A Transfer of Database Skills
from the Classroom to the Real World

INTRODUCTION

Electronic databases are becoming commonplace. As society becomes more information-oriented, workers need skills that allow them to quickly and efficiently use technology to solve company problems and satisfy customer needs. As database technology expands, issues regarding database size, speed of data access, sorting and searching techniques, and data organization must be addressed.

Since today's students are tomorrow's workforce, millions of dollars have been spent on computer hardware and software for public school use in an effort to develop technologically competent students. Today's students are required to be "computer literate." There are many different definitions of this term, but it generally means that students are required to use the computer as a tool. This tool use usually emphasizes word processing, spreadsheet and database management.

Database technology allows one to easily add, delete, and manipulate data stored in a file as well as analyze stored information. The analysis and manipulation of data involve higher-order thinking skills: analysis, synthesis, and evaluation (Bloom, 1956; Watso, 1988). These skills, described in Bloom's Taxonomy of Educational Objectives, are important because they can help students classify, differentiate, combine separate ideas, contrast and compare information and solve problems.

DEMETRIA ENNIS is Assistant Professor, University of North Texas, 1200 Dallas Drive, Denton, TX 76205.

Computers in the Schools, Vol. 9(2/3) 1993
© 1993 by The Haworth Press, Inc. All rights reserved.
The database is an electronic tool that not only can help instructors teach students to develop and practice these higher-order thinking skills but can provide its user with the opportunity to develop hypotheses, make inferences, test hypotheses, analyze and modify tests of various hypotheses, identify and evaluate data, and draw conclusions. (Vockell & Van Deusen, 1989; Hunter, 1985; & Hannah, 1987).

REVIEW OF THE LITERATURE

Database technology has been used in many classrooms. One elementary school teacher introduced the database and higher-order thinking skills to her third and fourth graders through a two month study of the California Indians (Maidu and Pomo tribes). Children in the class collected information on various tribes’ locations, food sources, tools, clothing, habits and lodging. The data collected by students were assembled and entered into a database which was used to make inquiries about certain tribes.

The teacher held small group sessions at the computer. During these sessions students generalized and searched the database for tribes that satisfied certain criteria. The teacher introduced Venn diagrams into the unit in order to enable students to visualize commonalities and discover relationships that existed between the Pomo and Maidu Indian tribes. The Venn diagrams also helped students make generalizations about tribal locations, clothing, tools, and food sources. After stating generalizations, students verified their generalizations, by searching the class database.

One group of students in the classroom generalized and converted generalizations into if-then statements. These students tested cause-and-effect relationships by locating information in the database (Pon, 1984).

Dudley-Marling and Owston (1988) discovered that students need many opportunities to develop and practice higher-order thinking skills if they are to become good problem solvers. These authors also indicated that real problems confront students in their daily lives and microcomputer applications (database technology) can help students learn effective problem-solving skills.

Another important element in the development of a student's
higher-order thinking skills is the type of instruction the student receives; the instructor must actively teach these skills and provide the student with clear direction and sufficient practice in problem solving. Van Deusen and Donham (1987) found that situations where the teacher interacted with students and the computer tended to promote the development of higher-order thinking skills.

STRATEGIES THAT ENCOURAGE THE DEVELOPMENT OF HIGHER-ORDER THINKING SKILLS

Van Deusen and Donham (1987) suggested that instruction focus on and label targeted thinking skills. Instructors must also have appropriate software. The software should focus on higher-order thinking skills. It should provide levels of difficulty, have many different problems that emphasize the same skills, and provide a cooperative, noncompetitive learning environment. Also, the instructor should be familiar with the software's content and feel comfortable using the software. Van Deusen and Donham (1987) identified the steps teachers should follow to encourage the development of higher-order thinking skills:

1. Question students during problem solving,
2. Demonstrate effective strategies for problem solving,
3. Ask students what they think and how they intend to figure out the answer,
4. Resist the urge to provide "the answer," and
5. Use the computer to test student's suggestions.

In 1988, Watson and Strudler indicated that instructional database activities provided a number of opportunities to help students develop higher-order thinking skills. Students can use a database to store and organize information, generate and answer questions, test hypotheses, and make inquiries. Synthesis, evaluation and analysis are skills that database use fosters. Students can develop these skills by sorting and interpreting data. In order for these skills to have a significant impact on student abilities, effective teaching strategies must encourage their use.
PROBLEM STATEMENT

The purpose of this descriptive study was to compare the problem-solving performance of fourth graders receiving search strategy training with fourth graders who did not receive this training. Both groups of students were compared on the amount of class room time they used and the answers they provided.

Another focus of this study was search strategy training. Students were taught how to use Boolean operators (AND, OR, NOT) in an organized way to manipulate information in the database. It was hoped that this instruction would help students effectively search the database and analyze its contents.

Two hypotheses were investigated during this research:

1. Students with search strategy training will solve a given problem using less class time than students without this training.
2. Students with search strategy training will produce more correct answers than students without this training.

METHOD

The major treatment in this descriptive study was the search strategy training (see Figure 1). This training teaches students to develop an organized plan to combine database fields to answer questions or solve problems that require analysis, synthesis, and evaluation skills.

The participants were fourth-grade students in three different Midwestern elementary schools. Each fourth grader was randomly assigned to one of two groups: a treatment group or a control group. The treatment group received search strategy training and was labeled Group 1. The control group did not receive the search strategy training and was labeled Group 2.

There were three schools designated A, B, and C. The fourth grade class in School A contained a total of 28 students. Each of the two groups in this school contained 14 members. School B’s fourth-grade class contained a total of 13 students. Seven class members were assigned to Group 1 while six students were assigned to Group
Figure 1. A Comparison of Group Completion Times

SST = Search Strategy Training

Group 1 = (SST)

Group 2 = (NO SST)
2. School C’s fourth-grade class had a total of 38 students. Eighteen students were assigned to Group 1, while 20 students were assigned to Group 2. A total of 79 students were involved in this project.

The following procedure was followed at each school:

1. The researcher spent time defining and demonstrating database use and its higher-order thinking skill applications to the teacher.

2. The teacher selected a real world problem from one of the database problems designed by the researcher.

3. Group 1 at each school was given a lesson on search strategy development. The same treatment was applied at each school. Group 2 was not given this instruction.

4. Both groups in each school were given the same real world problem (selected by the instructor). The two groups at each school attempted to solve their problem using AppleWorks software on an Apple Computer.

5. The results of the group performances were recorded by the researcher. The researcher observed student and teacher responses and conducted interviews with participants after the exercise.

6. The researcher recorded the length of time it took for each of the six groups to complete their problem. The answers the groups provided were also collected.

7. The researcher performed the Mann-Whitney-U Test to determine if a significant difference between completion times among samples occurred. The completion time was the length of time each group required to solve the given problem.

RESULTS

The researcher found that students with search strategy training and those without this training gave correct answers to the problems they were given. However, groups with the training tended to solve their problems in shorter time periods than their counterparts. A nonparametric test, the Mann-Whitney-U Test, was used to analyze the data. This test was selected because the researcher had small
groups of varying sizes and the random samples could be ordered. Using this test, the values for \( U^1 \) and \( U^2 \) are computed. \( U^1 \) represents the score for the three groups that received the training. \( U^2 \) represented the score for the three groups of students that did not receive search strategy training. \( U^1 \) is calculated using each school’s treatment group. Thirty-nine students are included in \( U^1 \): 14 from School A, 7 from School B, and 18 from School C. \( U^2 \) is calculated using each school’s control group. Forty students are included in \( U^2 \): 14 from School A, 6 from School B, and 20 from School C. \( U^1 \) and \( U^2 \) should be identical or almost identical if there is no treatment effect (Gravetter & Wallnau, 1985). \( U^2 \) was calculated at .5, while \( U^1 \) was calculated at 8.5. Since these values are not identical or nearly identical, this indicates a treatment effect. See Table 1 for details.

**DISCUSSION**

Several interesting things appeared during this research project. Students’ interpersonal skills and networking aided problem solving, students enjoyed working with the database, and the project gained teacher support and interest.

“Press return.” “Try and . . .” “Press return again.” “That’s it!” “No, it’s not.” “Let’s start again.” These comments and others were made by several groups of fourth graders. The students were trying to build a search strategy on an Apple IIc to find an answer to the database problem they were given. Students observed worked diligently to locate and combine all clues that would lead them to the correct answer. At times the students disagreed with one another. They resolved their differences, exchanged ideas, and modified their approaches to solving the problem.

The interpersonal action between students was interesting. Regardless of the students’ abilities, knowledge levels, and experiences, they worked together. This networking activity was important. Through it students learned from one another and correctly solved the problem they were given.

Clapping, smiling, and feelings of accomplishment were observed when students found the correct answer to the database problem they were given. The students discussed what they learned
and expressed pleasure because they "were right." When group problem-solving with a database produces these types of responses, these types of exercises could make learning new concepts enjoyable and interesting for students. This could lead to greater student achievement and increased student knowledge.

Another observation the researcher documented was teacher support and interest. The three fourth-grade teachers had not attempted group problem-solving activities with the database. The teachers were helpful and eager to participate in this project. They chose one database problem for their students to solve and they wanted to keep the other problems for later use. They felt that the problems were a good way to integrate real world problems into the curriculum and develop higher-order thinking skills.

In this project, the amount of time the teacher spent providing
Group 1 with search strategy training varied. In replication of this study, this time should remain constant in each situation.

CONCLUSION

This research showed that fourth graders can develop search strategies and apply database technology to real world problems. It showed that search strategy training helps fourth graders develop correct answers to problems in a shorter time period than those without the training. This time reduction can efficiently use computer resources and save valuable classroom time.

REFERENCES

Van Deusen, R., & Donham, J. (1986-87). The teacher’s role in using the computer to teach thinking skills. The Computing Teacher, 14(4), 32-34.