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**A Comparison of Fourth Grade Students' Encyclopedia Research
Skills Utilizing Traditional Instruction Contrasted
with Traditional/Technological Instruction
at King Science Center**

A Field Project

Presented to the

Department of Educational Administration

and the

Faculty of the Graduate College

University of Nebraska

In Partial Fulfillment

of the Requirements for the Degree

Specialist in Education

University of Nebraska at Omaha

by

Mary Louise Snook Kluver

July 1992

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FIELD PROJECT PROPOSAL ACCEPTANCE FORM

A Comparison of Fourth Grade Students' Encyclopedia Research
Skills Utilizing Traditional Instruction Contrasted
with Traditional/Technological Instruction
at King Science Center

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TABLE OF CONTENTS

Chapter 1. Introduction.	1
Statement of the Problem	3
Statement of the Hypothesis	4
Methodology	6
Definition of Terms	10
Limitations	12
Chapter 2. Review of Related Literature.	13
Background.	13
Technical Innovations	19
Current Studies.	24
Summary.	26
Chapter 3. Composition of the Study.	27
Setting.	27
Population and Sample.	28
Design and Procedure.	29
Chapter 4. Presentation and Analysis of Data.	34
Descriptive Statistics	36
T Test of a Difference Between Means.	40

Chapter 5. Summary.	42
Conclusions.	43
Recommendations.	44
References.	46
Appendix A	52
B.	53
C.	57
D.	59
E.	61
F.	63
G.	65
H.	68

CHAPTER ONE

Introduction

The King Science Center was created in 1985 by the Omaha School Board which serves 43,000 students. The center was originally a magnet for grades four, five, and six. Formerly the building was a junior high school or a ninth grade center from 1959 to 1988. The facility was reorganized into a science middle school magnet by first removing the ninth grade and then transferring grades four, five, and six from the former King Science Center facility and adding grades seven and eight.

Currently 686 students attend King Science Center in a middle school environment. Students throughout the entire Omaha Public School District are eligible to attend this facility. Students are selected to attend King Science Center by the Student Personnel Services Department of Omaha Public Schools through a computerized selection process which draws from student or parental request applications. The racial balance of approximately one-third minority and two-thirds majority is maintained to reflect the racial balance of the Omaha Public School District. The students'

gender reflect that of the entire school district. Transportation is provided for students who live more than one mile from school.

The library at King Science Center was completely redesigned and renovated in 1989. It was formerly a traditional library. Now it is known as The Information Center and it is the model library media center for the Omaha Public School District. The center emphasizes combining the technical with the traditional. The use of technology in The Information Center is an ever-escalating endeavor that has changed the entire focus of the traditional library.

The use of technology in The Information Center is multifaceted, ranging from administrative/utilitarian to the latest in electronic researching capabilities. The Information Center is comprised of interrelated components: Teaching Area, Networked Automatic Circulation and Computer Catalog Stations, Electronic Research Region, Presentation Room, Telecommunications/Word Processing Graphics Stations, and Computer Center. All students and staff at King Science Center have access to the technology of The Information Center (See Appendix A).

The overall mission of the King Science Center and The Information Center programs is to capitalize upon the use of instructional technology. The mission of King Science Center supports a strong middle school philosophy in which the development of positive self-esteem for students is a high priority. The program of instruction is designed to accentuate the goal of developing students' autonomy. The mission of King Science Center is further delineated into four categories: Basic Education, Science Education, Civic Interaction and Technology. This mission is also guided by American Library Association guidelines published in Information Power: Guidelines for School Library Media Programs (American Library Association, 1988).

Statement of the Problem

The importance of The Information Center at King Science Center is that it is the pilot program for library media centers of the Omaha Public Schools. The school's emphasis on technology is to test whether the advancement in technology enhances learning. It is conjectured that such a program will improve the efficiency and the development of higher level thinking skills of students (School

Improvement Plan, 1987). In order to profit from this pilot program and to continue to develop exemplary library media programs in other schools, it is imperative to analyze the library media program at King Science Center through self-study.

This study addressed the topic of encyclopedia research skills by testing the methodology and outcomes of a library media curriculum application in a controlled setting. The study was limited to fourth grade students at King Science Center. The main question of the study was whether technological instruction utilizing a laser video disc and CD-ROM combined with traditional print instruction, as contrasted with sole traditional print instruction, exhibited an increase in fourth grade students' encyclopedia research skills. This question was further extended to explore individual encyclopedia research skills.

Statement of the Hypothesis

The research questioned if there are significant differences in encyclopedia research skills of fourth grade students instructed in traditional encyclopedia research procedures and fourth grade

students instructed with laser video disc, CD-ROM and traditional encyclopedia research procedures.

Hypothesis #1

There are no significant differences in encyclopedia research comprehension skills of fourth grade students instructed with traditional encyclopedia research procedures and those of fourth grade students instructed in a combination approach utilizing laser video disc, CD-ROM and traditional encyclopedia research procedures.

Hypothesis #2

There are no significant differences in individual research encyclopedia comprehension skills of fourth grade students instructed with traditional encyclopedia research procedures and those of fourth grade students instructed in a multimedia approach with laser video disc, CD-ROM and traditional encyclopedia research procedures.

Methodology

To test Hypothesis #1, the researcher used the following procedures. All five sections of fourth grade students were used in the study.

- 1) Two alternating King Science Center fourth grade classes were selected for the six week encyclopedia unit taught in the traditional format.
- 2) Three alternating King Science Center fourth grade classes were selected for the six week encyclopedia taught in the laser video disc, CD-ROM and traditional/ technological encyclopedia research format.
- 3) Designed a Pretest and a Posttest to assess encyclopedia research comprehension skills. Skills emphasized were those appropriate to fourth grade library media: general encyclopedia knowledge, alphabetizing, key words, and volume arrangement.
- 4) Pretested all students for encyclopedia comprehension skills.

- 5) Taught the instructional materials unit to each set of classes using the methods described above.
- 6) Posttested for student comprehension after completion of the instructional materials unit.
- 7) Tabulated and evaluated the mean gain score for each student and tested for significant differences in the mean gain scores.
- 8) Accepted or rejected the hypothesis on the basis of statistical differences at the .05 level.

To test Hypothesis #2, the researcher used the following procedures. All five sections of the fourth grade students were included in the study.

- 1) Two alternating King Science Center fourth grade classes were selected for the six week encyclopedia unit taught in the traditional encyclopedia research format.
- 2) Three alternating King Science Center fourth grade classes selected for the six week encyclopedia unit taught in the laser video disc, CD-ROM and traditional/ technological encyclopedia research format.

- 3) Designed individual lesson skills tests to assess the comprehension of lesson objectives. Skills emphasized were those appropriate to fourth grade library media: general encyclopedia knowledge, alphabetizing, key words, and volume arrangement.
- 4) Taught the individual skills lesson to each set of classes using the methods described above.
- 5) Tested for comprehension after each instructional lesson.
- 6) Tabulated the lesson accuracy scores, and calculated the individual skills scores and tested for significant differences in the mean scores.
- 7) Accepted or rejected the hypothesis on the basis of statistical differences at the .05 level.

The subjects were 124 fourth grade students in their first year of attendance at King Science Center. These students reflected the diverse demographic, gender, and educational background of the Omaha Public School District. The students were randomly selected in a computerized process from the application pool of those

applying to attend King Science Center. The subjects were then placed into five groups of approximately 25 students per class reflecting gender and racial balance of the Omaha Public School District. All five groups were taught library media skills on the same day of the week. The two instructional categories alternated every other class period throughout the day.

The independent variable, the instructional treatment, was subdivided into the two modalities of instruction: 1) traditional; 2) traditional combined with the technological. The dependent variable was the expected learning skills level.

The instructional program was tested as follows. The control group received the traditional instructional procedure utilizing the print encyclopedia, The Academic American. Lectures, student participation, board work and worksheets were emphasized. The experimental group received the traditional combined with the technological instructional procedure utilizing The Academic American print encyclopedia, The Knowledge Disc laser video disc, and The Electronic Encyclopedia CD-ROM. Lectures, using a data display with the CD-ROM, student participation and boardwork were

emphasized. No worksheets were used in the traditional combined with technological treatment. The three encyclopedia formats used were produced by Grolier Incorporated and have the same general readability levels.

Definition of Terms

CD-ROM

A four inch optical disc on which computer information is impressed then read by a laser beam and converted into audio and visual images shown on a computer.

Computer

A programmable electronic device that can store, retrieve and process data.

Electronic Encyclopedia

General CD-ROM or laser video discs where general reference topics are searched primarily by key words.

Laser video disc

A twelve inch two-sided disc with images impressed which are read by a laser beam then converted into visual and audio images.

Learning Outcomes

Instructional goals in which students achieve knowledge or skills as a result of a prescribed course of instructional objectives.

Magnet School

A school specifically designed to attract students with specialized instruction not available in other schools.

Middle school

A school including grades four through eight which promotes the development of positive student self-esteem utilizing a structured effective program of directed instruction.

Posttest

An examination taken by students after completion of instruction in a subject area in conjunction with a pretest to measure students' achievement and effectiveness of the program.

Pretest

A preliminary examination prior to instruction to evaluate the preparedness of students in a subject area.

Print Encyclopedia

A set of general reference materials on many topics, alphabetically arranged by topics.

Research

Inquiry into a subject area to discover, interpret and apply information about a topic.

School Library Media Center

An instructional resource center within a school which facilitates learning using a vast range of print and nonprint materials.

Technological procedure

A teaching method that emphasizes processes that are computer dependent to increase learning productivity.

Traditional procedure

A teaching method that emphasizes established, customary print patterns to increase learning productivity.

Limitations

This study was limited to 124 fourth grade students enrolled at King Science Center. At the time the study was conducted, the students were all in their first year of attendance at King Science Center. This study only addressed the curriculum area of encyclopedias using traditional instruction as compared to traditional combined with technological instruction. Due to the composition of the sample, results of this study are only generalizable to the King Science Center.

CHAPTER TWO

Review of Related Literature

Chapter Two is an inquiry into information skills taught in the school library media center. The chapter specifically addresses different modalities of encyclopedia research skills. The focus is library media information skills, especially encyclopedia skills, at the middle school level.

Background

Middle Schools

Education is continually in flux yet ever-enduring. Hopefully, education remains forever focused on the student. This premise adheres to the thinking of Thomas Dewey in the 1930s when he promoted the attitude that the greatest gift a teacher can give a student is that of a desire to go on learning (Koltnow, 1989). The middle school concept addresses individual needs and strives to bring each student to his overall highest potential and productivity. "We want teachers to give students the skills they will need to function in the work force and society" (David, 1991, p. 40).

The middle school concept became a viable entity in the 1960s and has grown steadily since that time. A middle school is a school in a transitional format that provides a bridge between traditional elementary school and high school. Middle school programs address the nature and developmental needs of students in transition. Such student-centered programs offer the opportunity for personal, academic and social growth.

The philosophy of a middle school is derived from the overall philosophy of the educational system of which it is a part. Programs are student-oriented and activity-oriented with clearly defined measurable objectives. The regular instructional program of a middle school is enhanced by specialized programs and activities. Teaching strategies include a vast variety of methods that allow for student activity, movement, and interaction (Van Vliet, 1984).

Library Media

The school library media center is an instructional resource center within a school which facilitates learning for all students using a vast range of print and nonprint materials. "A good library media program is the hub around which the entire educational

program of the school is built" (Hand, 1990, p. 15). Library media specialists have long been involved in teaching information skills. The impact of school library media programs is well-documented on student performances, grade point averages, and problem solving abilities (Mancall, 1983). Although improved reading and language skills are most often associated with school library media programs, studies indicate that these programs are also related to achievement in mathematics, social sciences and the related sciences (Baldrige & Broadway, 1987).

Traditional library instruction has, in the past, often been based on teaching sources of information with little emphasis on the learning process involved in information use. Instructional programs for information-seeking skills are the trend in education today as part of the overall focus of teaching thinking skills. "Skills for retrieving, filtering, and organizing information are vitally important in an information-oriented society" (Marchionini, Patrick, & Teague, 1987, p. 266). Kulthau (1989) cautions that "traditional instruction does not take into account the dynamic learning process in which students are involved in a library search" (p. 224).

Middle school programs and library media programs have common threads of development, for such programs are aspects of education viewed from the process perspectives. The escalating trend in education is for schools to better serve individual student needs with instructional opportunities. The structure of middle schools serves as an ideal setting for contemporary library media programs (Smith, 1989). Students in the middle grades are ready for instruction in the basic library media skills that will sustain life-long learning utilizing library media centers (Zlotnick, 1984).

In order to meet the needs of today's students, a contemporary library media program must combine traditional teaching with technological innovations. Library skills learned provide the basis for life-long learning. In our modern technological society, just learning facts is no longer enough; we must learn how to learn in order to keep abreast of what is happening in the world (Baldrige & Broadway, 1987). Technological innovations are now applied to information storage and retrieval. Today's library media specialists are often technologically ahead of other school staff

members. It is up to these professionals to teach technological innovations to staff and students alike (Davis & Scott, 1986).

The goals of providing students with relevant, meaningful, and challenging materials using both traditional and technological modalities, correlates with the integration of library media skills into the curriculum. "The impact of the school library media specialist on student achievement can be maximized by focusing activities on instructional goals" (Mancall, 1985, p. 35).

Information Power: Guidelines for School Library Media Programs (1988), set guidelines for developing school library programs to meet the needs of student development in the next century. Challenge Four discusses the mission of the school library media program in providing leadership and expertise in the use of information and instructional technologies. Electronic print and non-print communication enables students to quickly manipulate, store, transfer and create information in many formats. Library media specialists must assume leadership roles by promoting and facilitating instructional technologies into the curriculum.

Information Skills

Taking into consideration the contemporary philosophy of the middle school concept and innovative library media center approach of a rapidly expanding base of information and knowledge, a combined instructional program is indicated. The use of new technology allows students and teachers alike to use a variety of modalities for learning and teaching (Rockman, 1989). Instruction in library media research and study skills enable students to locate, select, interpret, and apply information available through print and nonprint sources (Zlotnick, 1984).

Media skills of today, formerly called library skills, are now broadly based. Traditional library skills originally explained only how to identify and retrieve materials from a collection. Research skills were next added to help students identify information sources within the collection. Today, technological advances have widened the scope of instruction to include nonprint and multimedia production. Thus, media skills now encompass library skills, production skills, study skills and thinking skills under the name of information skills (Smith, 1989).

Studies indicate that the knowledge of information skills can be related to the improvement of student achievement, performance on standardized tests and grade point average (Mancall, 1983). Assigning reports and research projects have been the traditional ways teachers involve their students in the material being studied. By analyzing information independently, students reach a deeper understanding of the subject (Kulthau, 1989).

Technological Innovations

The world of electronic research is here today; educators can be role models in technical applications. Technological innovations in the school and the library media center, in particular, are of critical importance. Educators can use data banks and other technologies to develop and enhance curriculum. According to Weal (1989), students utilizing technology spend less time gathering information and more time sequencing and synthesizing information. Library media specialists can greatly assist their teachers and students through this new technology (Goldstein, 1989). The best way for educators to utilize high tech tools is to develop a

comprehensive research skills curriculum that incorporates traditional and new elements (Plati, 1988).

Two specific forms of optical technology are becoming increasingly of use in the school library media center. CD-ROM and laser video disc technology both offer unique contributions to the educational endeavor. Electronic library data bases have long been available at the university level. Now similar technology is beginning to be applied to elementary and high school classes (Parham, 1988).

CD-ROM

A CD-ROM is a compact disc that stores computer programs. CD-ROMs are powerful and useful tools for learning today. The equivalent of 270,000 typewritten pages can be stored on a twelve centimeter CD-ROM disc. Sound and graphics may also be stored on a CD-ROM disc although they take up much more space than does text. CD-ROMs are called portable databases as they can be transported easily (Kesselman, 1991).

The escalating CD-ROM technology enables the library media specialist to teach students information skills to research

few years, and the use of this medium in libraries by staff and patrons for information delivery is well underway" (Barlow, Karnes & Marchionini, 1987, p. 66). This technology provides an excellent method for viewing information seeking skills as part of teaching thinking skills. "There is a clear need for both experiential and theoretical work in learning and teaching information-seeking skills in electronic environments" (Marchionini, Patrick & Teague, 1987, p. 267).

A variety of CD-ROM applications are currently available in the education field. These applications are expensive not only in the cost of the software, but also in the cost of the hardware needed to run the CD-ROM. "When CD-ROM versions of familiar print sources appear, particularly at a higher cost, there should be clear-cut advantage" (Anderson, 1991, p. 104). At this early stage of development, it is difficult to assess values and compare costs yet efforts must be made to set guidelines. "By the year 2000, probably 90% of software bought for school use will come on media like the CD-ROM that incorporates 100 to 4000 times as much information

and programmed logic as the media that schools have been using until now" (Becker, 1991, p. 20).

The Electronic Encyclopedia was the first commercial CD-ROM product produced for the education market, and it is the only one currently available in both MS-DOS and Macintosh versions. The Electronic Encyclopedia is actually an update of the CD-ROM encyclopedia first introduced by Grolier in 1986 and contains the equivalent of The Academic American print encyclopedia (Brady, 1989). A knowledge retrieval system is the essence of the system and has the ability to rapidly identify all of the contexts in which a given word, phrase or combination of words occurs. The Electronic Encyclopedia features the largest number of separate articles among electronic versions currently being marketed (Becker, 1991). It has the advantage of providing full text key word Boolean searching of The Academic American (Hollens & Rible, 1991).

Laser Video Discs

Laser video discs are part of what is often called interactive instructional systems. Laser video discs are produced optically as are the CD-ROM discs. Laser video discs are twelve inch plastic

covered, two-sided discs with images stored on each disc. Over 50,000 images may be impressed on each side. These images are read by a laser beam and converted into visual and audio images. Up to an hour of video footage and two parallel soundtracks are featured. Selection is becoming broader as there has been a 60% increase in available laser video disc courseware in the last year (Saltpeter, 1991).

There are two formats in video laser disc technology: CAV and CLV. Continuous Angular Velocity (CAV) accesses information randomly by chapter or frame. Continuous Linear Velocity (CLV) runs straight in linear fashion.

Laser video disc technology is rapidly being accepted as one of the most exciting innovations in learning. Educators are discovering the vast potential of this technology. For all levels of education, videodiscs appeal to both students and teachers and are expanding the possibilities of learning (Colman, 1989).

The KnowledgeDisc is the first laser video disc encyclopedia. It is a version of The Academic American. The KnowledgeDisc contains over nine million words in 32,000 articles. Designed on the

CAV format, access to information is gained through the scan, search and step frame functions.

Current Studies

A positive increase in library media skills and library media usage in two academic categories was documented in a study by Hutchinson in 1982. On-site training promoted continuous usage of the library media center as a practical survival developmental skill that will continue as life-long learning. This study's findings serve as a foundation for Information Power .

Research indicates that students were learning library skills while also learning technology skills. Such accountings have not been empirically tested but rather reported through teacher observation. Students ranging in abilities from learning disabled to gifted were reported to have successfully used the electronic encyclopedias. Children as young as four years of age regularly used electronic encyclopedias (Taylor & Debreczeni, 1987). Students studied by Plati (1988) learned to identify the key search words and to write topic sentences using an encyclopedia article either in print or the electronic version. Plati concluded that he was integrating

CD-ROM into classroom activities and also himself stressing traditional research practices. Research by Dishnow (1989) indicated that The Electronic Encyclopedia helped students conduct research for class assignments and allowed them to print out articles.

Rickelman (1991) observed a middle school library media specialist instruct a child in the use of The Electronic Encyclopedia. Other children watched the instruction and also learned. These students were then able to correctly utilize The Electronic Encyclopedia.

Several other studies with The Electronic Encyclopedia had positive results. "The best possible use (of New Grolier) of this product would be as an individualized learning/research/study tool that would prompt a student's curiosity and be of enormous help in research projects" (Anderson, 1991, p. 105). Teachers observed that student users found the electronic encyclopedias a productive way to find information (Barlow, Karnes & Marchionini, 1987). Plati noted that students used The Electronic Encyclopedia to carry

out research. "The Electronic Encyclopedia is an excellent tool for acquiring up-to-date information on a topic" (Plati, 1988, p. 44).

Marchionini, Patrick and Teague (1987) conducted a study of third, fourth and sixth grade students using The Electronic Encyclopedia. Overall, the authors concluded that elementary children were able to use the powerful electronic encyclopedia with success.

Summary

The concepts and research documented in this chapter clearly present the tentativeness of electronic encyclopedia research skills and the use of technology in teaching students to become life-long learners. In an era when information skills are conjectured to be vitally important, electronic encyclopedias in various formats must play an increasingly prominent role in education. However, definitive literature is lacking at this time to warrant that conclusion due to timeliness and the very nature of the technology 's contemporary applications in education.

CHAPTER THREE

Composition of the Study

This study was conducted at King Science Center at Mann, an Omaha Public School, to determine whether technological instruction utilizing a laser video disc and CD-ROM combined with traditional print instruction, as contrasted with sole traditional print instruction, exhibited an increase in fourth grade students' encyclopedia research skills.

Setting

King Science Center at Mann is a magnet school for students in grades four through eight who have a special interest in science. At the time the study was conducted, 686 students from throughout the entire Omaha Public School District attended King Science Center. Transportation was provided to those students who live more than one mile from home.

The library at King Science Center, The Information Center, was designed as the model for Omaha Public Schools combining traditional print sources with the latest in technological research advances. The Information Center features computerized research

tools, print materials and a fully equipped computer lab. Seven CD-ROM stations and five laser video discs stations comprise a portion of the technology available in The Information Center.

Population and Sample

Students applied to attend King Science Center and were selected in a randomized draw. The balance of one-third minority and two-thirds majority reflected the racial balance of the entire district.

The independent variable for this study was the instructional treatment, which was subdivided into two modalities of instruction: 1) traditional 2) traditional combined with the technological. The measured population was 124 fourth grade students who were in their first year of attendance at King Science Center. The subjects were placed into five classes of approximately 25 students. Two of the classes were identified as those instructed with 1) traditional encyclopedia research procedures: Class A and Class B. Three of the classes were identified as those instructed with 2) traditional encyclopedia research procedures, laser video

disc and CD-ROM: Class C, Class D and Class E. The dependent variable was the expected learning skills level.

Design and Procedure

This study investigated whether technological instruction utilizing a laser video disc and CD-ROM combined with traditional print instruction, as contrasted with sole traditional print instruction, exhibited an increase in fourth grade students' encyclopedia skills through two hypotheses.

Hypothesis #1 was there are no significant differences in encyclopedia research comprehension skills of fourth grade students instructed with traditional encyclopedia research procedures and those of fourth grade students instructed in a combination approach utilizing laser video disc, CD-ROM and traditional encyclopedia research procedures. The researcher used the following procedures.

- 1) Two alternating King Science Center fourth grade classes were selected for the six week encyclopedia unit taught in the traditional format: Class A and Class B.

- 2) Three alternating King Science Center fourth grade classes were selected for the six week encyclopedia unit taught in the laser video disc, CD-ROM and traditional encyclopedia research format: Class C, Class D and Class E.
- 3) Developed a Pretest and a Posttest to assess encyclopedia usage comprehension skills. Skills emphasized were those appropriate to fourth grade library media: general encyclopedia knowledge, alphabetizing, key words, and volume arrangement (See Appendix B).
- 4) Pretested all students for encyclopedia comprehension skills.
- 5) Taught the instructional materials unit to each set of classes using the methods described above.
- 6) Posttested for student comprehension after completion of the instructional materials unit (See Appendix B).
- 7) Tabulated and evaluated the mean gain score for each student and tested for significant differences in the mean gain scores.

8) Accepted or rejected the hypotheses on the basis of statistical differences at the .05 level.

Hypothesis #2 was there are no significant differences in individual encyclopedia comprehension skills of fourth grade students instructed with traditional encyclopedia research procedures and fourth grade students instructed in a multimedia approach with laser video disc, CD-ROM and traditional encyclopedia research procedures.

The researcher used the following procedures.

- 1) Two alternating King Science Center fourth grade classes were selected for the six week encyclopedia unit taught in the traditional format: Class A and Class B.
- 2) Three alternating King Science Center fourth grade classes were selected for the six week encyclopedia unit taught in the laser video disc, CD-ROM and traditional encyclopedia research format: Class C, Class D and Class E.
- 3) Developed individual lesson skills tests to assess the comprehension of lesson objectives. Skills emphasized were those appropriate to fourth grade library media: general

encyclopedia knowledge (See Appendix C), alphabetizing (See Appendix D), key words (See Appendix E), and volume arrangement (See Appendix F).

4) Taught the individual skills lesson to each set of classes using the methods described above.

5) Tested for mastery after each instructional lesson.

6) Tabulated the lesson accuracy scores, and calculated the cumulative unit mastery scores and tested for significant differences in the mean mastery scores for significant differences.

7) Accepted or rejected the hypotheses on the basis of statistical differences at the .05 level.

The traditional instructional procedure utilized the print encyclopedia, The Academic American, as the primary focus.

Lectures, student participation, board work and practice worksheets were emphasized. The traditional combined with the technological procedure utilized The Academic American print encyclopedia, The Knowledge Disc laser video disc and The Electronic Encyclopedia CD-ROM. Lectures, using a Macintosh data display with the CD-ROM,

no worksheets, student participation and boardwork were emphasized in the traditional combined with technological procedure. The three distinct encyclopedia formats were produced by Grolier Incorporated and have the same general readability levels.

CHAPTER FOUR

Presentation and Analysis of Data

To answer the question whether technological instruction utilizing a laser video disc and CD-ROM combined with traditional print instruction, as contrasted to sole traditional print instruction, exhibited an increase in fourth grade students' encyclopedia research skills, a study was conducted and data collected.

A six week encyclopedia unit was taught which addressed encyclopedia comprehension skills and individual encyclopedia comprehension skills. One hundred twenty-four fourth grade students participated in the study. Complete pretests, posttests and/or unit tests' data was collected on 99 students (See Appendix G). Due to scheduling conflicts with special classes some students had incomplete data. Furthermore, incomplete data in one experimental group (Class C) was excluded from the study because pretests, posttests and individual mastery quizzes needed to be administered on the day each unit was taught. Ten students had missing pretests while ten different students had missing posttests. Since mastery quizzes were administered on the day each unit was

taught, the majority of students did not have data for all four mastery tests. There were only eleven students who completed all the mastery tests (See Appendix H).

Two decision rules were established to evaluate the data. First, to evaluate Hypothesis #1 only students with both a pretest and posttest were included. Second, to evaluate Hypothesis #2 all students with data were included since the purpose was to determine if there was a significant difference between the mean performance of the two types of instructional processes.

Descriptive statistics and t-Tests of independent samples were conducted utilizing the Macintosh statistical package, MacSS. The descriptive statistics were the group means, standard deviation scores and standard error.

The independent variable for Hypothesis #1 was instruction: traditional and traditional/technological. The dependent variable was the mean gain score based on pretest and posttest scores. The independent variable for Hypothesis #2 was individual tests indicated by Unit 1, Unit 2, Unit 3 and Unit 4. The dependent variable for Hypothesis #2 was the individual mean gain scores based on each

individual unit test. Refer to Appendix G for student raw data which was used in this study.

Descriptive Statistics

Abbreviations were used due to spacing considerations in the tables. The mean was indicated in this study by the symbol M. The standard deviation, St. Dev., a measure of variability, indicated a representative value for all the individual differences taken from a common reference point. The standard of error, St. Er., showed how large the errors of estimation were in the specific sample situation. N. was the symbol for the number of observations in this study; Instr. was the instructional method symbol. Pret. indicated pretests while Post. indicated posttests.

Table 1 provided the descriptive statistics on Hypothesis #1, there are no significant differences in encyclopedia research comprehension skills of fourth grade students instructed with traditional encyclopedia research procedures and fourth grade students instructed with laser video disc, CD-ROM and traditional encyclopedia research procedures.

Table 1 provided descriptive statistics for the two instructional treatments. To test the group means, standard deviation and standard of errors for Hypothesis #1, a t-Test was used. Each group contained an equal number of subjects. Pretest (See Appendix B) means for each group showed proficiency of similar levels (See Appendix G for raw data). The standard error for each group was low. Posttest (See Appendix B) means showed an increased proficiency for each group (See Appendix G for raw scores). The standard error was again low (See Table 1).

Table 2 revealed that there were little differences in encyclopedia lesson research skills of fourth grade students instructed with traditional encyclopedia research procedures and those instructed with laser video disc, CD-ROM and traditional encyclopedia research procedures using data on student performance from individual unit tests (See Table 2).

Individual unit tests measured the specific lesson objectives presented in the two formats (See Appendix G). Unit 1 covered general encyclopedia knowledge (See Appendix C). Unit 2 emphasized alphabetizing (See Appendix D). Unit 3 stressed key

Table 1

Mean Prettest and Posttest Research Skills

Inst. Method	Prettest Skills	Posttest Skills
Traditional		
<u>N.</u>	46	46
<u>M.</u>	11.196	15.043
<u>St. Dev.</u>	3.096	3.944
<u>St. Er.</u>	0.456	0.581
Traditional/Technical		
<u>N.</u>	46	46
<u>M.</u>	11.065	14.783
<u>St. Dev.</u>	2.551	3.373
<u>St. Er.</u>	0.376	0.496
<u>M. Difference</u>	0.131	0.267

Table 2

Individual Mean Unit Test Research Skills

Instr. Method	Individual Mean Research			
	Unit 1 M.	Unit 2 M.	Unit 3 M.	Unit 4 M.
Traditional				
<u>N.</u>	45	50	50	48
<u>M.</u>	3.578	3.360	3.320	4.29
<u>St. Dev.</u>	1.357	1.352	0.957	0.617
<u>St. Er.</u>	0.202	0.191	0.135	0.089
Traditional/Technical				
<u>N.</u>	43	47	45	44
<u>M.</u>	3.907	3.543	3.156	3.932
<u>St. Dev.</u>	1.231	1.248	0.878	1.129
<u>St. Er.</u>	0.188	0.182	0.131	1.170
<u>M. Difference</u>	-0.329	-0.174	0.164	0.360

words (See Appendix E). Unit 4 comprised volume arrangement concepts (See Appendix F).

A t-Test was used to determine if there was a difference between the means for Hypothesis #2. Under both instructional treatments, standard deviation and standard error differences were low. The traditional/technological instructional method was slightly higher in the first two unit tests. The traditional instructional method resulted in slightly higher achievement figures in the second two unit tests.

T-Test of the Difference Between Means

The t-Test of the Difference Between Means was calculated for both hypotheses to determine if there was a significant difference between the two instructional treatments.

Table 3 provided t-Test and p ratio statistics which indicated differences for pretest and posttest data presented in Tables 1 and 2 were not significant. Both of the null hypotheses were accepted on the basis that the statistical differences at the .05 level were greater, using a two-tailed test criterion. P. indicated the level of significance. The reliability of the t-Test was strengthened in this

study in that the composition of the two samples were nearly equal.

Table 3

Difference Between the Means: Traditional & Traditional/Technical

	Pretest Posttest		Unit Lesson Tests			
	Pret.	Post.	Unit 1	Unit 2	Unit 3	Unit 4
t Test	0.221	0.341	-1.190	-0.650	0.869	1.918
p ratio	0.809*	0.731*	0.235*	0.524 *	0.390*	0.055*

Note. *Not statistically significant at .05 level

CHAPTER FIVE

Summary

The purpose of this study was to test the hypotheses that there were no significant differences in student comprehension of encyclopedia research skills when instructed in the use of traditional print encyclopedia resources or when instructed in the use of traditional print resources supplemented with laser video disc and CD-ROM technology.

For the purpose of testing the hypotheses, two alternating scheduled fourth grade King Science Center classes were selected for the control instruction group. Three other alternating scheduled fourth grade classes were selected for the experimental group using traditional combined with the technological instruction. One traditional combined with technological group was subsequently excluded from the study due to scheduling and testing problems. The data revealed that there was no significant differences between the pretest and posttest gain achievement or individual research encyclopedia comprehension skills.

Conclusions

First, the findings of the Pretest/Posttest mean achievement study resulted in no significant differences in encyclopedia research skills of fourth grade students instructed with traditional encyclopedia research procedures and those of fourth grade students instructed in a combination approach utilizing laser video disc, CD-ROM and traditional encyclopedia research procedures.

Second, the findings of this study revealed that there were no significant differences in individual lesson encyclopedia comprehension skills of fourth grade students instructed with traditional encyclopedia research procedures and those of fourth grade students instructed in a multimedia approach with laser video disc, CD-ROM and traditional encyclopedia research procedures.

Third, a further examination of the data revealed that a portion of students in both groups exhibited mastery as defined by the Omaha Public Schools, as 56.5% of the control group and 44.5 % of the experimental group achieved mastery.

Recommendations

The findings of this study are consistent with the literature review: technology use is increasing and the outcomes remain tentative. The thrust of this study was limited to student comprehension. Recommendation for future study should include student learning style, student locus of control, and student dependency. While different instructional methods and resources may reveal no significant comprehension outcomes, it is conjectured that the lasting outcomes may be found in different learning styles, self-initiation, student autonomy, internal locus of control and decreased dependency on teachers and others. In other words, the infusion of life-long learning may be a life-long goal of students.

A second consideration for a succeeding study would be to test for differences in student subject mastery associated with library media instructional programs on various topics of research skills. Subject mastery in the Omaha Public Schools is 80%. While mastery was not a specific criterion of this study, informal observation of data suggested that although students gained from pretest to posttest

using both methods of instruction somewhat higher gains were revealed in the control data.

The third concern is how instructional methods can maximize the use of new technology. The library media program at King Science Center serves as a pilot for the Omaha Public Schools. Start-up costs are high in a magnet pilot program. The value of a technologically rich library media instructional program such as at King Science Center is yet to be determined. The need for more comprehensive studies are necessary to evaluate the contemporary library media program. Therefore, it is further recommended that selected independent variables regarding past achievement, gender, race and social class be tested for their relationship to learning.

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**OMAHA PUBLIC SCHOOLS
KING SCIENCE CENTER AT MANN
THE INFORMATION CENTER**

1. TEACHING AREA

Print and nonprint Items (17,000+)

Realia, models, clocks (11), globes (9), skeleton, birds (2)

2. AUTOMATIC CIRCULATION-NETWORKED

LCS III & Computer Catalog; 5 stations

3. ELECTRONIC RESEARCH

Macintosh/interactive LaserDisc/HyperCard (1)

CD ROM: Webster's Collegiate Dictionary (1)

CD ROM: Grolier Electronic Encyclopedia (3)

CD ROM: Compton's MultiMedia Encyclopedia (1)

CD ROM: World Book's Information Finder (1)

CD ROM: Educorp 5.0

CD ROM: Timetables of Science

CD ROM: NewsBank/microfiche, 1987 to present

CD ROM: NewsBank Index to Periodicals/microfiche, 1988 to present

CD ROM: World Fact Book, 90

CD ROM: USA Fact Book, 90

CD ROM: Microsoft Bookshelf

Book Brain 4-6, 7-8

USA & World Geographs

Fourth Grade Forecasts

Franklin Learning Masters (32)

Videolaser KnowledgeDisc (5)

4. WORD PROCESSING/GRAPHICS

IBM (3), Printers (3)

Macintosh SE (5), CLASSIC, Printers (6)

Apple IIGS (5), Printers (5)

Microsoft Works, AppleWorks

BSW III, BeagleWrite

Paint & graph programs

5. PROJECTION ROOM

Large Screen Television - 60"

Dolby sound stereo interfaced with CD and cassette players

Macintosh/interactive LaserDisc/HyperCard

6. TELECOMMUNICATIONS

MagNet

NASA Weather Net

Express Exchange

Omaha Wired Library

IRIS

NASA SpaceLink

7. TV/CABLE HEAD (PROJECTED)**8. COMPUTER CENTER**

Apple IIGS (25), Macintosh SE

Networked printers (7)

Interfaced television display

Software items (4000+)

Apple IIe (9), Printers (9)

Appendix B

**King Science Center
Library Media Skills Test**

DIRECTIONS: Read the Sample Question. Decide which answer you think is correct then circle the letter in front of that answer.

SAMPLE QUESTION: In a print encyclopedia, which volume would have a picture of the Nebraska state flag?

- A. Volume A
- B. Volume S
- C. Volume F
- D. Volume N

Stop and put your pencil down when you are done with this answer. If you circled D, the answer is correct. When your teacher tells you to begin, answer the rest of the questions in the same way you did the sample.

1. Encyclopedias are designed to answer all but one of the following.
 - A. who
 - B. what
 - C. why
 - D. where

2. Which of the following items would be listed first in a print encyclopedia?
 - A. cars
 - B. horses
 - C. dogs
 - D. boats

3. Which of these books would be used to find the meaning of a word?
 - A. an encyclopedia
 - B. a dictionary
 - C. an atlas
 - D. an almanac

4. A print encyclopedia is divided into separate books called _____.
 - A. sets
 - B. chapters
 - C. volumes
 - D. pages

Appendix B (continued)

5. Individual volumes in a print encyclopedia volumes are arranged _____.
- A. numerically by the Dewey Decimal number
 - B. alphabetically by the author's last name
 - C. alphabetically by the author's first name
 - D. alphabetically by volume
6. A printed source of general information arranged by topic is _____.
- A. an almanac
 - B. an encyclopedia
 - C. an atlas
 - D. a dictionary
7. To **best** find more information on a topic in an encyclopedia, the reader should _____.
- A. browse through the material
 - B. guess where more information might be located
 - C. use the "see also" suggestions
 - D. watch television
8. To find information about a bluebird in a print encyclopedia, under which heading should the reader look?
- A. birds
 - B. animals
 - C. blue
 - D. pet stores
9. In which reference source would the reader find out where Michael Jordan was born?
- A. an atlas
 - B. a dictionary
 - C. a thesaurus
 - D. an encyclopedia
10. Where would a student look to find information about Martin Luther King in a print encyclopedia?
- A. Volume P-Q
 - B. Volume J-K
 - C. Volume L
 - D. Volume M

Appendix B (continued)

11. To use an encyclopedia to find information about the planet Mars, the key word would be _____.
 - A. star
 - B. planet
 - C. Jupiter
 - D. candy bar

12. To **best** begin a search for information in an encyclopedia the reader should know some _____ of the needed information.
 - A. page numbers
 - B. Dewey Decimal numbers
 - C. key words
 - D. volume letters

13. When using an encyclopedia to find out information about television star Bill Cosby, the key word is _____.
 - A. Bill
 - B. star
 - C. television
 - D. Cosby

14. To locate information in an encyclopedia, the reader must know the _____ of the desired information.
 - A. call number
 - B. length
 - C. index
 - D. key word

15. In which reference source would the reader find out how a computer was designed?
 - A. a dictionary
 - B. an encyclopedia
 - C. an almanac
 - D. an atlas

16. Which word would appear on the page with the guide words **celery** and **cement**?
 - A. cell
 - B. celebrate
 - C. census
 - D. cereal

Appendix B (continued)

17. When students make a report from an encyclopedia source, they should do all listed below **except** _____.
- A. put the report in their own words
 - B. copy every word from the encyclopedia articles
 - C. skim the articles for details
 - D. take notes in their own words
18. Information in a print encyclopedia about instruments in an orchestra would be located in Volume _____.
- A. O
 - B. I
 - C. T
 - D. W
19. When using an encyclopedia to find the customs of the Plains Indians the key word would be _____.
- A. Plains
 - B. customs
 - C. Indians
 - D. the
20. Which of the answers listed below **best** indicate where more information on a topic can be found in other places in the encyclopedia?
- A. cross references
 - B. main headings
 - C. key word
 - D. guide words

Appendix C

NAME _____

TEACHER NAME _____

TEST - GENERAL ENCYCLOPEDIA KNOWLEDGE**King Science Center
Library Media Skills Test**

DIRECTIONS: Read the Sample Question. Decide which answer you think is correct then circle the letter in front of that answer.

SAMPLE QUESTION: In a print encyclopedia, which volume would have a picture of the Nebraska state flag?

- A. Volume A
- B. Volume S
- C. Volume F
- D. Volume N

Stop and put your pencil down when you are done with this answer. If you circled D, the answer is correct. When your teacher tells you to begin, answer the rest of the questions in the same way you did the sample.

-
1. Encyclopedias are designed to answer all but one of the following.
 - A. who
 - B. what
 - C. why
 - D. where

 2. A printed source of general information arranged by topic is _____.
 - A. an almanac
 - B. an encyclopedia
 - C. an atlas
 - D. a dictionary

 3. To **best** find more information on a topic in an encyclopedia, the reader should _____.
 - A. browse through the material
 - B. guess where more information might be located
 - C. use the "see also" suggestions
 - D. watch television

Appendix C (continued)

4. In which reference source would the reader find out where Michael Jordan was born?
 - A. an atlas
 - B. a dictionary
 - C. a thesaurus
 - D. an encyclopedia

5. In which reference source would the reader find out how a computer was designed?
 - A. a dictionary
 - B. an encyclopedia
 - C. an almanac
 - D. an atlas

Appendix D

NAME _____

TEACHER NAME _____

TEST - ALPHABETIZING
King Science Center
Library Media Skills Test

DIRECTIONS: Read the Sample Question. Decide which answer you think is correct then circle the letter in front of that answer.

SAMPLE QUESTION: In a print encyclopedia, which volume would have a picture of the Nebraska state flag?

- A. Volume A
- B. Volume S
- C. Volume F
- D. Volume N

Stop and put your pencil down when you are done with this answer. If you circled D, the answer is correct. When your teacher tells you to begin, answer the rest of the questions in the same way you did the sample.

-
1. Which of the following items would be listed first in a print encyclopedia?
 - A. cars
 - B. horses
 - C. dogs
 - D. boats

 2. Which word would appear on the page with the guide words **celery** and **cement**?
 - A. cell
 - B. celebrate
 - C. census
 - D. cereal

Appendix D (continued)

3. Which word would appear last in Volume H of a print encyclopedia?
 - A. Hawaii
 - B. human being
 - C. heat
 - D. helicopter

4. Which name would appear first in Volume P of a print encyclopedia?
 - A. Joseph Pulitzer
 - B. Sarah Polk
 - C. Thomas Paine
 - D. William Pitt

5. Which subject would appear last in Volume D of a print encyclopedia?
 - A. drug abuse
 - B. digestive system
 - C. dove
 - D. Declaration of Independence

Appendix E

NAME _____

TEACHER NAME _____

TEST - Key Words
King Science Center
Library Media Skills Test

DIRECTIONS: Read the Sample Question. Decide which answer you think is correct then circle the letter in front of that answer.

SAMPLE QUESTION: In a print encyclopedia, which volume would have a picture of the Nebraska state flag?

- A. Volume A
- B. Volume S
- C. Volume F
- D. Volume N

Stop and put your pencil down when you are done with this answer. If you circled D, the answer is correct. When your teacher tells you to begin, answer the rest of the questions in the same way you did the sample.

1. To best find more information on a topic in an encyclopedia, the reader should _____ .
 - A. browse through the material
 - B. guess where more information might be located
 - C. use the "see also" suggestions
 - D. watch television

2. To find information about a bluebird in a print encyclopedia, under which heading should the reader look?
 - A. birds
 - B. animals
 - C. blue
 - D. pet stores

Appendix E (continued)

3. To use an encyclopedia to find information about the planet Mars, the key word would be_____. .
 - A. star
 - B. planet
 - C. Jupiter
 - D. candy bar

4. When using an encyclopedia to find out information about television
 - A. Bill
 - B. star
 - C. television
 - D. Cosby

5. To locate information in an encyclopedia, the reader must know the _____ of the desired information.
 - A. call number
 - B. length
 - C. index
 - D. key word

Appendix F

NAME _____

TEACHER NAME _____

TEST - VOLUME ARRANGEMENT**King Science Center
Library Media Skills Test**

DIRECTIONS: Read the Sample Question. Decide which answer you think is correct then circle the letter in front of that answer.

SAMPLE QUESTION: In a print encyclopedia, which volume would have a picture of the Nebraska state flag?

- A. Volume A
- B. Volume S
- C. Volume F
- D. Volume N

Stop and put your pencil down when you are done with this answer. If you circled D, the answer is correct. When your teacher tells you to begin, answer the rest of the questions in the same way you did the Sample Question.

1. A print encyclopedia is divided into separate books called. _____ .
 - A. sets
 - B. chapters
 - C. volumes
 - D. pages

2. Individual volumes in a print encyclopedia are arranged _____ .
 - A. numerically by the Dewey Decimal number
 - B. alphabetically by the author's last name
 - C. alphabetically by the author's first name
 - D. alphabetically by volume

Appendix F (continued)

3. Where would a student look to find information about Martin Luther King in a print encyclopedia?
 - A. Volume P-Q
 - B. Volume J-K
 - C. Volume L
 - D. Volume M

4. To **best** begin a search for information in an encyclopedia the reader should know some_____ of the needed information.
 - A. page numbers
 - B. Dewey Decimal numbers
 - C. key words
 - D. volume letters

5. Information in a print encyclopedia about instruments in an orchestra would be located in Volume_____ .
 - A. O
 - B. I
 - C. T
 - D. W

Appendix G

STUDENT DATA FOR STUDY

CLASSES A, B, D, E

	<u>Instr.</u>	<u>Pret.</u>	<u>Post.</u>	<u>Unit 1</u>	<u>Unit 2</u>	<u>Unit 3</u>	<u>Unit 4</u>	
CASE	1.	1	16	19	4	4	3	5
	2.	1	16	18	5		4	
	3.	1	15	17	4	2	3	4
	4.	1	15	19	4	4	3	
	5.	1	15	18	3	3		4
	6.	1	14	19	4	5	4	5
	7.	1	14	20	5	3	4	5
	8.	1	14	19	4	4	3	5
	9.	1	13	15	2	3	2	5
	10.	1			1	2	4	3
	11.	1	12	18	5	4	4	5
	12.	1	12	14	1	4	3	3
	13.	1	12	17	5		4	4
	14.	1			5	3	4	5
	15.	1	11	17	5	4	2	5
	16.	1	11	17	5	5	4	4
	17.	1	10	16	5	3	3	4
	18.	1	1	18	5	4	3	4
	19.	1	9	13	3	2	4	4
	20.	1	9	13	4	2	3	5
	21.	1				3	2	4
	22.	1	7	16		4	4	
	23.	1			2	1	2	
	24.	1	6	6	2			3
	25.	1	4	12	3	2	4	4
	26.	1	14	18		5	4	5
	27.	1	16	16	5	3	3	5
	28.	1	13	20	3	4	2	4
	29.	1	13	16	4	1	5	4
	30.	1	12	6		1	4	4

Appendix G (continued)

	<u>Instr.</u>	<u>Pret.</u>	<u>Post.</u>	<u>Unit 1</u>	<u>Unit 2</u>	<u>Unit 3</u>	<u>Unit 4</u>
31.	1	12	16	5	3	3	4
32.	1	12	13	1	5	5	4
33.	1	12	18	4	4	4	4
34.	1	12	12	3	3	3	5
35.	1	11	15		4	4	4
36.	1	11	16	3	4	3	5
37.	1	11	18	5	5	5	4
38.	1	11	14		0	3	4
39.	1	11	18	4	5	4	5
40.	1	10	8	2	2	4	4
41.	1	10	14	3	4	4	4
42.	1			1	5	3	5
43.	1	17	19	5	4	2	5
44.	1	9	12		5	2	4
45.	1	8	12	3	3		4
46.	1	8	15	3	4	4	5
47.	1	8	1	4	5	3	5
48.	1	3	9		2	2	
49.	1	7	13	5	5	4	
50.	1			2	4	3	4
51.	1	10	17	5	5	3	4
52.	1	9	2	1	1		4
53.	2	14	19	5	5	4	5
54.	2	14	15	5	3	4	5
55.	2	14	1	5	1	3	3
56.	2	14	19	4	5	4	5
57.	2	13	13	4	3	3	4
58.	2	13	11	5	4	3	3
59.	2	12	12	5	2	3	
60.	2	11	11	4	5	4	4
61.	2	11	17	5	2	3	3
62.	2	11	18	5	5	4	3
63.	2	11	16	5	3	5	4
64.	2	10	15	3	3	2	4
65.	2	10	15	5		3	5

Appendix G (continued)

	<u>Instr.</u>	<u>Pret.</u>	<u>Post.</u>	<u>Unit 1</u>	<u>Unit 2</u>	<u>Unit 3</u>	<u>Unit 4</u>
66.	2	10	15	5	3	3	5
67.	2	9	8	1	3	4	2
68.	2	9	18	4	3	4	4
69.	2	9	12		1	2	
70.	2	9	10	1	1	3	3
71.	2	9	14	1	2	2	3
72.	2	8	10		1	2	4
73.	2	8	9	2	3	2	2
74.	2	8	12	3	4	2	3
75.	2	7	8	2	3	2	0
76.	2	15	18	3	3	4	4
77.	2			4	3		
78.	2	14	15	4	4	1	3
79.	2	7	10	2	4	3	5
80.	2	7	16	4	4	4	5
81.	2	8	13	3		3	4
82.	2	8	14	3	4	4	4
83.	2	8	14	4	4	3	3
84.	2	9	16	3	4	3	5
85.	2		13	5	3	2	4
86.	2	11	18	4	4	3	5
87.	2	10	16	5	4	4	5
88.	2	11	10		2	3	3
89.	2	12	14	5		4	4
90.	2	13	16		5	5	5
91.	2	13	19	5	4	4	4
92.	2	13	19	4	5		5
93.	2	13	20	5	5	4	5
94.	2	14	17	4	2	2	5
95.	2	14	19	4	4	3	4
96.	2	14	18	5	5	3	
97.	2	14	17	5	5	3	5
98.	2	14	18	5	5	3	5
99.	2	11	20	3	5	3	5

Appendix H

STUDENT DATA FOR SURVEY

CLASS C

<u>Instr.</u>	<u>Pret.</u>	<u>Post.</u>	<u>Un.1</u>	<u>Un.2</u>	<u>Un.3</u>	<u>Un.4</u>	<u>Un.Cum.</u>
<u>Student</u>							
01	15	16	4				
02	14	08	4	2	3		
03	13		3				
04	12		5		1	5	
05	12		4				
06	10		3				
07	10	16	3	2	4	5	14
08	09		5				
09	09		5				
10	09		4				
11	08		3	2			
12	08	13	4	4	4	3	15
13	08	16	5	3	5	4	17
14	08	06	3			5	
15	07	15	4	3	2	4	13
16	06		3				
17	09	18	5	4	4	4	18
18		20	4	5	4	5	18
19		19	4	5	4	5	19
20		11	3	2		5	
21		14	3	3	2	4	12
22		11	5	3	2	5	15
23		11		2	1	5	
24		12	4	5	4	5	18
25			3	2	4	5	15