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AUTHOR McKeague, Carrie A.
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ABSTRACT

A study investigated the effects of text processing orientations and reader-generated versus text-based comprehension aids on readers' comprehension of expository text. The processing orientations included memory-oriented processing, organization-oriented processing, understanding-oriented processing, and a read and study control. Subjects, 136 undergraduate students, read an expository passage and engaged in one of the four processing approaches through either reader-generated or text-based activities. Following a 24-hour delay, students' learning was measured by memory measures, organization measures, and an understanding measure. Results indicated that processing orientations yielded different degrees of knowledge about the passage. Readers processing the text in the memory-oriented mode recalled significantly more on the memory measures than readers in the understanding-oriented processing. Similarly, readers processing the text in the organization-oriented processing mode performed significantly better on the organization measures than readers in the other processing orientations. Readers in the understanding-oriented processing mode did not, however, show significantly superior performance on the understanding measure. Readers using text-based comprehension aids for each processing orientation performed significantly higher on each of the outcome measures than readers generating their own comprehension aids for each processing orientation. Findings suggest that teachers should determine a reader's amount of prior knowledge on the reading topic before encouraging the reader to engage in a generative activity; and the way students read and study text information affects the way they comprehend and recall. (Three tables of data are included. Contains 30 references.) (Author/RS)

Effects of Processing Orientations and Reader-Generated and Text-Based Comprehension Aids on Text Processing

Carrie A. McKeague

The Pennsylvania State University

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Abstract

This study investigated the effects of text processing orientations and reader-generated versus text-based comprehension aids on readers' comprehension of expository text. The processing orientations included memory-oriented processing, organization-oriented processing, understanding-oriented processing, and a read and study control. It was hypothesized that readers' processing orientation would influence the kind of information learned from text. It was hypothesized that reader-generated activities would result in greater learning of information than would a text-based comprehension aid.

Students read an expository passage and engaged in one of the four processing approaches through either reader-generated or text-based activities. Following a 24 hour delay, students' learning was measured by memory measures, organization measures, and an understanding measure. The results show that processing orientations yielded different degrees of knowledge about the passage. Readers processing the text in the memory-oriented mode recalled significantly more on the memory measures than readers in the understanding-oriented processing. Similarly, readers processing the text in the organization-oriented processing mode performed significantly better on the organization measures than readers in the other processing orientations. Readers in the understanding-oriented processing mode did not, however, show significantly superior performance on the understanding measure. Readers using text-based comprehension aids for each processing orientation performed significantly higher on each of the outcome measures than readers generating their own comprehension aids for each processing orientation. Implications for the processing orientations and reader-generated versus text-based comprehension aids used in reading are discussed.

College students spend a great deal of time studying and learning information presented in expository text. They use a variety of strategies such as underlining or highlighting, outlining, making analogies, or rereading to increase their comprehension of text. Even though students read the same text, the information learned from text varies from reader to reader. For instance, after presenting an expository passage to college students Mayer (1984) found three global comprehension outcomes: (1) non-learners, readers who did not remember much information from the passage; (2) non-understanders, readers who remembered some information, but were unable to apply the information to new situations or problems; and (3) understanders, readers who remembered as much as non-understanders and were able to apply the information to new situations and problems. It seems that the three groups of readers processed the text material in different ways. Learning from text requires an active reader (Rothkopf, 1970; Wittrock, 1974, 1978, 1990), and processing at acquisition that matches the requirements of the learning outcome (Morris, Bransford, & Franks, 1977). Many students lack the strategies necessary to be active readers and/or they are not informed as to how they will need to use the information following the completion of reading. This lack of reader activity and objectives regarding how textual information will be used following reading may result in readers retaining different information from the same text.

Research studies have examined ways of improving reader's retention of expository text material (e.g. Cashen & Leicht, 1970; Christensen & Stordahl, 1955; Crouse & Idstein 1972; Dee-Lucas & Di Vesta, 1982; Mayer, 1980, 1983, Rickards & August, 1975; Wilhite 1988, 1989). Common to each of these studies is the use of comprehension aids. Comprehension aids are defined as any structure either provided for or generated by the reader which guides or aids a reader's processing of an expository text. Snowman (1986) suggests two comprehension aids, memory-directed and comprehension-directed, which promote storage and retrieval of ideas and promote understanding and interrelation of ideas from a text, respectively. For example, memory-directed tactics include underlining, summarizing, and mnemonics. Comprehension-directed tactics include questioning, note-taking, and text analysis which includes creating headings.

Similarly, Mayer (1984) discusses these learning tactics as well as one he calls integration. Integration aids the reader in building connections between the material in the text and the reader's prior knowledge, in an attempt to promote transfer of the material in the text to new situations or problem-solving tasks.

Given the different studying strategies suggested by Mayer (1984) and Snowman (1986) it seems that unguided readers may process and retain very different information from a text. The meaningfulness of what is retained depends on the desired learning outcome and the degree to which the processing approach matches it. Some readers may recall only isolated factual information from the text. Some readers may recall the organization and interrelationship among ideas in the text. Finally, some readers may understand the information thoroughly enough to apply it to new problem solving situations. Thus it seems that for optimal text processing two components must be present: reader processing that is consistent with the requirement of the learning outcome and an active reader.

Transfer Appropriate Processing

The processing a reader uses during reading determines what the reader comprehends from the passage. However, by knowing the way in which the information is to be used at the completion of reading, the reader can engage in a processing orientation that will optimize his/her comprehension for the desired learning outcome. Transfer appropriate processing suggests that different processing orientations may be the result of the orienting task performed on incoming stimuli, thus different processing orientations allow people to acquire different types of information each with the potential to be equally strong and durable depending on the criteria measure (Morris, et al. 1977). Morris et al., for example, investigated the effects of semantic orienting tasks and rhyme orienting tasks for recall of target words. Subjects who performed semantic orienting tasks scored significantly higher on the semantic recognition tests, and subjects who performed rhyme orienting tasks scored significantly higher on rhyme recognition tests. Similar results were found by Stein (1978) and Stein, Morris, and Bransford (1978). Morris et al. concluded that shallow levels of processing are not necessarily inferior to deeper levels of processing. Instead the shallow

levels of processing may look inferior to the deeper levels of processing if the tests or tasks to be completed following the processing are not directly related to what was learned during acquisition. When applied to reading, transfer appropriate processing theory (Morris, Bransford, & Franks, 1977) suggests that readers process text differently depending on their goal for reading or their desired learning outcome. Therefore, if the desired learning outcome after reading an expository text is to recall or remember the facts in the text, it seems that the reader should engage in memory-oriented processing. Likewise, if the desired learning outcome after reading an expository text is to organize and structure the information in the text, the reader should engage in organization-oriented processing. Finally, if the desired learning outcome after reading an expository text is to apply the information to novel problems, the reader should engage in understanding-oriented processing. Based on the transfer appropriate processing theory readers who process a text in a mode similar to the desired learning outcome should perform better on that outcome than those readers processing the text in a different processing mode.

Generative Learning

The second component to optimize learning from text is for the reader to be active. An active reader is one who is constructs meaning and interprets the material in the text (Wittrock, 1974 & 1990). Exactly what a reader is processing during the time of reading is not clear. Anderson (1970) points out that the reader may be reading every line of text, skimming the lines or pages of the text, skipping the difficult sections in the text, reading the words but not actively relating them with the other previously read words, and the like. Comprehension aids can be used to actively engage readers while reading a text. These aids can be provided for the reader in the text or generated by the reader. The question is which one results in better comprehension?

Research by Rothkopf (1970) demonstrates that a reader's activities during reading or learning determines the cognitive processing of the information which in turn determines what is learned. This is referred to as mathemagenic activities, "those student actions that are relevant to the achievement of specified instructional objectives" (Rothkopf, 1970, p. 325). Similarly, Wittrock (1974) suggests for "good" comprehension to occur during reading, the mind cannot be passive, it

must be actively engaged. Wittrock refers to this as generative processing, rooted in the generative model of learning. This model of learning suggests that people generate perceptions and meanings which are consistent with their prior knowledge. When generative learning is applied to reading, it suggests that comprehension of a text is enhanced when the reader actively constructs relations among parts of the text and between the text, prior knowledge, and world experience. Based on the generative theory, readers who perform generative activities should remember and understand more material from text than readers who perform no generative activity. However, mixed results have been reported regarding the effectiveness of reader-generated versus text-based comprehension aids. In some cases readers engaging in generative activities remember more and in other cases readers given text-based aids remember more, leaving the impact of these kinds of studying activities unresolved.

The present study investigated the effects of different acquisition processing orientations (memory-oriented processing, organization-oriented processing, and understanding-oriented processing) and reader activity on what is learned by college readers from an expository text. The specific questions under consideration in this study included: (1) What are the differential effects of processing orientations on a reader's comprehension of expository text in terms of the recall of facts and details, knowledge of structure and location of events, and ability to apply the information from an expository passage to new situations? Do the three processing orientations differ in their effectiveness as related to the criterion measures, as predicted by the transfer appropriate processing theory? (2) What are the effects of reader-generated versus text-based comprehension aids on a reader's recall of facts and details from an expository text, knowledge of structure and location accuracy of events in the expository text, and ability to apply the information from an expository passage to new situations?

Methods

Design

Subjects were randomly assigned to one treatment in a 4 x 2 design using processing orientations and comprehension aids as the two between subjects variables. Processing orientation had four conditions: memory-oriented processing, organization-oriented processing, understanding-oriented processing, and a control condition. Comprehension aid had two conditions: reader-generated and text-based.

Subjects

The subjects were 136 undergraduates enrolled in an introductory educational psychology course during the fall semester at a large public university. All conditions contained 17 subjects.

Materials

Passages

The study used an expository passage about radar that was adapted from Mayer's (1983) study. The same passage was used in all treatments. It consisted of 82 idea units and 5 paragraphs each discussing a separate aspect of radar. With the exception of the first paragraph the information contained in the paragraphs of the passage was the same for all treatments. For six of the treatments the first paragraph contained an additional sentence. This was included to keep the number of idea units equal among the passages. The additional sentence was not present in the other two treatments and the information contained in this sentence was not required in answering any of the test questions. The major difference among the passages was the manner in which selected information or concepts were presented for or generated by the reader.

Measures

Pre-and-Post-Treatment Questionnaires

The subjects completed a pre- and post-treatment questionnaire assessing their knowledge of radar. It was important that the subjects were not experts on this topic to ensure that the results obtained from the dependent measures were due to the treatments and not the subjects' prior knowledge on this topic.

The pre-treatment questionnaire asked the subjects to assess their knowledge of radar. Sixty-five percent of the subjects stated that they knew very little or less than the average person. The remaining thirty-five percent of the subjects stated they knew as much as the average person. The post-experiment questionnaire asked the subjects to assess how much of the information presented in the passage they already knew. Eighty-eight percent of the subjects stated that they knew less than half or none of the information presented in the passage. The remaining twelve percent stated that they knew about half of the information presented in the passage. Only four percent of the subjects stated that they had taken courses in college that briefly discussed the topic of radar.

Treatments

Memory-Oriented Processing

Memory-oriented processing treatment guided readers to memorize important facts and details through the use of underlining. In the text-based memory (TBM) treatment the subjects' attention was focused by underlining facts and details in the passage. An example of a sentence from the TBM treatment with underlining provided to the reader was as follows: "The letters of the word radar stand for radio detecting and ranging."

In the reader-generated memory (RGM) treatment the subjects underlined facts or details they considered to be important within the passage. In order to underline important facts and details the subjects needed to process the facts and details within each sentence to ascertain which information was important enough to be underlined.

Organization-Oriented Processing

The organization-oriented processing treatment guided readers to build internal connections within the text by organizing the information through the use of headings. In the text-based organization (TBO) treatment the headings were provided. The passage contained short headings and subheadings to provide a structured passage for the subjects. An example of part of the passage with a section heading and subheading from the TBO treatment is as follows:

Display Systems for Radar

Early Models

It is easiest to understand how radar is displayed if you begin with one of the earliest models used around the 1930's. This type of display was able to focus the broad radar pulse onto a single beam of light which proceeded from the left of the screen to the right. When no object impedes the traveling radar pulse, it continues its travel until lost from the screen on the right.

In the reader-generated organization (RGO) treatment the subjects created a heading for each of several paragraphs, prompted by lines where headings were needed. It was felt that generating headings required the subjects process the information in each paragraph or groups of paragraphs and impose an organization or structure to the passage. An example from the RGO treatment with the section heading and subheading prompts is as follows:

It is easiest to understand how radar is displayed if you begin with one of the earliest models used around the 1930's. This type of display was able to focus the broad radar pulse onto a single beam of light which proceeded from the left of the screen to the right. When no object impedes the traveling radar pulse, it continues its travel until lost from the screen on the right.

Understanding-Oriented Processing

The understanding-oriented processing treatment guided readers to build external connections between the text and prior knowledge through the use of analogies. In the text-based understanding (TBU) treatment the analogies relating to the content were provided. The passage contained analogies relating an aspect of radar to a common everyday occurrence that would be more easily understood by the subjects. The subjects were instructed to think how the analogy related to the radar concept being discussed. An example of a complete analogy provided in the TBU treatment is as follows:

> Radar waves hitting a remote object and reflecting back would be similar to a ball hitting a wall and reflecting back because radar, like the ball, hit the object and reflect back to the receiver.

In the reader-generated understanding (RGU) treatment the subjects were asked to complete an analogy embedded in the passage. For example, in the first paragraph of the RGU treatment the subjects were asked to complete the following analogy:

Radar waves hitting a remote object and reflecting back would be similar to a ball _____ because radar like the ball _____.

It was felt that completing the analogies caused the subjects to process the information and relate it to a common occurrence or event to make the unfamiliar concept of radar more familiar. In this way the readers may understand the information better by relating it to their prior knowledge or experience.

Control Condition

The control condition served as a comparison treatment for the other processing orientations to determine if the processing orientations were indeed having an effect on the readers' processing of the text. There were control conditions for both the reader-generated and text-based comprehension treatments. The text-based control (TBC) treatment consisted of providing a passage with irrelevant headings such as "Section 1", "Section 2", "Details", and "More Details." The subjects were explicitly asked to read the passage without taking notes, underlining, or outlining the passage. A paragraph from the TBC treatment is as follows:

Details

Section 1

To send out the radio waves a radio transmitter is connected to a directional antenna which sends out a stream of short pulses of radio waves. The first radio pulse that is transmitted consists of small waves that continue to grow outward. Usually both a transmitter and a receiver are employed separately, but it is possible to use only one antenna in which pulse transmission is momentarily suppressed to enable the antenna to receive echo pulses.

The reader-generated control (RGC) treatment was a passage with only paragraph indentations. The subjects were allowed to perform any studying activity they normally would use while reading text. Unlike the TBC condition they were not prevented from taking notes, underlining or outlining if that was their typical strategy. An example of a paragraph from the RGC treatment is:

To send out the radio waves a radio transmitter is connected to a directional antenna which sends out a stream of short pulses of radio waves. The first radio pulse that is transmitted consists of small waves that continue to grow outward. Usually both a transmitter and a rreceiver are employed separately, but it is possible to use only one antenna in which pulse transmission is momentarily suppressed to enable the antenna to receive echo pulses.

Dependent Measures

Five dependent measures were used to assess the subjects' retention of the passage: cloze test, verbatim recall test, a location accuracy test, an outlining test, and a problem solving test. Because the tests measured similar constructs the cloze test and verbatim recall test were combined to give a memory score, the location accuracy test and outlining test were combined to give an organization score, and the problem solving test was the understanding score.

Scoring

The items on each of the measures were scored as correct or incorrect. No partial credit was given.

Memory Test. Both the cloze and verbatim recall measures had only one acceptable answer for each question. These measures tested recall for basic facts and details from the passage, therefore, only exact words or phrases stated in the passage were accepted as correct answers.

Organization Test. The location accuracy measure had one acceptable answer for each question. The subjects placed the question number beside the paragraph containing the answer or they were incorrect. The outlining measure contained seven blank lines corresponding to the structure of the passage. The subjects were to write appropriate headings and subheadings on the lines provided. The outlining measure was scored by comparing the headings given by the subjects to the actual headings and subheadings provided in the text-based organization treatment. In the reader-generated organization treatment the subjects generated their own headings and subheadings during the reading of the passage. It was assumed that they would better remember the headings which they generated so the headings and subheadings generated the previous day by the subjects served as the correct responses to which the headings on the outlining measure were compared.

Understanding Test. The problem solving measure contained seven questions about radar concepts discussed in the passage. The experimenter generated an answer key to serve as the bases for evaluation of the answers. The answer key was developed through readings on the topic of radar and a pilot study.

Procedure

The study was conducted during two consecutive days. On the first day students were randomly assigned to a treatment and were given a packet of materials. First the subjects answered the prereading questionnaire to assess their prior knowledge of radar. After everyone completed the questionnaire, the subjects read the radar passage and engaged in the activities related to their treatment, as described previously. The specific directions for each treatment were presented in written form with the passage. Subjects in the text-based conditions were told to pay specific attention to the comprehension aid provided. Subjects in the reader-generated conditions were given examples of how to perform the generated activity. All subjects were encouraged to ask questions if the directions were unclear to them. If the subjects completed their reading before time was up, they were instructed to continue to study the passage material using the comprehension aid provided or generated in their passage. The time allocated for reading was determined by the time needed by the RGO and RGU treatments, which had been found to be the most time consuming treatments in the pilot study. The first day took approximately 20 minutes.

On the second day the subjects completed the dependent measures and a post-experiment questionnaire. The subjects were told to work at their own pace. The experimenter stressed that once a task or page was completed it should not be referred to again. The post-experiment questionnaire assessed how much of the information presented in the passage the subjects already knew. The second day took approximately 40 minutes.

Results

The data were analyzed with a 4 x 2 multivariate analysis of variance (MANOVA). The MANOVA was used to control for the intercorrelations between the dependent measures all of which measured different facets of reading comprehension. The MANOVA yielded a significant main effect for the Comprehension Aid (F (3,126) = 3.54, $p < .05$) and Processing Orientation (F (9,307) = 10.79, $p < .05$). The interaction between the Comprehension Aid and Processing Orientation was not significance (F (9,307) = 1.39, $p > .05$). The significant MANOVA for the

Processing Orientation and the Comprehension Aids indicated that each of these treatments did cause differences on a composite of the dependent variables. Separate ANOVAs were conducted for each of the dependent measures to investigate the nature of the significant main effects indicated by the MANOVA.

Memory Test

The memory test score was the percentage of correct responses on the fill in the blank measure plus the percentage of correct responses on the verbatim recall measure divided by two to obtain an average score. The ANOVA indicated a significant main effect for Comprehension Aid (F (1,128) = 6.01, $p < .05$). Readers who had the text-based comprehension aid (M = 59.14) scored significantly higher than those in the reader-generated condition (M = 52.83, see Table 1). The ANOVA also indicated a significant main effect for Processing Orientation (F (3,128) = 7.21, $p <$ .05). Subsequent multiple comparisons indicated that memory-oriented processing resulted in a significantly higher mean on the memory test than the understanding-oriented processing. No significant differences resulted among the memory-oriented processing, organization-oriented processing, and the control condition.

Insert Table 1 here

Organization Test

The organization test score was the percentage of correct responses on the location accuracy measure plus the percentage of correct responses on the outline measure divided by two to obtain an average percentage between the two measures. The ANOVA indicated a significant main effect for Comprehension Aid (F (1,128) = 16.39, $p < .05$). Readers who had the text-based comprehension aid (M = 44.07) scored significantly higher than those in the reader-generated conditions (M = 35.48, see Table 2). The ANOVA also indicated a significant main effect for Processing Orientation (F (1,128) = 16.39, $p < .05$). Subsequent multiple comparisons indicated that organization-oriented processing resulted in a significantly higher mean on the organization test than the other two processing orientations and the control condition.

Insert Table 2 here

Understanding Test

The understanding test score was the percentage of correct responses on the problem solving measure. There were no significant main effects. However, the means for Processing Orientation are in the direction hypothesized (see Table 3). The effects of understanding-oriented processing produced better, although not significantly better, performance on the understanding test than the other processing orientations and the control condition.

Insert Table 3 here

Discussion

The results of this study partially support the hypotheses that the processing orientation used by readers relates to the comprehension readers have of the passage information. When the processing orientation and the comprehension assessment match, readers score higher on comprehension. When they do not match, the processing orientation does not seem effective. The results did not support the hypothesis that readers generating comprehension aids would retain and understand significantly more information from the text. Instead readers who were provided with text-based comprehension aids scored significantly better on all the dependent measures than did readers generating comprehension aids.

Effects of Processing Orientation

Memory Processing. Readers who read the text using memory-oriented processing scored significantly higher on the memory test than did readers who read the text using understanding-oriented processing. This result supports to some degree the hypothesis that readers will retain different information from text depending on their processing mode or studying strategy.

There were, however, no significant differences between readers using memory-oriented processing and those using organization-oriented processing and the control condition. When considering the nature of the treatments and the passage content these results are not surprising. The readers in all conditions lacked significant prior knowledge about the topic of the passages,

radar. Mayer (1984) suggests that when readers lack prior knowledge about the topic and when the text gives no information as to what is important, readers default to processing the topic sentences and basic information such as definitions and formulas. In the organization and control treatment the readers may have defaulted to simply processing the important facts and details in the passage because they lacked prior knowledge or cues to do otherwise. Therefore, the default condition would be similar to the kind of studying or processing of text used in the memory-oriented treatment, a likely cause in the lack of difference between the memory-oriented treatment and the control.

An alternative explanation for lack of significant difference between the organization-oriented processing and the memory-oriented processing is that the headings generated or provided during organization-oriented processing may have served as a framework for the readers to integrate the important facts and details. Such an organizational framework would facilitate the retention and recall of details from the passage as well as higher-level concepts. Brown and Smiley (1978) found that college students recalled more essential details when they divided a text into relevant and irrelevant ideas units and related them to the theme of the passage. The relevant idea units served as a framework to structure the passage and the details could be integrated. Providing an organization for the passage, as in the organization processing treatments may have provided a useful top-level structure for the content which then may have facilitated the recall of relevant details from the text.

Organization Processing. Readers processing the text using organization-oriented processing scored significantly higher on the organization test than did readers processing the text using other processing orientations. This result gives support to the hypothesis that processing orientation or studying strategy will affect what information is retained. As suggested by the transfer appropriate processing theory (Morris et al., 1977), the correspondence between the initial processing during reading and studying and the outcome measures was optimized by the congruence between readers who used organization-oriented processing and the organization test. This helped the readers score

significantly higher on the organization test than the other processing orientations and the control condition, thus providing additional support for the notion of transfer appropriate processing.

Understanding Processing. None of the processing orientations had a significant effect on the understanding test. An inspection of the means does suggest that understanding-oriented processing resulted in a somewhat higher mean on this test (see Table 3). A re-examination of the analogies provided for or generated by the readers in the understanding-oriented processing suggests that there may have been a lack of congruence between them and the questions on the problem-solving test. Such an incongruence would inhibit the benefits of understanding-oriented processing. According to the transfer appropriate processing theory (Morris et al., 1977), optimal processing occurs when the acquisition processing matches the desired learning outcome. In this case it may be that the analogies provided for or generated by the readers were not addressed by the questions on the understanding test. Thus the transfer of the understanding-oriented processing to the problem solving measure may not be seen due to the inappropriateness of this measure.

Effects of Comprehension Aids

Readers provided with text-based comprehension aids performed better on all the dependent measures than readers generating their own comprehension aids. These results are inconsistent with much of the research which suggests that reader-generated activities increase comprehension (Anderson, Goldberg, & Hidde, 1971; Bobrow & Bower, 1969; Mistler-Lachman, 1974; Wittrock, 1974, cited in Rickard & August, 1975) and do not support the generative theory of learning.

However, these results can be interpreted according to the generative theory of learning. Readers who generate comprehension aids actively create links between new material and their prior knowledge which help them recall and understand more of the information presented in a text. Yet when readers lack sufficient prior knowledge the generative activities do not facilitate comprehension and recall. After reading the radar passage, 88% of the subjects in this study reported that they knew "less than half" or "none" of the information presented in the passage. The remaining 12% reported that they knew "only half" of the information presented in the passage.

Therefore, all of the readers were novices on the topic of radar. According to Bransford et al. (1982) novices lack the topical knowledge necessary to automatically assimilate new material with existing knowledge structures. Because generative learning is the process of building association between the ideas in the text and linking the ideas with prior knowledge (Wittrock, 1990), the readers in the reader-generated comprehension aid treatments were unable to engage in quality generative processing that is necessary to result in improved performance on comprehension and retention of text information. Although the readers performed the generative tasks, the readers were unable to structure the new information from the passage into meaningful text representations. Instead, they stored the information as isolated units of information.

Readers provided with the text-based comprehension aid were able to use the comprehension aids to organize the text information. They created links among the ideas in the text and structured the information into meaningful textual representations using the comprehension aid as a framework. Despite their lack of prior knowledge, readers who received text-based comprehension aids were able to perform better on all the measures because the structure provided aided their comprehension and retention of the information in the text.

Conclusions

Based on the results of this study two conclusions can be made. First, teachers should determine a reader's amount of prior knowledge on the reading topic before encouraging the reader to engage in a generative activity. If the reader lacks sufficient prior knowledge the generative activity will simply be a task for the reader to complete and will not enhance the reader's comprehension and retention of the information in the text. The readers can complete the activity, but the new material from the text seems to be processed as isolated information without adequate structure. Because generative learning is the process of building associations between the ideas in the text and linking these ideas with prior knowledge (Wittrock, 1990), prior knowledge is a necessary component for effective generative processing.

When readers lack prior knowledge the teacher should provided text-based comprehension aids to facilitate comprehension and retention. Readers can use the comprehension aid to guide their processing of the new material. The text-based comprehension aid provides an organization to the information and allows the reader to integrate the new material as it relates to the provided comprehension aid. In this case the comprehension aid serves as a substitute for the prior knowledge which is lacking.

The second conclusion is that the way students read and study text information affect what they comprehend and recall. Readers should set goals for themselves or they should be informed prior to reading a text how they will be required to use the new material from the text following reading. Optimal comprehension and retention will result if the initial processing or study strategy parallels the desired learning outcome. If a reader's goal is to recall the facts and details, the reader should focus his/her attention on the facts. Likewise, if the reader's goal is to structure the text, the reader should focus his/her attention on the structure of the passage and construct relationships among the ideas in the text. Finally, if a reader's goal is to apply the text information to novel or problem solving situations than the reader should focus his/her attention on relating the text information to prior knowledge. This integrated knowledge can then be used in new situations.

The design of the study to some degree limits conclusions to be drawn regarding the superiority of reader-generated versus text-based comprehension aids. The study used a passage topic that was unfamiliar to the subjects. This suggests that the readers in the reader-generated condition did not have adequate prior knowledge to build meaningful text representations of the new information. Even though the readers in the text-based comprehension aid treatments also lacked prior knowledge, they were able to use the comprehension aids in the text as a guide to create relations among the information in the text. In turn this helped them perform better on all the measures than the reader-generated comprehension aid treatments. Further research is needed to determine the effectiveness of reader-generated versus text-based comprehension aids for a familiar passage topic.

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Table 1

Memory Test Means for Processing Orientation and Comprehension Aid

Processing Orientation	Comprehension Aid: Reader-Generated			Comprehension Aid: Text-Based			Processing Orientation (Row) Means	
	Mean	SD	n	Mean	SD	n	Mean	SD
Memory-Oriented	58.46	15.96	17	63.75	14.84	17	61.10	15.41
Organization-Oriented	49.56	13.14	17	59.19	11.43	17	54.38	13.07
Understanding Oriented	44.78	14.86	17	48.97	15.71	17	46.88	15.22
Control Condition	58.52	16.99	17	64.63	16.28	17	61.58	16.68
Comprehension Aid (Column) Means	52.83	16.11	68	59.14	15.67	68		

Table 2

Organization Test Means for Processing Orientation and Comprehension Aid

Processing Orientation	Comprehension Aid: Reader-Generated			Comprehension Aid: Text-Based			Processing Orientation (Row) Means	
	Mean	SD	n	Mean	SD	n	Mean	SD
Memory-Oriented	25.74	12.66	17	41.28	18.92	17	33.51	17.71
Organization-Oriented	50.32	26.88	17	70.80	26.19	17	60.56	28.13
Understanding Oriented	29.52	15.36	17	32.46	15.28	17	30.99	15.15
Control Condition	36.34	20.33	17	31.73	20.19	17	34.03	20.09
Comprehension Aid (Column) Means	35.48	21.33	68	44.07	25.66	68		

Table 3

Understanding Test Means for Processing Orientation and Comprehension Aid

Processing Orientation	Comprehension Aid: Reader-Generated			Comprehension Aid: Text-Based			Processing Orientation (Row) Means	
	Mean	SD	n	Mean	SD	n	Mean	SD
Memory-Oriented	41.18	23.08	17	38.66	20.05	17	39.92	21.33
Organization-Oriented	31.93	22.88	17	49.58	23.21	17	40.76	24.40
Understanding Oriented	53.78	25.52	17	47.06	20.68	17	50.42	23.13
Control Condition	43.70	28.33	17	37.82	24.71	17	40.76	26.35
Comprehension Aid (Column) Means	42.65	25.71	68	43.28	22.35	68		