

Effects of Writing-to-Learn Activities on the Content Knowledge, Retention, and Attitudes of Secondary Vocational Agriculture Students

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Theorists agree that writing can be a valuable tool for learning content, not just a way to report what has been learned (Applebee, 1981; Emig, 1977; Walshe, 1987). Cooper (in Applebee, 1981). stated that current practices fail to develop students' writing abilities and also give students no understanding of the ways in which writing can be most useful to them. Most writing activities in secondary schools call for students to report facts, rather than to think reflectively about the subject matter. Students write to record what they thii they are supposed to learn and then they report in writing what they recorded.

The idea that writing is a method of learning is based on simple principle: when students write, they process information in a physical, tangible form. Writing activities require students to explore ideas, discover relationships, observe contrasts, sequence ideas, and process information (Fulwiler & Young, 1982; Gage, 1986). McGinley and Tierney (1989) pointed to writing as a means to improve the thinking and reasoning ability of students in academic subjects. Walshe (1987) concluded that writing activities increase the quality of learning by helping students clarify ideas and relationships between them.

Emig (1976) derived three primary ways learning activities should be designed: (1) enactive-learning by doing, (2) iconic-learning by seeing, and (3) representational or symbolic-learning by restatement in words. Emig describes writing-to-learn activities are unique in that they simultaneously deploy all three methods of learning. Parker and Goodkin (1987) agreed that the physical act of writing has mental consequences. As students write about information, they reconstruct the thinking process; they internalize the activity.

Applebee, Langer, and Mullis (1987) concluded that writing serves as a tool for three thought processes basic to learning: (a) to draw on relevant knowledge and experience in preparation for new activities, (b) to consolidate and review new information and experience, and (c) to reformulate and extend knowledge. Writing-to-learn activities cause students to think, not just record what the teacher has said or what they have read.

Experimental studies involving writing-to-learn activities have shown varying results. Selfe, Peterson, and Nahrgang (1986) reported no significant difference in student achievement between high school math students who wrote in journals and those who did not. Michalak (1989) found no difference in students' scores on an achievement test on foreign policy analysis between students taught by writing-to-learn techniques and students taught using traditional, lecture/discussion methods.

Some studies have shown significantly higher achievement scores for students taught by writing-to-learn techniques. Willey (1988/1989) reported significantly higher science achievement for tenth graders taught by writing-to-learn activities than for students taught by traditional methods. Sharp (1987) reported that expressive summary writing did help community college students learn biology better initially and retain information better than students who were not asked to write expressive summaries. Similarly, Dyer (1988/1989) reported that fourth grade students exposed to writing-to-learn activities performed better on both achievement tests and retention tests in science. Selfe, Peterson, and Nahrgang (1986) found that students exposed to writing-to-learn activities over a four year period experienced a significant decrease in apprehension about writing.

Vocational educators have been mandated to explore teaching techniques that reinforce critical thinking and learning skills. In light of this mandate, and since no previous studies were found on the effects of writing-to-learn in vocational education subjects, a study was conducted to determine if writing-to-learn activities would be effective in learning and retaining information related to vocational education. A need also existed to examine the effects of writing-to-learn activities on students' attitudes toward writing. For the purposes of this study, writing-to-learn activities were defined as short, expressive writing assignments done to clarify the students' thoughts or to develop an idea. These activities were *thiii* drafts, and were not graded on form or content.

Purpose and Objectives

The primary purpose of this study was to compare the effects of writing-to-learn activities and traditional lecture-discussion activities in teaching a selected problem area of vocational agriculture. The specific objectives of the study were stated as research questions, as follows:

What was the effect of writing-to-learn activities, as compared to traditional learning activities on the achievement of high school vocational agriculture students in North Carolina?

What was the effect of writing-to-learn activities, as compared to traditional learning activities, on the retention of subject matter?

What was the effect of writing-to-learn activities on the attitudes of high school vocational agriculture students toward writing and learning?

Procedures

The population for this study consisted of ninth grade students enrolled in Introduction to Agriculture and Natural Resources in North Carolina. Introduction to Agriculture and Natural Resources classes were chosen for two reasons: (a) multiple sections of this course were taught in several schools and (b) the researcher was capable of teaching the course content. Because this study was conducted with intact groups, random assignment of students to treatments was not possible. A quasi-experimental design, a variation of the nonequivalent control group design described by Campbell and Stanley

(1966). was used for Objectives 1 and 2 of this study. The research design used for Objective 3 was the one-group pretest-posttest design (Design 2 in Campbell and Stanley).

The necessary sample size for each group was computed using a formul suggested by Hays (1973). The required sample size was determined to be 104 students per group. The sample was drawn from North Carolina junior and senior high schools with four or more classes of the ninth grade course, Introduction to Agriculture and Natural Resources, within 100 miles of Greenville, North Carolina. Classes were randomly assigned to the treatments. A total of 102 students in seven classes served as the comparison group in the experiment. The experimental group consisted of 97 students in six classes. Absences during the time of the experiment and the unavailability of CAT scores (the covariate measure) reduced the sample size to 89 students in the experimental group and 88 students in the comparison group. However, this reduction in sample size resulted in only a slight change (from .50 to .54) in effect size, or the ability to detect differences between the treatment groups.

An instrument was developed by the researcher to collect data related to the dependent variables of achievement and retention of information. Content validity of the instrument was established by a panel of experts consisting of university level agricultural education faculty and secondary vocational agriculture teachers. The instrument was pilot tested for clarity and reliability using students in two similar classes not participating in the study. The instrument was revised as a result of the pilot test and an item-analysis performed on the instrument. The K-R 20 coefficient of internal consistency for the instrument was .89. The Writing Apprehension Test (WAT), adapted by Selfe, Gorman, & Gorman (1986), was used to measure student attitudes toward writing before and after the implementation of writing-to-learn strategies. The Writing Apprehension Test contained 26 items that were categorized into three subscales; (a) enjoyment of writing, (b) attitudes toward having writing evaluated, and (c) confidence in writing ability. Students were asked to respond to a series of statements about writing by indicating whether they strongly agreed, agreed, were uncertain, disagreed, or strongly disagreed with each statement on the Likert-type scale. Based upon pre-treatment data from students in the experimental classes, reliability as measured by the internal consistency of the instrument was established (Cronbach's $\alpha = .79$).

The writing-to-learn activities were designed by the researcher, based on the criteria cited in the literature. University writing instructors reviewed the writing-to-learn activities and found them appropriate for the purposes of this study.

A unit in groundwater resource protection was selected for this study. Instructional materials for the unit were developed as a result of a nationally funded project by the National Vocational Agricultural Teachers Association and the National FFA Foundation. Prior to the treatment, students in the writing-to-learn treatment groups were administered the Writing Apprehension Test (WAT). The student achievement test and the WAT instruments were administered immediately following instruction in the unit. The student retention test was administered three weeks after the achievement test. In order to control for possible preexisting group differences, California Achievement Test scores were collected to be used as a covariate measure in the study. To control for teacher effect, the

principal researcher was the instructor for both the experimental and comparison groups. Achievement tests, retention tests, and writing apprehension tests were administered by the researcher and scored via an electronic scanner.

The experimental treatment included a series of short writing activities at various points throughout the class period to help students clarify what they knew or did not know about the subject, to help students understand what they had just done or been shown, and to help students realize how what they learned could be applied. At the beginning of the class, the teacher posed questions that required students to write what they thought about the topic. At some point, near the mid-point of the class, a similar writing activity would occur, allowing students to summarize their thoughts. At the end of the class, students were asked to write in their learning logs.

The traditional treatment included the same kinds of activities as the experimental treatment; however, instead of writing responses at various points throughout the class period, students responded orally in either class or small-group discussion. The researcher attempted to use the oral discussions for the same purposes as the writing opportunities served: to clarify what students knew or did not know about the subject, to help students understand what **they have just** done or been shown, and to help students realize how what they learned could be applied. It was especially important to the researcher that students in both the experimental and comparison groups focused on the same topics; the only difference was in how the groups responded to the topics.

Multivariate analysis of covariance (MANCOVA) was used to determine if significant differences existed at the .05 level of significance between the two groups for the dependent measures of achievement and retention. Univariate tests were used as follow-up tests to determine the sources of significant difference. The data were also described using measures of central tendency, measures of variance, frequencies, and percentages. A Wilcoxon Sign Rank Test was used to compare students' scores on the Writing Apprehension Test from before they were exposed to the writing-to-learn treatment to their scores after the treatment.

Results

The results of the achievement test administered immediately following instruction in the unit on groundwater protection and the retention test administered three weeks following the achievement test for both treatment groups are presented in Table 1. The students in the writing-to-learn treatment group had slightly higher California Achievement Test (CAT) scores (the covariate measure) than the students taught by the traditional methods, resulting in adjusted mean scores that more accurately reflected the ability of the students in the study. Scores on the achievement and retention tests are presented in Table 1 as the percentage of correct responses. Students taught by writing-to-learn activities appeared to have lower scores on the initial achievement test, but higher scores on the retention test administered three weeks later than did students taught by lecture and discussion methods.

Multivariate analysis of covariance on the data related to the achievement and retention tests showed the two teaching methods in this study were significantly different (Hostelling $F = .039, F(2.173) = 3.38, p = .036$). There was a significant difference at

the .05 alpha level between the treatment groups when student achievement and retention of knowledge were considered simultaneously. To determine the source of the difference detected by the multivariate analysis of covariance, univariate analysis of covariance tests were performed on the dependent variables of achievement and retention. The follow-up analysis resulted in the following findings:

Table 1. Mean Achievement and Retention Test Scores by Treatment Group

| Treatment group | Achievement test | | Retention test | |
|------------------|------------------|--------------------------|----------------|--------------------------|
| | observed | Adjusted | Observed | Adjusted |
| Writing-to-learn | 56.99 | 56.68 | 58.13 | 57.85 |
| Traditional | 58.86 | 59.17 | 54.60 | 54.90 |
| | | F(1,174) = 0.92. p = .34 | | F(1,174) = 1.26. p = .26 |

There was no significant difference in student achievement between students taught by the writing-to-learn strategy and students taught by traditional methods, as measured by scores on the student achievement test [F(1,174)= 0.92. p = .34].

There was no significant difference in student retention of information between treatment groups, as measured by the student retention test administered three weeks following the student achievement test [F(1,174) = 1.26, p = .26].

Although there was no significant difference in retention scores between the two treatment groups, the students in the writing-to-learn group scored lower on the achievement test but higher on the retention test administered three weeks later than did students taught by traditional methods (Table 2). This reversal in performance by the groups led the researcher to examine achievement loss, a measure of retention of information, as a means of accounting for the overall difference between the groups detected by the MANCOVA.

Achievement loss was defined as the difference in a student’s score on the achievement test and the retention test. Adjusted mean scores for the two treatment groups were used to examine achievement loss.

Table 2. Achievement Loss by Treatment Groups

| Treatment group | Achievement test adjusted mean | Retention test adjusted mean | Difference in scores |
|------------------|--------------------------------|------------------------------|----------------------|
| Writing-to-learn | 56.68 | 57.85 | 1.17 |
| Traditional | 59.17 | 54.90 | -4.27 |

(F(1,174) = 6.81. p<.05)

An analysis of covariance showed that there was a significant difference in student retention in favor of students taught by writing-to-learn activities as measured by achievement loss (F(1,174) = 6.81, p<.05). The reversal in scores for both groups from the achievement test to the retention test accounted for the overall difference detected by the multivariate analysis.

To measure changes in attitudes, students in writing-to-learn groups were asked to complete the 26 item Writing Apprehension Test before the beginning of the treatment and again immediately following the unit of instruction. Students **were** asked to respond to a series of statements about writing. A Wilcoxon Sign Rank Test was used to compare pre-treatment with post-treatment **attitudes** of students in the experimental classes. There was no significant difference **in the overall attitudes toward** writing for students who were taught by writing-to-learn activities from the beginning to the end of the treatment period as measured by the Writing Apprehension Test ($S = 151.5, p = .10$). However, as shown in Table 3, when responses to the 26 items on the instrument were grouped into three factors (confidence in writing ability, attitudes toward having writing evaluated, and level of enjoyment of writing), statistically significant differences were found in students' "confidence in writing ability" factor.

Table 3. Summary Table for Factors Related to **Attitudes** Toward Writing

| Factor | Pre- | | Post- | | Difference | |
|------------|-------|------|-------|------|------------|------|
| | Mean | SD | Mean | SD | Mean | SD |
| Enjoyment | 20.08 | 5.80 | 21.00 | 6.28 | .09 | 7.43 |
| Evaluation | 16.80 | 4.76 | 17.18 | 4.44 | .38 | 5.81 |
| Confidence | 37.92 | 9.21 | 40.62 | 9.49 | 2.70* | 9.97 |

*($S = 200.5, p = .04$)

The Wilcoxon Sign Rank statistic for difference in confidence in writing abilities as a result of writing-to-learn activities was significant ($S = 200.5, p = .04$). Students in the writing-to-learn groups demonstrated a significant positive change in confidence in their writing abilities after only one week of writing-to-learn activities.

Conclusions

Based upon the findings of this study the following conclusions were drawn. There is insufficient evidence to suggest that writing-to-learn activities are more or less effective than the traditional methods of teaching with regard to student achievement. However, students retain more of the information learned (**lower** achievement loss) with writing-to-learn techniques than with traditional teaching methods. In addition, exposure to writing-to-learn activities appeared to improve vocational students' confidence in their ability to write.

Recommendations

With increased emphasis placed upon effective teaching at all educational levels, it is important that teaching methods used are shown to be effective in terms of commonly accepted measures of teaching effectiveness--student achievement, retention, and attitudes toward the method of teaching. Because agricultural education students taught by writing-to-learn techniques retained more information, this finding would support the continued use of this teaching approach. The improvement in students' confidence in their writing ability further supports the continued use of writing-to-learn techniques.

This study also has implications for additional research involving writing-to-learn techniques. This study was conducted for a period of one week in each of the sample schools. Additional studies should be conducted to determine the effect of writing-to-learn

strategies on achievement and retention over a longer period of time. Further research also should be conducted to examine the effectiveness of writing-to-learn techniques with students at different age levels. Perhaps, seniors, with more practical experience and a better understanding of course content, would be able to make more connections or links in learning through writing-to-learn activities. Finally, future studies of writing-to-learn strategies should include a second retention test, perhaps six weeks following the end of the unit. Results of this study indicate that the contrast in the amount of knowledge retained by writing-to-learn groups as compared with that retained by comparison groups would be even more dramatic with the passing of more time.

References

- Applebee, A.N. (1981). Writing in the secondary school: English and the content areas. Urbana, IL: National Council of Teachers of English.
- Applebee, A.N., Langer, J.A., & Mullis, I.V. (1987). Learning to be literate in America: Reading, writing, and reasoning. Princeton, NJ: Educational Testing Service.
- Campbell, D.T., & Stanley, J.D. (*1966). Experimental and quasi-experimental designs for research. Chicago: Rand McNally.
- Dyer, D.J. (1989). The impact of writing-to-learn techniques on the science achievement of fourth-graders (Doctoral dissertation, Old Dominion University, 1988). Dissertation Abstracts International, **49**: 2133A.
- Emig, J. (1977). Writing as a mode of learning. College Composition & Communication, **28**: 122-127.
- Fulwiler, T. & Young, A. (Eds.). (1982). Language connections: Writing and reading across the curriculum. Urbana, IL: National Council of Teachers of English.
- Gage, J. (1986). Why write? In D. Bartholomew & A. Petrosky (Eds.), The teaching of writing. Chicago: National Society for the Study of Education.
- Hays, W.L. (1973). Statistics for the social sciences. New York: Holt, Rinehart, & Winston.
- McGinley, W., & Tiemey, R.J. (1989). Traversing the topical landscape: Reading and writing as ways of knowing. Written Communication, **6**: 243-269.
- Mickalak, Jr., S.J. (1989). Writing more, learning less? College Teaching, **37**: 43-45.
- Myers, J.W. (1984). Write to learn across the curriculum. Bloomington, IN: Phi Delta Kappa Educational Foundation.
- Parker, R.P. & Goodkin, V. (1987). The consequences of writing: Enhancing learning in the disciplines. Upper Montclair, NJ: Boynton/Cook, 1987.
- Selfe, C.L., Gorman, M.E., & Gorman, M.L. (1986). Watching our garden grow: Longitudinal changes in student writing apprehension. In A. Young & T. Fulwiler (Eds.), Writing across the disciplines: Research into practice (pp. 97-108). Upper Montclair, NJ: Boynton/Cook.
- Selfe, C.L., Petersen, B.T., & Nahrgang. (1986). Journal writing in mathematics. In A. Young & T. Fulwiler (Eds.), Writing across the disciplines: Research into practice (pp. 192-2107). Upper Montclair, NJ: Boynton/Cook.
- Sharp, J.E. (1987). Expressive summary writing-to-learn biology (Doctoral dissertation, Vanderbilt University, 1987). Dissertation Abstracts International, **48**: 586A.
- Walshe, R.D. (1987). The learning power of writing. English Journal, **76(6)**, 22-27.
- Wiley, L.H. (1989). The effects of selected writing-to-learn approaches on high school students' attitudes and achievements (Doctoral dissertation, Mississippi State University, 1988). Dissertation Abstracts International, **49**: 3611A.