EXPLORING MAIN IDEA GENERATION VIA ELECTRONIC NOTE-TAKING

Crystal M. Ramsay, MEd, MS
The Pennsylvania State University
225 CEDAR Building
University Park, PA 16802
cmg5@psu.edu

Rayne A. Sperling, PhD
The Pennsylvania State University
232 CEDAR Building
University Park, PA 16802

Abstract

In this study we explored the spontaneous strategies students used as they employed copy-and-paste note-taking and generated main idea statements for a long web-based expository text. Analyses indicated that students employed ten different strategies. For three of these strategies students relied solely on their notes to generate a main idea, while in five strategies they relied both on notes and the full text. For two strategies students used elaborative processing. On average, students used three different strategies across multiple segments of the text. Students with higher comprehension scores more often paraphrased or elaborated to generate a main idea and those with lower scores more often restated parts of the text found in their copied notes. Implications for strategic reading comprehension and instructional practice are provided.

Students in classrooms in secondary and higher education are required to independently

read and comprehend lengthy expository text (NCES, 2000; 2005). Unfortunately, they are often

unable to effectively carry out these tasks (Dembo & Seli, 2007; NICHD, 2000). In the current

study we explored these difficulties as we prompted students to use a copy-and-paste note-taking

strategy and to subsequently generate main ideas as they read a long and challenging text. Our

intent was to increase students' effective strategy use and comprehension across multiple

segments of an expository text. Our approach was similar to the mixed methods explanatory

design (Creswell & Plano-Clark, 2007). Through this approach we explored the nexus of

electronic note-taking; content area reading; and a known reading comprehension strategy, the

Main Idea (MI) strategy.

Specifically, this study allowed us to examine what students do when they are instructed

to copy and paste notes and generate main ideas from a content area text presented in an

electronic environment. We know that readers' working memory capacity is limited (e.g.,

Baddeley, 2003; Miller, 1956). As such, when reading a long dense text, it is imperative that

students are able to abstract the 'gist' of what they read (e.g., Kintsch,1998; Kintsch & van Dijk,

1978). In this work we considered students' determination and notation of a text's gist to be the

Main Idea strategy (MI). In a world where students are bombarded by informational texts and at

a time when exceptional performance on high stakes tests is paramount, stepping inside of

students' actual notes to examine *how* they implement the common main idea strategy in an

electronic environment is critical to our understanding yet is a research task not previously

undertaken.

In a previous quantitative study, multiple measures of reading comprehension were

collected from more than 300 students at a large research university to compare the relative

benefit of prompted comprehension strategies to students' spontaneous study strategies. In that

work (Ramsay, Sperling, & Dornisch, 2009), students who employed the Main Idea strategy did

not perform as well as anticipated in reading comprehension as measured by matching items, and

explicit and implicit recognition items. It was beyond the scope of the research questions in the

initial experimental study to delve more deeply into the actual responses of participants to

address research questions related specifically to one of the research conditions. Therefore, in

this qualitative follow-up study, we posed additional novel research questions and further

investigated how students engaged in the MI task through examination of their actual note-taking

artifacts. The reason for this exploratory follow-up of 250 responses from 25 students from our

first study was to answer the critical question that emerged from findings from the data set from

our experimental research study: What do students actually do when instructed to generate a

main idea from electronic notes?

In this work we draw from and inform several areas of reading research and practice.

First, we situate our study in a construction-integration (Kintsch & van Dijk, 1988) model of

comprehension that focuses on the macro-structures of text. Second, this study expands recent

research in main idea generation and electronic note-taking. Third, we consider the findings of

this work within the context of the new literacies required for reading in electronic environments.

A theory of reading comprehension

As a reader proceeds through a text passage, limitations of working memory demand that

the text be reduced to its 'gist.' According to Kintsch and van Dijk's (1978) theory of discourse

processing, such reduction requires negotiating two structural text levels, a micro-level and a

macro-level. The micro-level is comprised of propositions, the separate semantic units that, when

connected, form an idea or concept. The second structural text level is a macro-level that

represents the structure of the whole text. Readers engage processes related to both levels when

developing text summaries and recall protocols.

As supported by the 2009 NAEP Reading Framework (National Assessment Governing

Board, 2008), there are several informational text structures. The macro-level text structures that

regularly comprise informational texts include description, sequential, comparison/contrast,

cause/effect, and problem/solution (e.g., Meyer, Brandt, & Bluth, 1980). Such structures

represent ways of organizing text content and of aiding readers in creation of mental

representations of text (e.g., Meyer & Poon, 2001; Williams, 2008). A long history of research

supports that such organization facilitates comprehension and recall (e.g., Kintsch & Yarbrough,

1982; Ozuro, Dempsey, McNamara, 2009; Wolfe, 2005). To best exploit a text's structure and

aid creation of a coherent mental representation, students may ask questions (e.g., Almassi, 2008,

King, 1995; Palinscar & Brown, 1984), make predictions (Moss, 2008; Palinscar & Brown,

1984), or interpret textual signals (Meyer et al., 1980; Meyer & Poon, 2001; Moss, 2008).

Navigating such structures and strategies facilitates main idea generation and comprehension

(e.g., Almassi, 2008; McMahon, 2008; Palinscar & Brown, 1984).

The main idea (MI) strategy

To understand how we addressed our research question, it is critical to know how we

defined what a main idea is, what a main idea strategy is, and how critical it is for students to

build main idea skills. Consistent with existing literature, we defined the main idea of a passage

as the 'gist' of the text (e.g., Armbruster, Anderson & Ostertag, 1987; Baumann, 1983). The

Main Idea strategy (MI) is an empirically-supported summarization strategy used by students to

improve reading comprehension (NICHD, 2000). As a strategy, this important means for

effective comprehension of expository text requires students to identify and generate main ideas

(e.g., Jitendra, Chard, Hoppes, Renouf, & Gardill, 2001). Researchers both historically (e.g.,

Axelrod, 1975; Dishner & Readence, 1977) and recently (e.g., Jitendra et al., 2001; Wang, 2009)

argue that the ability to extract a text's central ideas and themes is the most fundamental skill in

reading comprehension.

As such an important reading strategy, it is not surprising that the Progress in

International Reading Literacy Study (PIRLS) (Mullis, Martin, Gonzalez, & Kennedy, 2003)

reported that by second grade identifying main ideas is a focus of strategic reading instruction in

the United States, and that 94% of American 4th grade teachers report emphasizing MI on a

weekly basis. Thus, students experience high exposure to the MI strategy. This exposure is

consistent with an increasing recognition by educators of the need to teach strategies that

specifically aid in comprehension of expository texts. This need is also reflected in current

standardized tests, such as the NAEP assessments (NAGB, 2008), which include items that

require students to comprehend texts' main ideas. According to Daniels (2002), 70-80% of text

material found on standardized reading tests is expository. A combination of the demands of the

"Information Age" and the realities of standardized testing have boosted teachers' recognition of

the instructional imperative that students know how to read and understand informational texts

(e.g., Montelongo & Hernández, 2007; Moss, 2004). Students require effective strategies, such

as the MI strategy, to successfully navigate these texts.

Extensive research supports that instructing students in the use of the MI strategy results in improved reading comprehension (e.g., Brown & Day, 1983; Mastropieri, Scruggs, & Graetz, 2003; Meyer, Brandt, & Bluth, 1980; Sjostrom & Hare, 1984; Stevens, 1988). Benefit from the strategy transcends age and ability. For example, researchers found benefit for 4th and 5th grade students taught a main idea strategy as part of direct instruction in sentence completion tasks (Montelongo, Berber-Jiménez, Hernández, & Hosking, 2006; Montelongo & Hernández, 2007). Secondary level students' comprehension has been shown to improve following MI instruction (e.g., Sjostrom & Hare, 1984). Additionally, researchers studying effective comprehension strategies for struggling readers have found the MI strategy to be effective (e.g., Mason, Meadan, Hedan, & Corso, 2006; Mastropieri et al., 2003). As additional support, in a recent research synthesis, Gajria, Jitendra, Sood, and Sacks (2007) found large effects at posttest among studies testing the effects of MI on students with learning disabilities.

In spite of extensive empirical evidence in support of MI, the National Reading Panel (NICHD, 2000) reported that readers do not identify main ideas, summarize text, nor integrate multiple comprehension strategies to effectively construct meaning. In order to effectively identify the main idea, students must integrate other comprehension strategies such as identifying text structure. As with MI, unfortunately, readers often lack the ability to recognize and understand the structure of a text (e.g., Armbruster et al., 1987). However, when students receive instruction in identifying text structure, memory for main ideas increases (e.g. Meyer et al., 1980). In summary, extensive research leads us to conclude that instructing students in MI can increase reading comprehension. Further, research clearly supports efficacy for MI as a strategy to support reading comprehension for nearly any learner. Yet, some research indicates

readers struggle when independently using the strategy. Therefore the benefit of the strategy

may be limited. In this work, we meaningfully contribute to the existing MI research by

exploring what college learners do when given the task of executing the strategy to facilitate

their comprehension of a long, authentic, expository text delivered in a web-based learning

environment.

A deeper understanding of MI, as represented in this work, is critical, because not only do

students report using the strategy and teachers report teaching it but it is also one of only five

empirically-supported student-level comprehension strategies (NICHD, 2000) and has been

shown to be an effective strategy with expository text, a type of text students must know how to

comprehend. Still, evidence supports that students need to be better at integrating MI with other

effective strategies to maximize comprehension and learning. What is not known, and is

foundational to this study, is how students actually go about generating a main idea, especially

when doing so from their own electronic notes.

Electronic note-taking

In addition to its important contributions to the existing MI research base, this work also

adds to our understanding of learners' electronic note-taking (e.g., Igo, Bruning, & McCrudden,

2005; Katayama, Shambaugh, & Doctor, 2005; Nesbitt, Winne, Jamieson-Noel, Code, Zhou, &

MacAllister, et al., 2006; Perry & Winne, 2006) and self-regulated learning (Azevedo, Moos,

Greene, Winters, & Cromley, 2008), both critical areas of recent research given the prevalence of

online and electronically-supported reading materials. This emerging area of focused research

suggests that students' performance on comprehension tasks that require them to apply what they

have read from an electronic text source may vary depending on effective note-taking and other

self-regulated learning strategies. In this work we explored students' use of strategies when

learning from an electronic text and found support for students' spontaneous use of copy-and-

paste tactics and regulatory processing.

Note-taking, online or not, serves multiple purposes. DiVesta and Gray (1972) first

suggested that note-taking serves either an encoding function or an external storage function.

Kiewra, DuBois, Christian, McShane, Meyerhofer, and Roskelly (1991) acknowledged encoding

and storage functions, but added a function, encoding *and* storage, finding that students benefited

most when they took notes and were also given an opportunity to study them. In addition to

studies of the forms and functions of note-taking, other research has addressed the processes of

note-taking (e.g. Katayama & Crooks, 2003; Kiewra et al., 1991; Robinson, Katayama, Beth,

Odom, Hseih, & Vanderveen, 2006). Others have considered the nature of the target information

itself, formal vs. informal (Bretzing & Kulhavy, 1981). Still others (e.g., Igo et al., 2005; Igo &

Kiewra, 2007; Van Meter, Yokoi, & Pressley, 1994) have examined the decision-making of

students as they solve the problem of what to 'note.'

Increasingly, students are searching and exploiting electronic resource material (Kriebel

& Lapham, 2008) and presumably taking notes from it. Academic standards in states across the

nation require students to research, comprehend, and evaluate electronic resources. Given the

prevalence of students' self-reported MI training (Mullis et al., 2001), it seems reasonable to

expect that they would employ the MI strategy when taking electronic notes. The current study

is strategy-specific research conducted on students' use of the copy-and-paste function. Igo et al.

(2003) (as cited in Igo, Kiewra, & Bruning et al., 2007) noted that approximately 80% of high

school students will select a copy-and-paste note-taking approach if given the opportunity to do

so. Given the pervasiveness of electronic text material, the prevalence of the MI strategy as an

instructional focus, and the simultaneous preference of students to use copy-and-paste note-

taking, in this study we examined what students actually do when instructed to generate a main

idea from their generated electronic notes.

Method

In this study we examined artifacts of students' note-taking. The data were initially

collected during an experimental study of comprehension strategies. The experimental study

compared three reading comprehension strategies. The context was an electronic environment

where students were required to read, take notes online, and generate main ideas. The main idea

(MI) strategy focused on extracting the 'gist' of the text's meaning. The elaborative interrogation

(EI) strategy required participants to determine the main idea of the text, to pose a 'why'

question about the content, then answer the question. Finally, the independent study (IS) strategy

functioned as a control where participants were simply instructed to read the text as they might

read any online text for a class. While we held high expectations for participants instructed to ask

elaborative questions, we also expected students in the MI condition to perform well, especially

given their expected prior experience with the MI strategy. Contrary to expectations, however,

on all dependent measures from the initial experimental study, participants in the MI condition

posted the lowest means behind both EI and IS. As an extension of this work we posed a critical

new research question that emerged from the initial experiment (Creswell & Plano-Clark, 2007)

and set to examine how students in the MI condition actually carried out the task of the Main

Idea strategy in practice and whether their approach might have led to their unexpectedly poor

performance. The present study is a qualitative look at the previously unexamined artifacts of

these students' note-taking.

The original study

Participants in the MI condition of the original study were 119 students recruited from

introductory Educational Psychology classes at a large Mid-Atlantic university. They were

given a URL to link them to the study. Once online, they read an experimental text, copied and

pasted main idea statements, and answered varying types of recall and recognition items. The

text and all relevant measures were presented electronically. The experimental text was a 5518-

word passage from nineteen actual text pages from an American History survey text (Foner,

2005).   As history is a content area routinely encountered by both younger and older

adolescents, a history text met criteria for both exposition and generalizability to both high

school and undergraduate students.

To support students' use of the MI strategy, participants were asked to read the text, copy

and paste main idea statements, and then rewrite the main idea in their own words. A text box

was provided at each of ten natural section breaks for participants to copy and paste notes and

again for them to type the main ideas they generated. To assure students were familiar with the

MI strategy and to scaffold their use of the strategy, a page describing and modeling the MI

strategy on a single paragraph of unrelated text was provided.

The current analyses

Data from our related quantitative study (Ramsay et al., 2009) indicated students were

not able to effectively employ the MI strategy. It was beyond the purposes of the initial

investigation to delve into the student responses; therefore, to address how students employed the MI strategy, in this new study we turned to the electronic artifacts students generated during the experiment. These data included students' copied and pasted notes and the main idea statements they generated. It was through analyses of these data from students' independent reading that we addressed what strategies students use when they employ copy-and-paste note-taking and generate main idea statements for a lengthy expository text.

Analyses of the data required a multi-step process. First, we randomly selected a subset of participants from the MI condition (n=37) for examination. From these, we examined a subset of responses. That is, we analyzed all 37 students' generated main ideas for text segments 1, 2, 3, 4, 9. The first four segments were representative of all ten. Responses to segment 9 were examined as we considered the possibility that effortful responses may have waned if students experienced fatigue by the end of the long passage. In spite of our concern, this did not appear to be the case as data across these sample segments were consistent. This subset of responses was deemed adequate to begin identifying response patterns.

A coding scheme was developed from patterns in students' responses. When participants' generated MI statements were examined (n=185 responses), four broad categories of strategies students appeared to use emerged. In the first category, students *Recopied* directly from their copied and pasted notes. In the second category, students *Restated* from their copied and pasted notes but did not merely recopy. In the third and fourth categories, students *Paraphrased* from their notes or *Elaborated* their notes.

To test the adequacy of this coding scheme, we randomly selected a second set of students from the MI condition and coded all of their responses (n=10 students; 100 responses).

As both authors individually and collaboratively examined the data and themes, nuances

suggested that there were important subcategories within the original themes. Through additional

coding and further examination, it became clear that student-generated main ideas were either

constrained or unconstrained by the notes they took during the copy-and-paste note-taking phase

of their task. That is, constrained main ideas were those that relied solely on the text that

students copied and pasted to generate a main idea. In contrast, responses not constrained by the

copy-and-paste notes drew, at least in part, from the text itself. Through analyses, six additional

codes were revealed.

These six codes were: *Elaborated*, a category expanded to include elaborations on text

content outside of what students recorded in their notes; *Recopied-Text*, a main idea statement

recopied, not from student notes, but from the text only; *Recopied-Text-Copy/Paste,* a main idea

recopied from the text as well as from what was copied and pasted; *Restated-Text-Copy/Paste,*

the main idea as a restatement of both text content and copied and pasted notes; *Paraphrased-*

Text-Copy/Paste, representing a paraphrase from the text and the copied and pasted notes;

Paraphrased-Text Only, a main idea paraphrased from content in the text only; and *Nonsense*

information reflecting minimum effort or noncompliance.

To train on the expanded coding scheme, both researchers scored a random 30 responses.

These were a sub-sample from among the middle-scoring 80% of participants whose data were

not part of our primary investigation. Next, researchers then independently rated an additional 70

responses to establish inter-rater reliability and validity of the coding scheme. The correlation

between researchers' independent ratings was $r=.91$. Discrepant items were discussed, clarified,

and rescored.

Confident in the external validity of the coding scheme, we returned to our MI data set

and split the data file into those students with either high or low scores on the dependent

comprehension measures employed in the quantitative study. We examined responses from the

MI participants who scored at the 90th percentile or above (the high-achieving group, n=13) and

those scoring at the 10th percentile or below (the low-achieving group, n=12). Having earlier

reached acceptable inter-rater reliability on the coding scheme, one researcher scored all

responses (n=25 students, 250 responses).

Results

In this investigation, students were directed to read a multi-paragraph passage, copy and

paste words or phrases related to the main idea, and, from those, generate a main idea statement.

Our analyses explored what students did when they were asked to employ the MI strategy while

reading an authentic electronically delivered expository text. We examined results for the overall

sample, for low-scoring students, and for high-scoring students, and also considered within-

student patterns. Ten categories representing student strategies emerged from students'

responses. (See Table 1.)

Table 1. Students' main idea generation strategies.

Strategy	Definition	Constrained or unconstrained by copy/paste notes	Example	
			Copy/paste notes directly from text	Stu
Recopy	Main idea was copied directly from copied and pasted notes	Constrained	*Railroads and other companies tried various means of bringing order to the chaotic marketplace.*	Railroads various n chaotic n
Restate	Main idea was a restatement of what was copied and pasted.	Constrained	*Despite the emergence of a few "bonanza" farms that covered thousands of acres and employed large numbers of agricultural wage workers, family farms still dominated the trans-Mississippi West.*	Farming was dom the emerg farms.
Paraphrase	Main idea represented a paraphrase from what was copied and pasted (may include inaccuracies but content bound).	Constrained	*Two decades following the Civil War also witnessed the golden age of the cattle kingdom. The Kansas Pacific Railroad's stations at Abilene, Dodge City, and Witchita, Kansas, became destinations for the fabled drives of millions of cattle from Texas. A collection of white, Mexican, and black men who conducted the cattle drives, the*	The post of the cat frontier. flourishe ideal for stations. romantic but his li

			cowboys became symbols of a life of freedom on the open range. Their exploits would later serve as the theme of many a Hollywood movie, and their clothing inspired fashions that remain popular today. But there was nothing romantic about the life of the cowboys, most of whom were low-paid wage workers.	
Elaborate	Main idea was an elaboration; This could be accurate or inaccurate as long as it was deemed effortful or intentional.	Constrained or Unconstrained	*The 600 dignitaries (598 of them men) who gathered on what is now called Liberty Island for the dedication hoped the Statue of Liberty would inspire renewed devotion to the nation's political and economic system.*	Even though 600 people gathered for the dedication of the Statue of Liberty, hoping it would inspire devotion to USA's politics and economics, the fact that only two were women-and that this was important enough to be noted-show that not all the original hopes of equality had been realized.
Nonsense/ Noncompliance	Main idea was 'made up' nonsense; This strategy represents minimum compliance.	Constrained or Unconstrained	*The combination of a market flooded with goods and federal monetary policies that removed money from the national economy led to a relentless fall in prices.*	The policies federal money and the flood with goods from the market should put together, then national economy removed relentless.
Recopy Text Only	Main idea was a copy of text outside what the student copied	Unconstrained	*Evidence of this strategy appeared in developmental samples, but none appeared in the final sample chosen for qualitative study.*	

	and pasted.			
Recopy Text and C/P	Main idea was a copy of text content and of copied and pasted notes.	Unconstrained	*Evidence of this strategy appeared in developmental samples, but none appeared in the final sample chosen for qualitative study.*	
Restate Text and C/P	Main idea was a restatement of text content and of copied and pasted notes.	Unconstrained	*The incorporation of the West into the national economy spelled the doom of the Plains Indians and their world.*	The Plains Indians communities were attacked and demolished throughout Western expansion until nearly none were existent.
Paraphrase Text and C/P	Main idea was paraphrased from the text and from copied and pasted notes (may include inaccuracies but is content-bound).	Unconstrained	*Striking as it was, the country's economic growth distributed its benefits very unevenly.*	Even though there was economic growth in America, the distribution of the wealth was uneven therefore the rich was getting richer and the poor was getting poorer.
Paraphrase Text Only	Main idea was paraphrased from the text only (may include inaccuracies but is content-bound).	Unconstrained	*A collection of white, Mexican, and black men who conducted the cattle drives, the cowboys became symbols of a life of freedom on the open range. The West was more than a farming empire. By 1890, a higher percentage of its population lived in cities than was the case in other regions.*	Cattle driving became very important, and while cowboys are highly revered, live was very difficult. At the same time San Francisco and other regions in the was were becoming more industrialized. New Mexico was also becoming industrial, with the introduction of railroads to some regions.

We first examined the strategy choices of the overall sample. Ideally, when generating a

main idea from text, we hope students either paraphrase or elaborate upon what they have read.

Four categories in the current study encompassed those two behaviors: *Paraphrase, Elaborate,*

Paraphrase Text and Copy/Paste, and *Paraphrase Text Only.* Data revealed that 60% of

responses in the overall sample represented these strategies. Of these, the vast majority (96%)

were paraphrases. We concluded that, as the research literature suggests, students use MI

strategies. (See Table 2.)

Table 2. Frequency of students' overall strategy choices.

Item	Recopy	Restate	Paraphrase	Elaborate	Nonsense/ Noncompliance	Recopy Text only	Recopy Text & C/P	Restate Text & C/P	Paraphrase Text & C/P	Paraphrase Text Only
Item 1	0	10	4	2	3	0	0	0	6	0
Item 2	0	8	11	0	1	0	0	0	4	1
Item 3	1	9	8	0	1	0	0	0	4	2
Item 4	2	6	7	1	3	0	0	0	6	0
Item 5	2	4	5	1	4	0	0	1	7	1
Item 6	2	7	9	0	0	0	0	0	7	0
Item 7	2	4	10	0	3	0	0	0	5	1
Item 8	2	7	4	1	3	0	0	0	5	3
Item 9	2	4	10	1	2	0	0	1	5	0
Item 10	2	3	13	0	2	0	0	0	5	0
Total	15	62	81	6	22	0	0	2	54	8

Students generated main idea statements that were either constrained or unconstrained by the notes they copied and pasted. Main idea statements constrained by copy-and-paste notes reflected only content recorded in students' notes. Unconstrained MI statements reflected content found completely outside of the copy-and-paste notes or content that combined both noted content and content outside of student notes. In such cases, students went beyond their copied notes to generate a main idea. Among the paraphrasing and elaboration strategies, the *Paraphrase* strategy was constrained by students' notes, *Paraphrase Text and Copy/Paste* and *Paraphrase Text Only* were unconstrained, and the *Elaboration* strategy was either (see Table 1 for examples). In the overall sample, when students were apt to constrain their generated main idea to their copy-and-paste notes, the least used strategy was *Recopy* while the most used strategies among those formulated from copy-and-paste notes were *Restate, Paraphrase,* and *Recopy*.

Elaboration was one of two strategies not necessarily constrained by students' copy-and-paste notes. It was also the one strategy that was sometimes challenging to differentiate from the *Nonsense/Noncompliance* category. Among these, some responses were clearly identified as sophisticated elaborations. Others were just as clearly defined as nonsense. It was difficult, at times, to discern subtle differences between meaningful elaboration and articulate nonsense.

Upon examination, differences were indicated between the low-comprehending and high-comprehending students (see Table 3). First, while there were no instances of the simplistic *Recopy* strategy among high comprehenders, 12.5% of responses by low comprehenders were generated this way. Another 28.3% of low comprehenders' main ideas were generated by merely restating copied and pasted notes, compared with 21.5% among high comprehenders. A

third difference between the two groups was evident in students' use of paraphrasing strategies.

The coding scheme included three possible paraphrasing strategies (*Paraphrase, Paraphrase*

Text and Copy/Paste, and *Paraphrase Text Only)*. The combined total of these three strategies

used by low comprehenders comprised 19% of all responses compared with 38% generated

through these means by high comprehenders. Thus, high comprehenders used paraphrasing

strategies—strategies we want students to use—twice as often as low comprehenders.

Table 3. Frequency of strategy choices among high and low comprehenders.

Item	Recopy	Restate	Paraphrase	Elaborate	Nonsense/ Noncompliance	Recopy Text Only	Recopy Text & C/P	Restate Text & C/P	Paraphrase Text & C/P	Paraphrase Text Only
High Comprehenders (*n*=13)										
Item 1	0	5	1	2	1	0	0	0	4	0
Item 2	0	4	6	0	0	0	0	0	2	1
Item 3	0	2	6	0	0	0	0	0	3	2
Item 4	0	3	5	1	0	0	0	0	4	0
Item 5	0	2	2	0	1	0	0	1	6	1
Item 6	0	2	5	0	0	0	0	0	6	0
Item 7	0	1	6	0	0	0	0	0	5	1
Item 8	0	4	3	0	0	0	0	0	4	2
Item 9	0	3	5	1	0	0	0	0	4	0
Item 10	0	2	7	0	0	0	0	0	4	0
Total	0	28	46	4	2	0	0	1	42	7
Low Comprehenders (*n*=12)										
Item 1	0	5	3	0	2	0	0	0	2	0

Item 2	0	4	5	0	1	0	0	0	2	0
Item 3	1	7	2	0	1	0	0	0	1	0
Item 4	2	3	2	0	3	0	0	0	2	0
Item 5	2	2	3	1	3	0	0	0	1	0
Item 6	2	5	4	0	0	0	0	0	1	0
Item 7	2	3	4	0	3	0	0	0	0	0
Item 8	2	3	1	1	3	0	0	0	1	1
Item 9	2	1	5	0	2	0	0	1	1	0
Item 10	2	1	6	0	2	0	0	0	1	0
Total	15	34	35	2	20	0	0	1	12	1

Once we had established a coding scheme that represented students' overall responses and were able to compare strategies between high and low scorers, we were curious about whether there were patterns *within* students. The most notable pattern within participants was that, regardless of their score at posttest, students employed, on average, three different strategies across the ten segments. The highest number of strategies employed by any one student across the text was five, while the lowest was two. Not one participant chose to implement the same singular strategy time and again across every section of the passage. In short, all students used a combination of strategies, but high comprehenders chose strategies that required them to evaluate and manipulate their notes as they generated main idea statements. This is especially important as we revisit the implications of students' strategy choices and the characteristic encoding and storage functions they afford learners.

Discussion

We instructed students to copy and paste text that related to the main ideas of ten sections of a long naturally-occurring text. We did this as part of our controlled experiment. While we imagine that few instructors direct students to engage in this specific task, we also expect that it is common for students to do so independently when they encounter such texts in online environments. Ideally we hope that, as students read text content, they are able to critically examine it and integrate it with their existing knowledge (Igo & Kiewra, 2007). Yet when text is long and dense and contains numerous main ideas, capturing the gist quickly and storing it for later integration may be a strategy that students select for its efficiency.

Main idea literature has established the effectiveness of the MI strategy for independent comprehension of expository text and as an integrative component with other effective strategies.

We investigated how students generate a main idea from their own electronic notes. Our

examination of students' note-taking and main idea artifacts indicated that students use main idea

strategies. Beyond that, however, the specific way they carry out the copy-and-paste task varies

across learners. Three specific findings resulted from this examination. First, students used a

variety of strategies for generating main ideas across multiple segments of the same long

passage.   Some students constrained their main idea generation to the notes they copied and

pasted as they read, while others went beyond their copy-and-paste notes and incorporated

information from the text. Some students simply recopied their notes, while others paraphrased,

and a few elaborated. Second, across the full text each student employed, on average, three

different strategies for generating main ideas from their notes. All students employed at least

two strategies.

Finally, results indicated that those considered high-scorers on outcome measures used

more sophisticated strategies than low-scorers. Low-comprehending students were more likely

to use simplistic strategies such as *Recopy* and *Restate* than were high-comprehending students

who used paraphrasing strategies more frequently. Consistent with existing beliefs regarding the

benefits of MI, our findings suggest that students who are more successful when comprehending

expository text are also, when prompted, able to generate paraphrases of what they read. What is

yet unclear is whether high-comprehenders elaborate because they comprehend better, or if they

comprehend more because they elaborate better. Although this is an empirical question, from

research on elaboration (e.g., Reder, Charney, & Morgan, 1986) and elaborative questioning

(e.g., Seifert, 1993, 1994; Woloshyn, Willoughby, Wood, & Pressley, 1990), we would suspect

that the elaboration aids comprehension.

In addition to the contributions this work makes to our understanding of MI, our findings also build upon current research in electronic note-taking. For example, findings support Igo and colleagues' (2005) cognitive engagement hypothesis. This hypothesis holds that when learners are forced into cognitive engagement, such as evaluation of content for inclusion in notes where space limitations have been imposed, they are forced to be evaluative in their decision-making and, consequently, recall more than those with unlimited space and no evaluative constraints. From their work, we know that limited space constraints strengthen the encoding function of note-taking.

In the present study, there were neither space constraints nor word limits. Students were free to employ any strategy they chose. Yet they were not permitted to return to their notes prior to posttest comprehension measures. This constraint rendered the storage function of note-taking irrelevant for all strategies and instead focused on encoding effects. We found that those who chose strategies with inherent encoding features (i.e., paraphrasing strategies and elaboration strategies) recalled more information after reading. In contrast, those who chose strategies which might have been helpful had they been able to return to their notes scored lower at posttest possibly because of the limited encoding effects at the initial point of note-taking. All students copied and pasted notes, but patterns in strategy choices suggested that those who chose strategies that required them to manipulate and evaluate the information, and seemingly move from a mere storage function, recalled more. This supports recent work by Igo and Kiewra (2007) that high-achieving students tend to be selective in their note-taking even when not forced to be so.

Recent work in *new literacies* (e.g., Coiro, Knobel, Lankshear, & Leu, 2008; Leu, Coiro, Castek, Hartman, Henry, & Reinking, 2008) suggests that students engage different processes and employ different strategies when comprehending online text compared with traditional text (Coiro & Dobler, 2007; Henry, 2006; Leu, 2007; Sutherland-Smith, 2002). Yet, very little is known as to the strategies learners use when they engage with electronic texts (Coiro & Dobler, 2007). Addressing this gap, we explicitly examined artifacts of students' processing. Similar to current use of gStudy and other related technologies, our methodology can help inform how to further examine students' tactics. The tactics students used in our environment may transfer to other similar environments and, as such, may be foundational for future studies such as those initiated by Dabbagh and Kitsantas (2005), Perry and Winne (2006), and others for exploration of the tactics students use during self-regulated strategic study. Knowledge of how students comprehend basic electronic text such as that used in the present study may also inform the ongoing parallel work in new literacies and studies of how strategies transfer to web-based intertextual comprehension.

Future research might also manipulate text topic. Students' theory of note-taking (Van Meter et al., 1994) indicates that how students take notes is determined partly by the nature of the content. The task in the current study was based upon a passage about the Gilded Age in American History. Note-taking in this chronological yet thematic, factual yet cause and effect, domain may be very different from note-taking on topics used in electronic note-taking research thus far: education (Igo et al., 2005; Katayama & Crooks, 2003), computers (Dabbagh & Kitsantas, 2005; Katayama et al., 2005), and physical science (Igo, Riccomini, Bruning, & Pope, 2006; Robinson et al., 2006).

Students in the 21st century encounter many types of texts, both traditional and non-traditional. The Pew Internet and American Life Project (Lenhart, Madden, & Hitlin, 2005) found that nearly 90% of teens ages 12-18 use the Internet, and more than 50% use it daily. While students report extensive use of the Internet, we are only beginning to explore ways to help them effectively comprehend what they find there (Coiro, 2003; Henry, 2006). Once students have secured the desired information from an Internet source, what do they do with it? How effectively do they comprehend it? If they take notes on it, what do those notes look like? The 2009 Program for International Students Assessment (PISA) will include assessment of online reading. Such change is an attempt to capture student comprehension of the myriad forms of electronic texts students encounter daily.

Thus we believe that, given students' increasing access to electronic text material and new efforts to assess their understanding of it, implications for instructional practice in online reading must be considered. Understanding what processes students do engage seems like a prudent and necessary starting point for outlining the steps toward more critical literacy skills. Implications for practice include a need to teach the MI strategy in technology-rich reading environments, to prompt the use of the strategy, and perhaps most importantly, to teach students how to best engage the strategy to enhance their comprehension. Future research should employ similar methodologies to examine other strategies students engage as they read text. Such research should include exploration of the nuances in which strategies are successfully prompted and implemented by independent readers.

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