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ABSTRACT

This practicum was designed to improve the research and com[illegible]ation skills of eighth-grade students with the integra[illegible] of technology, mathematics, and science when doing real-experience problem solving. Four units were developed that related the use of technology to skills that are also used in gathering, organizing, and manipulating research data and in communicating the findings in a written or oral presentation. Instruction was given during computer literacy class. Units focused on word processing, using a spreadsheet to organize data and create graphs, using design layout principles, and setting up a database and manipulating data. Six of the original 103 subjects, who excelled in scientific research projects, learned to create presentations using Hyperstudio. Analysis of the data indicated that five of the expected outcomes were achieved. The post performance-based test indicated that 92% of the students mastered outlining and reporting skills, and 93% mastered the graphing skills. Student portfolio assessments revealed that 99% learned how to create slides and overheads. Student confidence in the use of skills to enhance presentations rose substantially. Appendixes contain a student self-assessment and a five-item annotated software bibliography. (Contains 6 tables and 28 references.) (Author/SLD)

Enhancing Eighth Grade Student Presentations of Scientific Research with Technology

by

Berdella H. Shreiner

Cluster 65

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

NOVA SOUTHEASTERN UNIVERSITY

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PRACTICUM APPROVAL SHEET

This practicum took place as described.

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July 24, 1995

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

Approved:

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William W. Anderson, Ed. D. , Advisor

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This practicum was designed to improve research and communication skills of eighth grade students with the integration of technology, math, and science when doing real-experience problem-solving.

The writer developed four units that related the use of technology to skills that are used in gathering, organizing, and manipulating research data and in communicating the findings in a written or oral presentation. Instruction was given during computer literacy class. One unit focused on word processing skills that are used to construct an outline and write a report. Another unit concentrated on using a spreadsheet to organize data and create graphs; and on how to select a graph type that represents the relationship of the data. A third unit taught layout design principles in making slides/overheads. The fourth unit instructed students on how to set up a database and manipulate the data with search and sort commands. An outgrowth of the units of study involved six students, who excelled in scientific research projects. These students learned to create presentations using Hyperstudio.

Analysis of the data indicated that five of the five expected outcomes were achieved. The post performance-based test indicated that 92% of the students mastered outlining and reporting skills. The number of students who mastered graphing skills increased from 1% to 93%. The student portfolio assessments revealed that 99% of the students learned how to create slides/overheads. Student confidence in the use of skills that enhance presentations increased from 15% and 40% to 80% and 100%.

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CHAPTER I

INTRODUCTION

Description of Community

The school district is located in a rural, suburban area. The nearby state capital and federal government facilities provides employment for many of the nearly 38,000 residents. In this community, there are two middle schools, one high school, and seven elementary schools. The more than 7,100 students attending these schools live within four townships, covering 105 square miles. The socioeconomic conditions of the community are diverse. Affluent developments, industrious horse and dairy farms, trailer parks and apartment complexes are within two or three miles of each other. One half of the district is mostly farm land surrounded by small housing developments and natural areas and trails. The other half of this community is typical suburbia, with heavy traffic and congested shopping areas. The economic base for the schools is primarily the individual taxpayers. There is no major manufacturer within the community. Because of its location near intersecting interstate highways, it is the location of six large trucking terminals. The predominate middle and upper socioeconomic classification disqualifies the district for many of the state and federal funds. As diverse as the economic conditions of the residents may be, little ethnic or racial diversity exists within the schools and community.

The Writer's Work Setting and Role

The eighth grade students are part of a student body consisting of 820 sixth, seventh, and eighth graders. The middle school students are organized by teams composed of heterogeneous groups. The class sizes are predominately large. Many of the sixth grade classes are between 35 and 40 students. There are two teams of approximately 120 to 170 pupils for each grade. Each team has a group of five subject area teachers. The sixth and seventh grade team teachers include math, language arts, reading, science, and social studies. Eighth grade team teachers specialize in math, language arts, science, social studies, and Language Survey. Language Survey is a course that provides students with an introduction to four languages: Spanish, French, Latin, and German. Team teachers rarely integrate their subject areas. Most of the learning is subject-dominated.

It is the intent of this district to provide an environment in which teachers and students can learn, develop academically, and communicate. The students are highly competitive in both academics and sports. Much emphasis is placed on the achievements of students. The four-page newspaper, which is published monthly by seventh-grade students reflects the importance which students place on achievement. Birthdays, team and individual academic awards, and achievements in sporting competitions are recognized in this publication. Students operate a Student Store, planetarium, and a Weather Station. They televise morning announcements and weather reports.

The school provides a safe and nurturing environment for all of its students. This middle school promotes inclusion. The students with learning disabilities receive assistance outside of the regular classroom. Gifted students receive additional enrichment without missing regular classroom time. Students who have social and emotional problems have learning support personnel in and out of the regular classroom. Students with autism, cerebral palsy, and Down syndrome also have support personnel to assist them in the regular classroom. Of the special needs students, only those who are gifted or have learning disabilities are included in the regular classes in the eighth grade at this time.

The students of this middle school often perform well in state, national, and international academic competitions. It is important that students are able to present themselves and their work in the best possible manner. Science teachers encourage students to prepare presentations of their research that will be competitive. Administrators encourage teachers to use performance-based assessment methods to evaluate pupils. There is an emphasis on hands-on, meaningful experiences in the classroom. The school board appropriated large sums of money to promote technology integration into the school environment. The changes in the learning environment require eighth grade students to develop new technology skills which they can integrate with other curriculum areas.

The writer is a middle school computer specialist. The role of the computer specialist is to help students learn to use computers in the same manner as adults. Emphasis in the computer literacy program is to teach students technological skills that help them to solve problems. The technological skills, which they are taught, are integrated with other curriculum areas. They are taught skills that help them to explore and discover new ideas.

Students in this middle school are required to take one semester of computer literacy in sixth, seventh, and eighth grades. They have one period of class each six-day cycle. There are other opportunities for students to use computers in the computer lab or in the

Informational Media Center. The computer curriculum activities are integrated with other subject areas. Students learn skills which they are able to use to do work for other classes. Classroom teachers of other subjects use the computer lab with their students on occasion. It is important that students are comfortable and confident in using the computer lab, if this environment is to promote learning.

It is the writer's role to encourage the use of technology by students and faculty to improve learning. Students and teachers learn to integrate the use of technology into their everyday activities. This enables them to access and manage information. Using technology as a tool, improves the quality of work and reforms the way teachers teach and students learn.

CHAPTER II

THE STUDY OF THE PROBLEM

Problem Description

A problem exists when eighth grade students are asked to present the findings of their scientific research. According to science teachers, science fair presentations by eighth grade students are not well prepared without parental help. The presentations that use overheads, neat documentation, and graphs that accurately reflect data are made by parents rather than the students. When eighth grade students create graphs and charts, they are not accurately labeled. Students are not able to organize the data they have collected. They have difficulty entering data into tables and creating graphs that accurately reflect the relationship of the data.

The visual aids and overheads created by students are not neat and clear. The overheads or slides they use do not focus on one idea. The overhead does not capture the attention of the audience and communicate the student's point in a clear manner.

Documentation which accompanies student presentations is sometimes handwritten. Many times the handwritten or typed work is not properly formatted. Although some students do use a typewriter or computer to generate their work, they have not followed acceptable formats, nor have they used the tab features properly.

Eighth grade students are not able to create a presentation of their scientific research without parental help. Students in the eighth grade should be able to clearly communicate their findings of scientific research in presentations that use meaningful charts or graphs, visual aids, and documentation created by them.

Problem Documentation

Informal interviews with seven middle school science teachers indicated a general consensus that sixth and seventh grade students had difficulty with graphing scientific data. On the average, these teachers felt that maybe 10 to 30 out of 120 to 150 students might be able to create a graph without supervision. Eighth grade students were able to create graphs, but had difficulty in organizing the data. This sometimes led to inaccurate labeling of the graphs.

A self-assessment test given to eighth graders indicated their lack of confidence in presentations with graphs, visuals, and other documentation. (see Table 1) Fewer than 3 of 103 (3%) felt that they were experts in creating graphs. Of the 103 students surveyed, 9 (9%) felt that they did know how to outline. Only 5 of the 103 (5%) felt that they knew how to make overheads.

Table 1. Student Self-Assessment Data

Make Graphs:	
Expert	3
Okay	38
Inexperienced	46
Don't know	16
Make Outlines:	
Expert	9
Okay	35
Inexperienced	44
Don't know	15
Create Overheads:	
Expert	5
Okay	16
Inexperienced	48
Don't know	33
Use Spreadsheets:	
Expert	6
Okay	33
Inexperienced	46
Don't know	18
Organize Data:	
Expert	3
Okay	29
Inexperienced	47
Don't know	24
Use Databases:	
Expert	3
Okay	12
Inexperienced	44
Don't know	44

Total number of students: 103

The eighth grade survey indicated that 6 out of 103 (6%) thought they knew how to use a spreadsheet. Only 3 of the 103 (3%) of the students were confident that they could create and use a database.

A performance pretest given to this same group of students indicated that only 1 out of 103 students could correctly create and label a graph. Of the 17 students, who tried to create an outline, only 6 were able to create the outline correctly. Fewer than 28 students entered data into a spreadsheet. Only 3 entered formulas and correctly manipulated data. (see Table 2)

Table 2. <u>Pretest Performance Assessment Data</u>

Skill Tested	[a]n
Creating Graphs:	
Attempted	18
Achieved	1
Writing Outlines:	
Attempted	17
Achieved	6
Using Spreadsheets:	
Attempted	28
Achieved	3

[a]n: number of students out of 103.

Causative Analysis

In seventh grade, the science teachers provided activities for students to create graphs using pencil and paper. These teachers noticed that more than half of the students had difficulty with spacing and the mechanics of this activity. The students required teacher directives to make the graph. Understanding the relationship of data was a problem for seventh grade students. Students lacked understanding in labeling graphs and how data might be related. Eighth graders experienced graphing; however, they lacked an understanding of how it is done.

It appears that four situations contributed to the existing problem: Developmentally, middle school students are generally moving from concrete to the abstract thinking. In sixth and seventh grades, they are able to understand abstract thoughts when they are related to concrete models. It is difficult for students to relate collected data directly to a graph. Creating charts provides a concrete relationship of data. The use of paper and pencil graphs causes students to temporarily focus their concentration on the mechanics of establishing axis and scales. For a student, who is not yet able to use formal abstract thought, this is difficult. They cannot relate the parts of the graph and the data.

Secondly, past science curriculums were based on memorization of facts, not tied to real experiences. The middle school curriculum is only beginning to put aside the textbooks and get students involved in real experiences. Students are learning how to make observations. It is difficult for them to relate what they learn to symbolic representation, such as a chart. The students needed to have more practice with observations and data recording before they related these concrete experiences.

Students did not have much experience with the application of the scientific or inquiry method to solve problems prior to eighth grade. Many teachers had been using the traditional methods of teaching science where they illustrated or lectured about a scientific phenomenon. Middle school teachers used the textbook from one-third of the time to daily. Approximately one-fourth of them had students use the text as a reference. The experiential approach to science required that students question and reflect on what they observe. Over the past several decades, students had not been made to think "why" or "what if". Students needed to develop an inquiry method of problem solving. Helping students to research and state a position on what they think, increased their confidence in science and helped them to learn to make an hypothesis statement. Many of them felt that there is one right rule and they must find it. It is more important that students understood there are many ways to look at a problem; their point of view is one viewpoint and their data can support or refute it.

Lastly, students had not been equipped with technological skills that make science research easier and more meaningful to them. The science teachers did not use computer technology to teach graphing to the middle school students. The curriculum was subject-dominated. Although students may have used spreadsheets and created graphs, their experiences had been minimal and had not been related to scientific research.

Relationship of the Problem to the Literature

If American students are to be first in science in the year 2000, Then the manner in which science is taught needs to be reformed. Research indicated that science curriculum needs to be revised to use real experiences and an inquiry-based method. Stephans and Veath (1994) recognized that middle and high school students have a problem with understanding and applying abstract ideas. When learning involves solving real problems, students became more interested in science. They are able to perceive a concrete problem that is real and meaningful to them. This requires students to learn new skills. Students need to learn skills for developing hypothesis; gathering, organizing, and analyzing data; and communicating their results.

The research of many educators showed evidence relating to this problem. Science and math educators see a need for students to learn how to apply math and science principles to problem-solving. Bombaugh (1993), Sanders (1993), Schack (1993), and Weiss (1993) observed that students do not know how to collect, analyze, and manipulate data; and communicate their ideas. Sanders feels that science projects require problem-solving skills and a need for students to learn how to gather data and formulate hypothesis. According to Alghren (1991), the International Assessment of Educational Progress Report indicates that only 42% of American students can use the scientific procedures and analyze scientific data. Kanning (1994) found that students need help with scientific observation skills. Schnitzer (1993) noticed that students had difficulty with relating data and applying what they know.

Science educators see a need to provide students with real experiences and project-based learning. The middle school curriculum needs to be project-based if these students are to be prepared for an information age, according to Hunter, Bagley, and Bagley, (1993). If students are to benefit from using the scientific method, then they need to learn to use the scientific method like scientists. Weiss (1993) and Newman (1992) would like to see students use the scientific method and communicate their ideas like real scientists. According to Newman, students, working like real scientists, would collaborate and use technology. With so much emphasis on the scientific method, Storey and Carter (1992) caution educators that students need to be involved in a method of inquiry to help them apply it.

It is important that educators create an environment that integrates skills and develops collaboration. The integration of technology skills into content areas enhances learning according to Muir(1994) and Richey (1994). Seiff (1993) emphasizes that these skills need to be identified if the curriculum is to be integrated. The integration of technology is undergoing reform, too. Betts (1994) recognizes the birth of the communication age as an outgrowth of the information age. This changes the way technology is used. Real experiences in science are complex. If these tasks are to be integrated with technology, Means and Olson (1994) state that it will require reform in its use. Future demands of technology create student needs which have to be recognized (Peck & Dorricott, 1994).

These future demands and the needs of our students to become life-long learners are causing educators to restructure and reform education. The restructuring of science curriculum is demanded by the inappropriate teaching methods, the Goals 2000, and the need to improve science achievement. A study by Yager (1992) indicated that most of the science curriculums were inappropriate and in need of revision. The traditional teaching methods dictated by the textbook-driven curriculums leave students unchallenged, according to Stiles (1994). Wright and Perna (1992) advocate that reform is necessary to improve student science achievement. Donovan and Sneider (1994) agree that if our students are to reach the Goals 2000, then the science curriculum must be reformed. Anderson (1994) argues that science curriculum reform is not a one time deal, but an ongoing process.

If educators reform the science curriculum, then educators need to be cognizant of those factors that impede student education. Research revealed that traditional curriculum, disregard for child development, compartmentalized instruction, and recent emphasis on technology and the lack of integration contribute to the stagnation of science achievement. Traditional curriculum is based on memorization of theory and fact. Reform of science curriculum means that the curriculum should be changed to hands-on experiences that are real and meaningful to students. Yager (1992) feels that most science learning is measured with tests on information; it should instead be based on experiences. This restructuring of science education necessitates a change, also, in the way students learn science. Donovan and Sneider (1994) emphasize the use of inquiry learning. Rote learning has not helped students to understand science concepts. Traditional methods have created a non-lab setting for an inquiry subject. Doran, Boorman, Chan, and Hejaily (1992) say that the assessment of real science in the traditional non-lab setting is outdated. Doran et. al (1992) and Kumar, Helgeson, and White (1994) identify a need for alternative assessments to evaluate hands-on science experiences, if science education is to change. Since most students have been unchallenged by the traditional methods, it has done little to encourage them to advance their learning of science and math, according to Ahlgren (1991) and Stiles (1994).

While traditional science programs have been based on memorization and abstract ideas such as theories, they have not been cognizant of the development of the adolescent child. The middle school child is in transition, moving from the concrete to formal abstract thought. Frequently, students are expected to learn and apply ideas which are too abstract for them to understand. The text-based curriculums of traditional science education has caused students to memorize facts without understanding their meaning. Stephans and Veath (1994) attribute the student's inability to apply abstract concepts to the textbook's movement to using abstract ideas before the student is developmentally ready.

The middle school was developed to create an environment that is conducive to the transition of the student from concrete to formal abstract thinking. Traditionally, it has reflected the high school structure of text-based curriculum and compartmentalized instruction. According to Newman (1992) and Seif (1993), this does not lead to the integration of subjects, which provides students with meaningful concrete experiences. Compartmentalized instruction does not allow students to see the connections between subjects. With each subject area emphasizing excellence, students do not learn to integrate the skills they learn. This lack of interaction, which is fostered by text-driven curriculums, stifles creativity and exploration which improve scientific achievement. (Wright and Perna, 1992)

Math must be integrated with science to provide students with experience and familiarity with measurement, data, and graphing. Without this integrated method of teaching measurement, students do not develop the ability to work with data in scientific research. According to Bombaugh (1993), students are not experienced with collecting, measuring, and manipulating data. Without these experiences, students can not understand how the data is related. Sanders' observations in 1993 indicate that students do not have enough understanding to apply scientific principles to solutions.

Understanding how to apply scientific principles to solutions is a necessary problem-solving skill which students need to develop. The students' inability to apply principles of the scientific method to research, Storey and Carter (1992) attribute to the memorization and formal hypothesizing required by traditional science programs. Students lack the real-life problem solving skills required of self-directed learners. (Stephen and Gallagher, 1993). According to Schnitzer (1993), students lack problem-solving skills, because they have not been taught thinking processes for problem-solving.

Although real scientists use technology everyday to do their work, technology has not been integrated with the science curriculum to provide students with hands-on problem solving skills. The emphasis of technology in science research and business has created new demands for students. Restructuring of science education and the middle school curriculum is required to prepare students for the workplace, according to Hunter, Bagley, and Bagely, (1993) and Peck and Dorricott (1994).

CHAPTER III

ANTICIPATED OUTCOMES AND EVALUATION INSTRUMENTS

Goals and Expectations

The goal projected for this practicum was for eighth grade students to clearly communicate the results of scientific research in a presentation. There were four expectations related to this goal: (a) Students will be able to outline scientific information, (b) organize data in a meaningful format, (c) create charts and graphs that accurately represent the data, and (d) create visual aids that help them give meaningful presentations.

Expected Outcomes

The pretest assessment tool indicated that 6 of the 103 students correctly organized information in outline form. An expected outcome was that the number of the eighth grade students, who can correctly organize information in outline form, would increase from 6% to 85%. These students would correctly create an outline that organizes information, using skills that could be applied to other curriculum areas.

Only 1 out of the 18 students, who attempted, was able to create a graph that correctly represented given data. It was expected that the 1% would increase to 85% of the 103 students, who could create graphs that are representative of research data. They would be able to construct a graph and select the type of graph that best represents the relationship of the data.

Presently, only the few students who compete in science fair competitions on the local and state level create overheads. An expected outcome is that 90% of the students in the sample will know how to create visual aids.

It was an expected outcome that those students, who compete in state and local levels of competitions, create and use visual aids, such as overheads and slides, in making their presentations. Students' science fair presentations would include graphs, visual aids, and documentation that clearly communicate their research findings.

The student pretest self-assessment data indicated a lack of confidence in use of presentation skills. An expected outcome would be an increase in student confidence in using presentation skills. One indication of this would be that the five skills evaluated in a self-assessment rubric show an increase. Students, who felt they were either an expert or okay on the self-assessment pretest, would increase from 15% and 41% to 50% or greater for each skill on the self-assessment post test.

Measurement of Outcomes

The outcomes were measured with assessment of student portfolios, a comparison of pre and post performance-based assessment, a pre and post student self-assessment, and student presentations to district administrators. The portfolio assessed the quality, correctness, and completion of the work produced by the student throughout the period. The post performance-based assessment was compared to the pre performance-based assessment (see Appendix A). Evaluation was based on the correct completion of the tasks, which reflected desired skills. The student post self-assessment was used to indicate changes in student confidence by showing any movement from "inexperienced" and "don't know" categories to "expert" and "okay" for each skill. Presentations to district officials by students, who had achieved a competitive status, were used to indicate the success of learned skills applied to the multimedia presentation of scientific research. Although the success of presentations at competitions could not be directly related to the success of these outcomes; it was expected that the presentation skills enhanced the students' communication of the research, the success of which relied on its own merit.

CHAPTER IV

SOLUTION STRATEGY

Discussion and Evaluation

Eighth grade students needed to learn how to communicate results from scientific research in presentations that used clear and accurate charts or graphs, visual aids, and other written documentation. Students did not know how to organize data. They did not know how to create charts and graphs. They were not able to select a graph type that reflected the relationship of the data. It was necessary for them to learn how to create slides and overheads. Finally, students needed to learn to document their research experience and findings in writing.

Three ideas were prominent in solutions that related to this problem: (a) Technology can improve research and communication skills.; (b) math, science, and technology should be integrated when doing real experience problem-solving; and (c) middle school students learn best when they are able to work with concrete scientific data from real experiences.

Research, gathering, organizing, and analyzing data are important skills in performing scientific research. Technology can improve the application of these skills. It is an important tool that can help students manipulate data. Donovan and Sneider (1994) feel that the technological skills, which students learn in working with data, improve research.

When technology-based projects are integrated into the curriculum, students become skilled in using the processes involved in scientific research (Hunter, Bagely, & Bagley, 1993). Technological skills used in spreadsheets and making graphs help students to learn decision making and develop problem-solving skills (Bombaugh, 1993; Kumar, Helgeson, & White, 1994; Richey, 1994; Schnitzer, 1993). According to Peck and Dorricott (1994), technology is an integral part of learning that can improve thinking and writing. It can help students solve problems and perform meaningful work like real scientist (Peck & Dorricott, 1993; Weiss 1993). Science principles can be applied to problem-solving when science and technology education are combined. According to Sanders (1993), the integration of technology, math, and science makes learning more relevant and interesting to students and promotes interest in science. Seiff (1993), Stiles (1994), and Wright and Perna (1992) suggest that curriculum focus on integrating skills such as outlining, listening, organizing, research, report generation, time management, problem-solving, graphing, writing, and communicating.

Anderson (1994) and Stephans and Veath (1994) emphasize the use of concrete models for instruction in the middle school. Ahlgren (1991) and Yager (1992) agree that students be given real experiences to provide them with hands-on experience. Students need to participate in real and meaningful experiences if they are to learn new skills. Technology enables middle school students to work with real experiences, which would otherwise be too complex and abstract for them to understand. The collaborative efforts of teachers help students learn the integrated skills of math, science, and technology, which students use in real experiences.

Description of Selected Solution

According to Muir, "computers improve communications, promote investigation, and inspire creativity in the middle school" (1994, p. 30). Presenting scientific research requires good communications and investigative skills. Using computer technology enhances students' research and presentation.

In the Berlin-White Integrated Science and Mathematics (BWISM) Model, Berlin and White (1994) identified six aspects of integrating mathematics and science education. These include the following considerations:

1. Students must actively be involved in exploratory, learning experiences.

2. Integrated activities provide opportunities for students to use both inductive and deductive processes.

3. Inquiry and problem-solving are relate in the integrated use of math and science skills.

4. Science and math are more meaningful to students when their content are integrated.

5. Integration of math and science increases student motivation and bolsters the student confidence in their ability.

6. Teaching strategies should align science and mathematics with real world science and math.

The insights provided by the integrated math and science "connections" in the BWISM Model, are useful in selecting resources and materials to integrated math and science with technology. The suggested guidelines indicate the positive affects which math and science integration can have on the skills which this practicum developed: collecting and organizing data, graphing, developing hypotheses, and communicating.

Mc Donald and Czerniak's (1994) interdisciplinary unit strategies suggest a schematic plan to integrate curriculum around one central theme. Interdisciplinary units, organized around a central theme, integrate skills, used in problem solving, critical thinking, and communicating (McDonald & Czerniak, 1994). Some of their suggested guidelines are not applicable to a subject-dominated environment. The suggestion of beginning the integration with two or three domains would be feasible. Integrating technology with other subject curricula is the normal practice for the computer literacy course; however, McDonald and Czerniak suggest that all subject curricula involved be integrated to work on a centralized theme. If teachers wanted to combine the studies of home economics, science, and technology to focus on plants that could exist in a space colony, it could be done with only a cross-section of eighth grade students due to the various schedules. Of students on one team, only 1 out of 12 would have home economics the same marking period as computer literacy.

The best solution to help eighth graders enhance their presentation of science research, in this school setting, incorporated three prominent ideas: (a) improving research and communication skills using technology; (b) integrating math, science, technology, and language arts; and (c) providing students with real and meaningful experiences.

Additional support for students, who have achieved recognition at area science competitions, was integrated into the schedule. These students worked independently to prepare presentations for future competitions and evaluations by district administrators. Their presentations were created using multimedia software.

Report of Action Taken

The implementation of this practicum involved 103 eighth grade students who were assigned to computer literacy class during that period of time. Technology, science, math, and language arts were integrated into four units of instruction: developing reports, creating overheads and slides, preparing databases, and using spreadsheets to construct charts.

In the first unit, students developed a report after constructing an outline. Students selected a topic from among real world problems or experiences. The topic was to be meaningful to them. Topics included endangered sea turtles, the use of microwaves, electromagnetic trains, etc. They developed a list of questions pertaining to their subject. Answers to these questions were researched using journals, books, and CD-ROM references. An outline was developed for the report using the information, which was found. Oral and written instructions were given to pupils on how to correctly format an outline. Outlining skills, which were introduced, followed the format adopted by the district's English department. Instruction focused on eight objectives. Students were taught the correct use and placement of Roman numerals, uppercase letters, and Arabic letters in an outline. Decimal tab stops were used to align the outline labels with the period after the Roman numerals, letters, or numbers. Students were instructed to use the tab key, not the space bar to align outline labels. The period after the outline label was followed with one space. The first word of a heading or subheading was capitalized. Punctuation was not used at the end of headings or subheadings. Headings were to be mutually exclusive. Students were taught to keep topics within a division parallel; that is, a subheading "A" required a subheading "B" of similar grammatical structure.

Students created a title page and developed their report from the outline. They were instructed on proper spacing, alignment, and spell-checking using desktop publishing software.

This unit was introduced during as two lessons. One lesson focused on researching and creating the outline. The second was committed to the mechanics of typing the report and title page. Students required time beyond the two 45 minute class periods to develop the full content of the report. Many students worked in the computer lab during times beyond their regularly scheduled class.

Students learned to develop questions and organize their ideas to support a thesis statement. Technology-based research skills were applied in accessing the Reader's Guide on CD-ROM and CD-ROM multimedia encyclopedias. Students constructed and used outlines. The skills, which they gained in this unit, helped students create reports and outline notes for scientific research, as well as for other subjects. It was important to keep the thesis of the report in this exercise narrowly focused. Students were concentrating on the structure and mechanics of the outline and report; therefore, a three-paragraph report was sufficient.

The second unit focused on creating overheads or slides using computer technology. This was a difficult unit for eighth graders. They had to synthesize both design and draw techniques. Creating the slides involved two separate concepts: the use of draw tools in a works program on the computer and the understanding of good layout design. Students had previously been introduced to the draw tools of the Microsoft Works software program (See Appendix F). The tools were reviewed and time was provided for students to master their use. Basic guidelines in design layout were provided in written instructions. These were demonstrated and discussed. Students executed step by step instructions to create one slide. Each student chose a simple concept to demonstrate. The topic was related to the use of the Microsoft Works program. Concepts included how to justify text, save a file, etc. It was important that the task remained small, since students were focusing on the process. The individual slides created by the students were put together into a slide show to demonstrate to students how this would be accomplished using the draw tools of Microsoft Works.

Students developed many useful skills. They learned how to create and effectively use text boxes from the draw module of a works program. They gained an understanding of sans serif and serif fonts and how they are used. Learning how the eye moves and is affected by color was an important design element for them to understand. The one third rule was introduced to explain how the eye focuses on the overhead or slide. An important criterion, which students were taught, was that the content of the slide needs to be focused enough that the audience can grasp its meaning within 20 seconds.

Students used the draw tools of Microsoft Works to create their overheads or slides. They printed the overheads in both color and black and white to see the effectiveness. The slides were combined to show students how they could easily create several slides and join them together into a presentation. Note that the same file, which the student created for a slide was printed as an overhead. Some printers print directly on the transparencies to make overheads.

Caution should be taken to see that the correct transparencies are used. Many of the skills which students learned from this unit were used to create overheads or slides for oral presentations in other classes as well as posters or bulletin boards.

The third unit of instruction centered on developing and using a database. The objective of this unit was to help students learn how the database can organize information in a manageable structure. Learning to setup a database and perform sorts and searches of the database are valuable skills. It was important that the size of the database in this exercise be kept small, so that students focused on understanding the mechanics involved, rather than becoming overwhelmed with the data.

Students created five records for their database. The database contained five fields of information about inventors: (a) inventor's name, (b) date of death, (c) invention, (d) date of invention, and (e) contribution or importance of the invention. The date of death field, although not directly related, gets students to understand how they can use lateral thinking when establishing the fields. It is important that they add fields that might have relevance to how they intend to use the database. The date of death field, in this case, can assist the student if the student wished to discuss with the inventor, questions that related to her/his invention.

Students learned skills necessary to construct a database to organize information. They also learned how information in a database can be manipulated to find specific data or arranged data into a meaningful order. Databases are used by students to store research data, keep bibliographies, create note cards for literature research, or organize class notes.

The fourth unit taught students to use spreadsheets to organize data and create charts. Students were given three science-related problems. The first problem involved recording the daily high and low temperatures for a seven-day period. This information was recorded into a spreadsheet in the Microsoft Works program. Students created a chart using the spreadsheet. Important concepts which students learned were to identify the horizontal and vertical axis labels, the legend, and the control. Each problem was represented with four graphs. Creating four graphs allowed the student to see how each graph type represented and related the data. The student then suggested which graph best represented the data and which graphs were not suitable. The purpose of the first problem was to demonstrate the change in temperatures for a geographic area over a period of time. This information would be useful to inform visitors about the fluctuation in weather, so that they would know what clothing would be comfortable.

The other two problems involved controls and variables. One problem measured plant growth over time using various soil mixtures. The third problem compared the weight of recyclable plastic, paper, aluminum/tin, and organic waste.

This activity required more than three class periods. In addition to creating the graphs, students had to learn how to prepare the graphs for presentation. This required computer techniques to copy and paste graphs into word processing documents and print these documents.

Students learned how to organize data in a spreadsheet. They were able to see the relationships of the data and variables and controls. Using the computer to make graphs took away the distraction of the paper-pencil construction of the graph and it permitted students to concentrate on how the data was related. Students gained a better understanding of why one type of graph represents the data in a problem, while other types might not. These were difficult concepts for middle school students to master; however, the computer technology made these experiences easier and data manipulation more manageable.

Students have many opportunities to apply the skills which they have learned to enhance their presentations of science research. Students make class presentations of science research to their peers.

The district also sponsors a science fair; students, who achieve top recognition in this contest, can choose to participate in a series of other science competitions. While some of the competitions use posters and reports; others require oral presentations that use overheads. Emerging technology affects the presentations that can be expected at the higher levels. Interactive multimedia presentations incorporated into oral presentations by the students are becoming more common.

An outgrowth of the class instruction was a hypermedia course developed for students, who displayed excellence in executing a research project. The course was by invitation only for those students who had won at local science competitions. Seven students were eligible, six elected to participate. The students learned how to use Hyperstudio (see Appendix B for bibliography) and created presentations of their scientific research.

The class consisted of six instructional periods and three independent work periods. Instruction concentrated on six different features of Hyperstudio. During the first class, students learned how to add buttons and cards. The second period focused on adding clip art and importing pictures. In the third class period, students added graphs made with Microsoft Works and ClarisWorks (see Appendix B for bibliography). Voice clips were added during the fourth class.

During the fifth class, pictures were scanned and added to the cards. Finally, students added new button action functions to their cards. The remaining classes permitted students to work independently on their own presentations. They took the presentations, which they used for competitions, and converted them to Hyperstudio stacks. They presented their final work to administrators (including the Superintendent) at the district's administrative building.

Student preparations of interactive presentations of research using Hyperstudio are important in preparation for future competitions. Emerging technologies that employ multimedia and QuickTime features are used to show the development of the research in progress. Future presentations will include digitized pictures of each step of the research or QuickTime movies made from video clips. These students learned how pictures are scanned, digitized and added to a presentation. Within a few years, the actual research will be presented with QuickTime VR created with digitized videos or pictures, which are taken as the research occurs.

CHAPTER V

RESULTS, DISCUSSION, AND RECOMMENDATIONS

Results

Middle school science teachers noticed that eighth grade students were not able to make a clear and meaningful presentation of information from scientific research which they had performed. They had difficulty organizing data and creating charts and graphs. Students did not completely understand how data was related and were confused with selecting a graph type that accurately represented their findings. Oral presentations given by students in science class used few overheads. Written reports indicated that students lacked experience in writing research documentation.

Middle school students are just beginning to use abstract thinking. They often need to have abstract ideas tied to concrete models. It was important that students gain an understanding of the processes involved in creating presentations and confidence in applying them. The solution used real experiences to develop organizational and problem-solving skills that assist students in performing meaningful work like real scientists. Technology was used to improve thinking and integrate science with math and writing. The solution applied technology to classroom experiences that improved research and communication skills.

The pretest assessment tool indicated that 6 out of 103 students correctly organized information in outline form. An expected outcome was that the number of eighth grade students, who could correctly organize information in outline form, would increase from 6% to 85%. This outcome was achieved in that the results of the post test assessment showed that 93% of the students correctly organized information in outline form (see Table 4).

The pretest assessment tool indicated that 1 out of the 18 students who attempted was able to create a graph correctly. It was expected that the 1% would increase to 85% of the 103 students, who could create graphs that represent research data. This outcome was achieved in that the post test assessment indicated that 92% of the students were able to correctly construct a graph and select a graph type that best represented the relationship of the data (see Table 4).

An expected outcome was that 90% of the students would know how to create visual aids to use with oral presentations. Only 32% of the students felt that they were experts at creating slides/overheads.

Table 3. Pre and Post Student Self-Assessment Data

Self- Assessment	Pre	Post
Make Graphs:		
Expert	3	41
Okay	38	59
Inexperienced	46	3
Don't know	16	0
Make Outlines:		
Expert	9	46
Okay	35	57
Inexperienced	44	0
Don't know	15	0
Create Overheads:		
Expert	5	30
Okay	16	60
Inexperienced	48	8
Don't know	33	5
Use Spreadsheets:		
Expert	6	51
Okay	33	49
Inexperienced	46	1
Don't know	18	2
Organize Data:		
Expert	3	27
Okay	29	71
Inexperienced	47	5
Don't know	24	0
Use Databases:		
Expert	3	14
Okay	12	68
Inexperienced	44	12
Don't know	44	9

Total number of students: 103

An additional 56% felt confident that their skills were okay when creating slides/overheads. Student portfolios indicated that this outcome was achieved in that 98% actually knew how to create good slides/overheads, applying layout design principles and using the draw tools from Microsoft Works (see Table 5).

Table 4. Post Test Performance Assessment Data

Skill Tested	n[a]
Creating Graphs:	
Attempted	96
Achieved	96
Percent of Students Showing Mastery	93%
Writing Outlines:	
Attempted	95
Achieved	95
Percent of Students Showing Mastery	92%
Using Spreadsheets:	
Attempted	65
Achieved	65
Percent of Students Showing Mastery	63%

[a] n: number of students out of 103.

An expected outcome was that students would create and use graphs and visual aids, which clearly communicated their research findings, in presentations at local and state competitions. The eighth grade students, who participated in the science competitions, did create graphs and posters, which they used for their presentations. The outcome was met in that students, who made presentations of their science research projects at the Junior Academy, regional, and state competitions, used graphs and other visual aids that clearly communicated their research findings.

Table 5. Portfolio Assessment Data

Skill Tested	^{a}n
Composition:	
Total number Assessment Points	300
Number of Incomplete	0
Number Under 290 points	4
Number of Mastery	99
Percent Showing Mastery	96%
Overheads/Slides:	
Total number Assessment Points	100
Number of Incomplete	2
Number of Mastery	101
Percent Showing Mastery	98%
Graphs:	
Total number Assessment Points	300
Number of Incomplete	6
Number of Mastery	97
Percent Showing Mastery	94%

^{a}n: number of students out of 103.

Pretest self-assessment data indicated that students lacked confidence in using presentation skills. It was expected that student confidence in applying presentation skills would improve. An expected outcome for students, who indicated their skills were expert or okay, would increase from 15% and 41% to 50% or greater for each skill on the self-assessment test. This outcome was met in that the results from the post test self-assessment data indicated that student confidence, as an expert or okay, increased to greater than 50% for each skill. The following percents were calculated for student confidence in using each skill (sum of expert and okay responses divided by total number students): making charts/ graphs, 97%; outlining, 100%; creating overheads, 87%; using a spreadsheet, 97%; organizing data, 95%; and using a database, 80% (see Table 3).

Discussion

Enhancing eighth grade student presentations of scientific research was to help eighth grade students clearly communicate the results from scientific research in a presentation. Four expectations of this goal were to enable students to outline information, organize data, construct charts and graphs, and create appropriate visual aids. The success of these objectives was measured with a student assessment portfolio, pre and post performance-based assessments, pre and post student self-assessments, and informal interviews with science teachers and administrators.

The student portfolio contained a composition and outline, from which the composition was generated; an overhead; and 10 to 12 graphs that depicted the data of three science-related research problems. Assessment of the portfolio work indicated that 94% of the students (total number students minus number of students, who did not master one or all skills, divided by total number students) mastered the skills, which the portfolio assessed.

Results showed that 96% of the students mastered skills for constructing an outline and writing a composition using that outline (see Table 5). Only four students had fewer than 290 points out of the 300 possible points for their composition and outline assessment. Mastery was demonstrated with an assessment of 290 points or greater. These results seemed reasonable when compared to the student post self-evaluations of outlining skills. On the self-assessment, 100% of the students indicated that they were an expert or okay (see Table 3). The post performance-based assessment indicated that 92% of the students attempted the outlining activity (see Table 4). Some students were limited to complete the post self-assessment and performance-based tests within a fifteen minute period and did not have an opportunity to complete all of the tasks. All of the 95 students, who attempted the outlining task, performed the task correctly. Transfer of the outlining skills was indicated by an eighth grade science teacher in an informal interview. The teacher reported that students were using the computer to outline their biology notes.

Students learned to use spreadsheets and databases to organize data. The student portfolio contained graphs for three science-related problems. Students were to create four graphs for each problem to show how each graph type related the data. This exercise helped students to learn how to select a graph type that best illustrates a problem. Students became adept at applying graphing skills and organizing data. The portfolio assessment indicated that 94% (total number students minus number students, who did not complete/ master graphs, divided by total number students) of eighth grade students mastered the use of spreadsheets to organize data and create graphs (see Table 5). All of the students had generated four graphs for the first problem. Some students had difficulty scheduling time to complete the graphs for the second and third problems. The post performance-based test indicated that 93% of the students attempted the graphing problem (see Table 4). All of those students, who attempted the problem, illustrated mastery of graphing skills by correctly completing the task. Students indicated that 97% of them felt confident in applying their graphing skills (see Table 3). On the post self-assessment, 40% of the students expressed that they were experts and 57% suggested that they were okay at making graphs. Eighth grade students spent many hours beyond class time generating the graphs for their portfolios. Graphing skills were transferred by eighth grade students to seventh grade students during the lab periods. The seventh grade students, who publish a middle school paper, conducted surveys and showed the results in graphs. One science teacher noticed that eighth grade students were more willing to generate a graph, they were less hesitant to start, and they had a better understanding of a graph's interpretation. The science teachers assessed this activity as helpful to students, well-chosen situations, and an excellent idea for teaching data analysis.

Transfer of spreadsheet skills, from organizing science data to organizing currency, was assessed in one activity on the post performance-based assessment. Although students may receive an allowance and spend money, organizing these transactions in a spreadsheet to analyze the flow of money is new to them. Results showed that 63% of the students correctly performed this activity (see Table 3).

Table 6. Portfolio Database Assessment Data

Skill Tested	^{a}n	
Using Databases:		
Total number Assessment Points		100
Number of Incomplete	1	
Number of Mastery	57	
Students Showing Mastery	57 out of 58	

^{a}n: number of students out of 58.

Note: Only 58 out of 103 students included Database assessments in their portfolios.

Students were limited in their experience with databases. Four classes included database assessments in their portfolios. Only 1 out of the 58 students, who assessed their database skills in their portfolio, did not illustrate mastery in the use of the database to organize and manipulate data (see Table 6). Students indicated, in the post self-assessment, that 80% of them were confident in constructing a database and manipulating the information (see table 3).

Assessment of student portfolios indicated that 98% of the students mastered the skills to create slide/overhead transparencies (see Table 5). Only two students did not have completed overheads in their portfolios. The post self-assessment test indicated that only 88% of the students considered themselves to be an expert or okay at creating overheads (see Table 3). When students first thought about creating overheads, they were not aware of the layout design principles that applied to making quality slides/overheads. They experienced using the technology tools of a draw program and applying layout design guidelines. Learning the technicalities involved in developing a good slide, was difficult for eighth grade students and could account for their lack of confidence, indicated by the post self-assessment. The quality of the slides/overheads, produced by the students, however, was excellent.

Six students, who participated and won awards at the Junior Academy of Science Competition or the Capital Area Science and Engineering Fair, were invited to participate in a hypermedia class. The purpose of this class was to instruct students, who excelled in science research, in the use of Hyperstudio (see Appendix B for bibliography). At future competitions it will help students to be prepared with a computer generated presentation that can show pictures, graphs or charts, and illustrations. These students were not students who excelled in the use of technology, although they were very literate in the use of a computer. These students created a multimedia presentation with their research data. The students invested their own time, during a student interest period, which lasted 30 minutes on one day out of every five school days. They also stayed after school and had their parents bring them for a special half-day session and for demonstrations at the district's office. They never lost their enthusiasm for what they were doing. It is important that young students learn to use Hyperstudio or another hypermedia software. Scanned pictures, digitized photos, and QuickTime movies, generated from video clips, are important to presenting information in scientific research. Videos and photos cannot be captured on overheads. The development of QuickTime VR will make three-dimensional models of scientific information possible. Digitized cameras will enhance the presentation of shared research data that can be viewed in multimedia. These students will be comfortable and confident in the generation and use of multimedia presentations. Administrators were impressed with the Hyperstudio presentations created by these students. The students noticed how the use of three-dimensional graphs and pictures enhanced the understanding of their research. Many administrators were enlightened with the ways in which they can use Hyperstudio in their school setting. The presentations of the students, not only furthered their use of technology in scientific research, but they also inspired many innovative uses for hypermedia in the elementary schools and high school. These students were recognized with a Certificate of Achievement signed by the District's Superintendent. Three of the six students participated in a state competition. One student received a second place award. Two students were awarded first place; one student had a perfect score.

Recommendations

Helping students develop technology skills that support learning in other curriculum areas is important to the writer and this practicum. The results of this practicum motivated students to continue their learning beyond the walls of the classroom. Eighth grade students spent many hours in the lab before and after school and during free periods. Students applied the skills to other situations. The activities used technology to integrate math, science, and language arts. Although presentation skills require abstract thought; the support provided by the technology, helped students to develop understanding and build confidence in accomplishing their work.

There are four recommendations offered to readers, who are interested in implementing a similar curriculum in their school setting: allow ample time, provide real-experience learning, integrate curriculum, and create a free-learning environment.

Allow students ample time, both in class and out of class, to work on the projects at their own pace. Many students worked well during open lab periods. This allowed other students to learn from the eighth grade students. It also allowed students, who were friends, to assist each other.

Use authentic or real-experience simulation problems. Develop lessons that use situations tnat are meaningful to students of that age. Catch the interest of students by sharing something that is fascinating about the topic or by relating the topic to other subjects that appeal to students.

Integrate technology with other curriculum areas. When possible, enlist cooperative teaching of projects. If there would have been enough time during the implementation of this project, the science, Home economics, and technology teachers would have developed a unit on plants that grow in space. The idea is to help students learn in an authentic environment that combines various skills and appeal to the interests of as many students as possible.

Create a free environment in which students are encouraged to learn and help each other learn. After introducing concepts, allow students the freedom to learn independently and with each other. Often one student can explain a process to other students in a different manner which promotes understanding. Encourage peer teaching. A student shows mastery of concepts and skills when they teach others. It also builds self-esteem among students. This environment encourages the teacher and students to work together and reduces the stigma associated with the teacher helping only the students, who have difficulty.

Dissemination

The door to the computer lab was always open. The merits of this practicum were disseminated to students and faculty of the middle school, where the practicum was implemented, through the "open-door." Their responses were positive and supportive.

The district's Instructional Technology Coordinator was very interested in the results of the practicum. The coordinator shared the practicum ideas with other faculty and administrators within the district as well as with other school districts. The coordinator commended the free learning environment and real-experience simulation activities. The Hyperstudio presentations, created by six of the students, were shared by the Instructional Technology Coordinator with the technology directors of seven other school districts.

The eighth grade student presentations of scientific research enhanced with Hyperstudio had a great impact on administrators. These are the people who are in a position to advance the use of technology. They were greatly moved by the power of Hyperstudio and the integration of technology in the curriculum, that was demonstrated in this practicum. The response was so positive, that some of them went immediately after the presentation to a computer to see how it worked. They began brainstorming ideas and how teachers can apply the ideas presented.

Presentation of the ideas and accomplishments of this practicum have been shared with others who work with children and youth. Educators, who advance the use of technology, have expressed an interest to learn more about the skills which this practicum developed for middle school students. New science-related technology programs are being developed by the writer, for elementary and middle school students, as a result of this successful experience.

Enhancing the learning of students with the development of technology skills was the underlying solution to this practicum. If the writer has encouraged others to use technology to improve the learning of students, then the labor of this work has been rewarding.

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APPENDIX A

STUDENT SELF-ASSESSMENT AND PERFORMANCE ASSESSMENT

Day Mod Computer #

How would you describe your computer skills:

		EXPERT	OKAY	INEXPERIENCED	DON'T KNOW
1	MAKING GRAPHS:				
2	MAKING OUTLINES:				
3	CREATING OVERHEADS:				
4	USING SPREADSHEETS:				
5	ORGANIZING DATA:				
6	USING DATABASES:				

Show what you know: (This is not graded) Use Microsoft Works.

1. Create a graph using the computer to show comparison of heights:

   Curly (5 meters); Moe (5.6 meters); and Jack (4.9 meters)

2. Create an outline for Sally's work:

   Math - problems page 102; fraction chart

   Science - presentation materials; project

3. Use the spreadsheet to show Mary's budget:

   Allowance: $15 - Jan. 6 & Jan. 20

   Spent: Jan. 7 - $6 for movies

   Spent: Jan. 14 - $3 for lipstick

   Spent: Jan. 21 - $10 for gift for friend

How much money does Mary have left?

APPENDIX B

SOFTWARE BIBLIOGRAPHY

Software used to Teach Technology Skills that
Enhance the Presentation of Scientific Research

The software bibliography is divided into three sections: The first section includes integrated software programs that were used for instruction in this practicum. The Second division names the multimedia software that was used by the special group of students, who created multimedia presentations of their science research. The third division is a list of reference software used by the students during this practicum.

Integrated Software Programs

These programs contain basic tools such as word processing, spreadsheets, databases, communication, and draw.

Claris Works (Version 2.0) [Computer Software]. (1993). Santa Clara, CA: Claris Corporation.

Microsoft Works (Version 3.0) [Computer Software]. (1992). Redmond, WA: The Microsoft Corporation.

Multimedia Software

Multimedia software is a software that can be used to create a presentation, access laser discs or CD-ROMs, or show QuickTime movies. It was used to create a stack of cards, which allowed students to create a presentation that could show charts/graphs or pictures along with recorded speech or sound.

Wagner, R. (1992-1994). Hyperstudio (Version 2.0) [Computer Software]. El Cajon, CA: Roger Wagner Publishing, Inc.

Reference Software

Reference software used for this practicum was of two types. One type allowed students to directly reference the information, which they sought. The second type was a Reader's Guide on CD-ROM that allowed students to search for journals that contained the information, they sought.

Encyclopedia Reference:

Grolier's Multimedia Encyclopedia [CD-ROM]. (1993). Novato, CA: The Software Toolworks, Inc.

Reader's Guide on CD:

Wilson Disc [CD-ROM]. (1995, March - May). St. Paul, MN: The H.W. Wilson Company.