

# Using Computer Games to Challenge Elementary School Students

by

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*A program for elementary school youngsters was offered during the summer of 1978 by a local school district. The goal of this program was to present classes which would stimulate and challenge gifted students with topics not in their standard curriculum. The authors were invited to participate by offering a class on Math and Computer Games. This paper is a report on the computer portion of this class.*

## Objectives of the Course

Because of the objectives of the program and the type of students that would be participating, we formulated the following objectives for the course:

1. To intellectually challenge the students through games in which they compete with the computer or with each other.
2. To teach the students new mathematical concepts and increase their understanding of previously learned ideas through the use of games.
3. To stimulate the students' creative abilities by permitting them to design their own games on the computer.
4. To expose the students to computers and encourage their interest in further computer experiences.

## Course Environment

The classes were held during a two week period in July and met for 1½ hours each weekday. We conducted two classes simultaneously, dividing the group by grade level with third and fourth graders in one class and fifth and sixth graders in the other. Each day, one group did math games while the other group did computer games. The following class day, the two groups switched classes. Therefore, the computer games class actually consisted of five 1½ hour periods.

Each group was made up of ten students. The students who participated in this program were not chosen by any selection process. They were, rather, the first ones who responded to an announcement sent home with all elementary school children in the school district. Therefore, participation in the class was on the basis of student interest, (or in some cases parent interest) rather than ability.

The computing equipment used for this class was varied, not by choice, but by necessity since we had to use what was available. That happened to be two Radio Shack TRS-80 computers, two Texas Instruments Silent 700 terminals connected to the Hope College central computer system, and a Tektronics 4051 Graphics computer. This variety of computing systems proved to be no handicap to the students. The students could move easily from one system to another. In fact, it gave the students an opportunity to appreciate the advantages of each system, and permitted the instructors to utilize the various features such as hard copy and graphics, and to choose the most appropriate computer for each game.

The computer stations were all set up in one classroom with two or three chairs around each station. Each period, the students were introduced to two or three games which they were to play that day. At the beginning of the period, the instructor would discuss the games for that day, giving the rules and demonstrating the games to the entire class. During this discussion, the instructor was careful not to give away any hints on strategy, leaving this as a challenge to the students. Then for about an hour, the students were distributed in pairs to the various computing stations to play the games. Periodically the student pairs were rotated to other stations to permit all students to play all of the games. At the end of the period, ten minutes was spent discussing the games with the students. At this point the students shared their results, the strategies they found successful, and their reactions to the games.

At the end of the two week period an open house for parents was held. At this event the students demonstrated the games they created and those they played.

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## The Games

The following is a brief description of each of the games that we used. In most cases the games were not original with us, so rather than providing a detailed description, we will reference to a source for the game. In most cases we made modifications to the games to adapt them to our objectives and our students.

*Guessing Game.* This game is a generalization of the game of Animal found in [1]. In this game the player thinks of an animal. The computer by asking a sequence of questions that can be answered yes or no, tries to guess the animal. If the computer fails, it then requests an additional question from the player which it then adds to its file so that it will correctly identify that animal in the future.

The version of the game which we had available allowed the student to create his or her own category and play the game with the computer repeatedly to build up an effective file of questions. The students were introduced to the game by playing with the category animals using a question file built by the instructor. They were then shown how to create their own category and question file and invited to do so during the rest of the course. The students created files for several interesting categories including: cities, makes of automobiles, famous baseball players, and empires of the world.

*Wordfind.* This is more of a puzzle than a game. A version of it was published in [2]. It creates a rectangular array of letters in which a given set of words is embedded horizontally, vertically, or diagonally, and either forward or backward. The first day of class each student was presented with a puzzle in which all first and all last names of students in the class were hidden. They were also shown how they could create their own puzzles for any set of words they wished to enter and were invited to do so during the remainder of the two week period.

*Timing Game.* This game was another one designed to allow the children to be creative. The original version of the game displayed the name of a number of the screen, such as "TWO". The player had to respond by typing the number itself. The computer, in this case a TRS-80, measured the amount of time it took the student to respond, and that number of seconds was added to his or her score. The player with the smallest total time after a fixed number of rounds was the winner. After this game was no longer challenging, a second version of the game could be played in which the computer displayed the name of the number with the letters scrambled such as "OTW".

This game was set up so that the computer prompts and expected responses were read in from a tape file. Another program was provided which allowed the students to create such a file of their own using any categories they wished. One such file was created by a student using the name of cities as prompts and the two letter abbreviation for their state as the expected response.

*Hurkle.* This hunting game, along with its three dimensional version, Depthcharge, are also found in [1]. The students enjoyed playing this game and it gave them an opportunity to practice using coordinate systems as well as an opportunity to exercise logical thinking. The students were able to deduce that the three-dimensional version of the game is no more difficult than the two-dimensional version. The graphics facility of the TRS-80 was used to further enhance these games.

*Madlib.* This game, a version of which is found in [1], asks the player to enter a number of words in response to questions. These words are then placed at certain places in a story previously unknown to the player. The result is frequently hilarious nonsense. The students enjoyed playing this game very much and loved reading their version of a story to the class.

The students were then shown how they might enter stories of their own indicating where words are to be provided and how to enter appropriate requests for words. The students were amazingly creative with this game and the results were quite impressive. Instructor assistance was required in typing in the stories because of the length of the stories and the limitations of the students' typing speed.

*Factor.* This game, found in [3], is a game which the students play against the computer. It is a game which requires skill in identifying factors of integers and entails a great deal of strategy. This game was used only with the fifth and sixth grade class since the third and fourth graders were not at a mathematical level where they could play this game easily.

*Game of Even Wins.* This game begins with an odd number of chips on the table. At each turn a player takes one, two, three, or four of the chips. The player with an even number of chips when the last chip is taken is the winner. This program, found in [1], is a learning program where the computer progresses from very dumb to unbeatable in 20-30 games. It was quite an experience for the students to witness this progression, and quite a challenge for them to determine the unbeatable strategy.

*Exagon.* The player must deduce the rules by playing this game, which is found in [4]. It is a challenging board game which requires logical skill on the part of the students. They had fun beating the computer after they figured out how to play. The graphics facility of the TRS-80 also added to the enjoyment of this game.

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**Square.** This game from [5], consists of a 5x5 board where each player in turn chooses a point from the 25 on the grid. The object is to choose four points that occupy the four corners of a square. This game challenged the students to think about some geometry.

**Pill Box.** This game, played on the TRS-80, gives each of two players a pill box. The two pill boxes are separated by a mountain. Each game has a different random configuration. The two pill boxes then take turns firing at each other using an angle and muzzle velocity provided by the player. This was the most popular of the games and required the students to think about angles.

**Reverse.** This game of placing randomly ordered numbers into ascending order by a sequence of reversals is found in [1]. Its two dimensional extension, Double Reverse, found in [6], was also available and unlike Hurdle, the students found adding a dimension to Reverse greatly complicated things.

**Not One.** This game is played by simulating dice. A version of it is found in [7]. Each player rolls a pair of dice and then continued rolling pairs until s/he decides s/he has enough or until s/he obtains a duplicate sum to that of the first pair rolled. If s/he quits before s/he rolls a duplicate, s/he scores the sum of all dice rolled. If s/he rolls a duplicate first, s/he scores no points for this round. The players alternate turns for ten rounds. The particular program used for this class utilized TRS-80 graphics for the dice and played a very strong game against the students.

Several other games and programs were provided for the students to use outside of class. These included a horse race on the TRS-80, a design generator on the Tektronix 4051, and, of course, Star Trek on the campus system. A demonstration of the Tower of Hanoi (see [1]) was also shown on the TRS-80.

### Conclusions

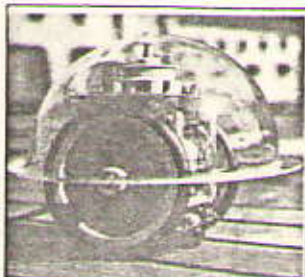
If the value of this course were to be judged by the enthusiasm of the students, there would be no doubt that it was a success. The students were informed on the first day of class that they could come ½ hour early and stay ½ hour after class to further use the computers. By the end of the two week period, almost all students were coming early, and we usually had to pry loose a few children an hour after the end of class! Teachers and school administrators who visited the class were impressed with the activity and learning which was occurring.

As a result of this program, progress is being made toward placing computer systems such as the TRS-80 in elementary schools in the local school district. Our major problem is getting teachers enthused about their use.

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