NOTE: This publication includes references to computer technologies that are out of date.

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Using Computer Concepts as Problem-Solving Tools in the Language Classroom

From a Curriculum Guide Prepared by
Department of Early Childhood Education
Georgia State University

Compiled by Lorraine Valdez Pierce

Introduction

Many classroom teachers, paraprofessionals, and other school personnel working with limited English proficient (LEP) students face a double challenge. They must find time and means to help these students acquire English proficiency and at the same time help students learn the content area material expected of their age and grade levels. Fortunately, current insights into the process of language acquisition have the potential for influencing instructional practices aimed at LEP students in both English as a second language (ESL) and regular classrooms. Evidence from multi-dimensional, qualitative studies (see reviews by Berko-Gleason and Weintraub, 1978 and Lindfors 1980) suggests that child language development is a strongly interactive process, one which relies not only on specific (and perhaps innate) cognitive and linguistic mechanisms, but also on the child's active participation in a linguistic environment attuned to the child's communicative needs. This communicative view of language development is expressed in many forms today and has been proposed as a set of assumptions and criteria forming the basis for a communicative or natural approach" curriculum (Savignon 1983, Krashen and Terrell 1983, Enright and McCloskey 1985). In communicative/natural approaches, children are seen as learning language as a means of communication. The second language is acquired by purposeful interaction, and acquisition is enhanced by input that is interesting and meaningful to students (Urzua 1985, Dulay, Burt, and Krashen 1982).

Input can be of various types: linguistic and nonlinguistic, internal (cognitive, affective) and external (social, environmental). For LEP children, meaningful input can be provided through a comfortable classroom environment which encourages and rewards efforts at communication and focuses on the meaning of utterances rather than on their form. Errors are treated as a normal part of the language acquisition process. Because this communicative approach is holistic and integrative, it can be used as an effective option for integrating ESL and content area instruction. Communicative lessons which teach language through content and require active student participation can be designed.

Activities

This NCBE Program Information Guide has two purposes: (1) to provide teachers a communicative teaching unit that integrates instruction in language, math, and computer skills, and (2) to present a model for integrating other content areas (e.g., science and social studies with ESL) in developing classroom activities. The lessons in this field-tested unit present computer concepts as problem-solving tools and actively involve students in the learning activities process. Activities include many opportunities for children to play games, to

move freely about the classroom, dramatize, create art work and other constructions, cook, and manipulate materials. Different learning techniques, such as large and small group activities and learning centers for independent work are used. In addition, field trip ideas have been provided to help bridge the gap between classroom learning and the real world and to provide students with motivating experiences as they learn about their new culture and language.

To help students achieve full literacy, the activities in this guide use a whole language approach, including many and varied reading experiences and opportunities to develop writing skills. A whole language approach takes into account the whole learner and builds oh his or her total array of skills and abilities (Goodman 1986). The focus of instruction in the whole language approach is on meaning and not on language for its own sake. Activities revolve around specific content in a real setting and not around language in an abstract form (Hamayan and Pfleger 1987).

Although the curriculum objectives have been designed to help students achieve math objectives of the Georgia Basic Curriculum, they have been left flexible for increased adaptability by local school districts and classroom teachers across the United States.

This Guide was designed as an introduction to computer concepts and database management. Activities begin with a review of math terminology and progress to organizing and categorizing number sets. Students then learn how to create a database of numbers and apply this database to solve problems.

Nine activities are presented, beginning with games which introduce and reinforce math vocabulary and problem-solving strategies (Activities 1 and 2) and ending with actual hands-on practice at the computer (Activities 8 and 9). Lessons progress gradually from review of math concepts such as whole number subsets e.g., even numbers, squares, multiples, and greater than/less than to classification and categorization of number sets (Activity 3).

The concept of organizing data to form a database is introduced in Activity 4. In this lesson, students are presented with basic database terms, such as data, field, record, and database. Students are actively engaged in arranging numbers and information about numbers (e.g., odd, even, divisible by 3) in order to solve mathematical problems.

In Activities 5 and 6, students are guided in the use of a database to organize and manipulate specific lists of numbers. As they participate in these activities, students develop strategies to solve a variety of number logic problems. Activity 7 includes a game which involves the actual application of a database in problem-solving.

Activities 8 and 9 are optional and provide practice in designing a database on a computer and searching this database to solve problems. Gradually, students begin to understand that when large amounts of data are required to solve a problem, a computer's capacity to instantly analyze the data makes it an essential tool.

Each activity includes recommended grouping and teacher role, a list of materials needed, detailed procedures, suggestions for evaluation, and possible extensions of the activity. Two glossaries, one of mathematical terms and one on database terms, are provided as appendices. Suggested references and classroom resources are also provided.

In all of the activities, the teacher introduces the concepts to the whole class, and then reinforces and extends these concepts in small groups, in a learning center, and through homework activities. Lessons encompass hands-on manipulation of objects and numbers, debate, dramatic expression, graphing, and the use of computer database software, if available.

All of the objectives for math, computer science, and language learning are listed in the "Objectives" section of the guide. Next to these lists are grids to indicate which lessons cover each concept. For example, the

mathematics objective, "uses deductive reasoning in manipulating organized list," is in all activities except Activities 1 and 2. On the other hand, "using data-base software," is only covered in Activities 8 and 9.

The following is a list of the lessons:

Vocabulary/terminology games

1. You bet your life
2. Twenty questions

Whole numbers and subsets

3. The dilemma of the boxes

Databases

4. Organizing data
5. Solving problems
6. Expanding the database
7. Hit the jackpot game

Access to computers

8. On the computer
9. Solving problems the computer way

OBJECTIVES
Grades 4-6

Activities									Objectives
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**MATHEMATICS**
		*	*						Interprets and uses ordinal numbers to 12th.
	*	*	*	*	*	*	*	*	Compares and orders whole numbers and fractions.
	*	*	*	*	*	*	*	*	Adds, subtracts, multiplies, and divides with whole numbers.
			*	*	*	*	*	*	Selects appropriate operation for a given problem situation.
		*		*	*	*	*	*	Plans the solution for simple word/logic problems with one, two, or more operations.
	*	*	*	*	*	*	*	*	Uses deductive reasoning in manipulating organized lists.
	*	*		*	*	*	*	*	Determines a missing number from a set given a rule.
		*		*	*	*	*	*	Identifies place value for a given digit in a number.
		*	*	*	*	*	*	*	Collects quantitative data by measuring and reading charts and graphs.

Activities									Objectives
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**COMPUTER SCIENCE**

		*	*	*	*	*	*	*	Demonstrates skill in processing information using a database.
*	*		*	*	*	*			Demonstrates an understanding of. the meaning of database terms.
			*		*		*		Creates a database using sets of numbers. Collects and writes information in a database.
			*						Determines data for extending a database.
				*		*		*	Demonstrates skill using the database to search records to solve systematically logic problems of varying degrees of difficulty.
				*		*		*	Determines the correct category or field on which to search records in order to solve a problem with a database.
				*		*		*	Determines the best conditional relation to use in a record search in order to solve a problem with a database.
				*		*		*	Decides on comparison information for a record search in order to solve a problem with a database.
							*	*	Demonstrates an understanding of the specialized uses of database software.
*	*						*	*	Demonstrates an understanding of the meaning of database terms specific to database software.
							*	*	Using database software, creates a database using sets of numbers, collects and writes information in a database, searches records systematically to solve logic problems of varying degrees of difficulty.

Activities									Objectives
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**LANGUAGE**
*	*	*	*	*	*	*	*	*	Participates in oral activities as an active listener in the environment.
*	*	*	*	*	*	*	*	*	Listens and responds to language presented orally for the purpose of gathering information arid following directions of one or multi parts, making judgments, recognizing cause and effect relationships, recognizing sequence of events, drawing conclusions, arid making comparisons.
*			*	*		*	*	*	Defines and interprets a word by example, description. and through comparison and contrast.
*			*	*		*		*	Develops meanings for new words through experiences.
*									Classifies words in the context of everyday situations.
	*			*		*		*	Interprets syntactic relationships in the context of both academic and everyday situations.
*		*		*	*	*	*	*	Uses conventional language patterns.
	*			*		*	*	*	Demonstrates a variety of ways to communicate and describes experiences clearly including dramatic, oral, written and artistic

									presentations.
*	*	*	*	*	*	*	*	*	Understands and uses a functional vocabulary related to the environment.
*	*	*	*	*		*	*	*	Uses elaborated language to describe experiences and environment.
		*	*	*	*	*	*	*	Interprets and follows written instructions and labeling information.

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1. YOU BET YOUR LIFE

You Bet Your Life can be played with any lesson throughout this unit in order to reinforce math or database vocabulary. The game can be varied and continued throughout the year to build vocabulary.

Procedures:

Large group, teacher directed
Small groups
Center activity

1. Have you ever seen Groucho Marx, who hosted "You Bet Your Life?" During the course of the show there was always a Magic Word known to Groucho's "behind the scene" co-worker. If, in the course of playing the game, a player said the Magic Word, a duck puppet would drop down, bells would ring, music would play and the contestant would win money. Then the word would change and play would continue.
2. Don your Groucho costume and explain to students that as they work throughout the day, you will be listening to hear if they use the new words they have been learning. Choose a list of "Magic Words" for the day, and write them on a chart.
3. Assign a student to be Groucho's assistant and listen out for the "Magic Word" at the top of the list. When it is used, the assistant plays the recording or toots a horn and waves the duck puppet to catch the attention of the class. Then he/she writes the Magic Word on the class graph next to the name of the student who said it. The next word on the list becomes the new "Magic Word" and play continues.
4. Refer to the graph frequently to reinforce important terminology and motivate students to use new language.

Evaluation:
Use the graph to evaluate student progress in learning and using vocabulary.

Materials:

- Groucho Marx glasses, nose and moustache.
- Lists of "Magic Words" from various lessons.
- Magic "Duck" puppet or doll.
- Tape recording of bells, buzzers, and musical phrase (optional).

- Class roll graph (see example).

Duck Words

Name						

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2. TWENTY QUESTIONS

Twenty Questions is an old favorite of many teachers. The game fits easily into these lessons and reinforces both math terminology and problem solving strategies.

Procedures:

Large group, teacher directed
Small groups

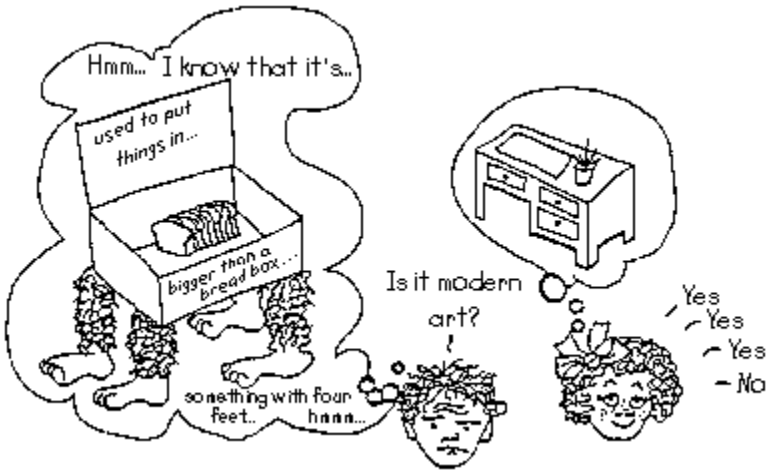
1. Secretly determine a number such as 16 and say: "I'm thinking of a number." Students must try to guess the number by first naming possible sets to which the number belongs, such as: Even, Multiple of 4, Square and Square Root. When the students guess a set the teacher must answer only "yes" or "no." Then, from the answers given, students may try to name the number.
2. Students may ask up to, but not more than, 15 questions about the mystery number and may make 5 direct guesses. Questions must be phrased so that they can be answered only by yes or "no." Questions should also progress from general to specific. For instance, "Is the number a multiple of 5?" should be one of the first questions, whereas, "Is the number 15?" should be one of the last.
3. As your students progress through this unit, their expanding language and mathematical skills should allow them to take over the leadership of this game.

Evaluation:
Observe the level and quantity of questions asked by students, as well as their ability to correctly guess the answers, and their assumption of leadership roles.

Extension:
By changing the types of questions, this game can also be adapted to computer terminology and usage. For example, begin a game with "I'm a part of a database:" and students can ask questions to determine what you are. The one essential rule--asking questions that can be answered only by a "yes" or "no"--should still apply.

Materials:

- None



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3. THE DILEMMA OF THE BOXES

Before beginning this lesson, remind students of the number families that are subsets of the set of whole numbers. Set concepts such as "divisible by" or "even" or "square" are very important to this unit. You and your students may wish to read the book *Number Families* by Jane J. Srivastava.

Procedures:

Large group, teacher directed
Center activity

1. On the chalkboard write this pattern: 1, 9, 25, 49. Ask your students to add three more numbers to the pattern. Ask them to explain the logic they used to generate these numbers and then as a group to decide on a name for the pattern, "square numbers that are odd" or "uneven squares." Ask students to think of more sets of numbers that are named by more than one attribute, such as "even multiples of five" or "numbers greater than 10 that are odd and multiples of three."
2. The goal of the box activity is for students to use classification to solve problems. Tell students that they are going to use the same idea they just employed to solve "The Dilemma of the Boxes." Help students define the term "dilemma" if necessary.
3. Before beginning this problem, set up your classroom:
   Label four sets of seven boxes or cards in the following manner:

A. 1112, 1324, 1568, 1030, 1998, 1002, 1754
B. 9, 49, 81, 169, 9, 25, 121
C. 105, 195, 150, 135, 115, 185, 120
D. 17, 19, 29, 31, 2, 3, 11

4. Place the first four boxes or cards of set A on the first shelf, set B on the second and soon. In each box of set A place one poker chip. If you are using cards and a pocket chair, tape chips to the backs of cards. All the chips in set A should be the same color. Put chips in each box of the remaining sets, using a different color chip for each set. This will make the problem self-checking. Keeping the chips hidden, mix up the last three boxes or cards of each set and pile them all on the floor.
5. Prizes of all kinds -- stickers, plastic charms, free reinforcers (such as a chance to tell the class a joke or five minutes of library time) -- can be used as consequences for correctly shelving the boxes. Prizes can be determined by coordinating them with the chip colors.

6. Show your students the dilemma. Tell a story about the boxes, e.g., you are a shoe salesperson and the store was so busy you didn't have time to put the shoes away. Now they are all mixed up. You tried to put the boxes on your shelves, but have forgotten how the shelves are organized. You need help remembering so that these other boxes can be shelved.
7. Have students look at the numbers on the shelved boxes in order to determine the set(s) to which those boxes belong. Have students sort and shelve the mixed up boxes according to their set names.

The sets of boxes that go on each shelf are:	Shelf A. Even numbers > 1000 and < 2000 Shelf B. Odd, square numbers Shelf C. Multiples of five > 100 and < 200 Shelf D. Prime numbers

8. While solving the problem, emphasize ordinal numbers and the following mathematical terms: even/odd, greater than/less than, multiples, squares, primes/composites, sets, and ones, tens, hundreds, thousands.
9. Students can find out if their boxes are correctly shelved by checking to see that all the boxes on each shelf contain the same color chip.
10. When you are finished with the problem, tell your students that they will be "paid" for their work. Then jumble the boxes in a pile, allow students to randomly choose a box. His/Her "paycheck" is then matched to the rewards you have decided upon. Change the numbers on the boxes and repeat this problem as a center activity.

Evaluation:
Observe the strategies that students use to analyze and determine sets.

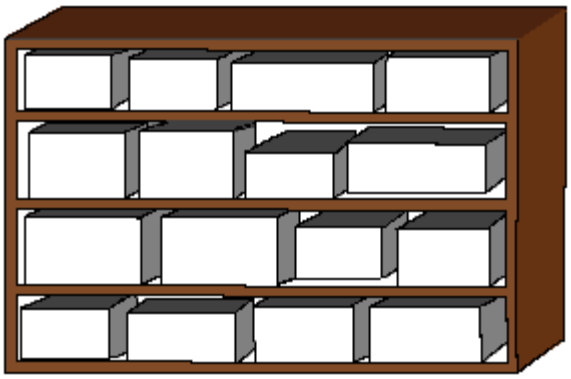
Extensions:

1. Change the number labels on your boxes or cards so that students can play this problem as many times as they like in a center or in small groups. Prepare sheets with box problems for Homefun***** or for use in a math learning center to reinforce the use of sets to solve problems.
2. Set up a "Classification Center." Provide groups of items for students to sort into categories according to given attributes. Place several items in a bag that "belong" together because of a particular characteristic and include one which does not "belong." Have students decide on a classification system for a group of items and challenge their classmates to come up with the attribute(s) upon which the system is based.

***** Homefun refers to activities to be done at home.

Materials:

- Bookcase, shelves, or pocket chart with at least four levels.
- Boxes that fit into your bookcase, shelf or cards for your pocketchart--at least four per level.
- Chips or squares of paper for each box in at least four different colors--these colors are matched to prizes or rewards.



4. ORGANIZING DATA

This lesson plan introduces the concept of databases and database components. An exciting enhancement to this lesson might be a field trip to a bank or other business that uses computer databases. Ask for a demonstration of the fields and records that the business uses in its work.

Procedures:

Large group, teacher directed
Small groups

1. Remind students that to solve the problem from the previous day they needed to consider specific lists of numbers defined by patterns such as "divisible by 5" or "square numbers." Tell them that the large table on the wall is a database template skeleton in which they are going to arrange numbers and information about numbers in order to solve some interesting problems with ease (see Database Bulletin Board).
2. Indicating the column marked "Wh#," tell students that this is a "field" called "whole numbers that are less than 26." Help students who are familiar with the term "field" see that it has a new mathematical definition. Write "17" on a card and place it on the first row of the column saying, "This is a data entry in the field 'whole numbers less than 26."' Ask a student to give you another data entry that would fit into this field. Write it on a card and place it in the second row of the field. Continue in this manner, emphasizing the words "data entry and "field."
3. As you get toward the end of your stack of cards, students will find it more difficult to come up with data entries that have not been used. Suggest that arranging the data entries in an orderly manner would be helpful. Let them rearrange those numbers already entered, and then finish filling in the field, with 1 in the first box and 26 in the last.
4. Tell students that this database has other fields besides "Wh#." Ask them to look across the top of the database and name them. Data entries across a row all belong together and are called a "record." Each record has data entries in every field.
5. Ask students to help you enter the data for the record "10." Say, "The first field is 'even.' Does the number 10 belong to the set of even numbers?" The students will tell you "yes" and then you will place a "yes" card in the correct data entry space. Say, "The next field is 'divisible by 3.' Does 10 belong to the set of numbers which are divisible by 3?" Your students will say "no" and then you will place a "no" card in the correct data entry space. Continue in this manner until the entire record is filled in. Emphasize the words "record," "data entry," and "field."
6. "Yes" and "No" are the entries for all data except in the fields called "Squ# (Number Squared)" and "#Cube (Number Cubed)." In these fields place the correct numerals, such as "100" and "1000" for the

record "10."
7. Work through the record "0" in the same way, but let the students fill in the entries across the row.
8. At this point your class can fill in the remaining records of the database. Depending on the size of your group and their abilities, assign the completion of the remaining records to individuals or groups.
9. Use the following terms for "You Bet Your Life" during the week: field, record, column, row, database.

Evaluation:
Observe students for the accuracy with which they fill in the database and the number of words that appear in the "You Bet Your Life" chart.

Extensions:
A database of the class is an interesting activity. Create a poster-sized database chart of your class. The first field is "Name" and the other fields include interesting categories of data about your students, such as "birthdate," "country of origin," etc. Each student should fill in the record that begins with his/her name.

Materials:

- Database Bulletin Board
- 364 small blank cards that fit the columns and rows of the database skeleton.

DATABASE BULLETIN BOARD: This bulletin board should be at least 6 feet x 4 feet. Use colored paper for the overall background. Alternate two or three different pastel shades of paper for the columns. Use a dark color (black or dark blue) for the numbers, lettering, and lines. Pictured below is the beginning of a database with only 5 rows. On a piece of paper design a similar database skeleton with as many rows as possible. This database skeleton can be made into a transparency for use on the overhead projector and into individual student copies.

NUMBER DATABASE

WH#	EVEN	DIV3	DIV4	DIV5	DIV7	DIV8	DIV9	PRIME	SQU	#SQU	CU	#CU	PALI

5. SOLVING PROBLEMS

Often young students find answers to simple problems, but cannot explain how they arrived at these answers. The use of this database teaches students to organize and manipulate specific lists of numbers as they develop strategies to solve a variety of logic problems.

Procedures:

Large group, teacher directed
Small groups, teacher available

1. Present your students with the following "Magical Mystery Number" problem: "I am the only 2-digit,

odd, composite number less than 20."

2. Ask the students to determine the sets of organized lists needed to solve the problem. These will include
    a. all 2-digit numbers;
    b. all odd numbers;
    c. all composite numbers; and
    d. all numbers that are less than 20.
3. Of the 4 possible fields, the easiest to search is "whole number less than 20." Poster #1 lists all fields, poster #2 lists all relations, and poster #3 asks for comparison information. As you walk students through this process, from poster #1 they will choose "Wh#" as the field to search; from poster #2 they will choose "less than" as the appropriate relationship; and for poster #3 they will enter "20" as the number to be compared (see Record Search Posters, next page).
4. A student, acting as the computer, will place a red push pin to the left of each record that satisfies the sentence, "Whole Number is less than 20." There should be push pins next to the numbers 0 through 19.
5. Now walk students through the process once again to search all the red records for those that are "odd". From poster #1 they will choose "even" as the field to search; from poster #2 they will choose "is equal to" as the appropriate relationship; and for poster #3 they will enter "no" as the necessary entry.
6. A different student, searching only the red records, will place a yellow push pin to the left of each red record that satisfies the sentence, "Even equals No." There should now be push pins next to the numbers 1, 3, 5,6,9, 11, 13, 15, 17, and 19.
7. Now search all the red/ yellow records for those that are "composite." From poster #1 choose "prime" as the field to search; from poster #2 choose "is equal to" as the appropriate relationship; and for Poster #3 enter "No" as the necessary entry.
8. A third student, searching only the red/yellow records, will place a blue push pin to the left of each red/yellow record that satisfies the sentence, "Prime equals No." Red/yellow/blue push pins will be next to 9 and 15.
9. Tell the students that there are no more colors of push pins. It is now up to them to search the red/ yellow/blue records for the answer to the problem. The fourth set is 2-digit numbers. Therefore 15 is "the only 2-digit, odd, composite number less than 20."
10. From "Tangled Problems" choose several problems that can be solved with this database. Divide the students into small groups, pass out copies of the three problem solving posters, and assign an appropriate problem to each group. As students discuss strategies, advise and encourage them.
11. Have students reassemble to dramatize their solutions on the database. Play "You Bet Your Life" during these dramatizations using the terms equals, is greater than, is less than, comparison, data, even/odd, multiples, squares, sets, field, prime/composites, record, entry, and database.

Evaluation:
Observe students' solutions, strategies, and use of terms.

Extensions:

1. Send home problems the students have solved in class to try out on their families. Be sure the students are comfortable with the explanations of the solutions so that they can share them with their parents.
2. If you have created the classroom database suggested in "Organizing Data," Extension #2, create "Who Am I?" problems using fields from the database chart. Students will search the fields as they did above to find the person or persons who fit the mystery descriptions. Have red, yellow, and blue sticky dots available to use instead of push pins.
3. Make up a BINGO game with the database categories. Use cards ruled off in inch square grids. Put whole numbers from the large database in each square in random fashion. The caller names numbers to be covered by naming categories, relations, information. For example: "Under the B column, a number that is even and divisible by 5." Using the large database as a reference students decide on the number

or set of numbers that can be covered and search their card for those numbers.

Materials:

- Push pins or dot stickers in 3 different colors, at least 25 each.
- "Tangled Problems" (Appendix C).
- Record Search Posters and dittos (see sample on. next page).

RECORD SEARCH POSTERS

#1	#2	#3
FIELD TO SEARCH 1. WH# 2. EVEN 3. DIV3 4. DIV4 5. DIV5 6. DIV7 7. DIV8 8. DIV9 9. SQU 10. SQU# 11. CUBE 12. CUBE# 13. PRIME 14. PALINDROME	RELATIONSHIP 1. equals 2. is greater than 3. is less than 4. Is not equal to 5. is blank 6. is not blank 7. contains 8. begins with 9. ends with 10. does not contain 11. does not begin with 12. does not end with	COMPARISON INFORMATION N/Y _

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6. EXPANDING THE database

In this lesson, students increase the usefulness of their database by completing the records for numbers to 100 and beyond. As they work together to fill out their new records, they will use a wide variety of mathematical terms and will discuss computation strategies and results.

Procedures:

Small group, teacher directed
Independent work at center

1. Divide the students into small groups of 2 to 4 each.
2. Give each group a copy of the database template. A set of 25 whole numbers should be listed on each group's template. Group 1 should have numbers 26-50. Group 2 should have 51-75, etc. Help each group begin to fill in its database.
3. At a math center at which there can be found manipulatives such as pebbles, cuisenaire rods, tables found in dictionaries or encyclopedias, and calculators, each group must fill in the database for its set of

numbers, just as the whole class did for the numbers 0-25.
4. When all group databases are completed, groups should trade databases and check to verify the accuracy of the data.
5. Give each group 26 of the large strips, each strip representing one record (or row) of the database. On one strip the database field titles should be written. The other strips should be filled in with the data.
6. Play "Twenty Questions" using the expanded database.

Evaluation:

Use the database records made by the students to evaluate students' understanding of the database, use of the properties of numbers, and knowledge of unit terminology.

Extension:
In your center create a new database chart on cars. Include fields such as make, color, year, number of doors, roof type, and foreign or domestic. Have students fill in the database for the car(s) their families own. Reproduce the chart, and suggest that students keep copies in their family cars. As they travel around the neighborhood, students can fill in records on the cars they see. When students have filled in records for ten cars they can enter these new data into the class database.

Materials:

- Ditto of the database Template.
- Strips of poster hoard, approximately 1 inch x 22 inches, marked off into fourteen 1.25 inch sections with one 43 inch section at the end (26 strips per group).

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7. HIT THE JACKPOT

A classroom game show provides painless practice in using the database to solve problems!

Procedures:

Large group, teacher directed
Small groups of 34

1. Prepare the class for this lesson in advance. Divide your students into several groups of three or four. Try to balance the groups by language proficiency. Have them decide upon at least three fields of a personal database to which they all belong. From this information let each group decide upon a name for its team.
2. Have the teams introduce themselves by using three sentences that describe the set of team members, such as "All members of our team are super soccer players;" "All members of our team are taller than 4 feet;" and "The names of all members of our team begin with the first 10 letters of the alphabet."
3. Prepare the classroom before the students enter. Set the "stage" to look like a television game show in front of the Record Search Posters. At center stage place a table and chair on which sit a fancy box and the timer. Have a chalkboard or chart paper accessible to the table. Facing the table set up chairs and tables for panels of contestants composed of teams of 3 or 4 students. Each team should have a heading strip and set of Records. From "Tangled Problems" choose those which are appropriate to your students and, on separate strips of paper, write out as many problems as there are teams. Jumble them up in the box.

4. Don an appropriate "host" costume, perhaps a top hat, bow tie, or glitters and bangles, and introduce yourself as the "Magnificent Host" of "Hit the Jackpot." Call out the contestants and have members of each team introduce themselves.
5. Explain that in order to play "Hit the Jackpot," the teams must guess the identity of the Magical Mystery Number by searching the number database. These records are located in separate stacks at each station and will be used to help contestants find the answers they seek.
6. To begin, ask Contestant Team #1 to identify the first Magical Mystery Number. Randomly choose a problem from the box and write it on the chalkboard for the contestants to see. Read the problem aloud for the "television audience."
7. Team #1 must identify, from the Record Search Posters, the three fields to search and the relations and comparison information to use with each field. Write its choices on the chartpaper.
8. After Team #1 has determined fields for record searching, all teams must search their database strips for records that satisfy the first conditional sentence and place them on the Record Search Posters. Team #1 must then direct the host to mark those records which fit the second conditional sentence and delete those which do noL Repeat this process for the third conditional sentence.
9. Team #1 then has two minutes for any eye searching or calculations necessary to arrive at a final solution. Let a student set the timer and count down the final thirty seconds in 5 second intervals. At the end of team #1's searching and figuring, members must name the Magical Mystery Number.
10. As soon as Team #1 has finished, Team #2 gets its problem and the game continues until all teams have had a chance to identify a number. Prizes or awards can be determined according to your own judgment. This game can be played often with many different problems. As the teams progress, allow students to take turns playing the role of host or hostess and add "You Bet Your Life" to the game.

Evaluation:
Observe team introductions for students' use of language forms such as those used in making introductions. Observe students' discussion of problem-solving strategies, and the success of their solutions. Continue to use the "You Bet Your Life" chart to assess students' use of terms.

Extensions:

1. Send home more problems that students have solved in class to try out on their families. Be sure the students can explain the solutions to their parents.
2. Once the automobile database is completed, questions about the cars of your community can be answered in the same way questions about numbers are answered above. Survey the group for questions, determine the fields to search and the best relation to use for the search. Create graphs of the information and/or a display to share with the rest of the school. Reports on the cars which turn up most often in the search may be included.

Materials:

- Record Search Posters.
- Record strips 0-26.
- Record and field strips from previous lesson.
- "Tangled Problems" (Appendix C).
- Kitchen timer.
- Chart paper or chalk board with these headings:
  CATEGORY RELATION INFORMATION

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8. ON THE COMPUTER

This lesson is optional, and if used should be spread over a period of several days. Using it depends on easy access to computers and database software, and on your willingness to play with the machines. Use the following procedures with the manual which goes to your software.

Procedures:

Large group, teacher directed
Small groups at computer center

1. Before beginning this lesson you should create and save a database on your computer called "Whole Numbers" using the data and fields from the previous lessons. Following your manual, create posters of the screens and directions for creating a database and filling in records.
2. Explain and demonstrate the commands needed to create the fields for the number database on the computer. Pretend you are the user and let students guide you in filling in the fields on your database poster.
3. On the chalkboard demonstrate the computer's instructions for creating fields and for entering new records. Let the students direct you as you enter your records.
4. Having decided on the final number of your computer database, give student teams equal sets of numbers to be entered into the "Whole Numbers" Database. These sets should begin where your computer database ended.
5. Briefly review the mathematical formulae or actions needed to determine the data for the numbers on the students' lists. Let students begin working at the calculation center to fill in their database records.
6. When this work is completed, instruct each group to determine who will perform the necessary data entry tasks at the computer. Direct the groups to create a database file on their computers called "Whole Numbers" Database. These sets should begin where your computer database ended.

Evaluation:
Check students' accuracy and independence in completing databases, listen for their use of vocabulary and forms in conversations with peers. Notice how well they help one another in pairs and small groups.

Extension:
Ask groups of students to create folders of instructions for all the commands and screens used with your database. These can be used with other classes or for a "sharing night" at which parents are taught about computers and databases.

Materials:

- Record Search Posters (See Activity 5).
- Ditto of database table (See Activity 4).
- Computers.
- Database Software, for example:
    - Appleworks for the Apple Computers
    - PC Files for most PC's, Apples & Macintosh, TRS 80 & 128
    - Data Manager for Commodore 64 and 128.
- Check Stuart Brand's *The Whole Earth Software Catalogue* for others.
- Calculation Center.

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9. SOLVING PROBLEMS THE COMPUTER WAY!

The previous lesson is a prerequisite for this lesson. Students begin to see that when a great deal of data must be searched to solve a problem, the computer's ability to handle massive amounts of data with lightning speed makes it an invaluable asset.

Procedures:

Large group, teacher directed
Small groups at computer

1. Before beginning this lesson, follow your database manual in order to arrange and clip together all of the student databases into a large database called "Whole Numbers."
2. Explain and demonstrate to the entire class the commands needed to search records and print reports. Assign the roles of User, CPU (Central Processing Unit), and Output to various students. Using the Record Search Posters for selecting and printing records and several record strips from the previous lessons, sImulate the computer's commands and actions needed to create and print the solution to a problem. Solve several problems in this way. Play "You Bet Your Life" using as "secret words" the specific commands of your database software.
3. Solve some of the same problems that students previously solved manually. Help students compare the amount of time that solving the problem takes manually and the time it takes using the computer.
4. At the computers, give each group a set of forms for creating reports, searching records, and printing reports. Give each group several problems to be solved. Direct each group to open the database, load "whole numbers," and solve the problems. As teams create and print out their reports, provide assistance and encouragement.
5. Ask groups to present their problems, reports, and the steps they followed to reach their solutions. In this way they can discuss the wide variety of steps one can follow to solve a problem.

Evaluation:
Observe students' discussion, and assess their computer solutions. Note which students are willing to present group information to the class. Interview individual students who are reluctant to speak before the group to assess their understanding of the problem solving steps when using a database.

Extensions:

1. On a bulletin board create a large crossword puzzle composed of number problems that can be solved by searching the database. Assign parts of the puzzle to each group for solutions. As solutions are found, students can put them on the board. Groups with interlocking solutions may find that they disagree and will then have to help one another with solution steps until agreement is reached.
2. Make a ditto of a word search puzzle using the important mathematical words and field titles such as **Divisible by 5**, **Square Root**, or **Digit Sum**.

Materials:

- Record Search Posters (See Activity 5).
- Ditto of database table (See Activity 4).
- Computers and database software.
- Completed Database "Whole Numbers" - 1 per computer.
- Problems to be solved by the Database.

Appendix A:

GLOSSARY OF MATHEMATICAL TERMS

Attribute - A defining quality or characteristic. Example: An attribute of a car would be its color.

Composite - A number that has more than two factors; not prime. Example: 15 is a composite number, since its factors are 1, 3, 5, and 15.

Counting Number - The infinite sequence of numbers beginning with 1; all whole numbers except 0.

Cube (cubed) - 1. The resulting product when one number is used as a factor three times. 2. The process of multiplication through which one number is used as a factor three times. Examples: 27 is a cube (9 x 9 x 9), 8 is a cube (2 x 2 x 2).

Cube Root - For any number A, the number that when multiplied by itself twice equals A~ Example: The cube root of 8 is 2, since 2 x 2 x 2 = 8.

Denominator - The expression below the line in a fraction. Example: 2 is the denominator in the fraction 1/2.

Difference - The result of subtracting a smaller value from a larger value. Example: 3 is the difference between 5 and 2.

Difference of digits - The result of subtracting the value of a smaller digit from that of a larger digit. Example: The difference of the digits in both the numbers 83 and 38 is 5.

Digits - The symbols of numerical value that compose a number system: 0, 1, 2, 3, 4, 5, 6, 7, 8, 9. There are only ten digits and they may occupy any place value. Example: The number 56 has two digits - a 5 and a 6.

Even - Any whole number evenly divisible by 2. Example: 2, 4, 6, 8 and 10 are the first five even numbers.

Factor (of a number) - A number that divides a given number, producing a whole number quotient. Example: Factors of 12 are 1, 2, 3, 4, 6 and 12.

Factors (proper) - All factors of a number, excluding 1 and the number itself. Example: The proper factors of 12 are 2, 3, 4 and 6.

Fraction (improper) - A fraction in which the numerator is greater than the denominator. Example: 4/3, 12/2, 9/5 are improper fractions.

Fraction (proper) - A fraction in which the numerator is less than the denominator. Example: 1/2, 5/9, 13/8 are proper fractions.

Fraction (unit) - A fraction in which the numerator is 1. Example: 1/2, 1/8, 1/0 are unit fractions.

Hundreds' digit - In decimal notation, the digit in the third place from the right. Example: S is the hundreds' digit in all four of these numbers: 1543, 11542, 532, 3582.

Mixed number - A numeral composed of a whole number and a fraction. Example: 3 1/3 is a mixed number.

Multiple (of a number) - The result of multiplying a given number by another number. Example: 15 is a multiple of 5, since 5 x 3 = 15.

Numerator - The expression above the line in a fraction. Example: 1 is the numerator in the fraction 1/2.

Odd - Any whole number not divisible by 2. Example: 1, 3, 5, 7 and 9 are the first five odd numbers.

Palindrome (palindromic) - A number whose value is the same when read left to right as it is when read right to left. Example: 12321 is a palindrome; 333 is also palindromic.

Prime - A number that has only two factors - 1 and the number itself. (1 is not a prime.) Example: 2, 3, 5, 7, 11 are the first five primes.

Prime factors (of a number) - Of any number A, the prime numbers that will divide A. Example: The prime factors of 30 are 2, 3, and 5.

Primes (twin) - Two prime numbers that differ by 2. Example: 17 and 19 are twin primes; 41 and 43 are twin primes.

Product - The result in a multiplication problem. Example: 14 is the product of 2 x 7.

Product of digits - The result of multiplying all the digits in a given number. Example: 24 is the product of the digits in the number 46; 30 is the product of the digits in the number 253.

Quotient - The result in a division problem. Example: 3 is the quotient of 18 divided by 6.

Quotient of digits - The result of dividing the value of a larger digit by that of a smaller digit. Example: The quotient of the digits in the number 93 is 3.

Set - Collection of items related by a common attribute. Example: All children born in the month of May are a set defined by the attribute of birth month.

Simplest (lowest) **terms** - The expression of a fraction in which all factors common to the numerator and the denominator have been divided out. Example: 6/8 = 2 x 3/2 x 2 x 2 = 3/4; 3/4 is expressed in simplest terms.

Square (squared) - 1. The resulting product when one number is used twice as a factor. 2. The process of multiplying a number by itself. Example: 4 is a square, since 2 x 2 = 4.

Square root - For any number A, the number that when multiplied by itself equals A. Example: The square root of 9 is 3, since 3 x 3 = 9.

Sum - The result of addition. Example: 8 is the sum of 5+3.

Sum of digits - The result of adding all the digits in a given number. Example: 8 is the sum of the digits in the number 134; 6 is the sum of the digits in the fraction
11/13.

Symmetry - Equal correspondence of opposite sides, divided by a central line. Tens' digit - In decimal notation, the digit in the second place from the right. Example: 1 is the tens' digit in all three of these numbers: 12, 517, 18, 319.

Thousands' digit - In decimal notation, the digit in the fourth place from the right Example: 3 is the thousands' digit in all four of these numbers: 13,442; 3,567; 33,532; 2,343,782.

Unique - Different from all others; consisting of one.

Units' digit - In decimal notation, the digit in the first place from the right. Example: 2 is the units' digit in all four of these numbers: 2, 42, 432, 3782.

Whole numbers - The set of Counting numbers and 0.

Adapted from:
Gregory, John and Seymour, Dale. (]978). ***I'm A Number Game.*** *Creative Publications: Palo Alto, Ca.*

Appendix B:
GLOSSARY OF database TERMS

Comparison Information: Data used to discover relationships for record selection.

Data: Information organized for analysis or used as the basis for a decision.

Database: A computer program or table which organizes, stores, retrieves, modifies, and reports data.

Entry: Each item of data entered into the database; a record contains an entry for each field of the database.

Field: Category by which data is organized; the columns of a database.

File: A collection of information stored as a named unit on a disk.

Record: All the data about one item stored in a database file; the rows of a database.

Record Search: Selecting only certain records from particular fields; choosing records which satisfy a sets of attributes.

Relationship: Condition on which to base record selection, such as "equal to, greater / less than," "begins with," "contains."

Appendix C
TANGLED PROBLEMS

These problems can be used as they are or can provide formats for problems you create yourself. They cover a wide range of numbers as well as various whole number subsets. Problems marked with "*****" can be solved with numerals from 0 - 25. Problems marked with "******" can be solved with numbers from 0 - 100.

1. Name the 8 sets of twin primes (primes that differ by two) less than 100.
   Solution: 3-5, 5-7, 11-13, 17-19, 29-31, 41-43, 59-61, 71-73 ******

   A. We are twin primes. Our sum is a two-digit number whose ten's digit is twice its unit's digit. What are our names?
      Solution: 41,43 ******

   B. I am a prime, and I have a twin. The product of my twin's two digits is 8 more than the product of my two digits. Who amI?
      Solution: 41 ******

2. There are only 16 prime palindromic numbers less than 1000. What are they?
   Solution: 11, 101, 131, 151, 181, 191, 213, 353, 727, 757, 787, 797, 919, 929

   A. I am the only 2 digit palindromic prime.
      Solution:11 *****

   B. I am a three-digit palindromic prime. My digits could be written as the variables A B A. I have a partner who is also a three-digit palindromic prime. His digits could be expressed as B A B. The sum of my digits is the first member of a set of single digit, twin primes; the second member of which is the sum of the digits of my partner.
   Solution: 131

3. I am the only three-digit, prime counting number

   A. Whose digits are all different and odd

   B. Whose digit sum is 13

   C. Whose digit product is greater than 30

   D. The sum of whose tens and hundreds digit is less than my units digit Who am I?
   Solution:157

4. I am the smallest three-digit square number whose digit sum totals a number that is not a square. Who am I?
   Solution: 256

5. I am the smallest number other than 1 that is both a square and a cube.
   Who am I?
   Solution: 64

6. I am the only palindromic, three-digit cube. Who am I? Solution: 343

7. I am a factor of 50 and an even multiple of 5. I am one more than a square and two more than a cube. Who am I?
   Solution: 10 *****

8. I am an odd three-digit number. I am the sum of 3 different odd cubes. My units and tens digits are alike. Who am I?
   Solution: 855

9. I am the only number who, when added separately to 100 and 164, will make them both perfect square numbers. Who am I?
   Solution: 125

10. I am the smallest one-digit odd prime number. Who am I?
    Solution: 3 *****

11. I am a square number and both my digits are square numbers. Who am I?
    Solution: 49 *****

12. I am the only two-digit odd composite number less than 20. Who am I?
    Solution: 15 *****

13. I am a prime number and a factor of 105, 20 and 30. Who am I?
    Solution: 5 *****

14. I am the only three-digit square other than 400 containing all even digits. I am a palindrome. Who am I?

Solution: 484

15. I am a square. The sum of my two digits is my square root. Who am I?
    Solution: 81 **

16. I am larger than 15^2 and less than 16^2. I'm odd and divisible by 3. The product of my digits is 24. Who am I?
    Solution: 243

17. lam a multiple of 7. I'm a factor of 210. The product of my two digits is odd. Who am I?
    Solution: 35 **

18. I am an even multiple of 3. I'm greater than 5^2 and less than 7^2. The product of my two digits is a cube. Who am I?
    Solution: 42 **

19. We are two-digit primes. If our digits are reversed, we become different primes. The products of our digits are also prime. We are four numbers. Who are we?
    Solution: 13, 17, 31, 71 **

20. I have 3 digits. One of my digits is a square and two are cubes. All three digits are different. My digits are ordered smallest to largest, left to right. The product of my digits is greater than 10. Their sum is less than 15. Who am I?
    Solution: 148

21. I am divisible by only one prime number. The sum of my digits is a prime, and the difference between my digits is another prime. I am less than 40. Who am I?
    Solution: 16 *

22. I am a three-digit palindrome. The sum of my digits is even. I am the difference between a palindromic cube and a palindromic square. Who am I?
    Solution: 222

23. We are 6 consecutive multiples of 5 which, when added together, make a sum between 340 and 350. Who are we?
    Solution: 50, 55, 60, 65, 70, 75 *

24. We are 2 consecutive prime numbers whose product is 899. Who are we?
    Solution: 29, 31 **

25. I am the decade between 50 and 150 in which there are four prime numbers. Who am I?
    Solution: 51 to 61 **

26. I am an odd two-digit prime number whose digit sum is 11. My tens digit is greater than my ones digit. Who am I?
    Solution: 83 **

All whole number problems can be reworked to become fraction problems as are the three below:

27. I am a proper fraction. The sum of my numerator and denominator is a one-digit square. Their product is a cube. Who am I?
    Solution: 1/8 *

28. I am the proper fraction whose denominator and numerator when multiplied is a multiple of 7 and when added is a perfect square. Who am I?
    Solution: 2/7 *****

29. We are three fractions each of whom has a value less than one-half. Both our numerators and denominators are one-digit primes. Who are we?
    Solution: 2/5, 2/7, 3/7 *****

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