OTS Master's Level Projects & Papers   STEM Education & Professional Studies

2007

The Effectiveness of Employing Content Area Writing Strategies on Student Knowledge and Concept Retention as Measured by Performance on an Examination Based on the Comptia A+ Certification Objectives

Timothy A. McLeod
Old Dominion University

Follow this and additional works at: https://digitalcommons.odu.edu/ots_masters_projects

Part of the Education Commons

THE EFFECTIVENESS OF EMPLOYING CONTENT AREA WRITING STRATIGIES ON STUDENT KNOWLEDGE AND CONCEPT RETENTION AS MEASURED BY PERFORMANCE ON AN EXAMINATION BASED ON THE COMPTIA A+ CERTIFICATION OBJECTIVES

A Research Report Presented to the Graduate Faculty of the
Department of Occupational and Technical Studies at
Old Dominion University

For Partial Fulfillment of the Requirements for the Masters of Science in
Occupational and Technical Education Degree

By
Timothy A. McLeod
August 2007

Signature Page

This research paper was prepared by Timothy A. McLeod under the

direction of Dr. John M. Ritz as part of OTED 636, Problems in Occupational and

Technical Education. It was submitted as partial fulfillment of the requirements

of the requirements for the degree of Masters of Science in Occupational and

Technical Education.

Approved by: _John M. Ritz_ _____   Date: _7-28-07_____

Dr. John M. Ritz
Advisor and Graduate Program Director

Table of Contents

Table of Tables

Table of Figures

CHAPTER I

Introduction

Spotsylvania Career and Technical Center (SCTC) serves students who attend the five high schools, Chancellor, Courtland, Massaponax, Riverbend, and Spotsylvania, in Spotsylvania County, Virginia. The Information Technology (IT) Pathways course was created in 2006 as one of the introductory "Pathways" courses for students who are interested in entering into classes within the Communications cluster.

With the decision for the county high schools to convert to an eight credit alternating day block schedule, there was a need for additional elective courses to be offered for students. This impelled SCTC to abandon the four credit instructional block in favor of a two credit block with the existing courses being structured into either one or two credit modules. The IT Pathways course consists of one semester of Basic Electronics and one semester of Computer Maintenance with students receiving two credits for successful completion of the course. The Computer Maintenance course is based on the competencies prescribed by the Virginia Department of Education for course TDI8621: Computer Maintenance and as prescribed by the Computing Technology Industry Association (CompTIA) A+ examination objectives as revised in 2006.

Statement of the Problem

The problem of the study was to evaluate the effectiveness of employing content area writing exercises on student knowledge and concept retention as

measured by performance on an examination based on the CompTIA A+ certification objectives in the Information Technologies Pathways course at Spotsylvania Career and Technical Center.

Hypothesis

To guide this study, the following hypotheses were established.

H_1:   The employment of content area writing exercises in the Information Technologies Pathways course will result in increased retention of basic computer knowledge and concepts.

H_2:   The employment of content area writing exercises in the Information Technologies Pathways course will result in an increased percentage of students achieving passing scores on the CompTIA A+ Certification practice examination.

Background and Significance

Courses at Spotsylvania Career and Technical Center had traditionally been taught as two year programs where the students spent three of the seven instructional periods of their academic day at SCTC in their respective courses and the other four periods in travel and at their home schools. The decision of Spotsylvania County Schools to change to a four block day with classes alternating each day afforded students to enroll in elective courses they may not have had room for in their schedules under the old system. Another factor was that moving from a seven credit year to a schedule which afforded the opportunity for an additional credit each year meant that there needed to be

additional elective courses offered for students.   With those issues in mind, the SCTC staff developed a plan to take existing classes which would have been three-credits under the old schedule and four-credits under the new block schedule and structure them into modules that could be taught as either half credit or one-credit units that would allow students to explore various occupational areas. This concept was piloted within the Communications and Construction clusters. The instructional areas that participated within the Communications cluster were Computer Maintenance, Electronics, Graphic Design and Printing, and Radio and Television Production, and those that participated in the Construction cluster were Carpentry, Electricity, Heating Air Conditioning and Refrigeration, and Masonry.

Each instructional area was allotted either one nine-weeks or one-semester of a two-credit instructional block for their respective area. This change in schedule resulted in the need for substantial curriculum modification and revision including review of the methodology employed in the classroom. One of the most identifiable changes was the amount of instructional time that is available under the new academic calendar as compared to the time that had been allotted to the same competencies in previous years under the old calendar model. This brought forward the question whether students were developing an adequate depth of understanding of the skills and concepts presented to them.

In particular was the question of whether they reached the level necessary to successfully acquire various industry certifications. Within the

Computer Maintenance area the question related to if the students developed

the knowledge necessary to successfully complete the requirements to obtain the

industry recognized A+ certification administered by CompTIA. With the change

in curriculum and the resulting change in methodology the question arose as to

what instructional techniques would be most successful in helping the students

develop the desired level of understanding as well as serving as a tool for

instructors to use in formative assessment of individual students.

Much has been written regarding the role of writing in learning and

assessment and recently the role writing plays in learning in all content areas

rather than just in language or literature. In Exploring Mathematics and Writing,

Keith suggests brief writing assignments in which students describe their

understanding by explaining concepts, creating definitions, relating concepts,

describing visual images, and summarizing rationalizing strategies while

communicating these to an audience of their peers (as cited in Brandenburg,

2002). Writing is a key component of the reflective learning process which

begins with the person and their own experiences and can result in development

of new knowledge. Dewey (1910), in How We Think, states that "Reflection thus

implies that something is believed in or disbelieved in, not on its own direct

account, but through something else which stands as witness, evidence, proof,

voucher, warrant; that is, as ground of belief" (p. 8). In any case reflection is an

active conscious process that occurs when an individual seeks to create order or

structure from knowledge that has previously not been encountered.

Limitations

The limitations of this study were as follows:

1. The experiment was limited to two sections of the IT Pathways course at Spotsylvania Career and Technical Center.

2. Data collected were based on instruction which took place during the second semester of the 2006-2007 academic year.

3. Data were collected by one instructor who taught two separate sections of the IT Pathways course.

Assumptions

The assumptions that this study was based upon included:

1. Students enrolled in the course were not assigned according to any academic grouping.

2. Instruction of both sections covered the same competencies as identified by the Virginia Department of Education in Task List for Course TDI8621 – Computer Maintenance.

3. Instruction in both sections of the course will be conducted using similar instructor led instructional methods.

4. Equipment and instructional aides used in class will be similar for both class sections.

5. Classroom instructional hours will be the same for both class sections.

Procedures

Evaluation of student performance was assessed using two different methods. The first method employed a nonrandomized pretest-posttest design and the second method of evaluation consisted of an assessment which is structured similar to and modeled after a high stakes certification examination. While the same course competencies were covered and similar instructor led instructional activities were employed in both classes, the experimental group also received instruction in writing to reflect and using writing to focus on new ideas and relationships. The test group also used writing tools for both formative and summative assessment, while the control group used more traditional assessment methods for evaluating student concept development.

The pretest-posttest instrument was designed using an approximate percentage of questions per domain as prescribed by CompTIA for the A+ Essentials examination based on the 2006 objectives. The pretest was administered to students during the first week of the semester in which instruction began. The posttest was administered after 15 weeks of instruction using the same testing instrument. The students' scores on the pretest and posttest were compared as a measure of increase in technical computer knowledge during the period of instruction.

The simulated high stakes certification examination instrument was based on a quasi-random selection of 70 questions from a pool of questions structured to emulate those questions which would be found on the actual CompTIA A+

certification examination. The testing environment was designed so that it
closely approximated an actual testing scenario to provide students with the
realization of what to expect during an actual certification test. A student who
scored 70% or higher on the simulated examination has a reasonable
expectation of passing the actual certification examination. Results from the
pretest-posttest and the simulated high stakes examination for each class were
compared to determine if there was a difference in the knowledge gained and
overall performance on the examinations between the two student groups.

Definition of Terms

The following definitions were provided to equip the reader with a better
understanding of the study.

1. A+ Certification - vendor-neutral certification recognized by major
    hardware and software vendors, distributors, and resellers which confirms
    a technician's ability to perform tasks such as installation, configuration,
    diagnosing, preventive maintenance, and basic networking.

2. Computing Technology Industry Association (CompTIA) - the leading
    association representing the international technology community whose
    goal is to provide a unified voice, global advocacy and leadership, and to
    advance industry growth through standards, professional competence,
    education, and business solutions.

3. Formative assessment - generally carried out throughout a course or project, used to aid learning, should be an integral part of instruction that informs and guides teachers and students.

4. Information Technology (IT) Pathways – introductory course consisting of one semester each of Basic Electronics and Computer Maintenance for students interested in entering into the Communications Cluster courses at Spotsylvania Career and Technical Center.

5. Summative assessment - generally carried out at the end of a course or project. In an educational setting, summative assessments are typically used to assign students a course grade, the purpose of which is evaluative.

Overview of Chapters

Chapter I introduced the problem of the study which was to determine if content area writing employed as an instructional technique would lead to an increase in student technical computer knowledge and increase the probability of students being successful on the CompTIA A+ certification examination. The research goal was stated in terms of the following hypotheses:

H_1:   The employment of content area writing exercises in the Information Technologies Pathways course will result in increased retention of basic computer knowledge and concepts.

H_2:   The employment of content area writing exercises in the Information Technologies Pathways course will result in an increased percentage

8

of students achieving passing scores on the CompTIA A+ Certification practice examination.

The background and significance identified the reasons for change in the instructional model and the impact these changes had on student schedule, instructional time, and time on task. The boundaries which impacted test implementation and data collection were identified along with those implied beliefs which the researcher felt to be true. The procedures employed in the evaluation were stated describing how the test was conducted and terms were listed which would provide the reader with additional knowledge of items particular to the study.

Chapter II provides a review of literature relative to summative and formative assessment, writing in the content area, and test instrument development. Chapter III provides specific information on the methods and procedures employed in the study. Chapter IV describes the analyzed data and expresses the findings of the study. Chapter V includes the summary, conclusions, and recommendations for additional research as indicated by the results of the study.

CHAPTER II

REVIEW OF LITERATURE

The purpose of this chapter was to provide a review of literature regarding the value of utilizing content area writing activities on concept development by students in the Information Technology Pathways courses at Spotsylvania Career and Technical Center. The influences driving the curriculum, the standards employed in measuring student success, and the techniques employed in the instructional process were discussed in this chapter.

High Stakes Exams and Students Assessment

Much attention is being focused on the success of Career and Technical Education students in earning industry recognized certifications as a result of participation in training programs in Virginia as well as throughout the United States. The Virginia Department of Education published a list of recognized industry certifications for each trade area in which Virginia schools provide training. The administration of evaluation for these certifications varied greatly from one trade area to the next and even could be quite diverse within a particular trade area and could be found in Section 10 of the Virginia Department of Education Career and Technical Education Administrative Planning Guide as revised in July 2006.

Many of the recognized certifications, particularly those in the Information Technology area, require successful completion of a high stakes examination. The term "high-stakes" is used to describe tests that have high stakes for

individual students, in other words there is much to gain in success and much to lose in failure. The magnitude of this model alone is burden enough to make many students waiver in committing to participating in this type of certification assessment. This coupled with the cost of exam administration, over $100 per examination in many cases, can be quite a burden on a high school student in preparing for one of these exams.

One of the most widely recognized entry level certifications for individual entering into an Information Technology career path is the CompTIA A+ certification. CompTIA is a non-profit organization whose goal is to provide a unified voice, global advocacy and leadership, and to advance industry growth through standards, professional competence, education and business solutions which efficiently serve the industry and its members. CompTIA A+ certification validates the latest skills needed by today's computer support professionals. It is an international, vendor-neutral certification recognized by major hardware and software vendors, distributors, and resellers. The A+ certification confirms a technician's ability to perform tasks such as installation, configuration, diagnosing, preventive maintenance, and basic networking. The exams also cover domains such as security, safety and environmental issues, and communication and professionalism.

CompTIA requires applicants to successfully pass the A+ Essentials exam and one of three elective exams in order to be awarded the A+ certification. The most widely taken elective exam is the A+ 220-602 IT Technician exam. The

2006 A+ Essentials and the A+ 220-602 IT Technician exam objectives as published by CompTIA are divided into domains as follows:

Table 1. 2006 A+ 220-601 Essentials Exam Objectives

Domain	Percentage of Examination
1.0 Personal Computer Components	21%
2.0 Laptop and Portable Devices	11%
3.0 Operating Systems	21%
4.0 Printers and Scanners	9%
5.0 Networks	12%
6.0 Security	11%
7.0 Safety and Environmental Issues	10%
8.0 Communication and Professionalism	5%
Total	100%

Table 2. 2006 A+ 220-602 IT Technician Exam Objectives

Domain	Percentage of Examination
1.0 Personal Computer Components	18%
2.0 Laptop and Portable Devices	9%
3.0 Operating Systems	20%
4.0 Printers and Scanners	14%
5.0 Networks	11%
6.0 Security	8%
7.0 Safety and Environmental Issues	5%
8.0 Communication and Professionalism	15%
Total	100%

The exams are designed in a linear format in which the contestant is given 90 questions to answer from a question pool. Of the 90 questions, ten are field test questions which do not count in the final score; the remaining 80 questions are used to determine the individual's score. While contestants are not provided with specific questions to study in preparation, the percentage of questions from each domain provides the contestant with the importance of each domain relative to the others.

Preparing students for the CompTIA A+ certification examination or any other high stakes exam can be a formidable task for any instructor. With so much weighing in this one experience, developing instructional tools that increase student understanding are now more critical than ever.

Formative and Summative Assessment for Learning

Much has been written in recent years in relation to the usage of formative and summative evaluation and while there is little debate on the usefulness of formative evaluation, all too often educators resort to the use of summative assessment as a means of determining a student's level of knowledge and comprehension. High stakes certification examinations are no exception to this. While instructors may work to develop alternative methods of assessment which are formative in design, educators ultimately are preparing students for a summative assessment which provides little or no feedback from which students can further their knowledge.

Sadler (1989) refers to formative assessment as being concerned about how judgments of the quality of student responses can be used to shape and improve student competence. He goes on to indicate that effective formative and summative assessment must go hand in hand. As practitioners educators must explore and define instructional methods which will provide appropriate assessment methods that will enhance students' learning.

In most every case the process of formative assessment involves some level of reflection. Whether this is reflection which is directed by a teachers

comment to a student or reflection by a student of their own work the process should lead to a deeper understanding and a stronger grasp of the knowledge in question. Reflection involves the process of scaffolding or linking our learning to past experiences and synthesizing new meaning from the collective knowledge. The development of student reflection requires that students understand that they are an active part of the process and they must be coached on the steps of the process just as they are coached in learning any other concept. Modeling of strategies by the teacher, when fitting, serves to reinforce reflection as a viable learning tool (Costa & Kallick, 2000).

Writing in the Content Area

Most frequently writing in secondary schools in the United States is viewed as the responsibility of English teachers and is only used on other content area classrooms as a tool for summative assessment. Writing, when used properly, is a means to evaluate a student's mastery of content and to identify misconceptions. Writing provides a chronology of our thoughts which can be used to clarify and objectify concepts (Jacobs, 2002). As a content area specialist, finding instructional strategies which are appropriate for our respective disciplines can be a difficult charge.

Teachers in technical areas have a tough challenge in that they must not only teach their content, but they must also teach students the reading and writing skills which are particular to their specific trade area. In evaluating this

need for teachers in technical areas to teach skills for reading and writing in that area one needs only to look to an article published by Vacca (2002);

> In the past, content literacy instruction did not easily find its way into subject-matter classrooms, despite the attention given to it by literacy researchers and educators. Traditionally, the responsibility for teaching reading and writing has rested with English/language arts teachers and reading specialists.
>
> Although they have important roles to play in adolescents' literacy development, language arts and reading teachers need content-area teachers to show students how to read and write like a scientist, historian, or mathematician. All teachers in all subjects share the responsibility for literacy development in middle grades and high school. Today, more and more content-area teachers recognize this responsibility and are incorporating content literacy into their teaching through a variety of instructional strategies (p. 10).

In preparing students for entering a particular trade area it is especially important that those individuals have the skills necessary to effectively communicate and continue the learning process as they advance their careers.

Tools for Writing in the Content Area

The tools available for guiding the reflective writing process are as varied as the different content area disciplines. Those most appropriate for technical content can usually be found in other technical areas such as the sciences and mathematics. In most every case, reflection requires students to write as part of the reflective process in understanding complex concepts. Content area writing can be divided into two categories: Writing to Learn and Writing to Demonstrate Knowledge. It might appear that writing to learn would be categorized as formative assessment and writing to demonstrate knowledge would be a

summative assessment. The argument can be made that both are formative in nature. This all depends on the nature of the assessment and how it is employed. There are a wide variety of assessments that can be used in the content area classroom as tools for furthering student learning.

Cruz (2001) suggests several activities that guide students to use writing as a cue for thinking. In the "think-pair-share" activity, which can be used when introducing a lesson, checking for comprehension, or helping students review material, they are asked to respond privately to a prompt, share their response with a partner, and discuss responses as a whole class. Secondly, "response/remembrance" allow students to respond to several prompting questions with information they have received from a variety of sources. A third technique is "collaborative note-taking", where students share the process of picking out key information and then sharing that information with peers. Another method is the use of letters in which students recap a lesson to share with a reader. All of these activities lend themselves to in-class discussion and further concept development.

Other possible strategies are note taking systems, guided writing, KWL (learning) logs, graphic organizers, quick-writes, Listen-Stop-Write (LSW), etc. All of these techniques provide the student with the opportunity to express what they know, want to know, or have learned in an open-ended written format. They also provide the instructor with a means to assess student learning

including the depth of their knowledge and they provide a means to identify student misconceptions (Fisher, 2002).

Structured note-taking systems provide students with a framework to organize their knowledge. One of the most common note-taking systems is the Cornell two-column system which has students organize information categorically by main ideas. This method works well when taking notes from reading and later annotating those notes with additional information obtained from other sources such as lecture. One of the biggest hurdles is students learning how to determine the main ideas from a lecture or reading. The other matter is that students do not need to write in complete sentences and some have difficulty in accepting this exception to normal writing exercises.

Guided writing involves brainstorming and individual writing and then reading the related text followed by further individual writing explaining what they have read. This allows students the opportunity to associate what they have read with what they already know. This results in a greater depth of understanding. Another method which is similar to guided writing is the use of KWL logs. KWL logs provide students with a means of organizing information regarding a particular topic. Students are given the topic and asked to write (K) what they know about the subject, secondly they are asked to write what they want (W) to know, after reading and discussion then they are asked to write (L) what they have learned.

A graphic organizer is an instructional tool used to illustrate a student or class's prior knowledge about a topic. Graphic organizers come in a variety of forms and are used to graphically represent the dependency and interrelation of information (Wood, 1992). These allow students to develop a graphical representation of data which can be easily displayed, understood, and recreated. Figure 1 shows an example of a graphic organizer used to systematize the various types of storage used in modern computers.

Quick-Writes are simply a process that is designed to give students the opportunity to immediately reflect upon what they are learning. This type of assignment is used at the beginning, middle, or end of a lesson. One clear advantage of this strategy is that it only takes about three to five minutes. The teacher gives the students short, open-ended statements and the students complete the statements with their own understanding. This can be done in journals, on note cards, or on a writing guide (Readence, 2000). This strategy is similar to the Listen-Stop-Write technique in which students are directed to stop taking notes, to listen to the class discussion, and then write about what they heard. This strategy works well with others such as structured note-taking.

Summary

Chapter II, the Review of Literature, gave an overview of the formative and summative assessments to be utilized in the study. The structure of the A+ certification examination was provided to give the reader an understanding of what is driving the curriculum and examples of the various instructional

strategies used were offered. While there is a significant amount of documented

research on using writing as a tool for content area learning, virtually no

research existed on how it pertains to Career and Technical Education. Chapter

III provides the Methods and Procedures that were employed in evaluating the

benefit of content area writing strategies in the IT Pathways course.
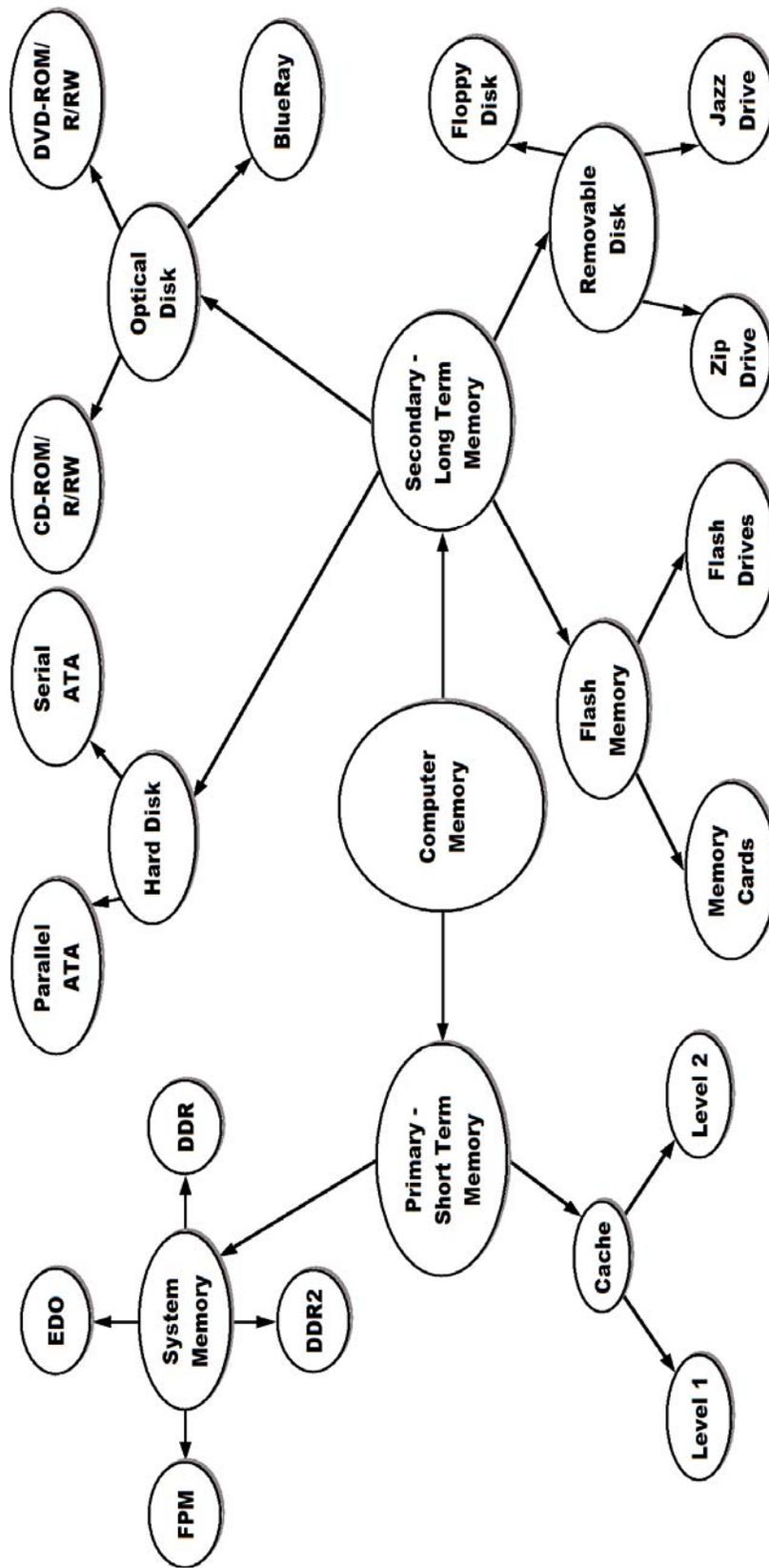
Figure 1. Computer Memory Graphic Organizer

CHAPTER III

METHODS AND PROCEDURES

The problem investigated by this study was to determine if content area writing strategies increased student knowledge and concept retention as measured by performance on an examination based on the CompTIA A+ certification objectives in the Information Technologies Pathways course at Spotsylvania Career and Technical Center. This chapter contains a discussion of the methods and procedures used for collection and analysis of data in the study. The study was conducted through experimental research using a control group and an experimental group of students. This chapter includes a definition of the population included in the study, an overview of the instruments used for data collection, the procedures employed in collecting data, and the method of statistical analysis used in data evaluation.

Population

The population included in this study were the 34 students enrolled in the two sections of Information Technology Pathways at Spotsylvania Career and Technical Center that were studying computer maintenance during the second semester of the 2006 – 2007 school year. Of this group of students, 17 were in the experimental group and 17 were in the control group. The students were in grades 10 through 12 from the five high schools in Spotsylvania County.

Research Variables

The independent variable identified in the study was the employment of various techniques of writing which focused on content area concept development. These techniques included but were not limited to use of note taking systems, guided writing, KWL (learning) logs, graphic organizers, quick-writes, Listen-Stop-Write (LSW), and collaborative note taking. The dependent variable was identified as student performance on two examinations which closely resembled the CompTIA A+ certification examination in content and structure.

Instrument Design

The first instrument employed in measuring student performance was a locally developed multiple choice examination that was created using the parameters defined by CompTIA for the A+ Essentials exam. This instrument is included in Appendix A.

The second instrument employed more closely resembles the CompTIA A+ certification examination in structure and administration. The instrument chosen for this was the A+ and PC Repair Practice Test developed by Jean Andrews from Course Technologies.

Methods of Data Collection

The first instrument was administered to all students at the beginning of the semester as a pre-test to assess their level of technical computer knowledge on entering the course. The same examination was administered at the end of

the semester as a post-test and the student scores on the two examinations were compared.

The second instrument was administered electronically and closely resembles the actual A+ examination interface. The examination was made up of pseudorandomly chosen questions from a bank of approximately 1300 questions. The questions were chosen so that the makeup of each exam matched the parameters identified by CompTIA for the A+ Essential Exam. Using this instrument, no two students received the same questions, but all exams covered the same content.

Statistical Analysis

After both the experimental and control groups completed both evaluation instruments at the end of the semester, the student improvement measured by the test instrument and the student performance on the simulated A+ examination were compared. The comparison of these quantities employed the use of the t-test method of statistical analysis. This method determined if there was a statistical difference in the knowledge gained between the two populations involved in the study.

Summary

Chapter III discussed the methods and procedures employed in completing the study. The population was identified and the research variables were defined. An overview of the instruments used in the study was provided along with the methods of administration for data collection. The method of

statistical analysis used was identified and the purpose of the analysis was given. Chapter IV will contain an explanation the actual findings of the study along with an analysis of the data collected.

CHAPTER IV

FINDINGS

The purpose of the study was to evaluate the effectiveness of employing content area writing exercises on student knowledge and concept retention as measured by performance on an examination based on the CompTIA A+ certification objectives in the Information Technologies Pathways course at Spotsylvania Career and Technical Center. Presented in this chapter are the results of data collected from test instruments.

Knowledge of Basic Computer Operation Concepts

Data were collected at two levels. The first measurement was obtained by administering a basic computer operations exam to students as a pretest during the first week of the term during which the study was conducted and again during the last week of the term. The resulting increase in basic knowledge was then calculated and used to serve as a measure of the increase in student knowledge. The second measurement was obtained by administering a practice exam based on the competencies from the 2006 CompTIA A+ objectives. In each case the resulting means of each group were compared using the t-test method.

Data Analysis

Each test group consisted of 17 students who each participated in both assessments. There were no deletions or additions to the student population during the study.

Basic Computer Maintenance Knowledge Examination

The mean of the net increase in scores on the basic Computer

Maintenance Knowledge examination was 46.58 for the control group and 50.88

for the experimental group. The computed t-value for the increase in score on

the Computer Maintenance Knowledge examination was 2.58 with a degree of

freedom of 32.

Simulated A+ Examination

The mean of the scores on the Simulated A+ Exam was 71.94 for the

control group and 79.41 for the experimental group. The computed t-value for

the score on the Simulated A+ Examination was 2.14 with a degree of freedom

of 32.

The mean of the scores and t-values can be found in Table 3.

Table 3. Comparison of Mean Scores of Assessment Instruments

	$\bar{X}$ change in post test score	$\bar{X}$ Simulated A+ Exam
Control Traditional instruction	46.58	71.94
Experimental Content area writing employed	50.88	79.41
t-Test	2.58	2.14
Degree of Freedom	32	32

Summary

The researcher collected data from two groups using two different

instruments in order to test the hypothesis. The t-test method was used to test

the significant differences in test scores of students who were taught using

content area writing strategies and those who were taught without focusing in content area writing. Chapter V will summarize the research study, provide conclusions based on the research goals and data collected, and make recommendations for further research relating to this study.

CHAPTER V

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

The purpose of this chapter is to report the summary, conclusions, and recommendations of this study. The summary will review the study, the conclusions will be based on the findings from evaluating the data, and recommendations will suggest further research studies which may be necessary to further evaluate the effectiveness of the experimental treatment.

Summary

The IT Pathways course was developed as part of a series of occupational cluster introductory courses adopted by Spotsylvania Career and Technical Center. The course provides students with an introduction to basic electronics and personal computer theory and operation with a focus on preparing students for the CompTIA A+ Computer Technician certification. The researcher believed that students who learned through the use of content area writing strategies would understand and retain information at a greater level than students who did not utilize the same strategies.

The problem of the study was to determine if employing content area writing strategies made a measurable difference in students' scores on a simulated A+ certification exam and on a post test designed using the 2006 CompTIA A+ competencies.

The population of this study consisted of 38 IT Pathways students at Spotsylvania Career and Technical Center in grades 10 through 12 who were

enrolled in the two sections of the course during the second semester of the 2006 – 2007 academic year. The instruments used were an 80 question examination designed to simulate the actual CompTIA A+ examination and a locally developed 80 question exam that was based on the 2006 CompTIA A+ objectives. Based on the t-test method used to determine significant differences in the test scores of the students in the two test groups, conclusions were drawn and recommendations made based in the data.

Conclusions

The hypotheses tested were:

H_1:　The employment of content area writing exercises in the Information Technologies Pathways course will result in increased retention of basic computer knowledge and concepts.

The researcher collected and analyzed the test scores for the Computer Maintenance Knowledge Examination with a sample size of 17 in each group. The statistical analysis of the data collected for H_1 resulted in a t-value of 2.58. This value exceeded the critical t-value of 2.04 at the 0.05 level of significance. Therefore, the hypothesis was accepted.

Based on the analysis of the data collected, the employment of content area writing strategies increased the students' retention of knowledge and understanding of concepts as measured by the increase in scores on the Computer Maintenance Knowledge Examination.

H_2:   The employment of content area writing exercises in the

Information Technologies Pathways course will result in an increased percentage

of students achieving passing scores on the CompTIA A+ Certification practice

examination.

The researcher collected and analyzed the test scores for the Simulated

A+ Examination for the two test groups with a sample size of 17 in each group.

The statistical analysis of the data collected for H_2 resulted in a t-value of 2.14.

This value exceeded the critical t-value of 2.04 at the 0.05 level of significance.

Therefore, the hypotheses are accepted.

Based on the analysis of the data collected, the employment of content

area writing strategies increased the students' knowledge and understanding of

concepts as measured by their scores on the Simulated A+ Examination.

Recommendations

The study reported that the employment of content area writing activities

served to improve student knowledge and understanding in the Information

Technology Pathways course. It is reasonable to believe that these strategies

would also improve student learning in courses with similar technical content.

Based on this study it is recommended that the employment of content area

writing strategies be expanded to the other Information Technology courses and

possibly to all of the courses within the Communications cluster at Spotsylvania

Career and Technical Center.

The review of literature indicated numerous activities that could be used to promote learning through writing activities. Further studies might be implicated to determine which activities had the greatest impact on student learning as well as determining which activities best utilize classroom time. There are several specific recommendations that the researcher suggest for further study.

The first of these recommendations is to increase the sample size and continuing the research. This could be accomplished by studying additional classes in the future and soliciting instructors of similar courses to participate in implementation of content area writing activities and data collection. This would allow for continued collection of data and expansion of the population involved in the study.

Since the test groups were a restricted population assigned based on the arrangement of each student's respective schedules, a second recommendation would be to determine if there is a correlation between student performance on the test instruments and their general academic performance as measured by high school grade point average. This would provide an indication as to the respective academic performance of the groups under study to see if this may have been a determining factor in the results.

A third recommendation would be to see if the same results are obtained by integrating content area writing activities in additional disciplines within the career and technical education realm. This could be accomplished by conducting

workshops for teachers who are interested in employing content area writing activities in their own classes.

A final recommendation would be to determine if students who experienced the writing exercises also performed higher in their English classes. A study of this nature could determine if experiences in career and technical education might improve student's academic performances, an overall objective of career and technical education.

References

Andrews, J. (2006). A+ and PC Repair Practice Test [computer software]. Florence, KY, Course Technologies.

Brandenburg, M.L. (2002). Advanced Math? Write! *Educational Leadership*, 60(3), 67-68.

Computing Technology Industry Association. (2007). CompTIA A+ ® Certification. Retrieved February 18, 2007, from the World Wide Web: http://www.comptia.org

Costa, A.L., & Kallick, B. (2000). Learning Through Reflection. In Costa, A.L., & Kallick, B. (Eds.), Assessing and Reporting on Habits of Mind (15-28). Alexandria, VA: Association for Supervision and Curriculum Development.

Cruz, M. E. (2001). Writing to learn as a way of making sense of the world. In H. A. Scarborough (Ed.), Writing across the curriculum: Teaching from a diverse perspective (pp. 71-90). Upper Saddle River, NJ: Merrill Prentice-Hall.

Dewey J. (1910). How We Think. Heath, Lexington, MA.

Fisher, D., Frey, N., & Williams, D. (2002). Seven Literacy Strategies That Work. *Educational Leadership*, 60(3), 70-73.

Jacobs, V.A. (2002). Reading, Writing, and Understanding. *Educational Leadership*, 60(3), 58-61.

Readence, J.E., Moore, D.W., & Rickelman, R.J. (2000). *Prereading Activities for Content Area Reading and Learning.* Newark, DE: International Reading Association.

Sadler, D.R. (1989). Formative Assessment and the Design of Instructional Systems. Instructional Science, 18, 145-165.

Vacca, R.T. (2002). From Efficient Decoders to Strategic Readers. *Educational Leadership*, 60(3), 6-11.

Virginia Department of Education (2006, July). CTE Administrative Planning Guide. Retrieved February 18, 2007 from http://www.doe.virginia.gov/VDOE /Instruction/CTE/apg/

Wood, K.D., Lapp, D., & Flood, J. (1992). *Guiding readers through texts: A review of study guides*. Newark, DE: International Reading Association.

APPENDIX A

Computer Maintenance Knowledge Examination

Computer Maintenance Knowledge Exam

Multiple Choice
Identify the letter of the choice that best completes the statement or answers the question.

____ 1. All processing and storage of data inside a computer is done in ____ form.
a. Binary
b. hexadecimal
c. decimal
d. character

____ 2. Transmission from the CPU to the printer is done in ____ form.
a. Binary
b. hexadecimal
c. decimal
d. character

____ 3. John Atanasoff came up with the binary system in the ____.
a. 1930s
b. 1940s
c. 1950s
d. 1960s

____ 4. Input/output devices communicate with components inside the computer case through a wireless connection or through cables attached to the case at a connection called a ____.
a. trace
b. BNC connector
c. port
d. jumper

____ 5. A(n) ____ board is a board that holds microchips, or integrated circuits, and the circuitry that connects these chips.
a. Trace
b. IDE
c. integrated
d. circuit

____ 6. A ____ port is a connection used by many different input/output devices such as keyboards, printers, scanners, and mice.
a. USB
b. Firewire
c. parallel
d. Either A or B

____ 7. Which type of expansion slot is best used for high-speed input/output devices?
a. PCI
b. AGP
c. ISA
d. MCA

____ 8. When speaking of computer systems, +12, -12, +5, and -5 are measures of ____.
a. Volts
b. Watts
c. amperes
d. ohms

____ 9. ____ control the flow of electricity in a circuit.
a. Transistors
b. Ohmmeters
c. Ammeters
d. Resistors

____ 10. A ____ is the basic building block of an integrated circuit, which is used to build a microchip.
a. Capacitor
c. transistor

b. Diode	d. resistor

____ 11.   A(n) ____ provides enough power to perform an orderly shutdown during a
blackout.

a. surge suppressor	c. uninterruptible power supply
b. power conditioner	d. ATX power supply

____ 12.   The ATX board uses ____ volts coming from the power supply.

a. 3.3	c. 12
b. 5	d. All of the above.

____ 13.   If a PC does not boot properly and you hear a single beep, then the problem is
with the ____.

a. Motherboard	c. CPU
b. Video	d. keyboard

____ 14.   If you are booting a PC and the video works, but the boot message is confusing
or unreadable, the first thing you should do is ____.

a. boot into safe mode	c. troubleshoot the motherboard
b. troubleshoot the video	d. troubleshoot the OS

____ 15.   ____ time is the time that elapses before the system reduces 80 percent of its
power consumption.

a. Doze	c. Suspend
b. Standby	d. Hard drive standby

____ 16.   ____ time is the time that elapses before the system reduces 99 percent of its
power consumption.

a. Doze	c. Suspend
b. Standby	d. Hard drive standby

____ 17.   Which of the following is false regarding Windows XP?
    a. It provides better integration of Windows 9x and NT than did Windows 2000.
    b. It adds advanced file sorting options, such as sorting pictures by resolution or sound files
       by artist.
    c. It uses significantly more memory for the OS than does Windows 2000.
    d. It offers significant GUI enhancements over earlier versions of Windows.

____ 18.   Windows XP supports the ____ file system.

a. FAT32	c. FAT16
b. NTFS	d. All of the above.

____ 19.   Use the ____ file system if you are setting up a dual boot with Windows XP and
Windows 9x, and each OS must access all partitions.

a. FAT32	c. FAT16
b. NTFS	d. Either A or C.

____ 20.   Use the ____ file system if you are setting up a dual boot with Windows XP and
MS-DOS or Windows NT and each OS must access all partitions.

a.	FAT32	c. FAT16
b.	NTFS	d. HPFS

____ 21. During the installation of Windows XP, if you create a partition that is at least 2 GB in size, the FAT file system will be ____.

a.	FAT32	c. FAT16
b.	NTFS	d. FAT12

____ 22. Windows XP Setup lists ____.
   a. the size of each partition that it finds on the hard drive
   b. the file system of each partition that it finds on the hard drive
   c. any free space on the drive that is not partitioned
   d. All of the above.

____ 23. When upgrading to Windows XP, the ____ option uses existing Windows folders and uses all existing settings it can.

a.	Custom	c. Express
b.	Typical	d. Default

____ 24. When upgrading to Windows XP, the ____ option allows you to change the file system to NTFS.

a.	Custom	c. Express
b.	Typical	d. Advanced

____ 25. When upgrading from ____ to Windows XP, the NTFS file system is automatically converted to the Windows XP version.

a.	Windows 98	c. Windows 2000
b.	Windows NT	d. Windows ME

____ 26. Windows XP Compatibility Mode applies to ____.

a.	Windows 95	c. Windows NT
b.	Windows Me	d. All of the above.

____ 27. Which of the following is false regarding local user accounts?
   a. They are created on a local computer.
   b. They are created by an administrator.
   c. They are stored in the SAM database on a domain controller.
   d. They are located on the local computer

____ 28. Which of the following is true regarding built-in user accounts?
   a. Every Windows XP workstation has three of these that are set up when the OS is first installed.
   b. They are created by an administrator.
   c. They are stored in the SAM database on a domain controller.
   d. None of the above.

____ 29. With ____ user profiles, settings established by a user at one computer are stored in a file on a file server on the network and shared with all computers in the workgroup.

a.	global	c. roaming
b.	group	d. central

____ 30. When administering local user accounts, which of the following is true?
    a. Usernames for Windows NT/2000/XP logons can consist of up to 20 characters.
    b. User accounts must be set up with passwords.
    c. Passwords can be up to 127 characters.
    d. Passwords can never change once created.

____ 31. ____ is the process of putting readable data into code that must be translated
before it can be accessed.
    a. Encoding   c. Encryption
    b. Translating   d. Coding

____ 32. The registry is organized logically into ____ subtrees.
    a. 4   c. 6
    b. 5   d. 7

____ 33. The ____ subtree contains all configuration data about the computer, including
information about device drivers and devices used at startup.
    a. HKEY_CURRENT_CONFIG   c. HKEY_CLASSES_ROOT
    b. HKEY_USERS   d. HKEY_LOCAL_MACHINE

____ 34. If you get the error "Inaccessible_Boot_Device," try ____.
    a. running Chkdsk   c. replacing Ntldr
    b. running Scandisk   d. Fdisk/mbr

____ 35. If you get the error "Kernel_Data_Inpage_Error," try ____.
    a. running Chkdsk or Scandisk
    b. booting into the Recovery Console and copying important data files that have not been
        backed up to another media before attempting to recover the system
    c. replacing Ntldr
    d. Fdisk/mbr

____ 36. The ____ creates standards for computer and electronics industries.
    a. FCC   c. IEEE
    b. ITU   d. CCITT

____ 37. Which of the following is a network protocol?
    a. NetBEUI   c. TCP/IP
    b. Ethernet   d. Both A and C.

____ 38. Which of the following is a hardware protocol?
    a. Ethernet   c. TCP/IP
    b. Token ring   d. Both A and B.

____ 39. Information at the beginning of data in a packet is called a ____.
    a. start bit   c. datagram
    b. Header   d. token

____ 40. ____ Ethernet is sometimes called ThickNet.

a.	10Base2	c.	10Base5
b.	10BaseT	d.	100BaseT

____ 41. Wireless devices can connect to a LAN by way of a wireless ____.

a.	wireless node	c.	patch node
b.	SMAU	d.	access point

____ 42. ____ is the standard for short-range wireless communication and data synchronization between devices.

a.	Bluetooth	c.	Airport
b.	IEEE 802.11	d.	IEEE 802.11g

____ 43. Which of the following is false regarding Bluetooth?
   a. It has a range of 25 meters.
   b. It is easy to configure.
   c. It works in the 2.4-GHz frequency range.
   d. It can be used with many different devices.

____ 44. Token ring technology was developed by ____.

a.	Intel	c.	Sun
b.	IBM	d.	Novell

____ 45. ____ has a centralized device to which the network nodes are connected to, called a CAU.

a.	Ethernet	c.	FDDI
b.	Token ring	d.	Wireless LAN technology

____ 46. An Ethernet card that can accommodate different cabling media is called a ____ card.

a.	multi-cable	c.	routable
b.	Combo	d.	multi-purpose

____ 47. Ethernet MAC addresses are ____-byte hex addresses.

a.	4	c.	8
b.	6	d.	10

____ 48. A ____ sends a packet only to the network segment for which it is destined.

a.	Bridge	c.	switch
b.	Router	d.	hub

____ 49. ____ is the protocol suite used on the Internet.

a.	TCP/IP	c.	NetBEUI
b.	IPX/SPX	d.	NetX

____ 50. ____ is the protocol suite designed for use with the Novell NetWare operating system.

a.	TCP/IP	c.	NetBEUI
b.	IPX/SPX	d.	NetX

____ 51. A(n) ____ address is a unique address that is permanently embedded in a NIC and identifies a device on a LAN.

a. IP   c. Port
b. MAC   d. Host

____ 52. An email server receiving mail is normally assigned port ____.

a. 21   c. 80
b. 25   d. 110

____ 53. POP3 is normally assigned port ____.

a. 21   c. 80
b. 25   d. 110

____ 54. TCP is a ____ protocol.

a. connection-oriented   c. best-effort
b. connectionless   d. check-connection

____ 55. ____ is primarily used for broadcasting and other types of transmissions, such as streaming video or sound over the Web, where fast transmission is important.

a. TCP   c. UDP
b. IP   d. PPP

____ 56. The ____ utility displays information about current TCP/IP connections.

a. Tracert   c. Nbtstat
b. Route   d. Netstat

____ 57. In Windows ____, you can create a new dial-up networking connection through the Network Connections applet in the Control Panel.

a. 9x   c. XP
b. 2000   d. NT

____ 58. The "S" in HTTPS stands for ____.

a. socket   c. system
b. secure   d. standard

____ 59. In FTP, use the command ____ to disconnect the FTP session.

a. STOP   c. DISCONNECT
b. EXIT   d. BYE

____ 60. In FTP, use the command ____ to copy a file from your computer to the remote computer.

a. COPY   c. GET
b. PUT   d. RCOPY

____ 61. Which of the following is false?

a. You are not as likely to upgrade the hardware and OS on a notebook as you might be on a desktop PC.
b. Many of the skills necessary to support notebooks are brand-specific.
c. You can open the notebook case and not void the warranty.

d. The LCD screen can be easily damaged.

____ 62. ACPI was developed by ____.
a. Intel
b. IBM
c. Toshiba
d. All of the above.

____ 63. Windows XP has the ability to create, delete, and modify ____ to customize how Windows 2000/XP manages power consumption.
a. power configuration
b. power profile
c. multiple power management schemes
d. power setting lists

____ 64. The first "S" in SO-DIMMS stands for ____.
a. small
b. simple
c. single
d. short

____ 65. ____ supports 64-bit transfers and uses SDRAM or EDO.
a. 72-pin SO-DIMM
b. 144-pin SO-DIMM
c. 160-pin SO-RIMM
d. Credit card memory

____ 66. ____ can be used as single modules in Pentium machines.
a. 72-pin SO-DIMMs
b. 144-pin SO-DIMMs
c. 160-pin SO-RIMMs
d. Credit card memory

____ 67. ____ can be used as single modules in 386 or 486 machines.
a. 72-pin SO-DIMMs
b. 144-pin SO-DIMMs
c. 160-pin SO-RIMMs
d. Credit card memory

____ 68. The "R" in FRU stands for ____.
a. replicator
b. resolution
c. replaceable
d. Research

____ 69. Which of the following is a FRU on a laptop?
a. CPU
b. Keyboard
c. LCD panel
d. All of the above.

____ 70. PC Card slots connect to the ____-bit PCMCIA I/O bus on the notebook motherboard.
a. 8
b. 16
c. 32
d. 64

____ 71. Which of the following is false?
a. All Web sites are designed to be accessed by a PDA.
b. Some PDAs support only the preinstalled applications and cannot download others.
c. Some PDAs can access the Internet directly by way of a modem.
d. Some PDAs can access the Internet by way of wireless connection.

____ 72. During the writing phase of laser printing, data from the PC is received by the ____.
a. Formatter
c. drum

b.   DC controller   d.   fuser

____   73.   During the writing phase of laser printing, the ____ controls the laser unit.
                    a.   Formatter   c.   drum
                    b.   DC controller   d.   fuser

____   74.   The static charge eliminator operates in the ____ step of laser printing.
                    a.   Cleaning   c.   transferring
                    b.   Writing   d.   developing

____   75.   ____ printers are popular because they are small and can print color
inexpensively.
                    a.   Laser   c.   Dot-matrix
                    b.   Inkjet   d.   Thermal

____   76.   What colors are used in a color inkjet printer?
                    a.   Cyan   c.   Yellow
                    b.   Magenta   d.   All of the above.

____   77.   For Windows 9x applications using a non-PostScript printer, the print job
data is ____.
                    a.   converted to EMF   c.   converted to the PostScript language
                    b.   sent to the printer as is   d.   converted to PCL

____   78.   If you have a problem with a printer cable, make sure it is IEEE ____ compliant.
                    a.   802   c.   802.c
                    b.   802.11b   d.   1284

____   79.   One of the ways to fix poor laser print quality is to turn off ____, which uses less
toner.
                    a.   LightPrint   c.   EconoMode
                    b.   PrintEasy   d.   LessInk

____   80.   In the ____ step of laser printing, toner transfers from the cylinder to the drum as
the two rotate very close together.
                    a.   Fusing   c.   transferring
                    b.   Writing   d.   developing