In light of recent theoretical and empirical developments in the areas of reading, writing, and learning, this article proposes a view of literacy learning in which various forms of reading and writing are conceptualized as unique ways of thinking about and exploring a topic of study en route to acquiring knowledge. Throughout this article, we take the theoretical position that a topic of study is analogous to a conceptual "landscape" about which knowledge is best acquired by "traversing" it from a variety of perspectives. In this system, different forms of reading and writing represent the "traversal routes" through which an individual can explore a given content domain. Specifically, we wish to argue that more complex or diverse combinations of different forms of reading and writing provide a learner with the means to conduct a more critical inquiry of a topic by virtue of the multiple perspectives or ways of "seeing" and thinking that these reading and writing exchanges permit. Finally, in light of this theoretical orientation, we contend that the ability to direct dynamically one's own reading and writing engagements en route to learning is central to conducting an inquiry of this nature. This perspective suggests a reexamination of a line of research that has pursued the question of how writing in combination with reading influences thinking and learning.

Traversing the Topical Landscape

Reading and Writing as Ways of Knowing

WILLIAM McGINLEY
University of Michigan

ROBERT J. TIERNEY
Ohio State University

McGinley, W. & Tierney, R. (1989). Traversing the Topical Landscape: Reading and Writing as Ways of Knowing. *Written Communication*, *6*(3), 243–269.

A principal tenet of recent theories in the area of writing is the belief that writing actually engenders understanding by virtue of the exploration and reexamination of ideas that it affords (for a review, see Applebee, 1984b). Recent instructional reforms have advocated the improvement of writing instruction as a means to improve the thinking

WRITTEN COMMUNICATION, Vol. 6 No. 3, July 1989 243-269

and reasoning ability of students in academic subjects. These reforms, often referred to as "*writing across the curriculum*," originate with the belief that the kind of writing students do in school has a direct influence on the quality of thinking in which they are required to engage (Fulweiler & Young, 1982; Gage, 1986; Gere, 1985; Langer & Applebee, 1987; Martin, 1975; Mayher, Lester, & Pradl, 1983; Newkirk & Atwell, 1982).

As a corollary of this view, both educators and theorists from a wide range of academic disciplines have expressed concern over the need to begin fostering students' ability to *think critically* about issues and topics of study (Ennis, 1987; Freire, 1982; McPeck, 1981; Smith, 1988; and Tchudi, 1988). In the area of literacy and literacy education, proponents of this view have emphasized the role of schooling in the development of students' "critical literacy" or more specifically, their ability to use reading and writing in ways that exceed those uses often associated with minimum competency (Giroux, 1988; Katz, 1982; Walters, Daniell, & Trachsel, 1987). Indeed, the comment offered by a recent panel of United States educators about the use of reading and writing in the study of biology underscores this relationship between reading and writing and the development of a kind of critical intelligence. As the panel concurred: "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" (Guthrie, 1986, p. 15).

Still other theorists have stressed the relationship between learner-initiative or student empowerment and the ability to use reading and writing to think dialectically in order to conduct a thorough topical inquiry (Giroux, 1988; McGinley & Tierney, 1988; O'Flahavan & Tierney, in press). Giroux, for example, advocates a redefinition of the pedagogy of both writing and critical thinking:

> Any approach to critical thinking, regardless of how progressive it might be, will vitiate its own possibilities if it operates out of a web of classroom social relations that are authoritatively hierarchial and promote passivity, docility, and silence. Social relations in the classroom that glorify the teacher as the expert, the dispenser of knowledge, end up crippling student imagination and creativity: in addition, such approaches teach students more about the legitimacy of passivity, than about the need to examine critically the lives they lead. (p. 64)

In their recent chapter on reading, writing, and thinking, O'Flahavan and Tierney (in press) explore the dependencies that underly this connection between literacy, student initiative, and fostering critical thinking:

> Critical thinkers must have and take the initiative in order to move along a line of inquiry. Critical thinkers must recognize the value of initiating an engagement (in reading or writing) at an appropriate time. They must have an understanding of the unique purposes of reading and writing, as well as the combinatorial power of the two.

Despite growing agreement on these claims, current empirical tests of the effects of writing in conjunction with reading upon thinking and learning offer little in the way of helping us to understand how students' ability to direct their own reading and writing engagements en route to learning might contribute to critical thinking and the acquisition of knowledge on various topics of study. In general, by restricting or prescribing the diversity of the reading and writing exchanges in which students are permitted to engage or by simply not examining such learner-initiated exchanges, these studies provide a somewhat limited picture of how students might *use* more complex combinations of reading and writing en route to thinking and learning. O'Flahavan and Tierney (in press) conceive of these more complex combinations of reading and writing as "higher-order juxtapositions" that are engendered by instructional settings that sanction and promote learner-initiative and self-direction. Similarly, in a recent study of the self-directed reading and writing in which students engaged en route to formulating a persuasive essay, McGinley (1989) found that an individual learner was capable of creating, through his or her own recursive engagements, "a kind of *vicarious community* of readers and writers" exchanging different topical notes, reading articles, writing the essay, reading the essay, and reading their notes (p. 131).

Therefore, the theoretical view and program of research presented in this article seeks to establish the importance of studying students' *self-directed* engagements in reading and writing to learn. This program is derived from the theoretical position that when students are involved in directing their own reading and writing activities (writing notes, reading articles, writing a draft, reading notes, reading a draft, making an outline, etc.) in pursuit of some other learning, they are able to avail themselves of the different perspectives and ways of thinking that more elaborate combinations of each of these activities will permit.

To reiterate, in this article we wish to propose that as students are able to move intentionally and recursively among these engagements (as it is relevant to their particular needs), they are making fuller use of the combined powers of reading and writing as ways of knowing and exploring a "topical landscape." In making our position clear, we begin by establishing the conceptual basis for reading and writing as ways of thinking. Second, we present our own theoretical perspective on literacy in which reading and writing are understood as different conceptual "lenses" through which one can explore a topic. The metaphor of "criss-crossing" is introduced as basis for reexamining a series of influential empirical studies on the effect of writing upon reading and learning in both literature and the social sciences. We then present the results of three recent studies that examined students' self-directed reading and writing engagements before discussing additional empirical paradigms for exploring the proposed theoretical position. Finally, we discuss the implications of this view for instructional programs that advocate the development of a critical literacy and a critical intelligence.

THE BASIS FOR READING AND WRITING AS WAYS OF THINKING AND LEARNING

Perhaps one of the most influential developments in language research of the last decade is the view that both readers and writers are involved in the act of creating or composing a "textual-world" during the process of making meaning (Kucer, 1985; Langer, 1986a; 1986b; Tierney & Pearson, 1984). Kucer, for example, explains that understanding the relationship between reading and writing lies in recognizing each act as an essentially separate instance of text-world production "drawing from a common pool of cognitive and linguistic operations" (p. 319). Similarily, Tierney and Pearson (1984) argue that fluent reading involves several processes that are also characteristics of good writing. According to their view, proficient readers often plan or set goals prior to reading, draft or compose an initial understanding of the meaning that they are making, align or take a stance about the meaning being composed, revise or refine the meaning that they are developing, and monitor or evaluate the plausibility of the interpretation that they are constructing. While these comparisons serve to establish some common ground between the processes of composing and comprehending, the metaphors of text-world production and composing are also of theoretical and pedagogical importance in that they reinforce the active, productive nature of reading as well as writing.

Historically, the act of reading has been viewed as a receptive, text-centered process of abstracting the author's meaning from the text. However, in light of recent empirical developments in cognitive psychology, readers have been described as performing a series of more cognitively engaging activities analogous to evolving a schema (Anderson & Pearson, 1984); building and revising a model of the text (Collins, Larkin, & Brown, 1980); developing envisionments or momentary understandings of a text (Langer, 1986a, 1986b); generating relations between the text and one's experience (Linden & Wittrock, 1981; Wittrock, 1984); testing and evaluating hypotheses for "goodness of fit" to aspects of a given test (Rumelhart, 1984); and enriching, elaborating, and assembling meaning based on context-relevant prior knowledge (Spiro, 1980).

Phenomenological theories of the act of reading reflect a somewhat similar position. For example, Barthes (1974) argues that the value in embracing a more "writerly" view of texts as opposed to a "readerly" view is that it holds the reader to be a "producer" rather than a "consumer" of texts (p. 4). Rosenblatt (1978) explains the reader's creation of meaning from a text as an "active, self-ordering and self-correcting process" characterized by subtle adjustments and refinements of meaning in an effort to achieve a coherent interpretation. Similarily, Iser (1978) suggests that "reading is not simply a text-based activity, but an interactive (transactive) process in which reader and the text both contribute to the meaning that evolves" (p. 588).

The notion that the act of writing engenders new learning has been a topic of interest and discussion among both psychologists and researchers in writing for a many years, appearing first in the writings of Aristotle and the arts of classical rhetoric. Though Aristotle's rhetorics were concerned with oratory as opposed to writing, the art of invention consisted of a set of heuristic procedures or an inventory that informed a writer en route to conducting a thorough examination of a topic of study (Freese's trans., 1975).

More recently, in exploring writing as heuristic, Luria and Yudovich (1971) explain that writing "represents a new and powerful instrument of thought" by virtue of its "slower, repeated mediating process of analysis and synthesis" as well as its "self-reviewing structure" (p. 118). Britton (1970) explains that the act of composing affords the symbolic

representation of experience, and in so doing has the effect of organizing experience and rendering it more memorable. In exploring the distinction between "inner speech" and "written speech," Vygotsky (1962) contends that writing requires more "deliberate analytical action" and an awareness of the process involved in constructing meaning (p. 99). As he writes: "The change from maximally compact inner speech to maximally detailed written speech requires what might be called deliberate semantics—deliberate structuring of the web of meaning" (p. 100).

In exploring writing as a unique mode of learning, different from other language processes such as listening, reading, and talking, Emig (1977) delineates how composing, as a single act, encompasses many of the features that psychologists have traditionally associated with learning strategies. For example, Emig explains that writing is a "uniquely powerful multi-representational mode for learning" because when we compose, we learn by doing, by witnessing what we have done, and by representing experience symbolically (p. 124).

Still other researchers have argued persuasively that writing can sponsor learning because it involves one in the process of "joining bits of information into relationships, many of which have never existed until the composer utters them" (Nostrand, 1979, p. 178). Martin (1975) expresses the view that the act of writing, which induces one to engage in a process of personal selection, contemplation, and differentiation, changes the writer, making him or her "a different person" for having "articulated a feeling, thought, or attitude more clearly" (p. 35). Van DeWeghe (1987) describes the composing process as the vehicle through which writers often create "heuristic moments" or moments of conceptual breakthrough or insight into a topic.

Recently, Gage (1986) described how writing contributes to knowing in his recent chapter "Why Write" in the NSSE yearbook:

> Writing is thinking made tangible, thinking that can be examined because it is on the page and not on the head invisibly floating around. Writing is thinking that can be stopped and tinkered with. It is a way of holding thought still enough to examine its structure, its flaws. The road to clearer understanding of one's thoughts is travelled 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)

TRAVERSING A TOPICAL LANDSCAPE: THEORIES OF KNOWLEDGE ACQUISITION

The view that different types of reading and writing represent different ways of thinking and knowing parallels current views of knowledge acquisition in complex and "ill-structured" content domains (Spiro et al., 1987). Inspired by the later work of Wittgenstein (1953) and his prominent metaphors for knowledge and learning, particulary the metaphor of the "criss-crossed landscape," Spiro and his colleagues describe an approach to knowledge acquisition that treats a content domain as a landscape that is explored by criss-crossing it in many directions and from several perspectives (Spiro et al., 1987).

Spiro introduces the term "ill-structured" in characterizing those knowledge domains that, "because of a combination of breadth, complexity, and irregularity, formulating knowledge in that domain to explicitly prescribe its full range of uses is impossible" (p. 2). Because of the ill-structured nature of many content domains (e.g., medicine, business, literature, history), knowledge representation systems and instructional strategies that tend to oversimplify or "artificially neaten" such complexity do not foster the kind of "cognitive flexibility" necessary for knowledge transfer and application to a wide range of new situations. In order to build flexibility, Spiro et al. (1987) propose an approach to knowledge acquisition that is highly case-based. In this approach, various cases provide the means or "routes" for "traversing a topical landscape," each affording its own unique view or perspective on the topic of interest. The instructional system underlying this theory emphasizes training that induces students to make "connections between several apparently dissimilar cases" that are related to a particular topic of study (p. 187). Spiro argues that while there may be some similarity across relevant cases, each individual case is capable of contributing something different to our knowledge of a given content. In this way, it is the *combination* of these different cases that forms the foundation of case-based cognitive processing. He explains: "Instead of a single case being the basis for case-based cognitive processing, *aspects* of different cases need to be *combined*, and it is the resulting assemblages, made up of fragments of different cases, that underlie an important part of case-based reasoning" (p. 7).

We wish to explore further the metaphors of Wittgenstein and the theoretical work of Spiro in case-based learning because they provide

support for a view of critical literacy in which various forms of reading and writing are understood as different ways of knowing or criss-crossing a conceptual landscape. After Wittgenstein (1953), we also take the theoretical position that a topic of study is analogous to a landscape about which knowledge is best acquired by "traversing" it from a variety of perspectives. However, in our system, different forms of reading and writing represent the "traversal routes" or cases through which an individual can explore a given content domain. As the combined *assemblages* of several cases provide multiple routes for acquiring knowledge, we argue that more complex or diverse combinations of different forms of reading and writing provide a learner with the means to conduct a more critical examination of a topic by way of the multiple perspectives or ways of "seeing" and thinking that these reading and writing exchanges permit. In light of this theoretical orientation, we contend that the ability to direct dynamically one's own reading and writing engagements in order to learn is central to conducting an inquiry of this nature by virtue of the diverse, situationally appropriate combinations and perpectives that self-direction permits. In the following section we examine a series of studies that have investigated the influence of writing upon reading and learning from text because they provide a basis for discussing the relationship between self-direction, reading and writing, and the notion of criss-crossing and conducting a critical inquiry of a subject.

STUDIES OF THE INFLUENCE OF READING AND WRITING UPON THINKING AND LEARNING

In examining the effects of writing on thinking and learning from texts, researchers have demonstrated that writing in conjunction with reading results in learning or understanding not achieved when either reading or writing are undertaken alone (Colvin-Murphy, 1986; Copeland, in press; Langer & Applebee, 1987; Salvatori, 1985; Tierney et al., in press). In addition, a group of related studies suggests that while extended forms of writing (e.g., analytical or personal essays) in combination with reading result in a more critical understanding of topics in both literature and the social sciences, various types of writing (e.g., analytical, personal, restricted, notes, summaries, and answers to study questions) resulted in uniquely different patterns of reasoning and

different types of learning (Langer & Applebee, 1987; Marshall, 1987; Newell, 1984; Tierney et al., in press).

Nevertheless, this class of very important contemporary approaches to understanding the influence of reading and writing upon thinking and learning have several interrelated limitations concerning our understanding of the dependencies that underlie literacy, student-initiative, and the ability to conduct a critical inquiry. In general, these limitations stem from the use of experimental approaches that have involved giving students a prescribed set of reading and writing engagements through which to think and learn about topics. As a result, these modes of inquiry have the following five limiting characteristics.

First, observing students as they move through a prescription of engagements offers little in the way of helping us to understand how students' ability to direct dynamically their own reading and writing activities en route to learning might contribute to thinking, learning, and conducting a topical investigation.

Second, because reading and writing engagements are often prescribed, they provide little opportunity to understand the reasoning underlying students' strategic *decisions* to shift back and forth from one form of reading or writing to another, as well as the purposes that these different engagements served in helping students make progress toward their goal.

Third, by restricting the diversity of the reading and writing exchanges in which students are permitted to engage or by simply not examining such recursive, self-directed exchanges, these studies provide only a glimpse of how more elaborate and complex combinations of reading and writing might contribute to learning and exploring a topic.

Fourth, in maintaining considerable control of the way in which students use reading and writing to learn, our knowledge of how students' reading and writing behaviors might vary as a function of the different tasks they are asked to perform, the topics they study, and the nature of their topical knowledge has not been fully explored.

Finally, these studies indirectly foster a pedagogy that inveighs against critical thinking by failing to invite students to assume a more active and self-directed stance with respect to learning and conducting a topical inquiry.

While research on the influence of writing on students' understanding of both narrative and expository texts provides some support and definition about how composing might facilitate such learning, our

intention here will be to reexamine these studies in hopes of understanding just how various *combinations* of reading and writing contribute to thinking, learning, and the process of researching a subject of interest. In particular, our purpose will be to reexamine each study for its potential to provide insight into how more elaborate reading and writing combinations or ways of knowing and "criss-crossing" a topic might engender critical understandings. Through our examination of these studies, we invite you to pursue the question of how learner-initiative or self-direction might engender the kinds of diverse reading and writing exchanges that are believed to be necessary in critically exploring a topic of study. In addition, we ask that you consider the extent to which each study represents an examination of the effects of a static set of prescribed reading and writing *juxtapositions* versus an exploration of students' *dynamic use* of a fluid set of recursive reading and writing exchanges. To appreciate the specific methodologies, ramifications, and limitations of this line of research, consider the following studies in which different forms of writing are combined with reading in the areas of literature, science, and the social sciences.

Reading, Writing, and Learning from Literature

As different forms of reading and writing represent the ways of "criss-crossing" or traversing a topic of study, the work of Marshall (1987) represents an attempt to offer students, in their respective experimental conditions, a *single* perspective or way of exploring a particular content or story. Specifically, this study examined the effects of combining writing and reading in conjunction with doing an instructional unit on J. D. Salinger with three classes of eleventh grade students. During the unit, students read Salinger's short stories with no teacher-sponsored discussion and then were directed to to examine the story from one of three possible perspectives as determined by the type of writing in which they were instructed to engage: (a) restricted writing—students were to respond to eight short-answer questions concerning aspects of each story; (b) personal writing—students were to explain and elaborate upon their individual responses to the story, drawing on their own values and previous experience; and (c) formal writing—students were to interpret the story in extended fashion, drawing inferences mainly from the text alone. Results indicated that *when students wrote extensively after reading, they performed better* on a posttest designed to measure several levels of literary understanding. Of special interest, when students engaged in personal writing, they approached the stories from more diverse literary perspectives when compared to restricted writing as evidenced by the range of descriptive, personal, interpretative, and evaluative statements appearing in their writing. In examining the reasoning operations that students engaged in before and during different types of writing, Marshall found that extended writing induced students to engage in significantly more examination, interpretation, and deliberation of the stories.

Employing a similar approach, Colvin-Murphy (1986) examined the thinking and learning that resulted from the controlled juxtaposition of three different forms of writing with reading, Specifically, Colvin-Murphy studied the effects of having 85 eleventh-grade students complete various post-reading activities in response to a series of poems. In the post-reading activities small groups of students engaged in a self-directed discussion of each poem following their completion of one of the following single perspective juxtapositions: reading a poem with extended writing, reading a poem with worksheet activities, and reading the poem only. The extended writing activity was done in response to Bleich's (1975) heuristic: What did you see? What thoughts and associations come to mind? What other things does it lead you to think about? Based upon pre- and posttest measures and interview data, students engaged in writing remembered more of the poem's content, were more engaged in thinking about what they were reading, and were more sensitive to the author's craft. Much like the research of Marshall (1987), students in this study were directed to think about and explore experiences from the twin perspectives of one engaged in three possible combinations of reading a poem with either extended writing, worksheets, or no writing at all. While such an approach is informative, it tells us little about students' ability to direct their own explorations as well as the effect that taking a number of diverse perspectives, through different forms of reading or writing, might have on students' learning and understanding. This is not to suggest that, in some instances, less complex traversals of material are inappropriate. Rather, we wish to argue that students' ability to navigate their own paths of study is an essential component in the process of thinking critically about topics.

From a more instructional orientation, the research of Salvatori (1985) represents an attempt to involve students in a series of more complex juxtapositions of reading, writing, and discussion with which

to traverse an area of study. Her research is based upon the notions of Gadamer (1986), a hermeneutic philosopher who believes that to understand a text is to come to understand oneself in a kind of dialogue. For example, in an attempt to have students become aware of their own voice, early stages of instruction involve them in combinations of both writing and discussion as a means of exploring a significant event in their lives. Using a thoughtfully developed sequence of writing with reading and discussion activities, Salvatori argues that the approach adopted by students can change from that which is passive to one which is active and dialectic. More specifically, by carefully guiding students' writing, reading, and discussion activities around significant events in their life, she demonstrated that she was able to move students away from mechanical responses, in which thinking and self-reflection either have no part or are unnecessarily complicating, to active engagements in critical inquiry involving self-reflection, dialogue, self-questioning, and discovery. Although the particular form and sequence of students' reading and writing is still carefully directed by the teacher, Salvatori's work is unique in that it represents an attempt to provide students with a strategic sequence of *recursive* reading and writing engagements that might more accurately resemble the sort of naturally occurring, dynamic reading and writing exchanges that a self-directed learner might enlist.

Reading, Writing, and Learning in Science and Social Science

Examination of a related group of studies investigating the influence of writing in combination with reading upon thinking and learning in two content areas reveals a similar set of empirical procedures and findings.

Newell (1984), for example, observed similar results in his investigation of learning in science and social science. Over the course of 12 weeks, Newell rotated 8 eleventh-grade students through the use of note taking, study-guide questions, and essays for different topics. Two major findings emerged from the study. First, students involved in essay writing, especially those who had limited knowledge of a topic, acquired more knowledge of key concepts than equivalent students who had either taken notes or responded to study guide questions. Second, based on an analysis of students' think-aloud protocols when they were involved in essay writing, students engaged in a greater number of overall cognitive (reasoning) operations (i.e., planning, generating, organizing, goal setting, translating, and reviewing) in comparison to notetaking and answering study-guide questions. Newell argues that the production of coherent rather than fragmentary text involved more extensive thought and consideration of passage content than either notetaking or study questions.

Copeland (in press) also investigated the influence of specific types of writing upon 120 sixth-grade students' ability to learn from informational texts. In this study, students were randomly assigned to one of four post-reading treatment conditions: (a) a writing activity that required them to synthesize major concepts in the passage; (b) a multiple-choice question activity that reviewed major concepts; (c) a directed rereading activity that required students to synthesize major concepts without writing; and (d) a control group activity that required students to solve vocabulary puzzles unrelated to the topic of the passages. Results of the study indicated that both good and poor writers who wrote compositions as part of their learning remembered substantially more factual information and were consistently more able to transfer and apply what they had learned to new situations.

In order to explain in more specific detail exactly how various forms of writing affect thinking and learning, Langer and Applebee (1987) conducted a three-year study which investigated writing and the teaching of writing in high school science, social science, and English classrooms. The study consisted of two basic lines of inquiry. On one level they sought to provide support for the contribution that writing can make to content area learning by examining the specific thinking process and learning that results from various tasks. On a second level, the authors worked collaboratively with content area teachers in various classroom settings in hopes of redirecting teachers' assignments of students' writing toward tasks that required more application, analysis, and interpretation of new learning. Findings from this first line of inquiry are of particular interest to us here.

In this aspect of the study, Langer and Applebee explored the nature of the thinking and learning that result when various types of writing/study activities are juxtaposed with reading in certain content areas. In order to examine students' thinking and learning during the tasks, students were taught to verbalize all thoughts that came to mind when completing the various assignments. Across three experiments, over 400 students from ninth to eleventh grade participated in a range of reading and/or writing tasks. Across the studies, these tasks directed students to engage in one of the following reading/writing prescrip-

tions that provided students with essentially two perspectives from which to examine or think about a topic: reading and studying without writing, reading and writing notes, reading and answering study-guide questions, reading and engaging in supplementary reading, reading and writing a summary, or reading and writing an analytical essay.

Across each of the studies conducted by Langer and Applebee, writing emerged as a powerful means of fostering students' subject matter learning. The authors report that each of the writing activities they examined resulted in learning not achieved when reading was performed in a context without some form of writing. In essence, different forms of writing provided learners with a somewhat different perspective or way of thinking about their topic. Results from students' think-aloud protocols and recall tasks indicated that summary writing and notetaking encouraged students to direct their attention to the whole text in more comprehensive yet more superficial ways. This is in sharp contrast to analytical writing that led students to think more deeply about fewer select ideas and information in the text. Finally, study-guide questions led to the least amount of in-depth processing of the information.

In general, the work of Newell, Copeland, and Langer and Applebee provides some very important insights into the influence that specific types of writing have upon understanding from texts. However, they reveal little about the effects that more elaborate combinations of dynamically occurring reading and writing engagements might have on learning and thinking critically. As reading and writing are conceptualized as different ways of knowing and exploring a topic, these studies represents an investigation of the effects of prescribing only two perspectives (reading a passage and some form of writing) from which students can examine or "criss-cross" an area of study.

An interesting recent study by Tierney et al. (in press) both complements and extends the findings of this research. However, it too leaves us with many important questions concerning the *dynamic use* of reading and writing as vehicles for learning and conducting an inquiry. This investigation was unique in its attempt to examine the effect that more complex combinations of reading, writing, rewriting, knowledge activation, and questioning have upon critical thinking and to provide insight into the role that each of these activities played in thinking and learning. In terms of the theoretical system we are proposing, this study represents an effort to "open up" or provide learners with more avenues (forms of reading and writing) through which to examine a

domain of study. In particular, this research pursued the question of whether writing in combination with reading prompts more thinking or cognitive engagement than reading or writing done separately or in combination with questions or a knowledge activation activity. They asked 137 undergraduate students to learn about and explore a topic through one of twelve prescribed combinations of the following: writing a letter to the editor about one of two issues; reading an editorial passage about the same issue; answering selected questions pertaining to the editorial; and revising a first draft of the letter to the editor. Upon completion of the activities, students responded to a series of written debriefing questions about the tasks. Analyses of the subjects' letters, revisions of those letters, responses to the passage questions, debriefing comments, and an examination of the contributions that reading, writing, knowledge activation, or questions had upon thinking and task engagement, revealed three major findings.

First, the individual activities of reading, writing, knowledge activation, and questions prompted different reasoning operations as measured by students' responses to a series of debriefing questions. Results also indicated that students who wrote in the context of reading were more engaged in the task (pursuing ideas, answering questions, and judging their own ideas and those of the authors); students who did not write at least once before composing a final draft (especially the knowledge activation group) appeared to read for purposes of remembering ideas. Second, the effects of these reasoning operations tended to shift depending on whether reading and writing occur separately or in combination with each other. This shift was especially apparent at the point of revision. Students who criss-crossed the topic through writing and reading were involved in pursuing a greater variety of changes to their original written text than those who explored the topic through writing alone. For example, while students who wrote and read made frequent additions and deletions in the process of reshaping their texts, students who wrote and did not read were most concerned with paraphrasing and correcting spelling and punctuation. Third, if having thought critically about an issue is reflected in a greater willingness to revise one's position on an issue, then the data suggest that certain combinations of reading and writing are more likely to induce one to think more carefully and deliberately than when reading or writing occurs separately.

While the research of Tierney et al. (in press) represents a significant contribution to our understanding of the effects that various

simulated combinations of reading and writing have upon thinking critically, we find ourselves at a theoretical crossroads with respect to future research efforts in this area. In particular, we must begin to address the questions and limitations that will accompany our decision to continue studying reading and writing as a static set of prescribed juxtapositions as opposed to exploring students' dynamic use of a fluid set of recursive reading and writing exchanges. Alternatively, a line of research aimed at exploring students' ability to use different forms of reading and writing in order to learn could conceivably offer insights into a series of important questions that heretofore had simply not been asked. For example, we might begin by asking, What is the relationship between learner initiative, literacy, and critical thinking? What is the nature of the reading and writing exchanges in which learners engage when they are invited to navigate their own particular path in investigating a topic? Can such complex arrays of naturally occurring reading and writing exchanges be prescribed or simulated experimentally? Do students vary in their ability to use different forms of reading and writing en route to conducting such inquiries? What effect would the combined engagements of reading passages, writing an essay, reading one's own essay, writing notes, reading notes, writing an outline, writing a series of brief summaries, etc., en route to learning, have upon topical understanding? Would the nature of such exchanges vary from complex to less complex as a function of students' topical knowledge, the specific task, and the particular academic discipline in which the inquiry was being conducted? And finally, how would the reasoning operations that characterize students' thinking over the course of a given task change as a result of the *combined* reading and writing activities in which they engaged?

While the specific approach that we propose has many connections to the prominent thematic strands of recent theoretical interest in understanding the relationship between reading, writing, and thinking, the specific questions that we wish to pursue and the empirical procedures that such questions entail are novel. In order to examine how these empirical procedures might be instantiated, we now turn to an examination of three recent studies of students' self-directed reading, writing, and learning. As we explore this research, special attention will be paid to the extent to which each study represents an exploration of the dynamic use of a variety of reading and writing activities and the insights such an exploration provides in understanding how different forms of reading and writing contribute to thinking and learning in specific content domains.

STUDIES OF THE DYNAMIC USE OF READING AND WRITING TO LEARN

The recent research of Kennedy (1985), Nelson and Hayes (1988), and McGinley (1989) incorporates many of the same themes of self-direction, dynamic use, and criss-crossing in attempting to understand some aspect of the role of reading and writing in learning. While each investigation bears certain similar thematic qualities, the specific way in which these similar themes are instantiated is unique.

In exploring the purposeful behaviors and processes of college learners, Kennedy (1985) studied the reading and writing of three fluent and three less fluent college readers as they engaged in the process of formulating an objective essay based on three specific articles on the topic of communication. By observing the self-directed reading and writing activities in which these learners engaged, Kennedy was able to pursue the question of how students differed in their ability to use various reading sources en route to learning and composing an essay. Results of the study indicated that when students were invited to pursue their own combinations of reading and writing, fluent and less fluent readers differed considerably in their ability to "write from sources." On the one hand, the fluent readers enlisted more diverse repertoires of various reading and writing study strategies through which to criss-cross and examine the topic of study. For example, more able readers tended to read and write with intention and purpose, retrieving information, writing notes, reading and revising their notes, and copying important quotations in order to integrate truly the source material with their own thoughts and ideas. As they composed their essays, these students relied on the "support texts" they had created (notes, quotations, etc.), rarely needing to refer back to the original articles for assistance. On the other hand, as the less able readers composed their essays, they enlisted a much less complex repertoire of reading and writing activities, drawing heavily on the resource articles, rereading them, and simply inserting pieces of text into their essays.

In a similar investigation consisting of two separate studies, Nelson and Hayes (1988) pursued the question of how college students direct their own searches for information as well as orchestrate the many tasks and decisions involved in writing a research paper over real time in naturalistic settings.

In the first study, Nelson and Hayes compared the strategies that eight freshmen and eight advanced writers (upperclassmen and graduate students) used as they both planned to search and searched for information in order to complete a research/writing assignment focussing on the relationship between the United States and a particular Latin American country. Examination of students' initial think-aloud protocols and their process logs (a written record of their own processes) as they directed their information searches revealed several important differences in the specific goals and strategies employed by both groups of writers. In general, students' strategies for planning their search, finding sources, limiting searches, and accepting or rejecting sources tended to be driven by their initial representation of the task as either one of finding facts (content-driven) or as a situation that required them to find a provocative issue or a unique perspective from which to direct their search (issue driven). For example, the tendency of freshman writers to define the task as a "fact-finding mission" was reflected in their attempts to "streamline" the entire information searching process by simply skimming for information in order to conveniently *assemble* content in their essay. In contrast, students employing a more issue-driven approach tended to search for, accept, and/or reject sources of information on the basis of how reliable and relevant the content was with respect to their specific goals.

In the second study, Nelson and Hayes examined the processes and strategies of eight college undergraduates, selected at random from a variety of academic courses in the arts, sciences, and humanities, as they performed the many tasks involved in writing a research paper. In general, analysis of the reading and writing activities in which students engaged, as gleaned from their process logs, revealed that students tended to apply either very efficient "low-investment" strategies requiring little engagement, or more time consuming "high-investment" strategies characteristic of a more critical approach to the topic.

It was interesting to find that careful examination of the strategies of individual students indicated that the disposition to assume a more high-investment response to conducting an inquiry entailed using much more elaborate combinations of reading and writing through

which to criss-cross and explore the material under investigation. This dynamic and recursive use of reading and writing is illustrated in the authors' discussion of how the activities of one student led her to explore and discover ideas on the topic of feminist criticism.

> Diane produced her draft in pieces, reading, refining ideas, and then writing a few paragraphs at a time. For example, she wrote her introductory paragraph after a period of reading and notetaking had confirmed her critical approach. After writing the introduction, she made more specific research plans and returned to the library "to get a handle on what feminist criticism is in general." This reading led to more writing, including a revision of the introduction (which she ended up rewriting four times). Diane's rough draft, written in longhand, is full of changes, notes to herself, and plans for future writing. She used the writing process for the same purpose as reading and notetaking—to explore and discover ideas. (p. 15)

By examining the thinking and learning of individuals working over real time in naturalistic settings, this study provides important insights into students' ability to use various forms of reading and writing in many phases of formulating a research paper. In addition, it offers significant information concerning the contextual factors that might influence students' disposition to engage in more high-investment strategies. In particular, the authors speculate that this more critical or analytical disposition to research may be due in part to the particular "communicative situations" that their respective teachers were responsible for establishing. These situations often provided students with opportunities to focus on high-level goals by writing for an audience other than the teacher-as-examiner, by allowing them to work collaboratively with both peers and teachers, and by providing them with in-process feedback throughout their project.

However, while both this research and the work of Kennedy (1985) offer significant insight into the nature of the reading and writing exchanges that more proficient learners might engage in when they are permitted to do so, precisely how different forms of reading and writing contribute to students' thinking and learning was explored in a recent study conducted by McGinley (1989).

In order to examine students' dynamic use of reading and writing, this study examined the processes and products of seven college undergraduates as they directed their own sequence of specific reading and writing activities en route to learning and composing a persuasive

essay. During their reading and writing, students engaged in a think-aloud procedure that required them to verbalize their thoughts as they worked. After students had completed their essay, they responded to a series of written debriefing questions about the purposes served by different forms of reading and writing, their decisions to shift from one activity to another across the task, and the conceptual insights or breakthroughs that such activities may have engendered.

Results indicated that the *reasoning operations* in which students engaged and how they changed as the students combined reading and writing en route to learning is a complex phenomenon mediated by both specific reading and writing activities and the *purposes* for which these activities were undertaken. Across students, various forms of reading and writing proved to be very versatile activities, each providing students with the means to fulfill a number of different purposes in addition to providing them with their own unique perspective from which to examine the topic of study as well as to examine their own thinking. The author explains that the result as a kind of "vicarious community":

> Indeed the emerging picture is one of a single learner, creating through his or her recursive engagements, a kind of *vicarious community* of collaborative readers and writers exchanging topical perspectives with one another as they move back and forth between writing notes, reading the text, writing the draft, reading the draft, reading their notes, and brainstorming. (p. 131)

A more detailed analysis of the debriefing interviews, in conjunction with the protocols and essays, as well as an analysis of sequential dependency of the reasoning operations in which three of the seven students were engaged, also revealed that each student varied in his or her ability to use reading and writing to engender conceptual insights and to make progress toward completion of the essay. According to the author, this ability was reflected in varying degrees in the reading, writing, and learning of Pam, Lisa, and Kathy:

> In general, Pam's reading and writing served the purpose of helping her to further *clarify* and *strengthen* the beliefs which she brought to the task. Lisa, on the other hand, was "carried along" by her reading and writing, readily *changing* her original beliefs in favor of the beliefs expressed in the articles before finally arriving at her own position. Kathy, having begun her work with no formal opinions on the topic, used her reading and writing in order to *discover* what she actually believed. (p. 126)

McGinley argues that the reading and writing in which Pam, Kathy and Lisa engaged represent in varying degrees their efforts to "criss-cross" the topic of study, enabling them to highlight the complexities of certain issues as well as to establish or create their own sources of support to be used as they progressed across the task.

CONCLUSIONS

In this paper we have proposed that different forms of reading and writing represent unique ways of thinking and learning about a topic of study. In light of the work of Wittgenstein (1953) and his prominent metaphors for knowledge organization and learning (particularly the metaphor of the "criss-cross landscape") in conjunction with the more recent work of Spiro et al. (1987) in knowledge acquisition, various forms of reading and writing can be conceptualized as those cognitive acts that provide a learner with multiple "traversal routes" or perspectives from which to "criss-cross" and explore a topical landscape. This use of reading and writing is further underscored in Spiro's comments concerning the importance of criss-crossing in acquiring knowledge:

> By criss-crossing the complex topical landscape, the twin goals of highlighting multifacetedness and establishing multiple connections are attained. Also, awareness of the 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. (p. 8)

Similarily, it is our position that different forms of reading and writing provide the means by which one is able to engage in the "general skill of working around a particular landscape." In addition, we contend that if we wish to understand more fully the roles that reading and writing play in learning and thinking critically, we must continue to explore students' dynamic use of a fluid set of recursive reading and writing engagements as opposed to examining a rather static set of prescribed reading and writing juxtapositions. Following

the theoretical work of Giroux (1988), Freire (1982), Katz (1982), O'Flahavan and Tierney (in press), and Smith (1988), we view learner-initiative as an essential factor in fostering students' ability to inform themselves and in engendering the kinds of complex reading and writing traversals that characterize the process of conducting a critical topical investigation.

This particular view of literacy and learning, which places a single learner at the center of a complex exchange of topical perspectives and different ways of knowing and "traversing" a topical landscape, leaves us with some provocative questions to answer. On a very general level, it asks that we continue to explore the nature of the relationship between literacy, student initiative, and the ability to conduct a thorough inquiry of a topic of study. On a more specific level, the work of Kennedy (1985) and Nelson and Hayes (1988) asks that we continue to examine those factors in the writing context itself that encourage students to assume a more critical approach to the process of research. In addition to asking that we examine the contextual factors that influence students' approach to research, the work of McGinley (1989) asks that we explore, in more detail, the nature of the internal dialogue in which self-directed readers and writers engage—how it evolves, as well as how such dialogues vary across students of different abilities and across a variety of rhetorical tasks and topics of study. Additionally, it invites us to examine how the internal communities that students construct and the more overt external communities that teachers and peers provide help learners to accomplish their goals.

As a corollary of these studies, a long tradition of research that falls under the rubric of *metacognition* would appear to hold considerable promise for understanding students' ability to use reading and writing dynamically in order to learn. Specifically, research in metacognition has examined students' awareness and control of their own thinking processes primarily during the act of reading (Brown, 1978; Brown et al., 1983; Flavell, 1978; Paris, Lipson, & Wixon, 1983; Shepard & Reynolds, 1987). More recently, whereas metacognitive research has involved the study of students' thinking about their own learning processes, research exploring students' *cognitive* strategies has explored those specific strategies through which students actively manipulate and learn material across several different content domains on both difficult and easy tasks (Dansereau, 1985; Paris & Oka, 1986; Pintrich, 1987; Weinstein & Mayer, 1986; Rohrkemper and Bershon, 1984). In particular, a related set of studies has begun to explore the relationship

between certain motivational factors (i.e., academic self-concept, perceptions of control, expectancy for success, and interest in subject matter), dynamic strategy use, and learning in the areas of reading (Paris & Oka, 1986), mathematics (Pokey, 1988), and science (Pintrich, 1987). Certainly, this rich line of research that has begun examining the dependencies that underlie motivation, strategy use, and achievement offers a rich source of information from which to continue our examination of students' different approaches to using reading and writing strategies in the process of conducting a critical inquiry.

In terms of instruction, few would argue that one of the more valued cognitive activities associated with formal schooling is the ability to use reading and writing in order to inform oneself about various topics or areas of interest. The research of Kennedy (1985), Nelson and Hayes (1988), and McGinley (1989) suggests that this ability would almost certainly require that individual learners understand the *functions* that different forms of reading and writing are capable of serving in order to avail themselves of the combined power of these acts. However, in actualizing this combined power and in informing themselves, students must also be able to make *timely decisions* about the usefulness of undertaking a specific reading or writing engagement across a task if they are to orchestrate and direct their recursive movements effectively from one form of reading or writing to another. Of what value is the ability to use reading and writing in order to learn if students are unable to customize the specific types of reading and writing they elect to undertake for particular tasks as well as the manner in which they choose to combine these engagements in order to accomplish their particular goals? How can we foster students' ability to use their repertoire of literacy skills in conducting a critical inquiry of a content domain if they are always supplied with the both the *types* as well as the specific instructional *sequence* of engagements they should undertake?

If we are to develop students' ability to explore topics and issues of importance, we cannot rely on models of instruction that do not equip them with the ability to direct their own reading and writing engagements. Indeed, if we wish for students to take control of their own learning and actively *inform* themselves through reading and writing, we must recognize the importance of learner-initiative in fostering the critical inquiry of topics. As this article argues, the true combined power of reading and writing can only be realized when a learner is able to orchestrate his or her own engagements dynamically according to particular needs. Indeed, if we want to foster students' ability

to inform themselves about topics of study, we must explore ways of helping them to begin directing their own reading and writing activities in order to learn.

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William McGinley is Assistant Professor at the University of Michigan, where he teaches graduate and undergraduate courses in reading and literacy education. A former high school and junior high school reading and writing instructor, his articles have appeared in Reading Research Quarterly, Journal of Reading, *and* American Journal of Educational Research. *He is currently conducting classroom-based research aimed at engaging children in the process of searching topics of interest as a forum within which they might begin to explore and understand the modes of inquiry that are available to them as self-directed writers, thinkers, and learners.*

Robert J. Tierney is on the faculty at the Ohio State University where he teaches graduate courses in reading and writing and conducts classroom-based research on the thought processes students engage in during reading and writing. His articles have appeared in journals such as Reading Research Quarterly, Journal of Reading Behavior, Research in the Teaching of English, *and* Language Arts. *He has been involved in the publication of several books as an author or editor, including* Reading Strategies and Practices, Understanding Readers' Understanding, *and* Learning to Read in American Schools.