how is what you read in the social studies book and what you read on the software different?
>
> Student: Those were like first accounts in the software. The history book is more revised. It's different because if you read a bunch of different history books, and I had to read a couple primary accounts. The primary accounts are going to be more like they're going to be the same unless the person totally changed it around.
>
> Researcher: Oh, I see what you're saying.
>
> Student: And then the history books are going to be different.
>
> Researcher: Why do you think the history books are different and the primary accounts are the same?
>
> Student: Because the primary accounts are just quotes, and you can't really change quotes because that just changes history.
>
> Researcher: And what happens with the history books stuff? Isn't that history?
>
> Student 2: Yeah, and they're telling the history like they're just like—it's not a first account. They just kind of bring it up. They don't really tell an individual person's story.

Students also reported their confidence levels (self-efficacy) as moderate to high throughout the activity. This is despite not ever having written in this format before. One student indicated his surprise at this feeling, "I think I learned a lot about the Selma March and I am surprised that I learn[ed] it on my own accordance [sic]."

Student articles demonstrated the characteristics of age-appropriate, well-written news articles. They contained answers to the questions who, what, where, when, and why that comprise news articles.

In general, students tended to rely on the Big6 materials during their writing process. Since most students rely heavily upon scaffolds when they are first provided for use, this reliance by the students was not surprising. Students frequently referred to the various steps in their journals, "I have completed my information seeking activity, tomorrow I will begin my information use activity." One student had a particularly difficult time understanding the assignment she was supposed to complete. The researcher used the structure of Big6 to help her define the task in terms that she could understand. The next class day, a letter was waiting for the researcher in the student's journal:

> Thank you very much for your help in explaining what I was suppose [sic] to do and my options. I didn't get very far after you left, however, I was able to organize my thoughts and figure out where I wanted to go with my information. I may be a little behind on Wednesday, but it should not take me that long to catch up with everyone. I will probably

be coming in on Wednesday after class again to make sure that I finish. As I said before I just wanted to thank you for your help and I wanted you to know that I know where I am going now.

Analysis of student journals revealed that the students utilized the steps of Big6 in order to manage their exploration of the DP database. Students indicated a general reliance on the Big6 materials, "finished the guide [the embedded scaffold within the DP database]," as well as a more specific awareness of the assistance the Big6 materials provided them, "Tomorrow, I am going to look at other sources and work on the 'Use of Information' activity. I am pretty confident on where to start tomorrow." Students had a variety of resources from a variety of types of information. They then used these sources in order to answer the questions related to newspaper articles.

Students indicated in their journals and in post-activity interviews that they visited certain types of articles first because they contained factual information (acknowledging the different qualities of information). They also connected their thinking to the process they had undertaken. At the end of the post-activity interview, one student told the researcher, "How to research was a good way of making us think [sic]." The evaluation portion of Big6 provided students with an opportunity to ensure success in their writing. One student (who, according to   the classroom teacher would typically submit a first draft as a final draft) wrote in his evaluation day entry, "I read the 'article' [and] I realized that I wrote a paper instead of a news article so I had to rewrite the article." Despite unfamiliarity with the content, most students' articles contained information directly pertaining to the Selma March. Also, despite little direct instruction about writing newspaper-style articles, most articles contained information pertaining to the "five Ws" (who, what, where, when, and why). See figure 6 for a sample article written by one of the students.

Figure 6. Sample student article

A March for Registry
By: E.B.
The Selma March was a march that took place from Selma to Montgomery and began on March 7th, only to end on March 25th.

March trail from Selma to Montgomery
This march was carried out in hope of giving blacks more rights, most importantly, the right for [voter] registration. The march was led and organized by Martin Luther King Jr.

Marchers Cross [Edmund] Pettus Bridge

Many arrests had taken place before the march occurred in earlier efforts to gain more rights. So the struggle for voting freedom had been going on since early February. [There] had been sit-ins and protests, and even men like MLK Jr. had been arrested. Jim Clark was infuriated if someone defied [his] authority. He would beat the men before he arrested anyone, he would arrest anyone for the smallest things, and he was going crazy. He was involved in stopping the first march attempt, and he used a lot for force.

The first march attempt at [Edmund] Pettus Bridge was on a Sunday. Over 600 marchers were turned back forcefully by troopers using tear gas, dogs, and excessive force. In the end, over 140 marchers were injured while more than 70 required hospitalization. This march was nicknamed "Bloody Sunday."

1st March Attempt at [Edmund] Pettus Bridge

At the second attempt the protestors were called back due to a compromise that MLK Jr. made with federal mediators. Later, Governor Wallace met with President Johnson. Johnson was requesting that Wallace make sure that there would be a safe passageway for the marches. Johnson also asked for the passage of a strict voting rights bill before a televised joint session of congress. Then, on March 17th, the Federal Court sanctioned the Selma to Montgomery March. A bill was sent to Congress authorizing the Attorney General to send people to protect the local registrators [sic] whenever or wherever they may be attacked.

The 3rd march was successful and that took place from March 21-25. The marchers had protection from the government, otherwise, they would have never made it. The Voting Rights Act of 1965 was passed and became a law on August 6th. The blacks succeeded in this one struggle, but is there still discrimination?

Day 1 of March to Montgomery

This article received "Highly Competent" scores on each element of the scoring rubric (see figure 5). Several of the elements exceeded requirements set forth in the scoring rubric, This article was more than the required one page length, the bookmark list had several types of information with multiple sources that answered the question words, the entire article was accurate and engaging, the pictures matched the accompanying text, and topic sentences were supported with specific details.

Conclusion

The research question investigated was, "How does Big6 support metacognitive strategies and knowledge management in students?" Results suggest that Big6 might act as a metacognitive scaffold for students who are asked to complete unfamiliar tasks involving complex content. Scaffolding, when implemented according to the principles presented by Vygotsky (1978) is gradually withdrawn from the learner as performance approaches an expert level. The time period of the study was too brief to gradually remove the scaffolded support for students. However, a reliance on the scaffold by the students in order to complete complex tasks was observed. Students indicated their understanding of the process as being beneficial outside the realm of the social studies class in which it was presented. Additionally, the researcher utilized the scaffolded format of Big6 in order to support her interaction with the students.

During the initial consultation between the classroom teacher and the researcher, the unfamiliarity of the writing style and topic was discussed. The classroom teacher was skeptical that the students would be able to complete articles in a news format without an adult acting as "editor-in-chief" for them. However, the articles submitted by the students fulfilled the requirements of the task. The classroom teacher was confident that the unit would be a success in the future, as well.

> Researcher: . . . I know you had said [that] this was the first time [the students] did newspaper writing. Is it something you would do [with future classes]?
>
> Classroom Teacher: Yes, and definitely want to approach again now that I've [seen] their experience with it.

The connections drawn by the students between research and thinking, between what occurs in one class in relation to what occurs in another class during the day, and between the product they

produce and the assignment given to them also suggest that Big6 may have been successful in aiding students in their metacognitive process management. Big6 and other models that provide a systematic guide for information problem solving seem to provide the elements for mental modeling so necessary in helping the novice construct a method to meet the information use tasks placed before him or her. These models appear to help students visualize the series of tasks that at first are not understood or seemingly connected. Such models may be powerful in construction of mental images to manage tasks that at first did not seem possible to accomplish.

Implications

There are several implications of the results presented in this study. School library media specialists and teachers should consider the items discussed below when collaborating to provide instruction in information problem solving and information-literacy skills.

The most compelling implication suggested from the results of this study is the potential link between a specific information problem-solving model, Big6, and metacognitive skills. Prior research has found that one of the essential skills students must possess in order to be successful in problem-based learning activities is metacognition (Hill and Hannafin 1997; Land and Hannafin 1997). The Big6 may act as a metacognitive scaffold that supports students while they become more adept at monitoring their own thought processes during the problem-solving process. Additionally, it provides a structured vocabulary that students and teachers can use while discussing the problem-solving strategies being employed in a particular learning situation. The structured vocabulary allows teachers and students to label behaviors and clarify terminology, two activities that are recommended to enhance metacognitive ability in students (Costa 1984). Consequently, an unobservable process is able to be monitored and tracked through a set of prescribed steps and described using a standardized vocabulary.

As students in this study indicated in their exit interviews, Big6 may also provide an overarching process that students can employ in a variety of learning situations. The benefit of strengthened metacognitive skills is that students can then apply these skills to a variety of learning situations that may differ from the original problem-solving task in which the process was initially introduced (Bondy 1984). However, students must be made aware that this is one possible strategy to use in order to successfully navigate problem situations. School library media specialists should help students utilize an organized problem-solving process in places other than the classroom. Bondy (1984) has recommended that educators adapt learning and studying models such as Big6 to "encourage a deliberate and systematic approach to learning and problem solving" (236).

Finally, the results presented in this article provide support for a growing body of research suggesting that with appropriate support students can succeed at complex, learner-centered, research-oriented tasks (Brush and Saye 2000; Eisenberg and Berkowitz 1998; Hill and Hannafin, 1997; Land and Hannafin 1997; Marchionini 1989; Perzylo and Oliver 1992). Students in this study used Big6 as a support mechanism for the completion of newspaper articles covering the complex set of events surrounding the Selma March. They wrote cohesive articles that accurately communicated the events of this historical moment.

As an initial study of the potential benefits of Big6 being utilized as a metacognitive scaffold, this study provides evidence that Big6 might support students in metacognitive and knowledge-

management tasks. More detailed examination and discussion about specific elements of Big6 that may have differing levels of support for metacognition is certainly warranted. Additionally, longitudinal study of Big6 in school settings should be explored. The authors believe that the most powerful and significant results would be found if the implementation of Big6 as a metacognitive scaffold were studied over the course of an academic semester, year, or longer. This would provide researchers with opportunities to observe what changes, if any, were affected through the use, and gradual withdrawal, of the scaffold.

Based on these results school library media specialists may want to consider collaborating with classroom teachers to implement this model into the kindergarten through twelfth grade curriculum of their schools. A process approach to problem solving is challenging. As Bondy (1984) stated,

> We cannot possibly provide school children with enough information to ensure their lifelong success in an ever-changing world. Preparing children to meet the demands of an uncertain future, however, may require a shift in educational focus from the content to the process of learning. Not only do children need to be able to think, but they need to exercise control over their own thinking. They need to know when they understand, when they need to know more, and how to direct efficiently their personal questions for knowledge. (238)

Through a collaborative effort between school library media specialists and kindergarten through twelfth-grade teachers, this type of metacognitive support can be effectively integrated into the school curriculum.

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