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The effects of reading and writing upon thinking critically

THE MAJOR question driving this study was whether writing in combination with reading prompts more critical thinking than reading alone, writing alone, or either activity combined with questions or with a knowledge activation activity. To answer this question, the authors randomly assigned 137 undergraduate students to one of 12 treatment groups involving combinations of the following conditions in relation to one of two topics: (a) an introductory activity (writing a letter to the editor, engaging in a knowledge activation task, or no activity); (b) a reading condition (reading or not reading an editorial passage about the topic); and (c) a question condition (answering or not answering questions related to the topic). Subsequent to these activities, all subjects wrote a letter to the editor (or a second draft if they had already written one) and responded to debriefing questions about the tasks. Analyses were conducted of the subjects' letters and revisions, responses to the questions, and debriefing comments. Significant differences emerged between students who both wrote and read and students in any of the other treatment groups. For example, an examination of the revisions suggested that students who both wrote and read produced significantly more changes than students who wrote but did not read. And, if thinking critically entails a greater willingness to revise one's position on an issue, then the data from the debriefing comments suggest that reading and writing in combination are more likely to prompt critical thinking than when reading is separated from writing or when reading is combined with knowledge activation or answering questions.

Les effets de la lecture et de l'écriture sur la pensée critique

LA QUESTION au coeur de cette recherche: est-ce que l'écriture favorise davantage la pensée critique lorsqu'elle est associée à la lecture, que lorsque l'une ou l'autre est exploitée seule ou lorsque l'une ou l'autre est combinée avec des questions ou avec des activités d'activation de connaissances? Pour répondre à cette question, les auteurs ont assigné au

hasard 137 étudiants américains à l'une des 12 conditions expérimentales définies par la combinaison de chacune des activités suivantes réalisées autour de deux thèmes différents: (a) une activité de pré-lecture (écrire une lettre à un éditeur, participer à une activité d'activation de connaissances, aucune activité); (b) une activité de lecture (lire ou ne pas lire un texte éditorial sur un des thèmes); (c) une activité de questionnement (répondre ou ne pas répondre à des questions reliées aux thèmes). A la suite de ces activités, les sujets devaient écrire une lettre à un éditeur (une seconde version, s'ils en avaient déjà écrit une) et répondaient à des questions sur les tâches dans le cadre d'une entrevue. Les données ont été recueillies à partir des lettres produites, des réponses aux questions et des commentaires recueillis au cours des entrevues. Les résultats montrèrent des différences significatives entre les sujets soumis aux conditions combinant lecture et écriture et ceux soumis aux autres conditions. Par exemple, on observa beaucoup plus de changements entre les deux versions de lettres chez les sujets qui ont été soumis aux deux activités combinées (lecture et écriture), que chez les sujets qui n'ont pas lu le texte. De même, selon l'évidence des commentaires, ces sujets ont modifié plus fréquemment leur position par rapport au sujet traité que les sujets des autres groupes ce qui constitue un autre indice de pensée critique.

Los efectos de la lectura y escritura en el pensamiento crítico

LA INTERROGANTE más importante atrás de este estudio fue descubrir si la escritura en combinación con la lectura promueve más el pensamiento crítico que la lectura por sí misma, la escritura por sí misma, o cualquiera de las dos actividades combinadas con preguntas o con una actividad activadora de conocimiento. Para responder a esta pregunta, los autores asignaron al azar a 137 estudiantes universitarios estadounidenses, a una de 12 tratamientos involucrando combinaciones de las siguientes actividades, en relación con uno o dos temas: (a) una condición de prelectura (escribir una carta al editor, involucrarse en una tarea de activación de conocimiento, o ninguna actividad); (b) una condición de lectura (leer o no leer un pasaje editorial sobre el tema); y (c) una condición de preguntas (contestar o no preguntas relacionadas al tema). Subsecuentemente a estas actividades, todos los sujetos escribieron una carta al editor (o un segundo borrador si ya habían escrito una) y respondieron a preguntas de sondeo sobre las tareas. Se condujeron análisis de las cartas de los sujetos y de las revisiones, de las respuestas a las preguntas y los comentarios de sondeo. Se encontró que hubo diferencias significativas entre los estudiantes que hicieron ambas cosas, escribir y leer; y todos los demás estudiantes en los otros tratamientos. Por ejemplo, un examen de las revisiones sugiere que los estudiantes que escribieron y leyeron, tuvieron significativamente más cambios que los estudiantes que sólo escribieron pero no leyeron. Y, si el pensar de forma crítica entraña una actitud más positiva a cambiar de opinión sobre un tema, entonces los datos de los comentarios de sondeo sugieren que la combinación de lectura y escritura promueven más fácilmente el pensamiento crítico que cuando se separa la lectura de la escritura o cuando la lectura se combina con la activación de conocimiento o con preguntas.

Die Auswirkungen des Lesens und Schreibens auf kritisches Denken

DIE HAUPTFRAGE, die sich hinter dieser Studie versteckte, war, ob Schreiben zusammen mit Lesen ein verstärktes kritisches Denken hervorrufen würde als Lesen allein, Schreiben allein oder eine dieser beiden Aktivitäten verbunden mit Fragen oder mit einer Übung, die Wissen aktiviert. Um diese Frage zu beantworten, wiesen die Verfasser 137 amerikanischen Studenten willkürlich einer von zwölf Situationen zu. Bei diesen Situationen handelt es sich um Kombinationen der folgenden Aktivitäten in bezug auf eins von zwei Themen: (a) eine Übung vor dem Lesen (einen Brief an den Redakteur schreiben; an einer Übung teilnehmen, bei der Wissen abgerufen wird; oder keinerlei Aktivität); (b) eine Lesehandlung (Lesen oder Nicht-Lesen eines Leitartikels oder Teils eines Leitartikels über das Thema); (c) eine Befragungsübung (Beantworten oder Nicht-Beantworten von Fragen, die sich aufs

Thema beziehen). Im Anschluß an diese Aktivitäten schreiben alle Teilnehmer entweder einen Brief an den Redakteur oder einen zweiten, falls sie bereits einen geschrieben hatten, und antworteten auf Abschlußfragen zu diesen Aufgaben. Die Briefe und Revisionen, Antworten auf die Fragen und Abschlußbemerkungen wurden dann ausgewertet. Wesentliche Unterschiede machten sich zwischen den Studenten, die lasen und schrieben, und denen, die in irgendeiner der anderen Situationen teilnahmen, bemerkbar. So deutete z.B. eine nähere Untersuchung der Revisionen darauf hin, daß die Studenten, die schrieben und lasen, wesentlich mehr Aenderungen durchführten als diejenigen, die zwar schrieben, dafür aber nicht lasen. Falls kritisches Denken eine größere Bereitschaft zum Aendern des eigenen Standpunkts herbeiführen sollte, dann lassen die Daten der Abschlußbesprechung vermuten, daß Lesen und Schreiben zusammen eher ein kritisches Denken wecken als wenn Lesen und Schreiben getrennt werden oder wenn Lesen zusammen mit einer Wissensaktivierung oder-befragung auftritt.

In our view, thinking critically involves the ongoing judgment of one's own thinking, a view which is consistent with the spirit of Ennis' current definition: "Critical thinking is reasonable reflective thinking that is focused on deciding what to believe and do" (Ennis, 1987). Critical thinking entails making a commitment to thinking about ideas—ideally, from different perspectives—as well as thinking about the quality and nature of that thinking. Our notion is consistent with Booth's (1974) contention that to be "genuinely critical" is "to judge on the basis of thought," or, as Dewey (1908) argued, "to maintain the state of doubt at the same time as systematic and protracted inquiry" is carried on.

Separately, the acts of reading and writing have been touted as powerful instruments for learning, capable of enabling thinking and the critical analysis of ideas (Applebee, 1984; Langer & Applebee, 1987; Tierney & McGinley, 1987). For example, in his often cited article "Reading as Reasoning," E.L. Thorndike (1917) describes reading as

...a very elaborate procedure, involving a weighing of each of many elements in a sentence, their organization in the proper relations one to another, the selection of certain connotations and rejection of others and the cooperation of many forces to determine final response. (p. 23)

Gage describes a similar relationship between writing and thinking in his chapter, "Why

Write?" in the recent NSSE volume on the teaching of writing (1986). As he states,

Writing is thinking made tangible, thinking that can be examined because it is on the page and not in the head, invisible floating around. Writing is thinking that can be stopped and tinkered with. It is a way of holding thought still long enough to examine its structures, its possibilities, its flaws. The road to a clearer understanding of one's thoughts is traveled on paper. It is through an attempt to find words for ourselves in which to express related ideas that we often discover what we think. (p. 24)

Unfortunately, the potential of reading and writing activities to enable thinking and learning often goes unrealized in instructional settings. Spiro (1980) contends that many readers give the text an autonomy which detracts from their effective engagement with the ideas. Indeed, surveys of the study habits of secondary students suggest that textbook material is read only once, with the goal of memorizing (Schallert & Tierney, 1982). Not surprisingly, assessments of reading performance indicate that most secondary school students tend to be unable to respond evaluatively to what they read, often remaining "satisfied with initial interpretations" and demonstrating "little evidence of well-developed problem-solving strategies or critical thinking" (National Assessment of Educational Progress, 1981; 1985, p. 2).

With regard to writing, a similar situation exists. In two recent investigations of secondary

school writing, the writing tasks used most frequently were mechanical in nature, such as multiple-choice or fill-in-the-blank tasks, note-taking, and short-answer activities (Applebee, 1981; Langer & Applebee, 1987). These studies also found that the majority of students' writing was undertaken for the purpose of "helping students remember information" and "to discover whether students had learned relevant content" (Applebee, 1981, p. 60). Writing activities that functioned as tests of knowledge of the subject matter were seldom used as vehicles for fostering critical inquiry into a topic.

Our interest in examining the effects of conjoining reading and writing is related to claims researchers have made about the power of reading and writing to enhance thinking. Mackie (1981) has argued that "to be literate is not to have arrived at some predetermined destination, but to utilize reading, writing, and speaking skills so that our understanding of the world is progressively enlarged" (p. 1). In a similar vein, Freire and Macedo (1987; Freire, 1982), and Walters, Daniell, and Trachsel (1987) have argued that "the ability to use appropriate discourse forms to accomplish desired ends" is crucial to the development of a critical consciousness (Walters et al., 1987, p. 860). In this sense, reading and writing represent the means by which students can think and learn, both in school and in their daily lives (Freeman & Sanders, 1987; Walter et al., 1987). Indeed, a panel of educators discussing the use of reading and writing in biology recently made similar claims regarding the power of conjoining reading, writing, speaking, and listening:

A learner is only a partial biologist, for instance, if he cannot read or write to discover information and meaning in biology. When a student takes the results of his or her observations about lobsters, reads, writes a draft, talks, reads, then writes again, he or she learns what it is to think critically as a biologist. (Guthrie, 1986, p. 15)

Recently, instructional reformers have advocated the conjoining of reading and writing as a means to improve students' thinking and reasoning ability in a variety of situations. For ex-

ample, Mariana Salvatori (1985) has claimed that, in doing reading and writing together, students engage in a type of dialectic. For example, students who write in conjunction with reading literature seem to be more critical of their own thinking, as well as of the thinking of the authors they are reading. Similar claims have been made by researchers in the content areas, including advocates of writing across the curriculum (Fulweiler & Young, 1982; Martin, 1975) and researchers exploring the nature of students' thinking when they engage in reading and writing in various subjects (Langer & Applebee, 1987; Newell, 1984; Tierney & McGinley, 1987).

In this study, we also examined the effects of questioning and of background knowledge activation upon critical thinking. Various researchers have examined the mathemagenic functions of questions (Reynolds & Anderson, 1982; Rothkopf, 1970) and have shown that questions affect the amount and type of information students focus on as they read and write. Similarly, some studies of background knowledge, and a large cadre of educators, support the hypothesis that background knowledge activation activities enhance learning (Anderson & Pearson, 1984; Langer, 1984; Lipson, 1982; Tierney & Cunningham, 1984). What we wanted to examine in this study was the impact that questions and background knowledge activation might have upon "deciding what to believe and do" (Ennis, 1987).

In summary, our goal in this study was to examine conditions that might detract from or contribute to thinking critically. We viewed the study as a first step toward filling the research gap noted by Applebee: "We have yet to develop a convincing research base for the argument that writing activities can make a significant contribution to the development of higher reasoning skills" (Applebee, 1986). Based on our review of the research and of commentaries on educational practice, we decided to examine the effects on students' thinking of writing with reading in comparison to the effects of two other activities purported to increase critical thinking in reading: the activation of background knowledge and questioning.

Method

Subjects

The subjects for this study were 137 undergraduate students from two large universities in the Midwestern United States. Each subject was randomly assigned to one of 12 conditions and one of two selected topics.

Topics

The two topics will be referred to as "Baby Fae" and "Women in the Movies." There was one passage on each topic. The "Baby Fae" passage dealt with the infant who received the world's first nonhuman heart transplant. The "Women in the Movies" passage dealt with sexual discrimination, inadequate salaries, and the prevalence of male leads cast in major motion pictures. Both passages originally appeared in current, popular periodicals. We assumed most subjects had sufficient knowledge of each topic with which to construct a position, even if they were assigned to an experimental condition in which they did not read the passage before writing. The passages were revised slightly to make them approximately equal in length and to bring them up to date. For example, recent movies were added to the "Women in the Movies" article.

Procedures

Each subject was randomly assigned to one topic, and then to an experimental treatment involving one of 12 combinations of activities. For example, in one treatment group, students were asked first, as an introductory activity, to write an essay on a selected issue, then to read an article on the same topic, and then to answer questions about the topic. In another treatment group, students first performed a background knowledge activation task (e.g., brainstorming, in which subjects were asked to list ideas about the topic), then to read an article on the same topic, then to respond to questions. Each combination involved some introductory activity, a reading condition, and a question condition. The three conditions that were combined to form the various treatments were as follows:

1. *Introductory activity.* After a brief introduction, each subject was assigned to one of three treatments: (a) writing a letter to the editor on the assigned topic, (b) completing a knowledge activation activity on the assigned topic, or (c) no activity.
2. *Reading condition.* Students either read or did not read an editorial on the assigned topic.
3. *Question condition.* Students either answered or did not answer selected open-ended and multiple-choice questions on issues raised by the topic.

Finally, students in all treatment groups were asked to write a letter to the editor on the selected topic (or, if they had already written such a letter as the introductory activity, to revise it).

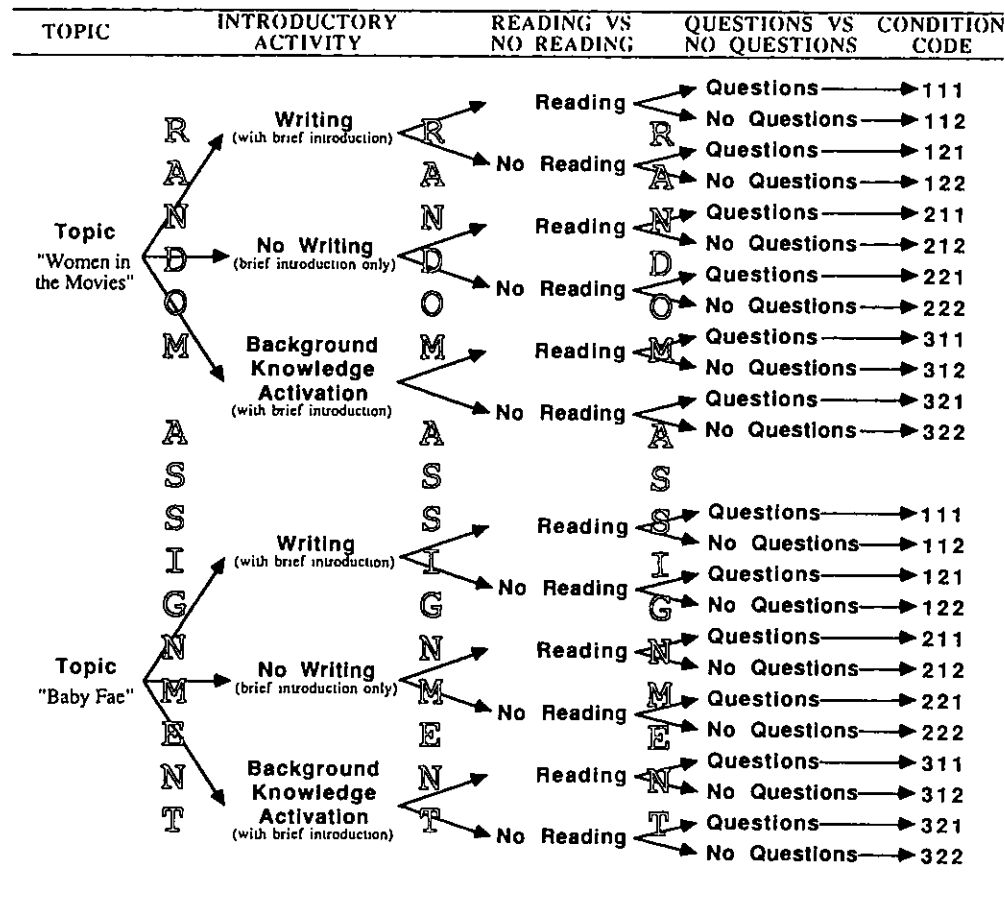
Figure 1 gives an overall sense of the design of the study and depicts the sequence and possible combinations of activities to which subjects were assigned. Each subject was randomly assigned to a topic and the equivalent of a single cell, which represented a combination of the introductory activity, reading condition, and question condition. For example, a subject who was assigned to Treatment 111 was asked to write a letter to the editor, to read an editorial concerning the appropriate topic, to answer questions about the topic, and finally to revise the letter to the editor he or she had written earlier. A subject assigned to Treatment 221 was asked only to answer the questions, then write a letter to the editor. A subject assigned to Treatment 311 first engaged in a knowledge activation task, consisting of listing everything he or she knew on either side of the issue, then read the editorial, answered questions, and finally wrote a letter to the editor.

Once all of the tasks in each treatment group had been completed, all subjects in all treatment groups were then asked to write or revise an essay and complete a range of debriefing questions. Examples of all the tasks and of the debriefing questions can be found in Appendix A.

Measures

The study was designed to allow us to examine the effects of writing, reading, and an-

Figure 1
Sequence of activities for each treatment group



swering questions both separately and in combination with one another. We examined the effects of writing alone, reading alone, reading and writing, reading and writing and answering questions, and so on.

We sought to include measures that would afford estimates both of students' ongoing thinking during these various activities, and of the products of this thinking. Product measures were all based on the students' writing. As mentioned earlier, all students were asked to write

an essay on the topic (in the form of a letter to the editor) after the completion of all other activities; those students who had already written an essay as the introductory activity were asked to revise it, and thus produced two drafts of the same essay. These writing samples were examined both quantitatively and qualitatively.

The first quantitative analysis was a simple count of the number of words used in each essay. Second, because word counts alone may fail to capture the number of ideas presented,

we also analyzed the number of T-units (Hunt, 1965) in each essay. Third, for those subjects who wrote two versions of the essay, we analyzed the types of revisions made from the first to the second draft. For this analysis, we used an adapted version of the revision coding scheme developed by Faigley and Witte (1981). In accord with this scheme, each change was labeled along two dimensions: the type of revision (addition, deletion, rewording, mechanics) and its effect upon the discourse. Each addition or deletion was further categorized as metalingual, an example, a superordinate idea, a subordinate idea, or a transition. Each rewording was further categorized as a paraphrase, a substitution, a permutation, a distribution, or a consolidation. Interrater agreement for the three raters ranged from .85 to .90 for the various categories. A copy of the revision coding scheme is included in Appendix B.

For the qualitative analyses, the essays were rated using a scale adapted from the holistic/analytic scoring scheme for persuasive writing suggested by the International Evaluation of Assessment of Written Composition (Purves, 1982). The main categories were as follows:

1. Scope and quality of content
2. Organization
3. Style, tone, appropriate wording
4. Mechanics and usage
5. General impression score
6. Overall effect

A scale of 1–5 (low–high) was used within each of the above categories. Interrater reliability ranged from .84 to .91 for the main categories described.

Changes in students' thinking may or may not be reflected in visible changes to drafts. As Witte (1985) has argued, changes in thinking may often be *pretextual*—that is, they may not be apparent unless one examines ongoing thought processes. Therefore, we asked students a series of debriefing questions regarding how the particular tasks (separately and in combination) facilitated their thinking. Answers to these questions were transcribed, and these debriefing comments were analyzed according to what reasoning operation (accessing, evaluat-

ing, organizing, etc.) the student appeared to have been using. Special attention was paid to those students who had written two drafts—that is, those students who were assigned to write the letter to the editor as an introductory activity, and then to rework or rewrite it after completion of all other activities. For this subpopulation, comparisons were made between the two versions of the essays, and the types of revisions students made were compared with their answers to the debriefing questions.

Results and discussion

Two sets of analyses will be discussed. The first set of analyses serves to address the major concern of the study: the effects of writing with and without reading. To address this question, we focused on those subjects who were assigned to write the essay as an introductory activity. Because these subjects later revised their essays, two drafts of their ideas were available. Furthermore, between drafts, some read and then answered questions, some did not read but did answer questions, some read but did not answer questions, and some neither read nor answered questions. By analyzing the changes made by these different groups in their revisions, along with their debriefing comments about their own thinking as they completed these various tasks, we could compare the effects of writing, reading, and answering questions, separately and in various combinations with each other.

The second set of analyses addresses a comparison of the effects of the various introductory activities (writing, background knowledge activation, and no activity), in combination with the other activities (reading or no reading, questions or no questions). Unfortunately, the data for these subjects were restricted to posttreatment measures only (essays and debriefing comments).

Effects of writing with reading

Our first set of analyses was designed to provide answers to the following questions:

Figure 2
Design of study

(Coding position: 1 = activity occurs; 2 = activity does not occur; 3 = knowledge activation activity occurs. Example: Treatment 111 = writing, reading, and questions.)

	Reading		No Reading	
	Questions	No Questions	Questions	No Questions
Writing	111	112	121	122
No Writing	211	212	221	222
Knowledge Activation	311	312	321	322

Across those treatments that involved writing, in combination with other activities, are there differences in the number of words, number of ideas, and types of revisions in the essays produced? If there are differences, how do they correlate with qualitative improvements in the revised essays, and with students' self-reports of their thought processes?

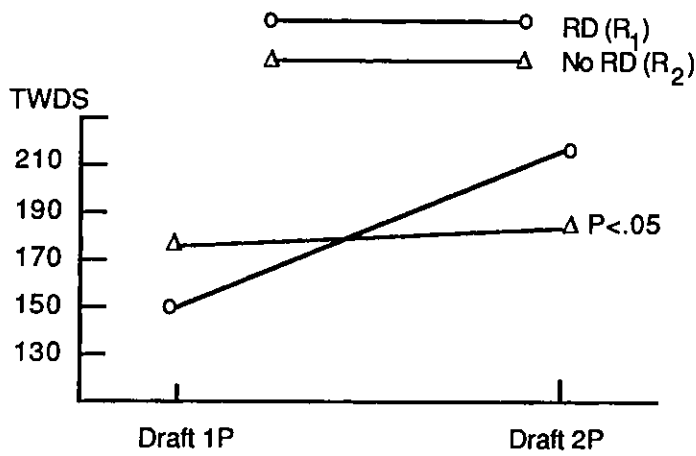
Number of words and T-units. As Figure 2 indicates (see portion of the figure inside the box), of the subjects who wrote essays as an introductory activity and revised them later, some read whereas others did not, and some answered questions whereas others did not. To address the impact of writing and reading working together, we examined the extent to which essays changed from Draft 1 to Draft 2 for subjects in each of these conditions.

Because we were interested in looking at any differences between the two drafts of the same essay, repeated-measures analyses of variance (ANOVAs) were used to determine whether there were significant differences between groups for changes in the number of words and T-units produced. For the change in total number of words from first draft to second draft, we found no significant difference between groups for subjects who wrote on the "Women in the Movies" topic. However, for those who wrote on "Baby Fae," there were sig-

nificant differences for the number of changes across the two drafts depending upon whether subjects read or not, $F(1, 20) = 6.17, p < .05$, and whether subjects answered questions or not, $F(1, 20) = 4.59, p < .05$. These main effects of the reading and question conditions are depicted in Figures 3 and 4.

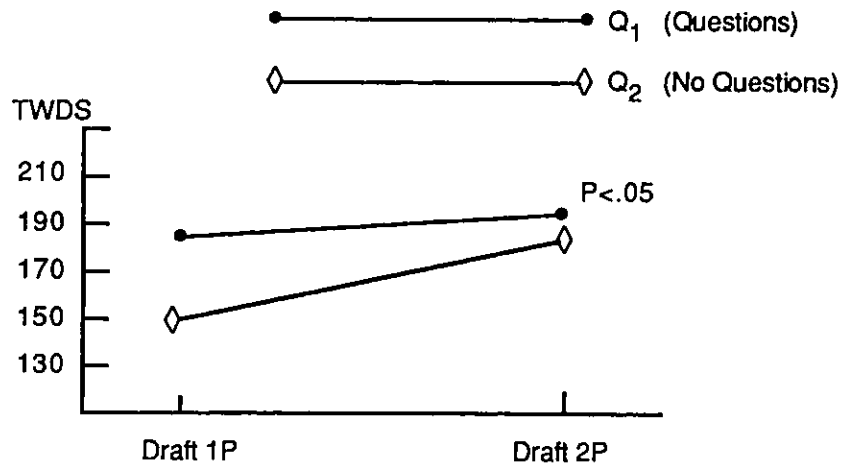
Total word counts alone are ambiguous measures, because they fail to capture quantifiable changes in the numbers of ideas presented. Therefore, we also performed repeated-measures ANOVAs of the change in the number of T-units from the first to the second draft. As in the previous analysis, no significant difference was found between treatment groups for subjects assigned to write on "Women in the Movies." On the other hand, for subjects assigned to write on "Baby Fae," there was a significant effect in the number of changes made across drafts for the interaction between reading condition and question condition, $F(1, 20) = 5.99, p < .05$. Table 1 shows the means for the various treatment conditions, and Figure 5 depicts these data. What is apparent in Figure 5 is that reading is correlated with an increase in the number of T-units produced across drafts, except in the treatments in which reading was coupled with answering questions. However, there may have been a ceiling effect for those subjects who both read and answered questions.

Figure 3
Total words for each draft by reading condition: "Baby Fae"



Baby Fae

Figure 4
Total words for each draft by question condition: "Baby Fae"



Baby Fae

Table 1 Mean number of words and T-units on first and second drafts of essays

Score	Reading		No reading		Questions		No questions	
	Words	T-units	Words	T-units	Words	T-units	Words	T-units
"Women in the Movies"								
Draft 1	218.99	16.31	234.40	18.50	260.17	19.25	188.09	15.10
Draft 2	241.77	17.54	200.10	17.10	242.75	18.17	202.82	16.75
Change	+22.78	+1.23	-34.30	-1.40	-17.42	-1.08	+14.73	+1.65
"Baby Fae"								
Draft 1	155.77	11.69	183.45	12.36	190.25	13.50	146.67	10.50
Draft 2	194.38	14.77	185.45	13.18	197.92	14.50	182.67	13.58
Change	+38.61	+3.08	+02.00	+0.82	+07.62	+1.00	+36.00	+3.08

In summary, for at least one of the passages, if we can assume that changes in the number of words and T-units correspond to changes in the quantity of thinking, then the different conditions were associated with varying amounts of thought. In essence, reading extended thinking, whereas questions appeared to inhibit it.

Types of revisions. Obviously, total word and T-unit counts do not tell us very much regarding the effects of these various combinations of tasks upon the nature of thinking. They merely point to the existence of possible trends; the next step is to examine the types of revisions made.

The mean number of revisions made by students in each treatment group is presented in Tables 2 and 3. These data represent the actual numbers of changes made by subjects in the various groups. For example, they show whether students who did the reading made more revisions of any given type than students who did not read. Tables 2 and 3 also present the proportions of revisions in the four major categories (additions, deletions, rewordings, and mechanics) for each treatment group. These data serve a different purpose: They allow for comparison across categories for the different treatments. Without this relative view, it would be difficult to compare differences in the extent to which students in different treat-

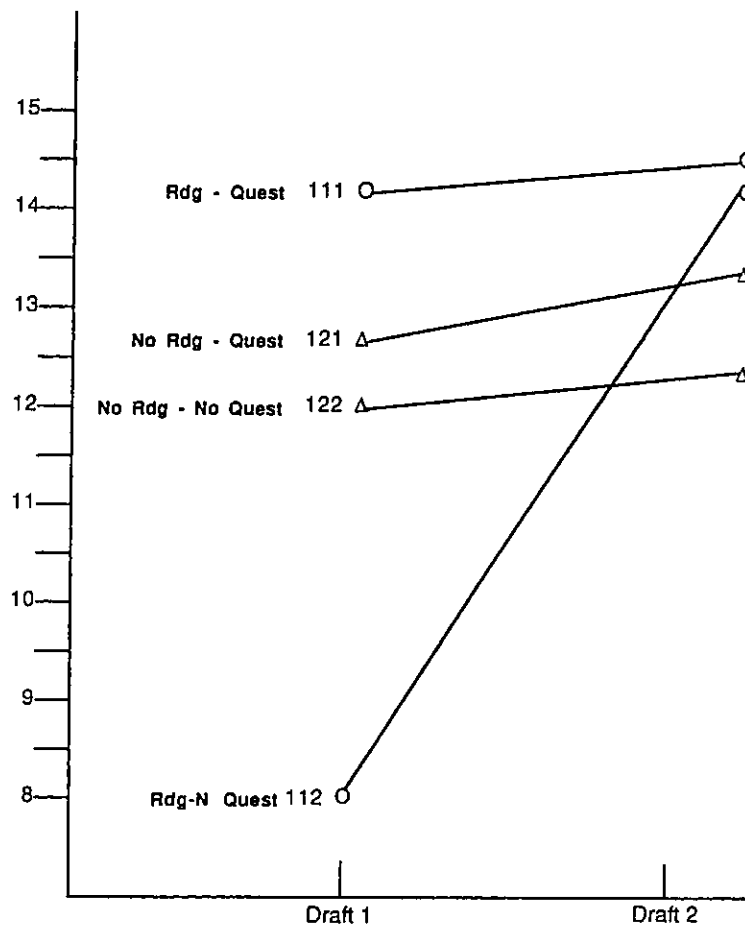
ment conditions were apt to pursue different types of revisions. Figure 6 presents the same proportions graphically for the subjects assigned to the "Baby Fae" topic.

Some noteworthy findings emerged. In particular, students enlisted various types of revisions in accordance with whether they read or not and whether or not they answered questions. Regardless of the topic to which they were assigned, those who read made more additions to their drafts than those who did not read. For subjects who read "Baby Fae," .61 of their revisions were additions; for those who read "Women in the Movies," .52. The proportions of additions made by those who did not read were .38 and .31, respectively.

The impact of questions upon subsequent revisions was less clear. The proportions of revisions that were additions did not differ greatly between those who answered questions (.40 for "Baby Fae" and .48 for "Women in the Movies") and those who did not answer questions (.49 for "Baby Fae" and .45 for "Women in the Movies"). The proportions of revisions which were either rewordings or mechanics were less stable across topics. However, we did note that proportionally fewer deletions were made by those students who had not answered questions.

Quality ratings. The revision data examined so far provide some support for the thesis that reading in combination with writing and

Figure 5
Total number of T-units for each draft by reading and question conditions: "Baby Fae"



questions fosters differences in thinking. However, it is important also to consider the quality of those changes in thinking. For example, although we know that the students who read generated more T-units and made more changes in content, we do not know whether the results were qualitatively better.

As described earlier, the essays were rated using a holistic/analytic scale for evaluating persuasive writing according to six main cate-

gories (Purves, 1982). Our major interest in the ratings was to discover whether there was any significant difference in the quality of the writing done by students in the various treatment groups. The means and standard deviations for the combined ratings of all three judges are presented in Table 4.

Repeated-measures ANOVAs of the change in quality ratings from the first draft to the second draft yielded different trends for the two

Table 2 Mean number (and proportion) of revisions in each category made by students who wrote on "Women in the Movies"

Category	Reading	No reading	Questions	No questions	Reading		No reading	
					Questions	No questions	Questions	No questions
Revision category								
Addition	5.70 (0.52)	4.00 (0.38)	3.50 (0.48)	6.55 (0.45)	3.43 (0.66)	8.33 (0.47)	3.60 (0.35)	4.40 (0.40)
Deletion	2.00 (0.18)	1.90 (0.18)	1.92 (0.26)	2.00 (0.13)	1.00 (0.19)	3.17 (0.18)	3.20 (0.31)	0.50 (0.05)
Rewording	2.92 (0.26)	4.50 (0.42)	1.83 (0.25)	5.55 (0.38)	0.71 (0.13)	5.50 (0.31)	3.40 (0.33)	5.60 (0.51)
Mechanical	0.23 (0.02)	0.10 (0.00)	0.00 (0.00)	0.36 (0.02)	0.00 (0.00)	0.50 (0.02)	0.00 (0.00)	0.20 (0.01)
Nature of discourse								
Content	9.23 (0.85)	8.80 (0.83)	6.42 (0.88)	11.91 (0.82)	4.43 (0.86)	14.83 (0.84)	9.20 (0.90)	8.40 (0.77)
Discourse structure	1.15 (0.10)	1.10 (0.10)	0.42 (0.05)	1.91 (0.13)	0.14 (0.02)	2.33 (0.13)	0.80 (0.07)	1.40 (0.12)
Stylistic	0.46 (0.04)	0.60 (0.05)	0.42 (0.05)	0.63 (0.04)	0.57 (0.11)	0.33 (0.01)	0.20 (0.01)	1.00 (0.09)
Revision subcategory								
Addition								
Superordinate	1.00 (0.17)	0.70 (0.17)	0.67 (0.19)	1.09 (0.16)	0.57 (0.16)	1.50 (0.18)	0.80 (0.22)	0.60 (0.13)
Subordinate	3.46 (0.60)	2.20 (0.55)	2.25 (0.64)	3.64 (0.55)	2.29 (0.66)	4.83 (0.57)	2.20 (0.61)	2.20 (0.50)
Deletion								
Superordinate	0.54 (0.27)	0.70 (0.36)	0.67 (0.34)	0.55 (0.27)	0.29 (0.29)	0.83 (0.26)	1.20 (0.37)	0.20 (0.33)
Subordinate	1.08 (0.54)	0.86 (0.45)	0.58 (0.30)	1.36 (0.68)	0.14 (0.41)	2.17 (0.68)	1.20 (0.37)	0.40 (0.66)
Paraphrase								
Substitution	1.08 (0.36)	2.00 (0.44)	0.42 (0.22)	2.64 (0.47)	0.00 (0.00)	2.33 (0.42)	1.00 (0.29)	3.00 (0.53)
Permutation	0.23 (0.07)	0.10 (0.02)	0.08 (0.04)	0.27 (0.04)	0.14 (0.19)	0.33 (0.06)	0.00 (0.00)	0.20 (0.03)
Distribution	0.85 (0.29)	0.60 (0.13)	0.33 (0.18)	1.18 (0.21)	0.43 (0.06)	1.33 (0.24)	0.20 (0.05)	1.00 (0.17)
Consolidation	0.38 (0.13)	0.70 (0.15)	0.33 (0.18)	0.73 (0.13)	0.00 (0.00)	0.83 (0.15)	0.80 (0.23)	0.60 (0.10)

topics. For "Baby Fae," there was a significant difference in the quality ratings for scope and quality of content from the first draft to the second draft across reading conditions, $F(1, 22) = 5.03, p < .05$, in conjunction with a significant interaction between the reading and question

conditions, $F(1, 22) = 4.50, p < .05$. Figure 7 depicts the interaction of reading condition and question condition. In addition, some differences were found between groups in the change from Draft 1 to Draft 2 on the ratings for organization and for style: The interaction between

Table 3 Mean number (and proportion) of revisions in each category made by students who wrote on "Baby Fae"

Category	Reading	No reading	Questions	No questions	Reading		No reading	
					Questions	No questions	Questions	No questions
Revision category								
Addition	3.62 (0.61)	2.33 (0.31)	2.50 (0.40)	3.50 (0.49)	1.86 (0.46)	5.67 (0.70)	3.40 (0.36)	1.51 (0.23)
Deletion	0.62 (0.10)	1.67 (0.22)	1.25 (0.20)	0.92 (0.12)	0.71 (0.17)	0.50 (0.06)	2.00 (0.21)	1.33 (0.20)
Rewording	1.54 (0.26)	2.92 (0.39)	2.41 (0.39)	2.17 (0.30)	1.43 (0.35)	1.67 (0.20)	3.80 (0.41)	2.67 (0.42)
Mechanical	0.08 (0.01)	0.42 (0.05)	0.00 (0.00)	0.50 (0.07)	0.00 (0.00)	0.17 (0.02)	0.00 (0.00)	0.83 (0.13)
Nature of discourse								
Content	4.85 (0.82)	4.25 (0.57)	4.92 (0.79)	4.17 (0.58)	3.71 (0.92)	6.16 (0.76)	6.60 (0.71)	2.17 (0.34)
Discourse structure	0.15 (0.02)	0.25 (0.03)	0.25 (0.04)	0.17 (0.02)	0.14 (0.03)	0.17 (0.02)	0.40 (0.04)	0.17 (0.02)
Stylistic	0.38 (0.06)	2.67 (0.36)	0.83 (0.13)	2.25 (0.31)	0.15 (0.03)	0.67 (0.08)	1.80 (0.19)	3.83 (0.60)
Revision subcategory								
Addition								
Superordinate	1.31 (0.36)	0.92 (0.39)	1.00 (0.04)	1.17 (0.33)	0.57 (0.30)	2.17 (0.38)	1.60 (0.47)	0.17 (0.02)
Subordinate	2.23 (0.61)	0.75 (0.32)	1.25 (0.05)	1.83 (0.52)	1.14 (0.61)	3.50 (0.61)	1.40 (0.41)	0.17 (0.11)
Deletion								
Superordinate	0.31 (0.50)	0.42 (0.25)	0.42 (0.33)	0.17 (0.18)	0.29 (0.40)	0.33 (0.66)	0.60 (0.30)	0.00 (0.00)
Subordinate	0.23 (0.37)	0.67 (0.40)	0.67 (0.53)	0.25 (0.27)	0.43 (0.60)	0.00 (0.00)	1.00 (0.50)	0.50 (0.37)
Paraphrase								
Substitution	0.38 (0.24)	1.75 (0.59)	0.91 (0.37)	1.25 (0.57)	0.29 (0.20)	0.50 (0.29)	1.80 (0.47)	2.00 (0.74)
Permutation	0.07 (0.04)	0.17 (0.05)	0.25 (0.10)	0.00 (0.00)	0.14 (0.20)	0.00 (0.00)	0.40 (0.10)	0.00 (0.00)
Distribution	0.15 (0.09)	0.00 (0.00)	0.17 (0.07)	0.00 (0.00)	0.29 (0.20)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Consolidation	0.38 (0.24)	0.50 (0.17)	0.84 (0.34)	0.08 (0.03)	0.57 (0.39)	0.17 (0.10)	1.20 (0.31)	0.00 (0.00)

reading condition and question condition approached significance for style, $F(1, 22) = 3.56, p < .10$, and for organization, $F(1, 22) = 3.84, p < .10$.

Differences between treatment groups in the change in quality ratings across the two

drafts were less substantial for the "Women in the Movies" topic. Main effects of reading condition that approached significance were found in the ratings of organization, $F(1, 19) = 3.01, p < .10$; mechanics, $F(1, 19) = 4.12, p < .10$; and overall impression $F(1, 19) = 3.81,$

Figure 6
Proportion of revisions in each category by reading and question conditions: "Baby Fae"

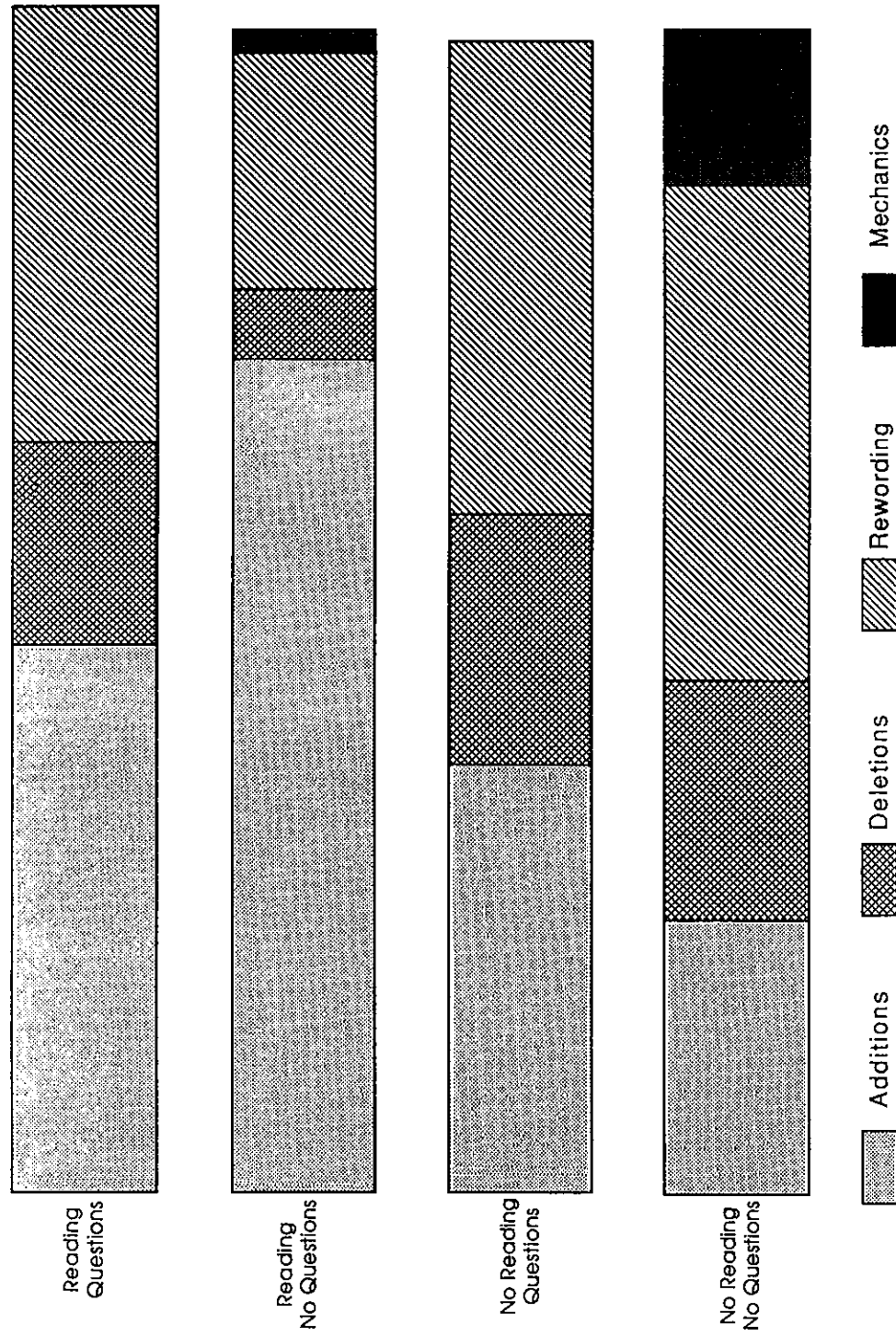


Table 4 Mean quality ratings for revisions of essays

Rating	"Women in the Movies"				"Baby Fae"			
	Reading		No reading		Reading		No reading	
	Questions	No questions	Questions	No questions	Questions	No questions	Questions	No questions
Draft 1								
Content	8.86	8.00	9.00	9.00	8.00	6.33	7.67	7.43
Organization	9.00	7.75	9.25	8.25	8.14	7.50	8.17	6.14
Style	10.71	9.75	11.25	10.50	9.43	10.00	9.33	8.86
Mechanics	10.14	9.75	10.00	8.50	9.71	9.67	9.17	9.72
General impression	8.57	8.25	9.00	8.75	7.86	6.83	7.50	6.57
Draft 2								
Content	9.14	8.88	8.75	9.25	8.14	8.33	7.67	6.85
Organization	9.29	8.75	9.25	8.25	8.57	8.00	8.67	7.00
Style	10.71	10.50	10.50	10.75	8.71	9.50	9.00	8.14
Mechanics	10.43	10.37	9.75	9.50	9.57	9.66	8.00	9.57
General impression	8.57	9.50	9.00	9.00	7.86	7.83	7.33	6.86

$p < .10$. Main effects of question condition that approached significance were found for style, $F(1, 19) = 2.01$, $p < .10$, and general impression, $F(1, 19) = 3.37$, $p < .10$.

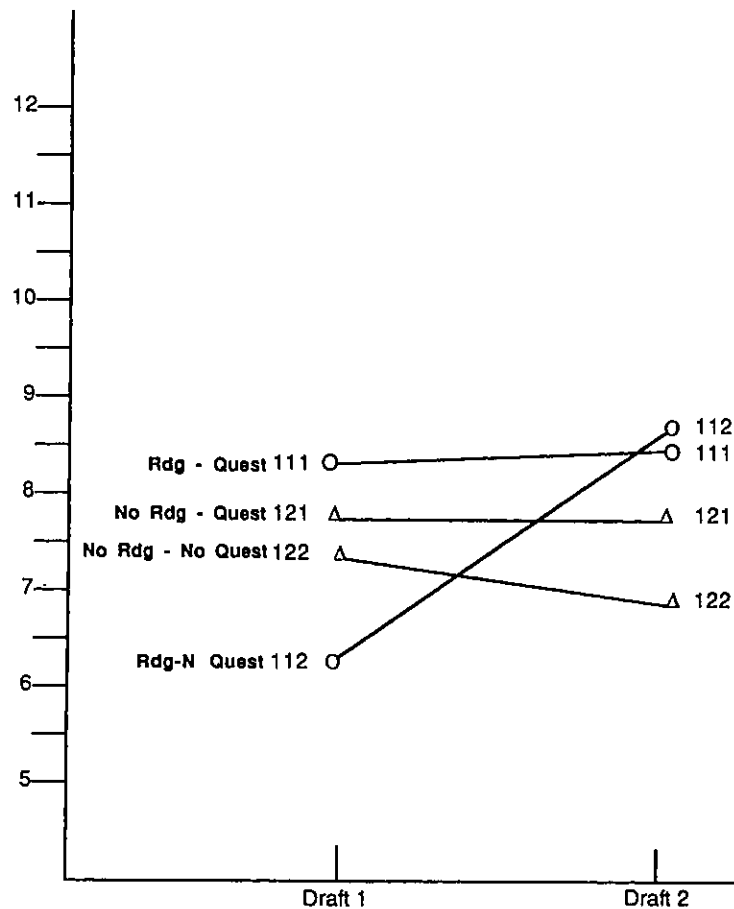
An examination of these differences in quality ratings confirms two trends: First, reading again appeared to make a significant contribution to improvements in student performance. The quality ratings for scope and quality of content improved significantly more when students had read "The Case of Baby Fae" than when they had not. The changes in quality ratings for scope and content across the two drafts were not significantly different for the "Women in the Movies" passage, but did follow the same general trend. Second, answering questions actually appeared in some cases to reduce performance. The quality ratings for content (for "Baby Fae") and for style and general impression (for "Women in the Movies") were significantly higher on the first drafts than on the revised drafts for students who answered questions in combination with reading and writing.

Debriefing comments. As we stated earlier, changes in students' thinking may or may not be reflected in visible changes to drafts. There-

fore, toward defining the nature of thinking associated with the various tasks across treatment conditions, we conducted an analysis of students' responses to the debriefing questions. From an initial examination of these debriefing comments, we developed seven major categories and several subcategories of types of thinking students reported: accessing, altering, clarifying, evaluating, acquiring momentum, organizing, and reacting. (See Appendix C for an elaboration of these categories.) Using these categories, two raters classified student responses; interrater agreement for the major categories ranged from .88 to .96.

Bar graphs were developed to depict the nature of the reasoning operations engaged across the various tasks. For example, Figure 8 depicts the type of reasoning students reported they were engaged in as they were reading. The first bar represents proportionately the type of thinking reported by subjects in Treatment 111 (who wrote, read, and responded to questions). The second, third, and fourth bars represent students who were involved in Treatment 112 (who wrote and read), Treatment 211 (who read and answered questions), and Treatment 212 (who read only). Figure 9 depicts the type of reasoning students reported being engaged in as

Figure 7
Quality ratings for each draft by reading and question conditions: "Baby Fae"



they answered the questions. The groups represented in the graphs are students in Treatment 111 (who wrote, read, and answered questions), Treatment 121 (who wrote and answered questions), Treatment 221 (who just answered questions), and Treatment 211 (who read and answered questions). Figure 10 depicts the type of reasoning students reported that they were engaged in during revision. The treatment groups graphed are Treatment 111 (who wrote, read, and answered questions), Treatment 112

(who wrote and read), Treatment 121 (who wrote and answered questions), and Treatment 122 (who just wrote).

The debriefing questions were designed to capture students' thinking at three crucial points: at the point of reading, at the point of answering questions, and at the point of revising. The graphs revealed considerable variation across treatment groups and tasks. The most marked difference was between subjects who wrote prior to reading and subjects who did not

Figure 8
 Proportion of debriefing comments in each category for students' thinking while reading for four treatment groups: "Baby Face"

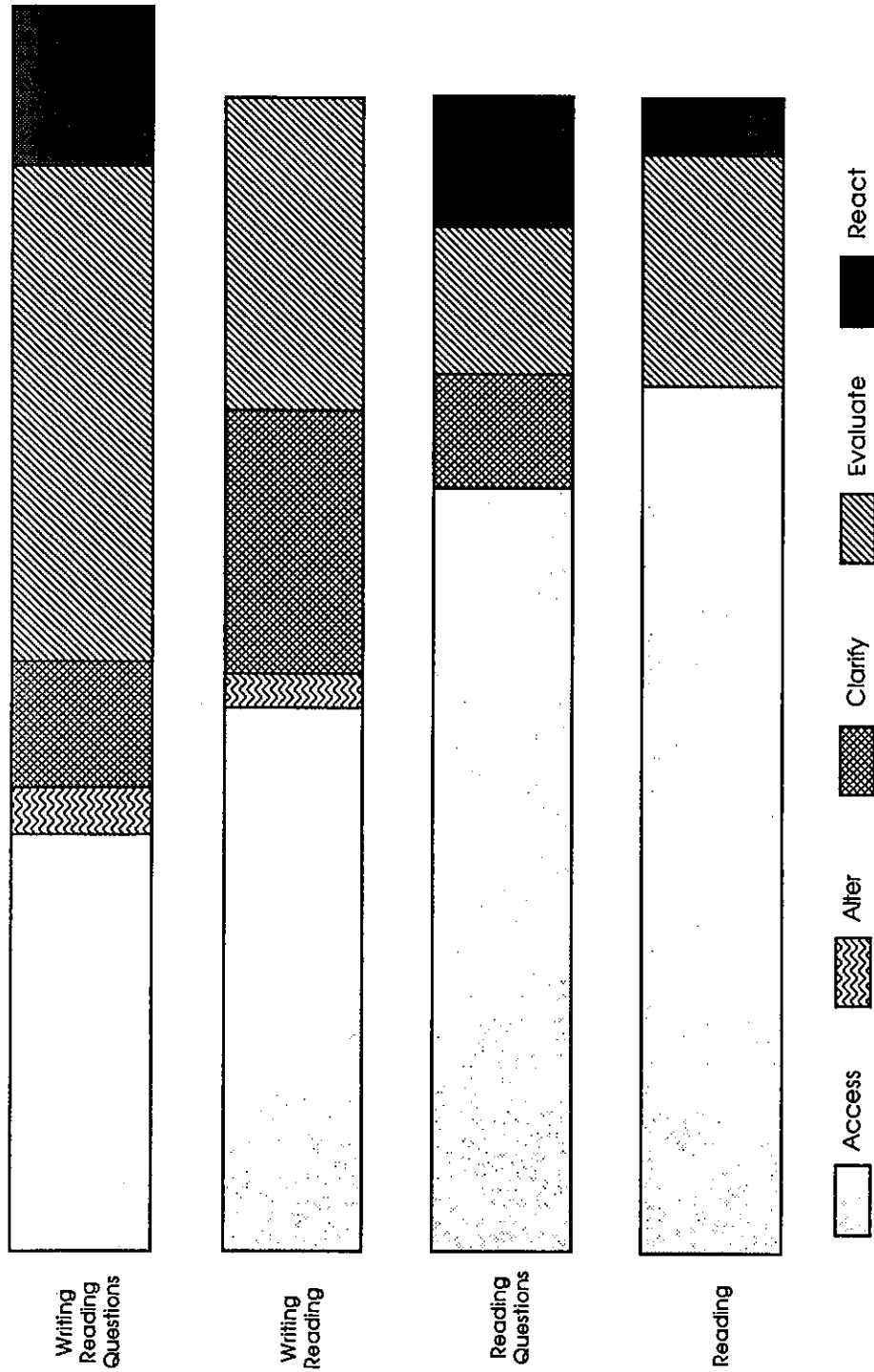


Figure 9
 Proportion of debriefing comments in each category for students' thinking while answering questions for four treatment groups:
 "Baby Fac"

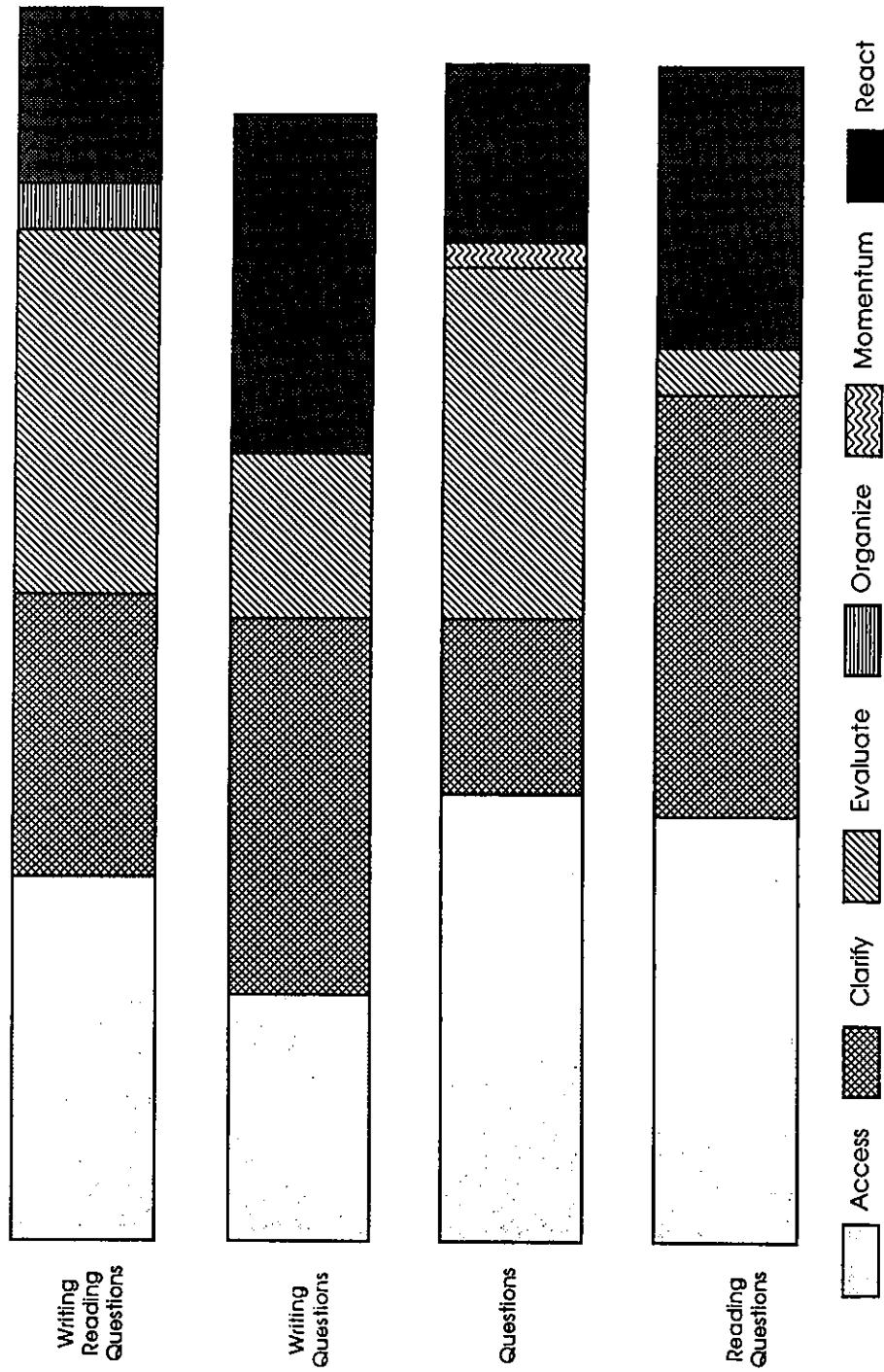
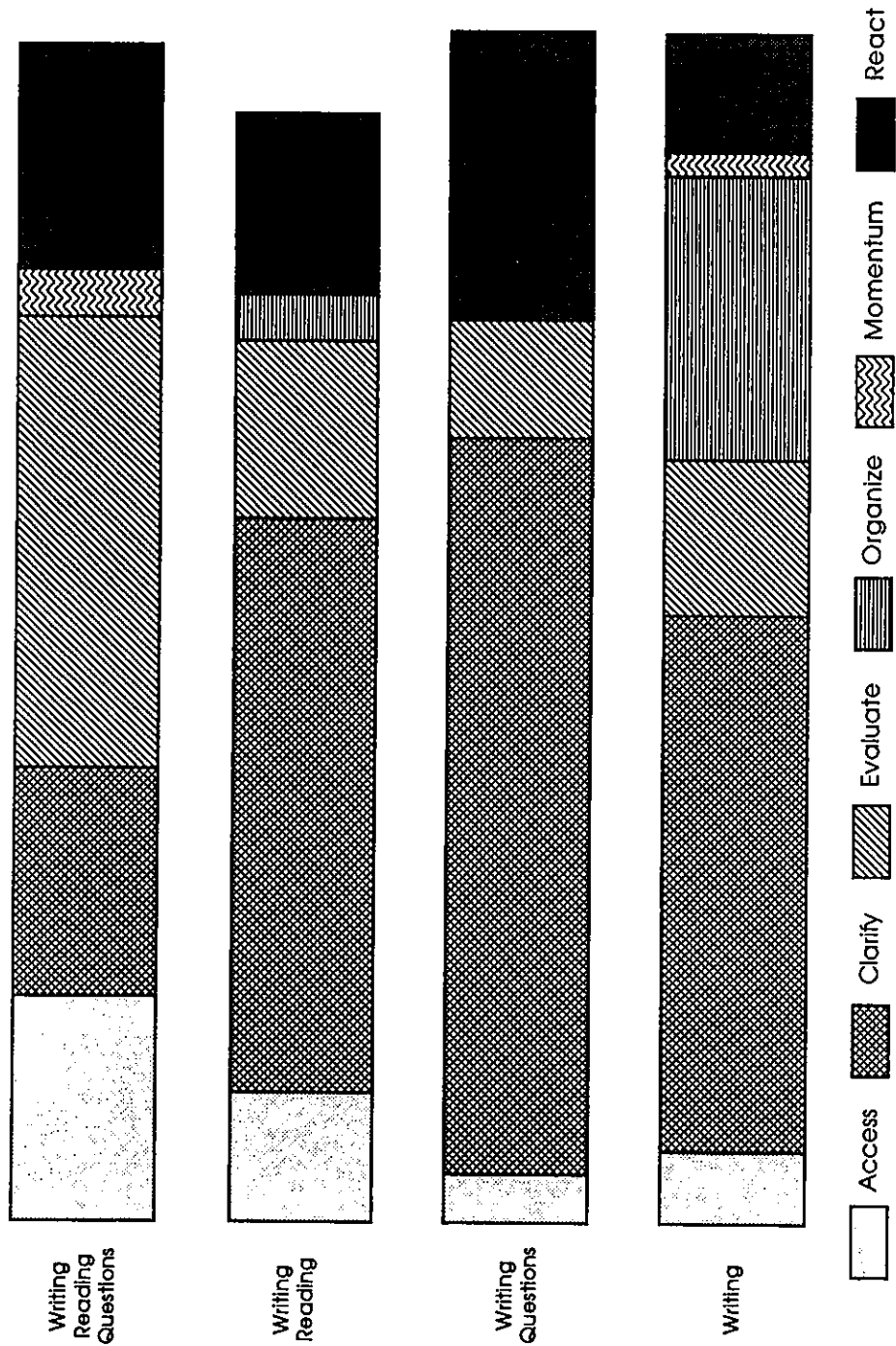


Figure 10
 Proportion of debriefing comments in each category for students' thinking while revising for four treatment groups: "Baby Fae"



write. An examination of the types of reasoning reported by these students indicated that those who wrote prior to reading were thinking more evaluatively than those who did not write prior to reading. At the time of reading, the proportions of evaluative comments for students who wrote prior to reading were .43 (Treatment 111) and .27 (Treatment 112), compared with .13 (Treatment 211) and .20 (Treatment 212) for those who only read. At the point of answering questions, the proportions of evaluative comments were .28 for those who both wrote and read (Treatment 111), compared with .14, .23, and .04 for the other groups (Treatments 121, 221, and 211). At the point of revision, the proportions of evaluative comments were .38 (Treatment 111) and .15 (Treatment 112) for those who both wrote and read, compared with .10 (Treatment 121) and .13 (Treatment 122) for those who did not.

A second trend was found among subjects who wrote only one draft of the essay. In particular, the comments of students who did not perform any other activity before writing the essay, or who wrote for the first time after reading or answering questions, suggested that they did little evaluative thinking. The proportion of these students' comments classified as evaluative was .06 or less.

The aforementioned trends may be more apparent if we examine the comments and products of specific writers.

AN EXAMINATION OF EIGHT SELECTED WRITERS

Tables 5–12 (Writers 1–8, respectively) display the first and second drafts of eight students whose revisions were representative of the kinds of revisions found in each of the treatment groups. Selected debriefing comments made by each of these subjects are also included. In their comments, each of these eight writers referred to their writing of a first draft as a chance to organize their ideas about the issue. Once their ideas were accessed and composed, however, their engagement in the various tasks of reading, answering questions, and revising produced varied results.

Reading. Our analyses of the students' revisions and debriefing comments suggested that reading prompted writers to add to their drafts, at the same time as it prompted them to think more evaluatively. However, the qualitative ratings for "Baby Fae" also suggested that the quality of the essays improved more after just reading than after reading and answering questions, just answering questions, or neither activity. To examine more closely the effects of writing and reading, with and without answering questions, we turn to the debriefing comments of Writer 2, from Treatment 111 (write, read, answer questions, revise) and Writer 6, from Treatment 112 (write, read, revise).

Writer 2 (see Table 6) claimed that reading "allowed me to educate myself on the issues involved," and that it "presented different points of view." A refinement of this writer's perspective surfaced in her revision. For example, in her second draft, she wrote, "had the doctors taken every opportunity to find a suitable human organ before implanting the baboon's [it would have been better].... However, what happened happened." Contrast this wording to her original position in the first draft: "The chances of finding a suitable human heart to transplant were probably just as slim as her chances of survival." Similarly, Writer 6 (see Table 10) stated that "Instead of just reading to be finished, I read to understand," and "I saw different positions people took on it.... [Reading] helped me a lot in writing because I could see which stands I agreed with." This writer's second draft shows much elaboration of his original position, as well as a slight shift in perspective from neutrality ("If this was the only heart... then I think [the doctors] did the right thing") to a more opposing stance ("I think the doctor's first priority should have been to save Baby Fae's life not to use her for experiments"). Although neither writer entirely discarded his or her perspective, much alteration to each stance is evident. The information from the article served as an added resource from which they could borrow in order to bolster or refine their arguments.

Answering questions with reading. Whereas the interpretation of the effect of read-

Table 5 Analysis of revisions and comments of Writer 1 from Treatment 111: "Women in the Movies"

Draft 1	Read	Answers to essay questions	Draft 2
<p>Dear Editor:</p> <p>Regarding the issue of women as they are depicted in the movies, I do feel strongly that they are treated unfairly in salary inadequacies all the way up to the general portrayal of women in film. I have a suggestion, although it takes a lot more than just words, every director who has made a movie successful has been a man. Don't you think it is about time for women to start directing and showing the viewers how women should really be treated? I think it is, and I sincerely hope that someone who is reading this will be fired up with the incentive to go out and direct a film.</p>	<p>[Writer read article concerning the topic.]</p>	<p>"Film makers are men and it is easier to depict a man winning the audience's attention, praise, and lust rather than having a 'man' let the women get all the publicity..."</p>	<p>[Writer resubmitted the first draft along with the following additions:]</p> <p>Or if the case may, and it can be, direct and produce a film. Or at least let or have MGM let a woman direct a "to be successful" film. I feel that if women are given a chance if the companies take the risk, one which they can afford to do, think of all the gratitude and publicity the company as well as the producer (female) will get! It would benefit more than just one party. It may even cause investors to think more of the film industry for making some money. I personally don't think anyone could loose—if the chance is given. So, give us women a chance, you probably won't be let down if you support the project wholeheartedly. As the saying goes, "Try it you might like it!"</p>
Debriefing comments regarding each task			
Writing a letter	Reading an article	Answering questions	Revising the letter
<p>"Writing the letter only confirmed my ideas."</p>	<p>"This had an influencing effect! I could imagine if I was given an article with the opposite views supported, I would have probably made a few more changes in the letter itself!"</p>	<p>"[Questions] helped me to finalize my thoughts and get them into a perspective."</p>	<p>"Didn't really help all that much because I was already set on my views."</p>

ing upon students' thinking is relatively straightforward, the impact of questions in combination with reading is less clear. For example, answering questions did result in a mean increase in the total number of words and T-units for those who wrote on "Baby Fae," but for those as-

signed to "Women in the Movies," answering questions brought about a mean decrease in words and T-units (Figures 3-5 and Table 2). These differences between topics resurfaced in the analysis of types of revisions made, where answering questions contributed to a wider

Table 6 Analysis of revisions and comments of Writer 2 from Treatment 111: "Baby Fae"

Draft 1	Read	Answers to essay questions	Draft 2
<p>Dear Mr. Editor:</p> <p>It is my opinion that transplanting a baboon's heart into Baby Fae was <i>not</i> an unethical procedure. Knowing that the baby's chances for survival were very slim if she did not receive a transplant, the doctors really didn't have anything to lose.</p> <p>The chances of finding a suitable human heart to transplant were probably just as slim as her chances of survival, thus transplanting a baboon's heart as an attempt at survival certainly was not wrong.</p> <p>The case of Baby Fae was a medical breakthrough. Although it only prolonged Baby Fae's life by 20 days, scientists had the opportunity to research the compatibility of the human biological system with that of the baboon, and perhaps, gained the knowledge required to save more lives in the future.</p>	<p><i>[Writer read article concerning the topic.]</i></p>	<p>"...No one has the right to use them [those who cannot give consent] for a means ...to an end..."</p> <p>"...Doctors did not search for a human heart..."</p> <p>"...To enhance the quality of life in the future requires sacrifice now, but not the sacrifice of innocent lives—of people that can't make their own choice."</p>	<p>Dear Mr. Editor:</p> <p>It is my opinion that, under the circumstances, transplanting a baboon's heart into an infant could be viewed as unethical. Had Fae been an adult who could have consented to what was being done to her, or had the doctors taken every opportunity to find a suitable human organ before implanting the baboon's, then the case should be looked at in a different light.</p> <p>However, what happened happened, and although attempts should be made not to allow such things to happen again. One cannot disregard the wonderful opportunity which has been presented to the medical community—to research the compatibility of the human biological system with that of a baboon and perhaps gain the knowledge required to save more human lives in the future.</p>
Debriefing comments regarding each task			
Writing a letter	Reading an article	Answering questions	Revising the letter
"Helped me to realize my opinions on the subject."	<p>"Opened me up to others opinions on the subject—presented different points of view."</p> <p>"...Made me think twice about mine..."</p> <p>"Allowed me to educate myself on the issues involved."</p>	"Forced me to think about the subject and form opinions."	"Allowed me to re-evaluate my position in light of what I had learned."

range of revisions than just reading. This increase in range suggests that the impact of questions upon critical thinking is unpredictable.

Upon closer examination, there are two possible explanations for this unpredictability. First, questions, when combined with reading,

may have served as a "conceptual funnel," in which information from the reading was organized or examined in more detail. Writers 1 and 2 (see Tables 5 and 6) claimed that questions helped them to think about the subject and to finalize an opinion. For instance, the answer

Table 7 Analysis of revisions and comments of Writer 3 from Treatment 121: "Baby Fae"

Draft 1	Answers to essay questions	Draft 2
<p>To the editor: I understand Baby Fae's parents' desperation in search for any means of extending their baby's life. I am certain that when they gave their consent to the operation they believed it might even be possible to save her life. My objection to the operation is not an objection to their decision but rather to the doctors who capitalized on their agonized desperation.</p> <p>Any physician with a "pet project" in mind could undoubtedly convince a bereaved parent that the "experiment" was worthwhile if not to save the life of their own baby even to save the life of someone else's baby sometime in the future. If these doctors seriously envisioned a future where various animals were bred to supply spare organs for human beings then perhaps they were justified, but I do not believe that this was the case. Human donors are best for human recipients, and the closer we get to the issue of donors bred to the purpose the closer we get to the issue of cloning humans solely for organ replacement.</p> <p>Stick to mechanical replacements! Perhaps even baboons have souls.</p> <p>Sincerely, A concerned reader</p>	<p>"...The parents, in giving consent, were coerced by the doctors." "...I have a strong mistrust of the ethics of the medical profession." "The researchers into artificial hearts have minimized the risks." "Baboon hearts will always be as imperfect a match to the human body as they are now."</p>	<p>To the editor: I understand Baby Fae's parents' desperation in search for any means of extending their baby's life. I am certain that when they gave their consent to the operation, they believed it might even be possible to save her life. My objection to the operation is not an objection to their decision, but rather to the doctors who capitalized on the agonized desperation.</p> <p>Any physician with a "pet project" in mind could undoubtedly convince a bereaved parent that the "experiment" was worthwhile if not to save the life of their own baby even to save the life of someone else's baby in the future. If these doctors seriously envisioned a future where various animals were bred to supply spare organs for human beings then perhaps they were justified but I do not believe that this was the case. I believe that the physicians in Baby Fae's case were curious to see what might happen. I do not believe that they felt there was a future for the procedure in sight or any means to make it possible on a larger scale.</p> <p>Stick to mechanical replacements. Perhaps even baboons have souls and their hearts will never be perfect replacements, as some mechanicals might.</p> <p>Sincerely, A concerned reader</p>
Debriefing comments regarding each task		
Draft 1	Answers to essay questions	Draft 2
<p>"Made me choose an opinion on the issue, and bring up all the facts and opinions." "[The letter] forced me to choose—against or for—polarized my opinion more than it had been originally."</p>	<p>"...Forced me to focus on other aspects than my chosen ones, broadening my consideration." "Brought up side issues which I had to evaluate. Made me check specifics."</p>	<p>"This helped me to see that I had gotten off the track into a side issue..." "Allowed me to focus my argument more rationally—made me cut out superfluous things."</p>

Table 8 Analysis of revisions and comments of Writer 4 from Treatment 121: "Women in the Movies"

Draft 1	Answers to essay questions	Draft 2
<p>Dear Editor,</p> <p>I am unaccustomed to writing letters to newspapers, however in this case my strong feelings were enough of a motivation. I've been hearing so many opinions concerning the inequality of women in many different aspects of society. The film industry is another of those aspects. It seems the film industry receives so much attention due to its importance and exposure in society. However, in viewing to position of a woman in this industry, it is first important to view it as a business, like many others, is going through some changes due to pressure from society. The continuing salary difference between men and women has improved somewhat over the past years. This is basically because of the pressures and demands of those striving for equality. I think the people and others, should continue to fight for equality of pay. Sometimes after all the excitement of a new issue dies down, the people lose their incentive to fight. If they believe in what they are fighting for, then they must continue, and try to bring others along with them. There has been progress, but there is still a long way to go.</p> <p>Now, turning back to the film industry as an exceptionally large influence on society, the portrayal of women in films becomes another issue. It is difficult to picture the progress of equality in society if it masses are seeing an inadequate portrayal of women in films. I believe that part of this responsibility falls on the women working in the industry. I realize it would be difficult to turn down a job because of a principle you hold, but that might be the only way to start some changes.</p> <p>Overall, the struggle falls not only on to women in general, but to the individual woman in her part of the world. The changes will be slow and gradual, but they will happen. It needs to become a way of thinking for society, so people have to start thinking about how they feel, and acting on it.</p>	<p>"They usually are in a role behind a male lead. They usually portray their girlfriend and are most seen being rescued or made love to..."</p> <p>"...The girl is a flat character ...don't get any thoughts or feelings."</p>	<p>Dear Editor,</p> <p>I believe the film industry has been treating women unfairly. As far as movie portrayals, there seems to be a small number of stock characters that are pulled out and dusted off when a woman's role is needed in a film. Very few movies show the woman's inner self, or growth, or change. However, the idea of keeping a man's role the same is quite less frequent. They strive for individuality and uniqueness. I think a lot of this has to do with the fact that women are not present in the decision-making positions of the film industry, and even in the writing field. The field of portrayal is very limited.</p> <p>The question of pay is basically related to business and occupation in society. There have been improvements in recent years, but there is still a lot to be done. I feel that the women in the film industry should try and take some stands against this unfair treatment. I have no intention of making this fight sound simple, but it is their interests they are fighting for. This change throughout society needs to develop into a whole new way of thinking and it will not happen overnight. However, it can happen.</p>

(cont'd)

Table 8 Analysis of revisions and comments of Writer 4 from Treatment 121: "Women in the Movies" (continued)

Debriefing comments regarding each task		
Draft 1	Answers to essay questions	Draft 2
"I had to get my thoughts and opinions together on the subject, and also try to find out how much I knew about it."	"These helped me narrow in on the issue and draw out some of my thoughts and feelings. I was able to focus much better."	"I could rethink the issue, after organizing a few ideas and thinking about my reactions."
"I realized you have to get to the point quickly, not talk around the subject. You have to know what to say."	"They helped me sort out my feelings. But, I also feel they could have persuaded me in a certain direction."	"For me it got me to focus on the main purpose and point of the letter."
"I hadn't really thought about [the topic], and I didn't really know much about it."	"They helped to formulate some of the major issues."	"I feel it [the letter] was a bit reactionary and I would want to know more before I really wrote a letter."

Writer 1 generated regarding the fact that men get all the publicity as filmmakers helped this writer to compose an additional point and to elaborate upon that point in the second draft. Similarly, Writer 2 used the essay questions as an opportunity to reflect upon new knowledge gained from reading ("Doctors did not search for a human heart"), and to elaborate upon a point mentioned in the first draft, that "the quality of life in the future requires sacrifice now." In short, first the reading engaged these writers in an interaction—and, in some cases a confrontation—with another author's ideas, and then answering the questions aided the assimilation of the new information into the writer's own knowledge.

A second possible explanation of the impact of questions is that the questions served to support each student's existing ideas—that is, that mainly those ideas salient to the writer's position on the issue as stated in the first draft tended to surface in subsequent revisions. Questions about salient issues prompted writers to reiterate, refine, or elaborate upon their previously held ideas. Indeed, in the essays represented in Tables 5–10, very few answers from the questions did surface in the second draft, except those related to the major issues each student had already mentioned in the first draft.

For example, Writer 3, a subject in Treatment 121 (write, answer questions, revise), stated that questions "brought up side issues which I had to evaluate," and "made me check specifics." Writer 4, from the same treatment group for the other topic, stated that questions "helped me narrow in on the issue and draw out some of my thoughts and feelings." A perusal of their revisions suggest that this was the case. Their ideas can be traced through the sequence of tasks, and those salient to their first drafts were either reiterated or elaborated upon in the answers to the questions, and then further refined in the second draft.

In summary, the impact of questions upon critical thinking may depend upon whether or not the questions relate to the reader's ideas. Questions that ask a writer to investigate ideas best facilitate critical thinking when those questions are directly related to the issues that writer has raised in an earlier draft. The writer will tend either to replicate or to elaborate upon those issues when challenged to do so by an open-ended question. If, however, a writer is asked questions that oppose his or her already established position, or questions that are not related to the salient issues raised in an earlier draft, the answers to the questions, even if well developed, appear to be of little immediate

value in helping the writer think critically during subsequent revisions.

Revising. Our analyses of the students' revisions and debriefing comments suggested that revising by itself enabled the writers the opportunity to reshape their ideas, either superficially or substantially. The debriefing comments pertaining to the nature of revising ranged from "Didn't really help all that much" (Writer 1), to "Allowed me to focus my argument more rationally" (Writer 3), to "I thought and wrote more constructively, citing examples and referring back to the article" (Writer 5). Students who wrote and revised without performing any other task between drafts made a larger proportion of comments that revising allowed them to organize their ideas, and a higher proportion of their actual revisions had to do with "fixing up" the letter (mechanics). Students in this treatment also made the fewest additions, although the students in Treatment 121 (write, answer questions, revise) made about the same number.

Tables 11 and 12 provide two examples of those in Treatment 122 (write, revise). Writer 8 claimed that revising alone "didn't give me any more understanding of the topic." In addition, she also stated that when she revised her letter, she paid more attention to grammar. Writer 7 stated that revising gave her a second chance to organize her thoughts. Both writers revised the presentation of their ideas, but as their revisions suggest, they did not reshape the content of their letters in any substantive way.

Effects of reading, questions, writing, and knowledge activation

Our discussion up until this point has been limited to the effects of writing in combination with reading and answering questions. Our second analysis was a comparison of the effects of the various introductory activities—that is, a comparison of the effects of writing, background knowledge activation, and no activity. Unlike the data for our previous analyses, the data we derived for this analysis were restricted to a single draft of the essay, rather than two drafts. As a result, we were not able to examine changes within treatment groups across time.

Because randomization of subjects does not ensure comparability of groups, we wish to emphasize that we view the results of these analyses as tentative.

Several multivariate and univariate ANOVAs were conducted on the number of words, number of T-units, and quality ratings for the essays across conditions. Separate analyses were conducted for the two passages. The mean number of words and T-units in each essay for each topic are listed in Table 13; the mean quality ratings are given in Table 14. In one group of analyses, we compared the essays written by students assigned to the knowledge activation activity and no activity with the first drafts of those subjects who wrote as an introductory activity; in the other group of analyses, the comparison was to the second draft of the subjects who wrote as an introductory activity.

Two major findings emerged from these analyses. First, across the two topics, the essays of students in the writing and no activity conditions were rated consistently higher on the various ratings than the essays of students in the knowledge activation group. For the "Baby Fae" topic, there was a significant difference between the knowledge activation group and the writing and no activity groups on all of the quality ratings except mechanics, Hotelling $t(12, 102) = .489, p < .03$. Most notably, the knowledge activation group scored significantly lower on content than either the writing group (Draft 2) or the no activity group, $F(2, 57) = 7.34, p < .001$. They scored significantly lower on style than the no activity group, $F(2, 57) = 4.4, p < .01$. For the "Women in the Movies" topic, a similar trend was found, but only on selected analyses. Essays of the no activity group were rated significantly higher than those of the knowledge activation group (and higher than the first drafts of the writing group) on general impression, $F(2, 56) = 2.90, p < .06$, and overall affect, $F(2, 56) = 4.77, p < .01$.

Second, answering questions often appeared to be related to diminished quality ratings. Specifically, the essays of students who answered questions tended to be rated lower (on the scope and quality of content and, to a lesser

Table 9 Analysis of revisions and comments of Writer 5 from Treatment 112: "Women in the Movies"

Draft 1	Read	Draft 2
<p>To the editor: Regarding the issue of unfair treatment of women in the film industry, I wish to state my opinion. In a day and age where equal rights and the ERA movement is so popular, I find it an insult for such degradation and exploitation of women. Surely the movie industry realizes the importance of women in the industry—their participation in filming, their ideas, and acting more crucial to the success of the industry. If you look at today's society women are professionals, and treated as such in the business world. Why not in the movies? That's business too. If women do the equal amount of work as men, they should earn the same amount, too, in money and respect.</p> <p>Thank you, [name]</p>	<p>[Writer read article concerning the topic.]</p>	<p>To the editor: Women have shown in the past two decades their important contribution to the film industry. This includes young as well as older actresses. For example, look at Angie Dickinson, Betty White and Bea Arthur. These are the "old-timers," yet they still have found a comfortable niche in Hollywood. The have "been around" and haven't jumped from the pedestal. Jane Fonda and Elizabeth Taylor are other fine examples. They've acted in dozens of films and are still marketable. Sure, they aren't Bo Derek, but they have something to sell still—talent. These women are talented! Just as talented as Redford, Newman, Eastwood and Burt Reynolds. Movies should be seen for entertainment—exploitation is not entertainment in a moral sense. Not women or men. Look at books which have been made into movies—The Thornbirds, Cain and Abel. These have been written by women and were quite successful on t.v. Women deserve the credit where it is due—whether it be as a model, writer, or other talented artist. It is about time Hollywood treat women with the respect they deserve and pay them what they rightfully should earn.</p>
Debriefing comments regarding each task		
Draft 1	Reading an article	Draft 2
<p>"I just wrote, not giving the topic enough thought."</p>	<p>"Reading helped me see the topic in a clearer perspective, but only one side of it. There was another direction I could've written, but I chose not to."</p>	<p>"...After reading the article, I wrote my editorial more thoroughly. I referred back to the article and thought about what parts of the article I was aware of—did I see actresses being exploited? Was age a factor?"</p> <p>"After reading, I thought and wrote more constructively, citing examples and referring back to the article."</p>

Table 10 Analysis of revisions and comments of Writer 6 from Treatment 112: "Baby Fae"

Draft 1	Read	Draft 2
<p>Dear Editor:</p> <p>I think the doctors did right in trying to save Baby Fae's life. If this was the only heart they could use then I think they did the right thing by planting the baboon's heart in Baby Fae.</p> <p>While some people may not agree with this, I think everyone has the right to life including babies. I think the doctors should try anything they can do to save lives.</p> <p>I think it would have been better if they could have found another human baby heart to transplant into Baby Fae. But, I know if that was my baby fighting for her life, I would have let the doctors do what they could do to save my baby.</p>	<p>[Writer read article concerning the topic.]</p>	<p>Dear Editor:</p> <p>I think the doctor's first priority should have been to save Baby Fae's life not to use her for experiments. The baby has a right to life!</p> <p>If the baboon heart had not been the only heart available, the I think the doctors were right in transplanting the baboon heart. However, the doctors never even tried to find a human heart. I think the doctor's should have done that first. They should have planted a human heart into Baby Fae. If they could not find a human, then it would have been okay to use a baboon heart.</p> <p>I do not think the issue here is whether or not it was right to use the animal to save a human life, but the issue is whether it was right to do that and use the baby for experimentation. This world is full of people who eat animal meat, wear fur coats made from animal skins etc., so I do not think these people have a right to go around saying animals have a right to life. Even if the experiment helped society a little it did not help that baby. The doctors should have given the baby a human heart or at least tried to find one. Babies have a right to life also!</p>
Debriefing comments regarding each task		
Draft 1	Reading an article	Draft 2
<p>"It helped me to understand the topic more and my feelings about it as I saw what I wrote. I had to think before I wrote to organize my thoughts. The more I thought about it the more I began to understand it."</p> <p>"It felt good to be able to take a stand and state my feelings...."</p>	<p>"This helped me to understand the situation more as I read the Baby Fae article. I saw the different positions people took on it and that helped me to understand. This helped me a lot in writing because I could see which stands I agreed with."</p> <p>"Instead of just reading to be finished, I read to understand...."</p>	<p>"I had to think about which stands I agreed with, and I had to think about what I read so I could understand the article before I wrote about it."</p> <p>"I felt better about my letter after getting the chance to revise it."</p>

Table 11 Analysis of revisions and comments of Writer 7 from Treatment 122: "Women in the Movies"

Draft 1	Draft 2
<p>I find it hard to write about an issue I don't know much about. My opinion stems only from what I see on the movie screen, not from behind the scenes.</p> <p>Many of today's movies suggest a definite stereotyping of women. Too often women are portrayed as being inferior and controlled by men. Films, that portray the woman as a sexual object for someone else's use, promote this inferiority. These type of films do little to create the independent woman of the 80's image, that so many women seek to gain. Films, for the most part, should do more to promote woman as an equal sex (with capabilities equal to men). Although it is obvious that men and women are not equal, each having different physical and emotional characteristics, they are equal in many thought processes and capabilities. Until films stop portraying women as inferior sexual objects, easily controlled by society, the image of woman by society will not change.</p>	<p>Many of today's movies suggest a definite stereotyping of women. Too often women are portrayed as inferior and controllable by men. Films, that portray the woman as a sexual object, promote this inferiority. Furthermore, these type of films do little to create the independent woman of the 80's image, sought by so many women. Although it is obvious that men and women are not entirely equal, each having different physical and emotional characteristics, they are equal in many thought processes and capabilities. Films should therefore do more to promote woman as an equal sex capable of self control and determination. Until films stop portraying woman as inferior sexual objects, the image of women will remain inferior and inaccurate.</p>
Debriefing comments regarding each task	
Draft 1	Draft 2
<p>"I was forced to think about the issue and to how much I knew about the topic being discussed."</p> <p>"..Helped me to practice putting ideas into words on paper. This process is not an easy one, and takes some hard work..."</p> <p>"I became aware of how much I don't know about the topic. It's true that I can form opinions by what I see in movies, but I need to do more reading on the topic..."</p>	<p>"...I could see how I could improve the order of it, as well as the clarity of it."</p> <p>"...I went back over and analyzed and organized my thoughts."</p>

extent, on style and overall impression), especially those of subjects in the writing and knowledge activation treatments who were not given an opportunity to read on the topic. For example, the scope and quality of content of the "Women in the Movies" essays varied significantly in conjunction with whether the students had read or not, and whether they had answered questions or not, $F(1, 56) = 38, p < .05$. Similar trends emerged in the interaction between reading condition and question condition for organization, $F(1, 56) = 3.03, p < .03$; style, $F(1, 56) = 3.78, p < .06$; and overall impression, $F(1, 56) = 4.67, p < .04$. In particular, students who both read and answered questions fared more poorly than students who just read

and students who neither read nor answered questions.

Again, comments made by students in response to the debriefing questions coincided with these findings. In particular, when we analyzed these comments by the type of thinking each represented, the comments offered by the knowledge activation group most frequently referred to accessing ideas; this group made very few comments that referred to thinking evaluatively. In particular, at the point of reading, the proportion of comments of the knowledge activation group that pertained to accessing ideas was .42. The proportion pertaining to evaluating was less than .20. On the other hand, students who wrote as an introductory activity

Table 12 Analysis of revisions and comments of Writer 8 from Treatment 122: "Baby Fae"

Draft 1	Draft 2
<p>Dear Editor:</p> <p>I feel that implanting a baboon's heart into Baby Fae was indeed ethical. Considering her condition, the transplant could do her no more harm than not transplanting the heart. Unfortunately, it did not work out, but at the same time, it did not put her in any worse condition than she was already in and medical researchers have learned from this experience.</p> <p>In closing, I feel since there was no future for Baby Fae, the baboon heart was her only good chance for survival and that the medical profession should have taken the advantage of this venture into new ideas for heart patients.</p>	<p>Dear Editor:</p> <p>I feel that implanting a baboon's heart into Baby Fae was indeed ethical. Considering her condition, transplanting could do her no more harm than not transplanting the heart. Unfortunately, the experiment eventually failed, but at the same time it did not put her in worsened condition than she was already in; and medical researchers have been given a chance to learn from this experience.</p> <p>In closing, I feel since there was no future for Baby Fae, the baboon heart was her only good chance for survival and that the people in the medical profession should have taken the advantage of this venture into new ideas for heart patients.</p>
Debriefing comments regarding each task:	
Draft 1	Draft 2
"Writing the letter didn't explain the topic to me, I just wrote my ideas that I had previously."	"This didn't give me any more understanding of the topic, because no new ideas were presented to me." "I paid more attention to grammar."

offered considerably more evaluative comments at the point of reading, both overall and proportionally. At the point of writing, however, the knowledge activation group offered more comments suggestive of evaluative thinking than they had earlier, but still fewer than those students who wrote as an introductory activity.

The comments offered by students in the question condition coincided with the trends reported earlier. Questions appeared to dampen rather than enhance evaluative thinking unless students had both written and read prior to answering questions. The results for the no activity groups somewhat parallel the results for the students who wrote as an introductory activity. At the point of reading, those students who had performed no introductory task offered fewer evaluative comments than those who had written prior to reading, but more than those who had completed the knowledge activation activity. Furthermore, those students who were given no introductory activity but did read and answer questions offered fewer evaluative comments than those students who just read.

The comments offered by students in the no activity group at the point of writing resembled those of the group that wrote as an introductory activity. At the point of writing, these students, who had not written a first draft, offered as many evaluative comments as students who had written a previous draft. The proportion of evaluative comments for the no activity group tended to be the same across reading and question conditions, except in the case of "Baby Fae." Among the no activity group, students who did not read "Baby Fae" made a higher proportion of evaluative comments at the point of writing (.40) than those students who did read the article (.20). Perhaps writing supports more evaluative thinking when it precedes rather than follows reading.

Limitations

On the positive side, the present study is unique in its attempt to examine the effects of reading and writing on critical thinking.

Table 13 Mean number of words and T-units in essays for students assigned to each introductory activity

Activity	"Women in the Movies"				"Baby Fae"			
	Reading		No reading		Reading		No reading	
	Questions	No questions	Questions	No questions	Questions	No questions	Questions	No questions
Writing								
Draft 1								
Words	260.86	170.17	259.20	209.60	177.86	130.00	207.60	163.33
T-units	19.29	12.83	19.20	17.80	14.14	8.83	12.60	12.17
Draft 2								
Words	284.14	192.33	184.80	215.40	189.43	200.17	209.80	165.17
T-units	21.57	16.17	13.40	20.80	14.86	14.67	14.00	12.50
Knowledge activation								
Words	178.50	220.17	136.67	332.20	162.33	182.40	176.40	188.83
T-units	14.00	16.67	11.83	27.00	12.33	11.80	13.80	13.83
No activity								
Words	222.33	209.40	269.57	275.00	164.57	158.20	251.20	218.80
T-units	18.33	15.20	19.43	19.40	10.71	10.60	18.40	15.80

Whereas past studies have compared the effects of different writing experiences on reading, the present study examined the effects of various combinations of reading and writing activities on thinking. In particular, we pursued the question of how reading and writing, separately or in combination, might influence thinking critically. To this end, a great deal of care went into the selection of (a) writing experiences that had been shown to be effective as learning enhancements in past studies (Marshall, 1987; Newell, 1984), (b) topics that were apt to be provocative, and (c) questions and directions for each task consistent with expert educators' views of activities intended to encourage critical thinking. Furthermore, all materials were pilot-tested, revised, and fine-tuned prior to the actual study. The study was also unique in its inclusion of various measures of thinking. Converging evidence was sought from both quantitative and qualitative indices, as well as from detailed analyses of the responses of a subset of subjects. The measures included in this study ranged from traditional measures, such as counts of T-units, to analyses of revisions and

examination of the correlates of thinking that emerged from retrospective accounts of individual subjects.

On the negative side, it is virtually impossible to conduct a study of this kind that would have widespread generalizability. There are major limitations in this study which made the results difficult to generalize. First, subjects were asked to complete the experimental packets under artificial constraints that are not often found in real writing situations. For example, most writers are not asked to generate a draft, read an article, answer questions related to the article, revise the first draft, and then answer debriefing questions related to the task, all within 75 to 105 minutes. In classroom situations, time constraints are less likely to be so oppressive, and students are assisted by a great deal of scaffolding (e.g., teacher and peer support) as they consider topics, undertake tasks, and thoughtfully develop ideas.

Second, in the present study the students' engagement with these topics was examined only over a short term. Neither long-term measures nor transfer measures were included.

Table 14 Mean quality ratings on essays for students assigned to each introductory activity

Rating	"Women in the Movies"				"Baby Fae"			
	Reading		No reading		Reading		No reading	
	Questions	No questions	Questions	No questions	Questions	No questions	Questions	No questions
Writing								
Draft 1								
Content	8.86	8.00	9.00	9.00	8.00	6.30	7.60	7.40
Organization	9.00	7.75	9.25	8.25	8.14	7.50	8.16	6.14
Style	10.71	9.75	11.25	10.50	9.42	10.00	9.33	8.85
Mechanics	10.14	9.75	10.00	8.50	9.71	9.66	9.16	9.71
General								
impression	8.57	8.25	9.00	8.75	7.86	6.83	7.50	6.57
Affect	5.29	4.75	6.75	5.25	5.29	4.83	5.70	4.70
Draft 2								
Content	9.14	8.87	8.75	9.25	8.14	8.33	7.67	6.85
Organization	9.28	8.75	9.25	8.25	8.57	8.00	8.67	7.00
Style	10.72	10.50	10.50	10.75	8.71	9.50	9.00	8.14
Mechanics	10.42	10.37	9.75	9.50	8.57	9.67	8.00	9.57
General								
impression	8.57	9.50	9.00	9.00	7.86	7.83	7.33	6.85
Affect	5.29	6.50	6.75	6.00	5.28	5.50	5.50	5.57
Knowledge activation								
Content	8.14	8.80	5.60	11.25	7.00	7.40	7.00	5.50
Organization	9.14	8.67	6.60	10.75	9.00	8.20	8.16	7.50
Style	9.28	10.00	8.20	11.00	9.75	10.60	8.83	8.75
Mechanics	8.85	9.67	8.60	10.75	11.00	10.60	10.00	8.50
General								
impression	7.71	8.16	5.80	10.50	8.75	8.00	8.00	6.00
Affect	6.00	5.83	4.60	8.25	5.75	5.80	5.66	4.25
No activity								
Content	8.50	9.40	7.16	11.50	8.70	9.00	10.62	8.85
Organization	8.67	9.20	9.83	12.00	8.42	8.00	9.00	10.43
Style	10.83	9.60	8.67	12.17	10.42	1.40	11.80	10.00
Mechanics	10.00	10.20	11.00	12.33	10.28	9.20	11.20	10.57
General								
impression	9.16	9.20	8.33	11.67	9.14	8.40	9.80	9.00
Affect	7.00	7.40	6.16	10.00	7.00	6.20	7.60	7.57

Thus, the study did not address whether students were empowered to think critically over an extended period of time, or whether there was any transfer to other situations.

Third, it is not clear to what degree these findings may be limited by the topics. We found differences between the "Baby Fae" and "Women in the Movies" topics which suggest that there may have been a topic effect influencing the data. Our subjects may have had stronger feelings about the "Baby Fae" case, and thus may have reacted more strongly to it than

they did to the "Women in the Movies" topic. It could be that the subjects initially had less detailed knowledge about the "Baby Fae" case, and consequently, after reading a detailed article about the case, were more apt to revise their knowledge. However, even though in many cases the findings for "Women in the Movies" did not reach statistical significance, most did approach significance.

In addition, both topics were somewhat controversial. It is possible that persuasive articles, such as those used in this study, promote

more critical thinking due to the polar nature of the issues. This limitation does not invalidate our findings, however; it merely narrows the generalizability. Subsequent research should focus upon the effects of reading and writing with other topics and rhetorical tasks.

The final limitation concerns the methods of assessment upon which we based some of our findings. On the one hand, findings based upon debriefing comments are suspect because they are self-reports (Afflerbach & Johnston, 1984). On the other hand, such data are vital if researchers are to go beyond what is on the page to evaluate what is in the mind of readers and writers across time (Flower & Hayes, 1980; Langer, 1986; Norris, in press).

Conclusions

Recognizing the aforementioned limitations, we wish to make the case that the present data support the view that reading and writing in combination have the potential to contribute in powerful ways to thinking. In particular, if we adopt the view that "critical thinking is reasonable reflecting thinking that is focused on deciding what to believe and do" (Ennis, 1987), then we contend that reading and writing, as invoking thought processes, can help a learner decide "what to believe and do."

Our data indicated that reading and writing in combination contributed to a wide range of revisions (additions, deletions, substitutions, etc.) and to higher quality drafts (especially in content) than writing alone. Furthermore, when the students' revisions were examined in conjunction with their ongoing thinking, it was apparent that students who read and wrote engaged in thinking that was somewhat dialectical in nature. Writing appeared to serve as a mode through which the learner allowed ideas to come to fruition and resolved disputes. Reading served as a resource for opposing views or for further elaborations upon an idea. In many ways, the students' debriefing comments provided the clearest evidence of the quality of the students' thinking as they pursued these tasks separately and in combination.

As a means of illuminating how reading and writing work together, it may be helpful to look at the students' debriefing comments about their thinking as it developed across the various tasks. For example, in the following comments students describe the impact of writing on their thinking as they wrote the first draft of the letter.

Writing made me choose an opinion on the issue and bring up all the facts and opinions.

The letter forced me to choose—against or for it—polarized my opinion more than it had been originally.

I had to get my thoughts and opinions together on the subject, and also try to find out how much I knew about it.

It helped me to understand the topic more and my feelings about it as I saw what I wrote. I had to think before I wrote to organize my thoughts. The more I thought about it, the more I began to understand it.

In each of the four comments, we see the mobilizing effect of writing, the generative process of accessing knowledge, followed by an attempt to organize this knowledge into communicable form. In addition, we see the beginning of one side of a dialectic in statements such as "Writing made me choose an opinion," and "The letter forced me to choose—against or for it—polarized my opinion." Furthermore, writing helped each learner elaborate upon his or her side of the argument: "It helped me understand the topic more and my feelings about it as I saw what I wrote."

Once these students mobilized their arguments, they were asked to read an article concerning the topic. In some cases, the article corroborated their own views; in others, the article offered an opposing view. In either case, reading served mainly as a way of examining perspectives (pro vs. con) and, perhaps, of acquiring new knowledge about the topic.

This had an influencing effect! I could imagine if I was given an article with the opposite views supported, I would have probably made a few more changes in the letter itself!

Reading opened me up to other opinions on the subject—presented different points of view.

...Made me think twice about my viewpoint....

Allowed me to educate myself on the issues involved.

Reading helped me to see the topic in a clearer perspective, but only one side of it. There was another direction I could've chosen but I chose not to.

After reading the article, I wrote my editorial more thoroughly. I referred back to the article and thought about what parts of the article I was aware of: Did I see actresses being exploited? Was age a factor?

[Reading] helped me a lot in writing because I could see which stands I agreed with.

I became aware of how much I don't know about the topic. It's true that I can form opinions by what I see in the movies, but I need to do more reading on the topic.

I feel it was a bit reactionary and I would want to know more before I really wrote a letter.

Just as in a constructive debate, in which each participant attempts to enlighten the opposing party, the reader can engage in a dialogue with the author of the text. If the reader enters this dialogue with an open mind and a willingness to update continually his or her understanding of various perspectives, reading will provide for examination, reflection, and acquisition.

The final stage in the reading/writing sequence in this study was revision. The students had mobilized a perspective, and had then entered in an exchange with another writer about the issue. Finally, they had the opportunity to return to their initial position and revise that stance, if they felt compelled to do so.

[Revision] allowed me to reevaluate my position in light of what I had just learned.

Revision allowed me to focus my argument more rationally—made me cut out superfluous things.

I could rethink the issue, after organizing a few ideas and thinking about my reactions.

I went back over and analyzed and organized my thoughts.

Revision afforded them the opportunity to explore the topic recursively: to rethink, reevaluate, and refocus. It was as if reading and writing in combination afforded an understanding that included transaction and self-reflection.

Implications

What are the ramifications of these findings for theory, research, and practice? In terms of theory, the results of the present study complement current notions of knowledge acquisition. In particular, we found that reading and writing together can help students to extend their thinking and to acquire multiple perspectives on a topic. This function of reading and writing is consistent with emerging views of the acquisition of complex understandings. For example, Spiro and associates (Spiro, Vispoel, Schmitz, Samarapungavan, & Boerger, 1987) have proposed a model that extends a metaphor first put forth by Wittgenstein (1953), which describes a domain of knowledge as a "landscape" which can be traversed by "criss-crossing it in many directions and from several perspectives."

By criss-crossing the complex topical landscape, the twin goals of highlighting multifacetedness and establishing multiple connections are attained. Also, awareness of variability and irregularity is heightened, alternative routes of traversal of the topic's complexity are illustrated, multiple routes for later information retrieval are established, and the general skill of working around that particular landscape is developed.... It builds flexible knowledge. (p. 8)

In accordance with this view, the present findings suggest that reading and writing can serve as different ways of traversing a topic.

In terms of research, the present study has both substantive and methodological implications for the interpretation of past studies and the planning of future ones. First, the present study highlights the importance of examining the reasoning operations concurrent with students' involvement in various tasks (reading, writing, answering questions, discussion, etc.). Delving into the thought processes of students can often inform us of invisible thinking, including shifts in perspective or changes in un-

derstanding which might otherwise have gone unnoticed.

Second, the present study suggests that thought processes are reflexive, so much so that researchers need to consider carefully the point in time or points in time at which they are studied. Several past studies have tended to offer rather static portrayals of thought processes students engage in as they work on various writing tasks or adjunct learning tasks such as note-taking. For example, Langer and Applebee (1987) have suggested that they can predict the thought processes likely to be engaged when students perform certain writing tasks. Data from the present study suggest that thought processes change over time, and that to assess the reasoning operations engaged during different tasks, researchers must consider time and other contextual features and view the process more dynamically. We see a need for studies that examine how reasoning operations are orchestrated and how they function across time.

Third, in future research it may be possible to address a limitation of, and to extend, the present study. In our study we restricted the students to sets of predetermined modes for exploring the given topics. Furthermore, we prescribed a limited number of drafts, readings, and so on. Future studies might be less restrictive by allowing students the opportunity to initiate their own use of reading, writing, and so on. To date, research is lacking on the type of thinking that occurs across extended learning situations in which students make use of various reading and writing opportunities for themselves (e.g., writing a term paper).

Fourth, the present study has ramifications for research on revision. Many researchers have commented that subjects who are not experienced or very proficient writers do little revising other than surface changes (for a review, see Hillocks, 1986). Furthermore, even when some revisions are made, it is very rare to see any shifts in perspective. The students involved in the present study (at least the students who read) did not fit this pattern. Those who both read and wrote went beyond just editing their first draft to making several additions and other transformations, including some shifts in per-

spective. Observations of professional writers suggest that they go back to other material as a means of fueling their reexamination, thinking, and subsequent development of ideas (Murray, 1982). Nevertheless, most research on revision to date has not addressed the question of the kinds of sources or resources—other than peers or instructors—that other writers use in their revision process.

For instruction, the findings of the study suggest some empirical support for the affidavits offered by educators regarding the value of reading and writing working together. In particular, reading and writing together appear to prompt more critical thinking. As we stated earlier, a kind of dialectic emerged in the context of writing and reading together, which did not occur when students only read, only wrote, only answered questions, or only participated in other introductory activities such as brainstorming. In other words, when writers engaged in reading and readers engaged in writing, a symbiotic relationship emerged between the two ways of knowing. In this symbiosis, reading and writing afforded students the opportunities to think more critically. By criss-crossing the terrain of a topic, they appeared to achieve multiple perspectives and a more evaluative stance with regard to their own understanding.

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APPENDIXES

Appendix A Sample instructions for each activity

Introductory activity

For writing group:

Baby Fae was an infant whose chances for survival were very slim, even with the heart transplant she required at birth. As an experiment and with her parents' approval, doctors at the Loma Linda University Medical Center transplanted a baboon's heart into the chest of Baby Fae. The medical experiment prolonged Baby Fae's life for twenty days. As a consequence, several objections have been raised concerning the ethics of the baboon heart transplant. What is your opinion regarding this issue?

Assuming the readers of the newspaper to which you are writing would be well informed about this issue, write a "Letter to the Editor" on the following page(s) expressing your opinion.

For knowledge activation group:

Baby Fae was an infant whose chances for survival were very slim, even with the heart transplant she required at birth. As an experiment and with her parents' approval, doctors at the Loma Linda University Medical Center transplanted a baboon's heart into the chest of Baby Fae. The medical experiment prolonged Baby Fae's life for twenty days.

On the following page using the columns "For" and "Against" list as many ideas as you can regarding the stated issue.

For no activity group:

Baby Fae was an infant whose chances for survival were very slim, even with the heart transplant she required at birth. As an experiment and with her parents' approval, doctors at the Loma Linda University Medical Center transplanted a baboon's heart into the chest of Baby Fae. The medical experiment prolonged Baby Fae's life for twenty days.

As a consequence, several objections have been raised concerning the ethics of the baboon heart transplant.

Reading task: "Baby Fae"

For reading group:

The placing of a baboon heart into the chest of little Baby Fae caused indignation in many sections of the community. For some, the concern was animal rights. For example, pickets outside the Loma Linda University Medical Center and elsewhere protested the use of baboons as organ factories. Dr. Leonard Bailey, the chief surgeon, was not impressed. "I am a member of the human species," he said. "Human babies come first." He did not even have to bring up the argument that in a society that eats meat, wears mink and has for some time been implanting pig valves in human hearts, the idea of weighing an animal's life equally against a human baby's is bizarre.

Others were more concerned with the dignity of the human recipient. Before Baby Fae's smile on television had won over the skeptics, some described the situation as "ghoulish": They felt as if some sacred line between human and animal had been broken or some principle which separated man from beast had been violated. To such people, it is a blow to man's...

Question task

For question group:

1. Baby Fae was an infant who, because of a severe heart condition, was the subject of an unusual, experimental heart transplant. With the approval of the young girl's parents, doctors transplanted the heart of a healthy baboon into Baby Fae's chest.

What are the objections that have been raised against Baby Fae's baboon heart transplant?

2. In your opinion, which arguments, either for or against the transplant, are the most persuasive? Why?
3. In years past, laboratory animals have been the only living subjects utilized in medical research. However, recently human subjects have been used for artificial heart transplant research and, more specifically, in Baby Fae's baboon heart transplant. How could one defend the statement "Only under certain conditions would the use of humans for medical research be considered ethical"?
4. With Baby Fae's situation in mind, either defend or argue the following statement: The quality of human life for the future requires individual sacrifice now.

Essay/revision task

For those subjects who had written an essay as an introductory activity:

Now that you have had a chance to perhaps formulate your ideas concerning the Baby Fae issue, please revise your letter to the editor. You have a choice: (1) make minor or major revisions using a different colored pen or pencil; (2) completely revise and rewrite your letter; or (3) if you are happy with your original letter, resubmit it.

For those subjects who had *not* written an essay as an introductory activity:

Now that you have had a chance to perhaps formulate your ideas concerning the Baby Fae issue, we would like you to write a "Letter to the Editor" of a newspaper. As you write your letter on the following page(s), assume the readers of the newspapers to which you are writing are well-informed of the issue.

Debriefing questions

For all groups:

We are considering the effects of writing an essay (a letter to the editor) on reading editorials on the same topic. To help us study this issue each of you performed one or more of the following activities:

Wrote a letter to an editor
 Read a persuasive article
 Answered selected questions
 Revised your original letter

What we would like you to do is identify how these different activities influenced your reading, writing, or ability to understand the topic. Please be honest in your response. Your response will help us understand better what happens when people read and write on the same topic.

1. In what ways did the activities that you completed help you to understand the topic?

Writing a letter to the editor
 Reading a persuasive article
 Answering selected questions
 Revising your original letter

2. How did the activities influence the way you did your reading and writing?

3. How did the activities influence your attitude toward the topic?

Appendix B Coding scheme for types of revisions

Tierney Study - Revision Coding Sheets

Student Number _____ Condition _____

	Change Categories	Content (TB/N, TB)	Discourse Structure	Stylistic	Basis for Judgment
ADDITIONS:	Metalingual				
	Examples				
	Transitions				
	New Ideas (Superordinate)				
	New Ideas (Subordinate)				
DELETIONS:	Metalingual				
	Examples				
	Transitions				
	Existing Ideas (Superordinate)				
	Existing Ideas (Subordinate)				
REWRITES/REWORK:	Paraphrase-Substitution				
	Paraphrase-Permutation				
	Paraphrase-Distribution				
	Paraphrase-Consolidation				
	Correction-Substitution				
	Correction-Permutation				
	Correction-Distribution				
	Correction Consolidation				
MECHANICS	Reversals				
	Spelling				
	Tense				
	Number				
	Modality				
	Punctuation				
	Syntax				
	Other Grammatical				
	Abbreviation				
	Register				
	Format				

Evaluative comments by writers in debriefing:

Appendix C Sample debriefing comments by cognitive category

Generating/accessing	
Ideas, topic	"Really got me thinking. I didn't realize that the famous actresses didn't get paid as much as actors." "It got me thinking about the topic/subject."
Questions	"It brought some questions to mind." "I had several questions about sexism."
Hypotheses	"I hypothesized what the basic problems or complaints might have been about."
Opinion (own)	"It made me decide what stance I would take on the issue based upon my previous knowledge."
Perspective of others	"It gave me some hints about how a person on the other side of the argument might feel."
Plan	"It made me realize that I needed to be careful reading the article." "I really had to read them carefully to try to understand what I was answering."
Altering opinion	
	"My attitude tended to change once I read the article turning toward the author's view." "It changed my opinion on the issue."
Clarifying, refining, confirming	
Elaboration (evidence, examples)	"It provided examples and other details." "I was forced to be specific with my evidence."
Coherence, clarity, logic	"Allowed one to reorganize/rethink any thoughts in a more logical manner." "It clarified some of the facts." "It helped me formulate ideas which were rational and coherent." "It allowed me to clarify and organize my thoughts." "Made me cut out superfluous things." "Allowed me to work through my argument again to make sure that everything fit together logically."
Focus	"It got me to focus on the main purpose and point of the letter." "This helped me narrow in on the issue. I was able to focus much better."
Opinion	"Strengthened my views." "It helped establish how I would defend my opinion." "It reinforced some of the opinions I had." "Reinforced my opinion and made my convictions in this area stronger."
Perspective of others	"It made clear another perspective."
Evaluating	
Ideas, topic	"I went back and analyzed my ideas." "It made me realize how important and serious this topic was to our everyday life." "Brought up some ideas which I had to evaluate. Made me check specifics."
Arguments	"I found a few logical flaws."
Questions	"Questions came to mind as I analyzed the ideas."
Hypotheses	"They made me analyze all the different possible conclusions that can be made."
Opinion	"It helped me find some inconsistencies in the way I felt." "It made me more critical of my own opinion."
Perspective of others	"I became very critical of the perspective. I became skeptical as I read more critically."
Plan	"I realized I was writing my ideas too quickly." "I realized that I was not being critical."

Acquiring momentum for further learning organization

- | | |
|------------------|--|
| Order/structure | "I paid attention to form using a type of antithesis for effectiveness."
"I was able to improve the order of it." |
| Surface features | "It was merely a quick check of punctuations which I found to be correct."
"I was able to state my ideas more grammatically correct." |

Reacting negatively/neutrally

- | | |
|------------|--|
| Not done | |
| No comment | |
| Negative | "Didn't help—didn't give me any information."
"I don't like writing letters to the editor." |

Making connections with other modes

- "After reading and writing my earlier piece, I was able to formulate my ideas more thoughtfully—citing examples, varying my organization, and cutting out superfluous details."
- "Writing gave me a basis for comparing my angles before reading someone else's point of view."
- "Writing helped me understand the article and my own ideas more clearly. It got me going back to it."
- "Revising helped me realize that the article I had read impacted me."
-