DOCUMENT RESUME

ED 436 369 SE 062 020

AUTHOR Litteral, Diana B.
TITLE Improving Instruction, Motivation, and Writing Skills To Foster Content Mastery among 11th Grade Chemistry Students.
PUB DATE 1998-00-00
NOTE 49p.; Ed.D. Practicum, Nova Southeastern University.
PUB TYPE Guides - Classroom - Teacher (052)
EDRS PRICE MF01/PC02 Plus Postage.
DESCRIPTORS *Chemistry; *Concept Formation; Evaluation; Grade 11; High Schools; Science Education; *Writing Skills

ABSTRACT

This practicum was designed to increase concept mastery of 11th grade chemistry students by improving instruction, motivation, and writing skills. The problem addressed was that many chemistry students, perform well in group learning situations, such as labs, but perform poorly on content-mastery tests. As a result of reviewing the literature, the writer found that a variety of methods and a student-centered approach made instruction more effective. The solution strategies selected were: (a) improving instruction by adjusting traditional teaching methods, (b) increasing motivation by using technology and cooperative learning, and (c) enhancing writing skills by means of SQ3R (Survey, Question, Read, Recite and Review), graphic organizers, and text analysis. The results of the practicum indicated that the selected solution strategies fostered content-mastery among the subject students. There was an increase in the number of correct multiple choice items on content-mastery tests and an increase in volunteered answers. Student' essay writing scores improved as well. (Author/WRM)

Improving Instruction, Motivation, and Writing Skills to Foster Content Mastery among 11th Grade Chemistry Students

by
Diana B. Litteral
Cluster 83

A Practicum I Report Presented to the Ed.D. Program in Child and Youth Studies in Partial Fulfillment of the Requirements for the Degree of Doctor of Education

Nova Southeastern University
1998

APPROVAL PAGE

This practicum took place as described.

Joan Kraeuter

Verifier: Jean Kraeuter
Science Department Chair

Caravel Academy
2801 Del Laws Road
Bear, Delaware 19701

6/19/98
Date

This practicum report was submitted by Diana B. Litteral under the direction of the adviser listed below. It was submitted to the Ed.D. Program in Child and Youth Studies and approved in partial fulfillment of the requirements for the degree of Doctor of Education at Nova Southeastern University.

Approved:

29 July 1998
Date of Final Approval of Report

Alden L Nickelson
Alden L. Nickelson, Ph.D., Adviser

Table of Contents

Abstract

Improving Instruction, Motivation, and Writing Skills to Foster Content Mastery among 11th Grade Chemistry Students. Litteral, Diana B., 1998: Practicum Report, Nova Southeastern University, Ed.D. Program in Child and Youth Studies. Chemistry Instruction/Education/Content Mastery/ Cooperative Learning/Graphic Organizers/Motivation.

This practicum was designed to increase concept mastery of 11th Grade chemistry students by improving instruction, motivation, and writing skills. The problem addressed was that many chemistry students, perform well in group learning situations, such as labs, but perform poorly on content-mastery tests.

As a result of reviewing the literature, the writer found that variety of methods and a student-centered approach made instruction more effective. The solution strategies selected were (a) improving instruction by adjusting traditional teaching methods, (b) increasing motivation by using technology and cooperative learning, and (c) enhancing writing skills by means of SQ3R, graphic organizers, and text analysis.

The results of the practicum indicated that the selected solution strategies fostered content mastery among the subject students. There was an increase in number of correct multiple choice items on content-mastery tests and increase in volunteered answers. Students' essay writing scores improved as well.

****

Chapter I: Introduction

Description of Community

The practicum took place at a school situated in an upper middle class suburban community on the northeast coast of a mid-Atlantic state. The northern area of the state is urban and more densely populated than the agricultural southern area. There are ocean beaches about two hours to the north and south of the community and ski resorts about two hours to the northwest.

The community is in the northernmost county of the state. Its population of 472,000 is greater than the other counties. There is a city of almost 100,000 people within fifteen miles. The once rural area surrounding the school and community is undergoing rapid development in terms of new housing, businesses and road construction. This development results from the movement of population away from the city to the suburbs. This has caused the population of the school go grow rapidly over the past few years.

The major employers in the county are chemical companies and banks. Other employers are a university, three colleges, two auto manufacturing plants, hospitals and government agencies. Pharmaceutical firms and agricultural products companies also employ many people in the area. White-collar workers make up about 62% of the workforce and service industry workers make up about 24%.

The median per capita income is $29,000 and the median household income is $36,000.

There are many other schools located in the area surrounding the school. Three of these are public high schools. Ten are church affiliated schools and seven are private schools without church affiliation.

Writer's Work Setting

The practicum was completed at a private, non-church affiliated school whose aims are twofold. The educational purpose of the school is to promote academic and intellectual growth of each student, while the philosophy is to foster individual responsibility and strength of character. The school's vision emphasizes psychological and social aspects of student life in a way that develops a positive self-image. Physical education and sports programs are designed to provide support and enhance self-confidence of students at a time when their lives are changing due to physical and emotional development.

One unique feature of the school is that its founder owned the company that built the school and the homes in the surrounding community. Many students who live nearby enter the preschool program and remain through elementary, middle school and high school. Often, graduates return to become teachers or coaches at the school after completing college.

Tuition reimbursement for graduate courses and funds for seminars and workshops are provided by the board to encourage teachers to continue their education. However, the salary scale for teachers remains lower than for public school teachers.

The school is accredited by the Middle States Association of Colleges and Schools, but is not required to comply with state standards of instruction or assessment. This situation allows some degree of creativity in the classroom. In general, the school follows curriculum guidelines and attendance schedules of the public school district in which it is located.

Approximately one thousand students are enrolled in the school. The classes range from pre-kindergarten to 12th-grade. There are 275 students enrolled in the upper school Grades 9 through 12. There are two administrators, eleven teachers and three secretaries working with the upper school students.

Writer's Role

The writer teaches chemistry to approximately sixty 11th-grade students who are enrolled in two introductory chemistry sections. In addition to chemistry, the writer teaches two 9th-grade physical science classes, one 12th-grade applied science class and a 12th-grade physics course. Responsibilities include developing the curriculum, choosing textbooks and ordering supplies for these courses.

Throughout the year, the writer attends seminars and workshops and writes grant proposals.

The upper school science department is comprised of two teachers. The science department chair is a middle school science teacher. Although there are few regularly scheduled department meetings, meetings can be arranged at any time to discuss issues or share information.

The writer is a member of the faculty council of the National Junior Honor Society and a member of the Steering Committee for the Middle States Accreditation self-study process. In addition to coaching a Science Olympics team, the writer is junior class advisor.

Although the school board does not require a core curriculum to be followed, they encourage creativity in classroom by supplying funds for special projects and needs. Decisions about topics and textbooks are left to individual teachers who discuss ideas among themselves and with the department chair. Teachers are responsible for developing, teaching, and modifying their own curriculum. The development phase consists of writing objectives for the course at the beginning of the year. The teaching phase occurs throughout the school year and modifications are made as needed. The next phase takes place at the end of the year and involves comparing what was taught with the original objectives. Finally, revisions are made to the

list so that what was covered matches the stated curriculum objectives.

Chapter II: Study of the Problem

Problem Statement

The problem to be solved in this practicum is that many chemistry students perform well in group learning situations, such as labs, but perform poorly on content-mastery tests.

Problem Description

Many eleventh-grade chemistry students performed well in group learning situations such as labs, but performed poorly on content-mastery tests. In the lab, they organized information, analyzed data, and responded thoughtfully to oral and written questions. Their level of performance in the lab was measured by evaluating analysis and conclusion answers, observing data collection methods, and discussing processes used. Many of the subject students were able to answer in ways that showed an understanding of concepts. However, when taking content-mastery tests, they performed poorly. This problem had not been addressed in the past because no comparison had been made between students' performance in the lab and their performance on content mastery tests.

Problem Documentation

Evidence of the problem in the work setting had been documented over a two-month period. The first piece of evidence was that many students who performed well in group learning situations, such as labs, were able to correctly

answer only 50% of multiple choice items when taking a content mastery test. The source of this information was student records. The data collection method used for this piece of evidence was to record numbers of correct answers to multiple choice questions.

The second piece of evidence was that many students who performed well in group learning situations, such as labs, rarely volunteered to answer questions in class. The source of this information was student records. The data collection method for this piece of evidence was recording the number of volunteered answers to questions in class.

The third piece of evidence was that many students who performed well in group learning situations, such as labs, earned scores of less than 50% on essay writing assignments. The source of this information was student records. The data collection method used was to evaluate samples of students' writing.

Causative Analysis

A number of factors were observed in the work setting. These may have contributed to possible causes of the problem. One potential cause was associated with method of instruction. The strategy used to determine this possible cause was to examine the subject students' responses to multiple choice items on content mastery tests. Further investigation revealed that these students had provided incorrect answers to multiple choice questions. The result

of the investigation was to conclude that because content mastery was not evident, that possible variables associated with instructional quality had caused students to perform poorly on content-mastery tests.

These variables involved time, planning, and purpose. Whole-group instruction, which had required less time and effort than small group activities, was the primary means of teaching. Thus, the needs of many students were not met. Instruction was often ineffective because teaching methods had not been used to accommodate individual differences. Exclusive use of whole-group instruction had resulted in failure of the subject students to master content.

In addition, diverse means of communicating ideas in the classroom were not planned to ensure that each student had the opportunity to master concepts. Because the teacher and the textbook were the only sources of information provided, many students were forced to operate in a way that was unsuited to their ability level.

When assignments were made without setting purposes for the expected learning, many students became overwhelmed by the unstructured nature of the task. The likelihood of success in locating, identifying and verifying essential information was decreased and content was not learned.

A second potential cause of the problem was low motivation among the subject students to become involved in lessons. The strategy used to determine the possible cause

was to count the number of times the subject students volunteered to answer oral questions. Further investigation revealed that the subject students rarely volunteered in class. The result of the investigation was to conclude that reluctance of students to volunteer to answer questions was a sign of low motivation.

Many students did poorly on content-mastery tests because they were unable to effectively communicate their ideas in writing. The strategy used to determine the possible cause was to evaluate essays written by students. Further investigation revealed that the subject students' essays contained elements of poor writing, such as incomplete sentences, inappropriate punctuation, and inadequate transitions. Introductory paragraphs and concluding statements were also missing. The result of the investigation was to conclude that because the essays did not contain these elements, that indeed the subject students had poor writing skills.

Relationship of the Problem to the Literature

A search of the literature revealed that other professionals are concerned about the problem. Sources consulted in the search were ERIC, MAS FullTEXT Select, PsycINFO, ProQuest Dissertation Abstracts, and WinSPIRS. Many sources were consulted to find evidence of the problem. Topical areas searched were chemistry instruction, education, content mastery, learning styles, cooperative

learning, graphic organizers, motivation, and concept mapping. No studies published prior to 1989 were included in the review. Only studies written in English were cited and those were limited to reports about secondary or post-secondary education. The literature review provided documentation of the existence of the problem in various educational settings and revealed possible causes of the problem.

Evidence that the problem exists elsewhere.

Others have written about the problem as it occurs in different settings. Gillespie (1997) wrote that students found the subject of chemistry abstract and difficult. Researchers observed individuals with low motivational levels had difficulty learning content (Yeh, 1994). Science instructors reported that many students did not understand theoretical concepts presented in science content classes (Pinkerton, 1994). Experts found that mastering chemistry concepts was difficult for many students (Pallrand, 1996).

Processing large bodies of information posed a problem for many students in content courses such as science (L.H. Goldsmith, personal communication, July 17, 1997). Regis, Albertazzi, and Roletto (1996) stated that many students were unable to comprehend relationships among large numbers of concepts. Boughan (1996) reported that many students found general chemistry arduous were unable to master the subject matter.

Causes of the problem described in the literature.

The literature described several causes of the problem. One cause was use of poor instructional methods. Lin (1995) found that asking students to memorize science knowledge did not foster content mastery. The result of using instructional activities that did not directly involve students was diminished concept mastery (Moje, 1992). Other studies indicated that achievement levels in chemistry were significantly affected by instructional methods and classroom strategies (Bednarek, 1991).

Krause (1997) suggested that no particular instructional method was best for all students because individual learners have a variety of needs. Furthermore, exclusive use of traditional instruction was shown to result in a lower level of science content mastery than use of inquiry (Smith, 1996).

A second cause of the problem was that students were not motivated to learn chemistry. Gibson (1994) wrote that following initial interest, many students lost motivation to study chemistry. Larson (1996) reported that many students had negative attitudes toward science. Doljanac (1995) found that many students were unmotivated to achieve in science classes. Finally, Thiele and Treagust (1991) stated that reasons for students' lack of motivation to learn science were complex. They suggested additional research was needed.

A third cause of the problem was that students had poor writing skills. Tierney, Readence, and Dishner (1995) found that students had difficulty determining acceptable use of parts of speech when writing. Moje and Handy (1995) reported that many students' papers contained poorly constructed sentences and incoherent arguments.

Tierney et al. reported that many students did not consider how their ideas should be arranged prior to writing.

In summary, the literature described the problem as it exists elsewhere and revealed several causes. Students in various settings found chemistry difficult and were not motivated to learn. Many students had trouble seeing relationships among concepts. Causes of the problem were factors associated with instructional methods, low motivation among students, and poor writing skills.

Chapter III: Anticipated Outcomes and Evaluation Instruments

Goals and Expectations

The goal of this practicum was to have chemistry students, who perform well in group learning situations, such as labs, perform equally well when taking content mastery tests.

Expected Outcomes

The following outcomes were projected for this practicum:

1. Chemistry students who perform well in group learning situations, but perform poorly on content mastery tests would increase the number of correct answers to multiple choice items on content mastery tests.

2. Chemistry students who perform well in group learning situations, but perform poorly on content mastery tests would increase the number of times they volunteer to answer questions in class.

3. Chemistry students who perform well in group learning situations, but perform poorly on content-mastery tests would write essays containing complete sentences, introductory and conclusion paragraphs, with appropriate punctuation.

Measurement of Outcomes

The first outcome measure was the number of correctly answered multiple choice questions. The standard of

performance was to be an increase of at least 10% in number of correctly answered multiple choice questions on content mastery tests. The second outcome measure was increased number of volunteered answers among the subject students. The standard of performance was to be an increase of at least 10% in number of volunteered answers. The third outcome measure was an increase in use of complete sentences, introductory and conclusion paragraphs, with appropriate punctuation. The standard of performance was to be an increase of at least 10% on essay writing scores.

Among students who performed well in group learning situations, such as labs, but did poorly on content mastery tests, data was collected and analyzed to determine if content mastery occurred as a result of the solutions described below. Teacher-made tests consisting of multiple choice and essay questions were used at the beginning, middle and end of implementation to evaluate students' progress. The number of times students volunteered to answer questions was counted at the beginning, middle and end of implementation to evaluate students' progress. Essay writing was evaluated using a writing rubric throughout implementation.

Chapter IV: Solution Strategy

Discussion and Evaluation of Solutions

The problem to be solved in this practicum was that many chemistry students perform well in group learning situations, such as labs, but perform poorly when taking content-mastery tests.

Suggested solution strategies from the literature.

A search of the literature revealed many possible solutions to the problem. Sources consulted in the search were ERIC, MAS FullTEXT Select, PsycINFO, ProQuest Dissertation Abstracts, and WinSPIRS. Many sources were consulted to find possible solutions. Topical areas searched were chemistry instruction, education, content mastery, learning styles, cooperative learning, graphic organizers, motivation, and concept mapping. No studies published prior to 1989 were included in this review. Only studies written in English were used and those were limited to reports about secondary and post-secondary education. The literature review provided documentation of possible solutions. The literature review was organized in broad terms at first. Reports by teachers, college instructors, and education experts provided information about the problem and posed various solutions. Then a more specific search was done to enlarge understanding and determine feasibility of suggested solutions. Finally, reports were

reviewed to determine strategies for implementation of selected solutions.

Possible strategies for solving the problem.

One possible solution strategy gleaned from the literature was improving instruction. Inquiry was reported to statistically enhance students' understanding of science (Forawi, 1996). This idea was used in the practicum.

Survey, Question, Read, Recite and Review (SQ3R) was shown to improve content mastery and foster understanding of concepts (Moje and Handy, 1995). This idea was used in the practicum.

Employing small-group activities was reported to be effective when teaching students with diverse learning styles (Eggen and Kauchek, 1996). Student Teams Achievement Division (STAD) was shown to be appropriate for teaching well-defined science objectives (Slavin, 1995). This idea was used in the practicum.

Using concept maps has been shown to help students make connections between ideas (Ruiz-Primo and Shavelson, 1996). Concept maps were considered idiosyncratic and inappropriate for practical classroom use (Regis, Albertazzi, and Roletto, 1996). This idea was not used in the practicum.

A second possible solution strategy gleaned from the literature was using motivational techniques. Using cooperative learning in the classroom was shown to create

situations which help less motivated students learn chemistry (Yeh, 1994). Working in cooperative learning groups was effective in raising approval and achievement motivation by presenting academic excellence as a socially desirable behavior (Daniels, 1994). This idea was used in the practicum.

Employing videodisk technology was reported to be a practical motivational tool (Sherwood, 1990). Using computer technology proved highly motivating for students (Keyes, 1994.) This idea was used in the practicum.

Using analogies was shown to help students relate science concepts to the real world and increase motivation (Thiele and Treagust, 1991). Using word and pictorial analogies was suggested as a way to teach chemistry concepts (Fortman, 1994). Using analogies was impractical due to the time needed for development of appropriate student-centered activities. This idea was not used in the practicum.

A third possible solution strategy gleaned from the literature was improving students' writing skills. Using Survey, Question, Read, Recite and Review (SQ3R) was shown to improve writing deficiencies in the content classroom. It was effective in helping students develop good writing skills as they analyzed and explained science ideas (Moje and Handy, 1995). This idea was used in the practicum.

Using graphic organizers was shown improve writing skills as students learned to make connections among concepts (Goldsmith, personal communication, July 17, 1997). This idea was used in the practicum.

Analyzing the structure of text through the writing process was reported to improve writing skills while teaching content (Tierney et al. 1995). Writing essays familiarized students with the structures used in science texts such as comparison-contrast patterns and cause-effect relationships. This idea was used in the practicum.

Review of the literature provided information about possible solutions to the problem. Many researchers recommended more frequent use of small group activities to improve instruction. Inquiry, SQ3R, and concept maps were suggested as ways to foster understanding of science ideas. A number of experts advised using cooperative learning, technology, and analogies to improve motivation and achievement. Finally, many investigators advocated using SQ3R, graphic organizers, and text analysis to improve students' essay writing skills.

Solution Strategies Generated by the Writer

As a result of reviewing the literature, the writer found that using a variety of methods and utilizing a student-centered approach made instruction more effective. Using STAD teams provided a means of incorporating the benefits of cooperative learning and addressing differences

among students. Practicing SQ3R provided practice of writing skills and reinforcement of concepts. Using technology for teacher presentations and students' reports actively involved less motivated students in the learning process. Creating teams of students who represented a cross-section of the class in terms of academics, sex, and race made STAD lessons effective.

Description of Selected Solutions

The solution strategies selected were improving instruction, increasing motivation, and enhancing writing skills to foster content-mastery. Improving instruction involved making adjustments to traditional methods to meet demands of new learning situations. SQ3R was incorporated into small-group work as a means to promote concept mastery. The benefits of small-group work were apparent. First, students learned by helping and challenging each other in active ways to enhance understanding. Second, collaboration on assignments improved learning and accommodated the needs of those who had difficulty in whole-group situations. Third, the teacher was able to circulate, observe and help students in to achieve objectives.

Improving motivation involved using the STAD model of cooperative learning and incorporating technology into lessons. Academic achievement was presented as a socially desirable behavior through team awards. Interaction among

team members motivated students to improve on past performance. Using videodisk and computer technology for instruction and student reports reached beyond the textbook to generate an enthusiasm for learning.

Improving writing skills involved use of SQ3R, graphic organizers, and text analysis. Using SQ3R, students worked together to practice writing essays and improve deficiencies. Making graphic organizers to relate concepts helped students to master content. Analyzing sections of text improved students' writing skills while teaching content. Implementing these solution strategies was expected to result in improved performance on content-mastery tests by the subject students.

Report of Action Taken

Action taken during the first part of implementation involved writing detailed lesson plans for each week of the practicum. These contained specific objectives from both the calendar plan and the curriculum. The first step was to explain to students how the Student Teams Achievement Division (STAD) model would be applied to learning science concepts. The main components were described and the students did team building exercises such as choosing names and designing logos.

Instruction consisted of a regular cycle of activities. The first part was the presentation when students listened, paid attention, and volunteered to

answer questions. Next was team study, when they worked together on problems or worksheets to master the material. Then they discussed ideas and assessed each other's knowledge to make sure everyone in the team grasped the key ideas. Slavin (1995) described this as working together to have an "aha" experience that builds deep understanding. The third part was individual quizzes on which improvement points were earned if score exceeded the base score. The final part was team recognition in the form of awards for the average number of improvement points earned by each team (Appendix A). The points and awards aspect of STAD was important for encouraging teamwork because it replaced normal and sometimes harmful classroom competition with a more effective kind. With STAD, recognition was based on team performance rather than individual raw scores.

Deviation from the original proposal occurred in the area of team composition. The original plan had been to place students according to preferred learning styles. However, there was not enough time to do this. Processing of the purchase order required one week. Several weeks were required for delivery and scoring of the Learning Style Inventory (Dunn and Dunn, 1993). Instead, teams were formed on the basis of mid-term exam scores. Each team was composed of one or two students with high scores, one or two with mid-range scores, and one or two with low scores. Teams were also mixed in terms of gender and race. This

plan had been suggested by Slavin (1995) and was effective for the purpose of the practicum.

Early team building exercises consisted of choosing team names and making logos. Decisions about names and logos were not final until each member agreed. These activities were intended to build team identity and get team members comfortable with each other.

Another deviation occurred at this point. The use of SQ3R as a group activity began earlier than planned. It was modified to help students learn the benefits of working as a team to accomplish a task. Step one involved reading a section of text without taking notes. In step two, students worked individually to list recalled items. Then they worked together to recall as many items as they could without looking at the book. Finally they consulted the book to complete their list of items and studied together for the first quiz. It was an essay based on the SQ3R exercise and was important because it showed students their base score and improvement points earned.

The STAD cycle continued for several weeks. Students listened to a presentation of the lesson, practiced problems or answered questions as a team, then took individual quizzes. Team averages increased and quiz scores improved. Team awards were posted following each quiz. This was an important aspect of STAD because team awards showed students that academic achievement was a desired goal. This

idea served to motivate students to improve upon past performance.

In the fourth week, teams did an inquiry project in the lab. This was the first time the STAD teams had worked together in the lab. Interest of the subject students in the lab was shown by the kinds of questions they asked. Interactions among team members helped everyone in the team to understand the concepts and to work the problems in the analysis section. Keeping notes in the practicum log while students worked in the lab was difficult due to frequent interaction between students and teacher.

Throughout the team study process, the idea of helping each other master concepts was stressed. There were four quizzes in the practicum period. These allowed teams and the writer to see progress was indeed being made in terms of individual improvements. Several of the subject students earned enough improvement points to increase their team average and earn awards.

There was some deviation from the plan at this time. The graphic organizer was used as a pre-lab activity and as a post lab activity. The original plan had been to use it only as a post-lab activity. The pre lab exercise was to use the graphic organizer to introduce the ideas involved in the investigation. The terms related to the lab were written on the board and the students offered ideas for

arranging the associated ideas. Several students remembered having used a similar diagram in other classes.

The post lab exercise was to use the graphic organizer to make connections between the analysis and results sections of the lab. As students explained their reasons for choosing connections between ideas they were able to review concepts learned in the lab. Text analysis was used to improve writing skills and teach content. It involved analyzing the structure of passages by identifying main and subordinate ideas. This helped students recognize how to develop and expand ideas by means of supporting details.

Use of technology to present a lesson involved a series of images from the World Wide Web. These images were intended to supplement the text lesson. Videodisk clips were used to demonstrate various concepts and applications.

SQ3R was used again at this point. For this lesson, students surveyed a section of text then wrote questions for classmates to answer. Individual students answered the questions without the book, then worked in their teams using the text to complete the more difficult answers. Team study followed.

In the last month of the practicum students wrote essays using graphic organizers as a guide and prepared reports for presentation to the class. The presentations involved showing students how to use the videodisk player and helping them locate information on the Internet. Each

team member was responsible for at least one part of the presentation. Jobs involved typing the report, making diagrams, using equipment, presenting, and making transparencies. The project gave students the opportunity to identify important concepts and present information to the class in a variety of ways.

A pretest and posttest were used to collect data about students' essay writing skills and multiple choice answers. For volunteering, data were collected by making notations in a daily journal and recording observations.

Data were assembled about multiple choice items by counting correct answers. Also, data were assembled about essay writing skills by counting points earned for using components correctly. To assemble data about volunteering, the number of times students volunteered to answer questions in class were counted.

Data were organized in tables for comparison of group mean scores earned prior to implementation and following completion of the practicum.

Writer's Leadership Role

The writer's anticipated leadership role during implementation was to reach beyond day-to-day responsibilities, keeping in mind that leadership is learned by doing. The practicum was guided by the writing of Conger (1989) who visualized leadership as a process of moving an organization from an existing state to some

future state. He described four behavioral stages for leaders, which corresponded in some ways to the practicum process. Stage one involved sensing opportunity and formulating a vision. This stage was related to recognizing a discrepancy between what existed and what should be. Stage two was communicating and interpreting the goals in ways that were meaningful in terms of the organization's aims. This was related to sharing the goal of the practicum with others and explaining how it promoted academic and intellectual growth. Relating the goal to the school's philosophy created a foundation for sharing and realizing a vision. The focus of stage three was building trust through effective communication. The writer discovered ways to lead others toward desired goals. Vital to the success of the practicum was the belief that all students can make significant gains and this idea guided the writer through each stage of practicum planning and implementation.

Chapter V: Results

Results

Many eleventh-grade chemistry students performed well when working together in the science lab, but performed poorly on content-mastery tests. When working in the lab, they demonstrated skills needed to organize information and analyze data. They were able to respond thoughtfully to oral and written questions about the science ideas they were studying. Students' answers to analysis and conclusion questions from lab investigations were evaluated. Their answers and explanations were complete and revealed a satisfactory understanding of concepts.

When taking content-mastery tests, many students performed poorly. This problem was not addressed in the past because no comparison had been made between students' performance in the lab and performance on content-mastery tests.

The selected solution strategies were intended to foster a greater degree of content mastery among the subject students. This was to be accomplished by improving instruction in the classroom, increasing students' motivation, and improving the skills they needed to explain ideas in essay form.

The goal of this practicum was to have chemistry students, who perform well in group learning situations, such as labs, perform equally well when taking content-

mastery tests. The following outcomes were projected for this practicum:

1. Chemistry students who perform well in group learning situations, but perform poorly on content-mastery tests would increase the number of correct answers to multiple choice items on content-mastery tests.

This outcome was met.

There was an increase of 10% in number of correctly answered multiple choice questions on content mastery tests, as shown in Table 1.

2. Chemistry students who perform well in group learning situations, but perform poorly on content mastery tests would increase the number of times they volunteer to answer questions in class.

This outcome was met.

There was an increase of 17% in number of volunteered answers among the subject students.

3. Chemistry students who perform well in group learning situations, but perform poorly on content-mastery tests would write essays containing complete, well-structured sentences, introductory and conclusion paragraphs, and appropriate punctuation.

This outcome was met.

There was an increase of 18% on essay writing scores among the subject students, as shown in Table 1.

Table 1.

Means of Scores for Twelve Subject Students on Pretest and Posttest of Multiple Choice and Essay Components

Test Component	Pretest	Posttest
Multiple choice	53	63
Essay	56	74

Discussion

The result of these outcomes was significant improvement in content mastery by the subject students by the end of implementation. Furthermore, results indicated the selected solution strategies played a significant role in improving instruction, motivation, and writing skills.

The first solution strategy had been to improve instruction by means of small group activities such as SQ3R, team study and inquiry. Using a variety of instructional methods reduced students' dependency on the teacher and encouraged interaction among peers of different genders, ethnic background and achievement levels.

The implication of increase in numbers of correct multiple choice answers was that using a variety of instructional methods had improved instruction and consequently learning.

Direct involvement of students improved content mastery (Moje, 1992). Working in small groups enhanced

understanding of science concepts was enhanced (Forawi, 1996). Using Student Teams Achievement Division (STAD) as a basis for small group work was effective because students did not compete against classmates but competed against their own prior performance (Slavin, 1995). Team members worked together to master the material by discussing ideas and assessing each other's knowledge to make sure key ideas were grasped by everyone. This step was the cornerstone of the cooperative learning component of the practicum.

The second solution strategy had been to improve motivation by using cooperative learning and technology to generate interaction, approval and enthusiasm. The implication of increased number of times the subject students volunteered was that cooperative learning and use of technology had improved motivation to learn chemistry. Posting of team logos and awards showed academic achievement as socially desirable behavior and increased motivation among the subject students (Daniels, 1994). The interaction among team members as they discussed problems and studied for quizzes was a source of motivation (Yeh, 1994).

An unexpected outcome was the discovery of a common point of discussion provided by use of technology. Students had to view several clips to find those most useful for their report. It was necessary to discuss each clip with the teacher and fellow students in order to choose the

appropriate one. For these students, using videodisk technology proved to be a practical motivational tool as reported by Sherwood (1990).

Only one group chose to use information from the Internet in their report. Using computer technology in this manner added a dimension to the report that was both interesting and motivational for students (Keyes, 1994).

The third solution strategy had been to improve writing skills by SQ3R, graphic organizers, and text analysis. SQ3R helped students improve writing deficiencies and familiarize them with elements of good writing. The result was enhanced ability to communicate ideas in writing (Moje and Handy, 1995). Their writing skills improved as they practiced using graphic organizers to make connections among concepts (Goldsmith, personal communication, July 17, 1997). They learned to consider the arrangement of ideas prior to writing. This resulted in improved scores for essay tests (Tierney et al. 1995).

Using text analysis helped students understand the structure of text, patterns, and cause-effect relationships (Tierney et al. 1995). Content-mastery test scores improved because students learned to effectively communicate their knowledge of science concepts when writing essays. An unexpected outcome was development of a writing rubric for use in scoring essays (Appendix B). This device made it possible to inform students of needed improvements. The

writing rubric provided a more satisfactory approach to essay evaluation. The implication of increased essay scores was that graphic organizers, text analysis and SQ3R improved writing skills. Structure provided by SQ3R improved writing skills and required students to analyze and explain ideas. This activity fostered understanding of concepts (Moje and Handy, 1995).

Making graphic organizers based on an inquiry project helped students consider how their ideas should be arranged prior to writing (Tierney et al. 1995). Text analysis provided good writing models and showed students correct use of various parts of speech (Tierney et al.). The result of these activities was the ability to write essays containing complete sentences and coherent, organized arguments.

In summary, improving instruction methods, motivation, and writing skills resulted in increased content mastery. Students, who performed well in group learning situations, such as labs, increased the number of correct answers to multiple choice items on content-mastery tests. In addition there was an increase in the number of times the subject students volunteered to answer questions in class. Finally they learned to write informative, well-structured essays which effectively communicated their knowledge of science concepts.

Recommendations

Others in similar situations would benefit from these recommendations:

1. Use a variety of instructional methods to eliminate over-dependence on teacher and text as sources of information.

2. Place students in diverse groups in terms of gender, ethnicity, and achievement level. This will encourage interaction and increase contact with those outside of friend groups.

3. Use motivational techniques to generate interaction among students and create enthusiasm for learning.

4. Involve students in activities that improve writing skills so they will be able to effectively communicate what they know and are able to do.

Ideas for furthering this solution in work setting are:

1. Encourage other teachers to use a variety of teaching methods to improve instruction.

2. Share with others the benefits of small-group instruction.

3. Extend the use of the STAD model of cooperative learning to grades seven through twelve.

4. Model the use of technology as a motivational tool.

5. Develop in-service workshops to teach writing in the content area.

Dissemination

The results of the practicum were shared with fellow faculty members at a science department meeting. The questions and comments were helpful and informative. There was interest in knowing more about the STAD model. The benefits of the points system and awards were discussed. There was concern about the amount of paperwork involved in the STAD lessons. The process was explained in more detail to clarify that only the initial organization of teams and quiz grading involved added effort.

Ways to incorporate technology into students' reports was also discussed. The process of making up teams was explained in more detail at the end of the presentation. Reactions to teaching writing in the science classroom were both positive and negative. It was suggested that improving writing skills was the English teacher's domain and would pose problems for science teachers not specifically trained to teach those skills. A positive comment was that students should understand what to expect in a good essay answer. The writing rubric was said to be an effective tool for helping students improve specific skills.

The department chair thought using varied instructional techniques was an interesting way to provide a positive approach to learning. She suggested the motivational techniques had improved self-confidence causing improved student scores.

Following the presentation, there was discussion about the extra effort involved. It was suggested that positive results would make the effort worthwhile. Finally, there was agreement that the results indicated the solution strategies used in the practicum had been successful in promoting concept mastery among the subject students.

References

Bednarek, L. J. (1991). An annotated bibliography of the literature concerning the factors affecting students' achievement in high school chemistry courses. South Bend: Indiana University at South Bend.

Boughan, K. (1996, August). Correlates of chemistry 101 course performances. Brief No. RB97-8. Largo, MD: Prince George's Community College.

Conger, J. A. (1989). The charismatic leader. San Francisco: Jossey-Bass.

Daniels, R. (1994). Motivational mediators of cooperative learning. Psychological Reports, 74, 1011-1022.

Doljanac, R. F. (1995). Using motivational factors and learning strategies to predict academic success [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9513340.

Dunn, R. & Dunn, K. (1993). Teaching secondary students through their individual learning styles. Needham Heights, MA: Allyn & Bacon.

Eggen, P. D., & Kauchak, D.P. (1996). Strategies for teachers. Needham Heights, MA: Allyn & Bacon.

Forawi, S. A. (1996). The effects of the interaction of teachers' understanding of the nature of science, instructional strategy, and textbook on students' understanding of the nature of science [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9621877.

Fortman, J. J. (1994). Pictorial analogies XII: Stoichiometric calculations. Journal of Chemical Education, 71, 571-72.

Gibson, G. D. (1994). High school science classrooms: Teachers' teaching and students' learning [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9414857.

Gillespie, R. J. (1997). Reforming the general chemistry textbook. Journal of Chemical Education, 74, 484-485.

Keyes, G. K. (1994). Motivating reluctant students. In J. Hirschbuhl & D. Bishop (Eds.), Computers in Education (7th ed.). (pp. 10-12). Guilford, CT: Dushkin.

Krause, L. B. (1997). An investigation of learning styles in general chemistry students [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9703465.

Larson, J. O. (1996, April). "I'm just not interested": Gender-related responses in a high school chemistry curriculum. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, St. Louis, MO.

Lin, H. S. (1995, April). The development of beginning chemistry teachers' teaching techniques. Paper presented at the Annual Meeting of the National Association for Research in Science Teaching, San Francisco, CA.

Moje, E. B., & Handy, D. (1995). Using literacy to modify traditional assessments: Alternatives for teaching and assessing content understanding. Journal of Reading, 38, 612-625.

Moje, E. B. (1992, December). Literacy in the chemistry classroom: An ethnographic study of effective teaching. Paper presented at the Annual Meeting of the 42nd National Reading Conference, San Antonio, TX.

Pallrand, G. J. (1996). The relationship of assessment to knowledge development in science education. Phi Delta Kappan, 78, 315-318.

Pinkerton, K. D. (1994). Using brain-based learning techniques in high school science. Teaching and Change, 2, 44-60.

Regis, A., Albertazzi, P. G., & Roletto, E. (1996). Concept maps in chemistry education. Journal of Chemical Education, 73, 1084-1088.

Ruiz-Primo, M. A., & Shavelson, R. J. (1996). Problems and issues in the use of concept maps in science assessment. Journal of Research in Science Teaching, 33, 569-700.

Sherwood, R. D. (1990, April). An evaluative study of a level one videodisk based chemistry program. Poster session presented at the annual meeting of the National Association for Research in Science Teaching, Atlanta.

Slavin, R. E. (1995). Cooperative Learning (2nd ed.). Boston: Allyn & Bacon.

Smith, D. A. (1996). A meta-analysis of student outcomes attributable to the teaching of science as inquiry as compared to traditional methodology [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9632097.

Thiele, R. B. & Treagust, D. F. (1991). Using analogies to aid understanding in secondary chemistry education. Paper presented at the Royal Australian Chemical Institute Conference on Chemical Education (Perth, Western Australia, Australia July 1991)

Tierney, R. J., Readence, J. E., & Dishner, E. K. (1995). Reading strategies and practices, A compendium (4th ed.). Boston: Allyn & Bacon.

Yeh, S. (1994). Perceptual learning style and academic intrinsic motivational level: The effect of using interactive video on student post-treatment preference and performance in a high school chemistry course [CD-ROM]. Abstract from: ProQuest File: Dissertation Abstracts Item: 9404761.

APPENDIX A

IMPROVEMENT POINTS AWARD SYSTEM

IMPROVEMENT POINTS AWARD SYSTEM

A perfect paper regardless of base score earns 30 improvement points. A paper with a score more than ten points above base score earns 30 improvement points. A paper with a score equal to the base score to ten points above the base score earns 20 improvement points.

A paper with a score ten points below the base score to one point below the base score earns 10 improvement points. A paper with a score more than ten points below the base score earns 5 improvement points.

The team average equals the total team improvement points divided by the number of team members. A team whose average number of improvement points is between 5 and 15 earns a "Good Team" award. A team whose average number of improvement points is between 16 and 24 earns a "Great Team" award. A team with an average of 25 or above earns a "Super Team" award.

APPENDIX B

WRITING RUBRIC

WRITING RUBRIC

Name _____ Date _____

Description of assignment _____

_____ Composition includes all required concepts presented in books and articles.

_____ Composition contains all of the specific details relating to required concepts.

_____ Ideas are presented in a clear manner and show logical progression from one point to the next.

_____ Compound sentences are used which show acceptable use of conditional phrases and coordinating conjunctions.

_____ Cause and effect relationships are presented in a clear logical manner.

_____ Sentences used in the composition are complete, logical and coherent.

_____ Use of tense is correct and consistent throughout the composition.

_____ Introduction is effective.

_____ Conclusion is effective.

_____ Writing is neat and legible with no grammar or spelling errors.

_____ Heading includes student's name, title and date.

_____ Works cited page contains all required citations.

_____ Authors' ideas are appropriately paraphrased.

_____ Effort is sufficient and evident.

SE042020

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement (OERI)
Educational Resources Information Center (ERIC)

REPRODUCTION RELEASE
(Specific Document)

I. DOCUMENT IDENTIFICATION:

Title: Improving Instruction, Motivation, and Writing Skills to Foster Content Mastery among 11th Grade Chemistry Students
Author(s): Diana B. Litteral
Corporate Source: Nova South Eastern University, Ft. Lauderdale, FL — Publication Date: October 1998

II. REPRODUCTION RELEASE:

In order to disseminate as widely as possible timely and significant materials of interest to the educational community, documents announced in the monthly abstract journal of the ERIC system, *Resources in Education* (RIE), are usually made available to users in microfiche, reproduced paper copy, and electronic/optical media, and sold through the ERIC Document Reproduction Service (EDRS) or other ERIC vendors. Credit is given to the source of each document, and, if reproduction release is granted, one of the following notices is affixed to the document.

If permission is granted to reproduce the identified document, please CHECK ONE of the following options and sign the release below.

☒ ← Sample sticker to be affixed to document

Check here
Permitting microfiche (4"x 6" film), paper copy, electronic, and optical media reproduction

"PERMISSION TO REPRODUCE THIS MATERIAL HAS BEEN GRANTED BY
Sample
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Level 1

Sample sticker to be affixed to document → ☐

"PERMISSION TO REPRODUCE THIS MATERIAL IN OTHER THAN PAPER COPY HAS BEEN GRANTED BY
Sample
TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)."

Level 2

or here
Permitting reproduction in other than paper copy.

Sign Here, Please

Documents will be processed as indicated provided reproduction quality permits. If permission to reproduce is granted, but neither box is checked, documents will be processed at Level 1.

"I hereby grant to the Educational Resources Information Center (ERIC) nonexclusive permission to reproduce this document as indicated above. Reproduction from the ERIC microfiche or electronic/optical media by persons other than ERIC employees and its system contractors requires permission from the copyright holder. Exception is made for non-profit reproduction by libraries and other service agencies to satisfy information needs of educators in response to discrete inquiries."

Signature: Diana B. Litteral	Position:
Printed Name: Diana B. Litteral	Organization: Nova Southeastern University
Address: 36B2 Golfview Drive, Newark, DE 19702	Telephone Number: (302) 292 1041
	Date: 10/22/98

III. DOCUMENT AVAILABILITY INFORMATION (FROM NON-ERIC SOURCE):

If permission to reproduce is not granted to ERIC, or, if you wish ERIC to cite the availability of this document from another source, please provide the following information regarding the availability of the document. (ERIC will not announce a document unless it is publicly available, and a dependable source can be specified. Contributors should also be aware that ERIC selection criteria are significantly more stringent for documents which cannot be made available through EDRS).

Publisher/Distributor:	
Address:	
Price Per Copy:	Quantity Price:

IV. REFERRAL OF ERIC TO COPYRIGHT/REPRODUCTION RIGHTS HOLDER:

If the right to grant reproduction release is held by someone other than the addressee, please provide the appropriate name and address:

Name and address of current copyright/reproduction rights holder:

Name:

Address:

V. WHERE TO SEND THIS FORM:

Send this form to the following ERIC Clearinghouse:

ERIC Clearinghouse on Educational Management
College of Education - Agate Hall
5207 University of Oregon
Eugene, OR 97403-5207

If you are making an unsolicited contribution to ERIC, you may return this form (and the document being contributed) to:

ERIC Facility
1301 Piccard Drive, Suite 300
Rockville, Maryland 20850-4305
Telephone: (301) 258-5500