

An Investigation of the Importance of Domain Specific Knowledge for Writing Proficiency

**William M. Bart &
Karen M. Evans**

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Interdisciplinary Studies of Writing*

**Technical Report Series
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Preface

In 1991, the Center for Interdisciplinary Studies of Writing awarded Professor William Bart and his research assistant Karen Evans a research grant for a project entitled “An Investigation of the Importance of Domain Specific Knowledge for Writing Proficiency.” By looking at samples of student writing, the study sought to determine whether content-knowledge in an area of study (in this case, educational psychology) is a good predictor of writing competency. The findings were intended to distinguish the value of teaching general thinking strategies versus the value of teaching domain-specific knowledge, and beyond that, the importance of content knowledge to the writing process.

Professor Bart received his Ph.D. from the University of Chicago, where he studied measurement, evaluation, and statistical analysis. There he developed his interests in relationships among cognition, instruction, and testing. Bart is also a fellow of the American Psychological Society, and is currently Professor of Educational Psychology at the University of Minnesota.

Projects such as this one, together with ongoing projects at the Center for Interdisciplinary Studies of Writing, should result in improved undergraduate writing, the Center’s primary goal. Along with colloquia, conferences, publications, and other outreach activities, the Center annually funds research projects by University of Minnesota faculty who study any of the following topics:

- characteristics of writing across the University’s curriculum;
- status reports on students’ writing ability and the University;
- the connections between writing and learning in all fields;
- the characteristics of writing beyond the academy;

- the effects of ethnicity, race, class, and gender on writing; and
- curricular reform through writing-intensive instruction.

We are pleased to present this technical report as part of the ongoing discussions about teaching with writing. One of the goals of the Center's publications is to encourage conversations about writing; we invite you to contact the Center about this publication or any others in the series.

Lillian Bridwell-Bowles, Series Editor
Mesut Akdere & Elizabeth Oliver, Editors
February 2003

Abstract

A current question in cognitive psychology concerns the role of domain-specific knowledge for the development of thinking skills. This study addressed a related question of whether having the content knowledge of educational psychology is a good predictor of writing competency within the domain. Seventy undergraduate and post-graduate subjects enrolled in an introductory educational psychology course were assessed for content knowledge and also produced a writing sample evaluating an article in the discipline. For the entire sample, content knowledge and writing proficiency were not significantly correlated. For a sample of ten high knowledge subjects and ten low knowledge subjects, results were inconclusive. Using the scores of one rater, the ten high subjects had significantly greater writing competency scores than the ten least knowledgeable subjects. Using the scores of the other rater, this difference did not occur. Certain factors, however, may have confounded the results, in particular, the fact that subjects were engaged in acquiring domain-specific knowledge rather than employing already established knowledge bases.

An Investigation of the Importance of Domain-Specific Knowledge for Writing Proficiency

One of the current controversies relative to higher order thinking skills is whether domain-specific knowledge or general strategies that apply across domains are more important. Some (Perkins & Saloman, 1989; de Bono, 1976; Ennis, 1989; Paul, 1982) argue that there are general strategies that can be learned and used in many domains while others (McPeck, 1981; Resnick, 1987; Glaser, 1984) argue that good thinking is subject-specific and dependent on domain knowledge of content and ways of thinking. Answering this question would obviously have significant ramifications on a central issue for teaching and learning: Should the focus of teaching writing be on general thinking strategies or domain-specific knowledge?

Recht and Leslie (1988) considered this question in terms of the skill of reading and found that poor readers--those who lacked general reading strategies--performed as well as good readers on tasks of memory and comprehension when they had substantial content knowledge. The question addressed in this study is whether content knowledge is similarly important for the writing process.

Intuitively, it would seem that knowing something about a subject is important for writing about it. But is it enough to overcome a lack of knowledge about general writing strategies? Can a substantial amount of domain knowledge carry a writer through a writing task, or are the skills specific to writing such that, even with subject knowledge, the writer cannot do well without them? Determining the importance of content knowledge would be useful for making decisions about how to teach writing. If the ability to write well is embedded in content knowledge, then writing must be stressed in

each subject area. On the other hand, if general strategies are more important, then courses that teach writing as a skill have more relevance.

It is also possible that more sophisticated writing, as is done at the college level, becomes more domain-specific in nature. In that case, general strategy teaching may be appropriate at beginning levels, but content approaches more appropriate for college-level work. Indeed, conventions of writing are unique to particular disciplines and initiates must learn to communicate within the established context or discourse community.

This study considered the discourse community of educational psychology. Teachers must have knowledge of educational psychology in order to practice effectively, and much of the literature teachers read and the theory they learn come from this discipline. In addition to understanding the foundations of their practice, teachers must communicate within their discourse community. Teachers also--as educated individuals--must be able to produce literate texts. It follows, then, that would-be teachers must possess knowledge of both educational psychology and how to write.

Drawing on these two features, this study considered three questions. First, is content knowledge of educational psychology a good predictor of writing competence within the discipline? Second, is the mean writing ability of the high knowledge group the same as that of the low knowledge group? Third, what is the index of inter-rater reliability based on the total writing ability score? Also considered was a related question about what kinds of knowledge can help students succeed on written work in pre-teacher training.

Background

Writing as a learned skill attests to the fact that writers must have certain knowledge in order to compose. Although no theorist has defined operationally how domain-knowledge influences the writing process (Faigley et al, 1985), the knowledge writers need has been described various ways. Moffett (1968) suggests that good writers possess four levels of knowledge about a subject such that they can move from recording knowledge to reporting it to generalizing about it and finally to theorizing.

More recently, Hayes (1990) suggests a framework similar to the declarative and procedural divisions of knowledge in cognitive psychology. He holds that a writer must have knowledge about subject matter, rhetorical goals, and the organization of writing (declarative or “knowing that”), and knowledge of strategies for composing (procedural or “knowing how”).

Jolliffe and Brier (1988), in discussing expert competence within academic domains, consider four interrelated components of competent writers’ knowledge. These include:

- Knowledge of the discipline as a discourse community;
- Knowledge of the subject matters writers in a discipline may write about, the methods writers in the discipline use to investigate subject matters in order to write about them, and the lines of argument or explanation writers employ in their texts;
- Knowledge of the ways writers in a discipline organize, arrange, and format their texts; and,

- Knowledge of the acceptable styles--in general terms, the syntax and diction--that writers in a discipline employ (p. 38).

While theory has acknowledged that various types of knowledge are needed for the composing process, how content knowledge specifically affects the writing process remains a relatively unexplored topic (Faigley et al, 1985; Hayes, 1990; McCutchen, 1986). However, the importance of content knowledge for performance in other domains has been well documented. For the skill of reading, content knowledge is a powerful determinant of both recall and comprehension (Langer, 1984; Marr & Gormley, 1982; Pearson & Raphael, 1990; Recht & Leslie, 1988; Schneider et al, 1987). What changes (Flavell, 1971) in memory development is increasingly being described as the knowledge base (Chi & Ceci, 1987; Chi, 1985; Chi & Rees, 1983). In a review on the interaction of domain knowledge and strategies, Alexander and Judy (1988) write, “those who know more about a particular domain generally understand better” (p. 375). In addition, a rich expertise/novice literature highlights the importance of domain knowledge (Chase & Simon, 1973; Chi, Feltovich, & Glaser, 1981; Larkin, McDermott, Simon, & Simon, 1980). Clearly, having content knowledge is an important predictor of success in other domains.

Most investigations have considered the link between subject matter knowledge and comprehension and recall; however, the relationship between having subject matter knowledge and composing a text about the subject has been less investigated. One such study by Voss, Vesonder, and Spilich (1980) used the idea of the size and complexity of the problem space in effecting the quality of a narrative text. Individuals were tested for their knowledge of baseball and then ten were designated as high knowledge and ten as

low. Subjects composed a 350-word narrative for ½ of an inning of a baseball game. Subjects with high knowledge and a generous problem solving space generated texts more detailed in content representation. Low knowledge, limited problem-space individuals wrote texts that discussed more non-game activities such as crowd size and reactions. The investigators concluded that high knowledge subjects had more “paths” or “slots” in their problem space and thus could generate more alternatives for the narrative.

In another study of the development of writing ability, McCutchen (1986) considered the importance of domain and linguistic knowledge. She tested 300 children in grades four, six, and eight and then divided them into two groups--high and low knowledge. Thirty males were matched between the two groups by age and reading ability. The subjects wrote eight texts, four on football and, as a control, four on school or friends. Using linguistic analysis, she analyzed the texts for coherence, structure, and content, specifically level of detail. High knowledge subjects wrote texts that are more coherent about football. Low knowledge subjects wrote texts that were poor in content and less locally coherent. They attempted to compensate for their lack of knowledge about football by talking about such things as winning or losing. In addition, younger writers jumped from point to point while older ones tended to build a coherent argument. Older subjects, to some degree, relied on their knowledge of discourse to carry them through the task.

Jolliffe and Brier (1988) tested four groups of student writers, fifteen nursing undergraduates, ten nursing Ph.D. students, twenty political science sophomores and juniors, and ten master's level political science students. Subjects read an article representative of their field and performed four tasks. Two are related to this discussion,

evaluating the text of the article, and writing an abstract. Results for nursing students showed significant differences for education and knowledge. Successful writers held a bachelor's degree or higher and had greater subject matter knowledge. Results were less conclusive for the political science students. The authors speculate that students in political science take a variety of courses to meet personal and professional needs. Therefore, they are socialized less into their discourse communities. Nurses on the other hand, take very specified course work and are exposed primarily to the writing of their field.

While the relationship between subject matter knowledge and writing in a field is a topic that has not been extensively investigated, the studies mentioned here suggest that subject matter knowledge affects the quality of texts for some domains.

Hypothesis

It was hypothesized in this study that the level of domain-specific knowledge in educational psychology would be significantly correlated with writing performance in educational psychology. The Voss et al, McCutchen, and Jolliffe and Brier studies all showed significant positive effects for domain knowledge. In addition, research in other domains (e.g., reading and memory development) has confirmed the importance of knowledge.

At the same time, teaching, as labeled by Etzioni (1969), is a semi- profession. Semi-professions are characterized by needing only a baccalaureate to enter the field and by training that is prescribed--i.e, offering little opportunity to take courses unrelated to professional training. Accordingly, teachers-in-training are exposed primarily to writings in their field. Education majors, however, probably receive little specific training in

writing for the field of education (Jolliffe and Brier, 1988). Therefore, the independent variable in this investigation is knowledge and the dependent variable is quality of writing.

Method

Procedures

Subjects' knowledge was determined by using the scores on course quizzes I and II, which were given in week 3 and week 6 of the quarter, respectively. The quizzes were 40-item, multiple-choice tests on course content.

The writing task was a short paper, 4-6 pages, on an article in educational psychology. Subjects chose from a collection of seven different articles. The paper was to contain a summary of the article, a section on application of ideas from the article, and a section critiquing importance whether or not the student would be likely to employ the ideas expressed in the article in his/her teaching. Papers were written as a course assignment and were due eight weeks into a ten-week course. Those subjects who wanted to participate in this study then submitted their papers to the researchers.

Toulmin (1972) described how novices in any discipline learn the structure of their subject and learn how to participate in the field. Disciplines differ in intellectual goals and activities. Toulmin characterizes the behavioral sciences as “would be disciplines.” He suggests that theoretical debate in these fields is fundamentally centered on the “general acceptability (or unacceptability) of rival approaches, patterns of explanations, and standards of judgment” (pp. 380-381, as quoted in Jolliffe & Brier, 1988, p. 55).

This writing task was chosen in accordance with the idea that a primary activity of educational psychology is the debating of theories and ideas. It required students first to identify and summarize the important points of a theory or method, second, to hypothesize applications of the theory, and, finally, to debate the merits of it--essentially to critique acceptability or unacceptability of the ideas. It was hypothesized that by writing with such a focus, subjects with better-developed schemata would generate a hypothesis and related examples that would lead to a well-supported critique.

The writing samples were judged by two raters using a performative assessment instrument as outlined in Faigley et al (1985). Such an instrument breaks the task into component subskills that reflect the task as assigned. (See Appendix A for the scoring sheet). Four subskills were identified as follows:

- I. The most successful writers will recognize that each writing situation calls for specific treatments. These treatments are tied to the assignment, the context, and the audience. Successful writers identify and meet the demands of a rhetorical situation.
- II. The most successful writers will recognize the need to identify the important points from the article. These points will lead to their own personal application. Thus, the successful writer will see the need to summarize. In addition, the assignment calls for a summary.
- III. From the summary, the successful writer will establish a hypothesis of how he/she can use the ideas in the paper in his/her teaching field. He/she will move from the hypothesis to application example or examples.

IV. The successful writer will identify the positive and negative aspects/strengths or the limitations/likelihood of applying his/her hypothesis.

Subjects received one to four points with four being the best performance. The scores on the four subskills were then totaled for an overall score.

Subjects

A total of 70 education majors at a state university were assessed in the fall of 1990 and spring of 1991. Subjects were enrolled in an introductory educational psychology class. They varied in their educational level as some were undergraduates and some were post- graduates in a fifth year teaching degree program.

Results

The independent variable is the sum of the scores received on the two quizzes, hereafter called Quiz Total. The dependent variable is the writing competency score. Two different raters, hereafter referred to as Rater 1 and Rater 2, scored writing samples. Table 1 provides information on the scores achieved for the Quiz Total for Rater 1 and for Rater 2.

TABLE 1

Some Descriptive Statistics for the Knowledge Task and the Writing Task

	<u>M</u>	<u>SD</u>	<u>Range</u>
n = 70			
Quiz Total	64.99	6.85	43- 78
Rater 1	12.21	1.90	7- 16
Rater 2	11.66	2.45	6 –15

Using the competency ratings of Rater 1, the correlation between course knowledge and writing proficiency was 0.08, which is not significant with $\alpha = 0.05$. Using the writing competency ratings Rater 2 the correlation was 0.194, which also is not significant with $\alpha = 0.05$. Therefore, we would accept the hypothesis that course knowledge and writing proficiency are uncorrelated (i.e., $\rho = 0.00$).

Table 2 provides information on the mean writing ability for the top ten or high knowledge subjects and bottom ten or low knowledge subjects, hereafter called H Rater 1 and L Rater 2, respectively.

TABLE 2

Some Descriptive Statistics for the 10 High Knowledge Subjects and 10 Low Knowledge Subjects

	High Knowledge n = 10			Low Knowledge n = 10			t
	<u>M</u>	<u>SD</u>	<u>Range</u>	<u>M</u>	<u>SD</u>	<u>Range</u>	
Quiz Total	72.4	2.01	69-75	53.4	4.09	43-57	
H Rater 1	13.2	1.55	11-15	12.3	1.57	10-16	1.29
L Rater 2	13.8	1.23	11-15	10.9	2.38	8-15	3.43*

*Significant at $p < 0.05$

Using the ratings of Rater 1, the mean writing competency of the high knowledge students, 13.20, was not significantly different from the mean writing competency score of the low knowledge students, 12.30, because the resulting t-statistic was not significant for 18 degrees of freedom ($t = 1.29$, $p > 0.05$). However, using the ratings of Rater 2, the mean writing competency of the high knowledge students, 13.8, was significantly

different from the mean writing competency score of the low knowledge students, 10.0, because the resulting t-statistic was significant for 18 degrees of freedom ($t = 3.43$, $p > 0.05$). Thus, it is inconclusive as to whether high domain-specific knowledge subjects have greater domain-specific writing competency than low knowledge subjects.

The index of inter-rater reliability agreement of Raters 1 and 2 based on the total writing performance score was fairly low, 0.548.

Discussion

In general, for this study, these findings generate more questions than answers. The three questions considered were: (a) Is content knowledge a good predictor of writing ability in a discourse community; (b) To what extent do high knowledge subjects differ from low knowledge subjects on a writing task; and (c) What is the inter-rater reliability based on the writing sample scores? Each question will be considered in turn.

Question A. For the first question, whether content knowledge is a good predictor of writing skill in a discourse community, the correlations of 0.080 for Rater 1 and 0.194 for Rater 2 indicate that knowledge is not a good predictor--at least within this context. However, other factors in this study suggest--at least to these researchers--that the results are confounded. The nature of the task chosen and how it was presented both may have affected the writing products.

The task was to summarize an article and to comment on the value and utility of the findings presented in the article. Although the researchers tried to choose a task that would tap an important activity in the field--debating the acceptability of a theory--the task may have constrained the use of content knowledge. An experienced educational psychologist would tend to consider an article within the broad context of his/her

knowledge; however, the subjects seemed unwilling, or unable to bring other knowledge to bear in their discussion of the articles. Only a few of the high knowledge subjects considered ideas outside the article itself. A better task for the purposes of this study may have been to ask the subject to read an article, summarize, and use ideas from the course to examine critically the theory presented in the article. Clearly, such a task would specifically incorporate the use of course knowledge.

This leads to the second factor that may have affected the results; the task as presented seemed to pre-structure how subjects wrote their papers. In an effort to make the task unambiguous, the researchers outlined carefully what the paper should cover in its review and critique of the article. Unfortunately, this specificity was manifested in the papers to such a degree that the papers assumed a question-answer format rather than a tightly constructed, internally coherent one. For example, only six subjects wrote introductions that both represented the entire task and addressed the audience. Most subjects plunged into the task of summarizing with little or no introduction.

Another common feature was that many subjects used the numerals and letters from the outline of the assignment sheet as the headings within the paper. Subjects were too tied to the details of the assignment to see the paper as a whole.

Question B. The second question, which compared the results for the ten highest and ten lowest achieving students in the course, also suggests further study. Although there were differences for the two groups, it cannot be determined whether the differences are related to content knowledge or academic ability. A qualitative evaluation of the writing samples from the two groups, however, notes an interesting difference. Eight of the samples from the high scoring group used the third person in their discussion

of the article. Their stance in the paper was that of an impartial observer evaluating a theory and they used factual arguments to support their contentions. This is a common stance in the sciences. On the other hand, seven out of the ten low scorers used the first person. They tended to speak from personal views and experiences and critiqued the article on that basis.

Although this is an important difference that reflects a practice of experienced writers in educational psychology, it is still difficult to determine, for the purposes of this study, whether the high achievers having greater content knowledge causes that difference.

Question C. The third question concerned inter-rater reliability. The modest correlation between the raters (0.548) may have affected the overall outcomes for this study. Such reliability may be due to the nature of the instrument, which did not allow for judgments about style and syntactic features except in terms of the introduction. Even though the raters initially worked together to assure agreement on interpreting the scales, the task of reading 70 papers 4-6 pages long led to their judgments diverging when they read in isolation. A similar study should take measures to prevent this problem.

Conclusions

This study has not found strong evidence for the importance of knowledge as a predictor of writing competence in a subject area. At the same time, certain considerations influence this conclusion, and suggestions to improve further investigations can be gleaned from these considerations. First, the task seemed to constrain the subjects' treatments of the assignment. The assignment was too specifically presented and that specificity prevented subjects from using course knowledge to

evaluate the ideas in the articles they read. Future studies need to consider how the task is presented in order to give subjects some latitude in their writing task.

Another related finding for this investigation has to do with the nature of studying the effects of content knowledge concomitant with acquiring new learning. Other studies that considered content knowledge and writing assessed the knowledge that subjects had prior to the study. In this investigation, subjects were learning the material and the only measure was the total score from two multiple-choice tests. The learning was new and ongoing and may not have been part of subjects' knowledge bases for the content area. Clearly, this affects the reliability of the measure of the relationship between content knowledge and writing proficiency. Future investigations must consider the interplay between learning that is in progress and writing that uses such learning.

Another suggestion for future investigations that would improve the interpretability of the results is to control for academic ability between the high and low knowledge groups.

Finally, it was hoped that results would suggest ways to best incorporate writing instruction for pre-education students. Given the outcomes of the study, it is not possible to say confidently whether a knowledge-based or strategy-based approach is better.

Although results do not support the hypothesis, much was learned about how better to investigate the relationship between learning a new subject and writing about it. Further study can only advance understanding of this question.

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Appendix A

Domain Knowledge and Writing Evaluation Form Rationale

Scale - 1 = least effective, 4 = most effective

I. The most successful writers will recognize that each writing situation calls for specific treatments. These treatments are tied to the assignment, the context, and the audience. Successful writers identify and meet the demands of a rhetorical situation.

II. The most successful writers will recognize the need to identify the important points from the article. These points will lead to their own personal application. Thus, the successful writer will see the need to summarize. In addition, the assignment calls for a summary.

III. From the summary, the successful writer will establish a hypothesis of how he/she can use the ideas in the paper in his/her teaching field. He/she will move from the hypothesis to application example or examples.

IV. The successful writer will identify the positive and negative aspects/strengths or the limitations/likelihood of applying his/her hypothesis.

Scoring Sheet for Writing Samples

I. Meets the demands of the rhetorical situation.

- 1 -Provides no introduction that describes the task.
- 2- Provides a brief, inadequate introductory sentence or two. Introduction may contain a vague generalization.
- 3 -Provides an introduction but fails to describe the task in detail and/or fails to suggest the audience for the paper.
- 4 -Provides an introduction that fully describes the task. It is clear from the introduction what the purpose of the assignment is & what the writer intends to do.

Score _____

II. Provides a summary of the article.

- 1 -Provides no overall summary.
- 2 -Summarizes briefly but does not synthesize into his/her own words. Uses the summary the author of the article provides. Does not demonstrate understanding.
- 3 -Summarizes in own words but the summary is incomplete/partial.
- 4 -Summarizes in own words and effectively demonstrates overall/complete understanding of the article as a whole.

Score _____

III. Provides a hypothesis and application.

- 1 -Provides either no example/s or no hypothesis of an idea from the paper that could be used in practice (Skips this section).
- 2- Provides an ineffective example, i.e., may have a poor connection to paper's ideas or example is poorly explicated.
- 3 -Implies but does not explicitly provide a hypothesis, but provides at least one good example.
- 4 -Establishes hypothesis, moves to examples and provides rationale between hypothesis and application.

Score _____

IV. Examines application critically.

- 1 -Provides no limitations or likelihood.
- 2 -Provides one or the other, limitations or likelihood but does not supply supporting details.
- 3 -(a) Provides one or the other, limitations/likelihood and support or
(b) Provides both sides but limited support.
- 4 -Provides limitations/likelihood and support from application arguments in part III.

Score_____