Summer 1973

An Educational Mathematics Game Called Allequator

Raymond Robert Beeson

AN EDUCATIONAL MATHEMATICS GAME CALLED ALLEQUATOR

A Project

Presented to

the Graduate Faculty

Central Washington State College

In Partial Fulfillment

of the Requirements for the Degree

Master of Education

Administration--High School Principal

---

by

Raymond Robert Beeson

August, 1973

APPROVED FOR THE GRADUATE FACULTY

Donald G. Goetschius

COMMITTEE CHAIRMAN

George C. Grossman

Dan Unruh

Ron Allbaugh

AN EDUCATIONAL MATHEMATICS GAME CALLED ALLEQUATOR

by

Raymond R. Beeson

August, 1973

This paper contains a brief description of the procedures involved in making the game Allequator, an educational tool capable of reinforcing basic algebra concepts for students 7th through 12th grades. With the help of the Richland Public School District #400, Allequator has been published and is now available to teachers within the district.

AN EDUCATIONAL MATHEMATICS GAME CALLED ALLEQUATOR

Allequator originated from a desire to teach certain algebra skills to students not only having difficulty in algebra but also being unmotivated. The game approach was to help in motivating while the idea within the game was to assist in teaching.

Many beginning algebra students have trouble with positive and negative number concepts as well as equations. The thought of taking an algebra class intimidates many potentially good students. Therefore, some special technique to both motivate and teach was needed, hence the solution in game form.

A game board with hundreds of little squares, each containing a number from -9 to +9, was first developed. Next a basic set of rules allowing 2 to 4 players each to advance 4 men across the board to a finish area was devised. Elements of capture and removal of players, penalty boxes, the roll of a die and the turn of a card were incorporated to stir the competitive spirit and thus motivate the student.

In its early stages of development, Allequator was given to groups of students in order to refine the operations. After many sessions of play and reworking of the rules, it became obvious that Allequator had a potential as an educational device for practicing mathematics.

Two to four players can play Allequator at one time. Each player has four markers to be moved from start to finish.

The playing rules state that three out of four markers in the finish area constitute a win. To shorten the game these rules can be altered so that two out of four players in the finish area constitute a win or even one out of four for a short game. In actual classroom play most games lasted over an hour. Therefore, to complete the game in a class period, two out of four markers in the finish area may work the best.

High number thrown on a regular numbered die determines who starts. The starting player now rolls the colored die. If his color appears he moves one marker out of start to the square marked with a 1 and then draws a card. The cards are marked with an equation containing a variable x. For instance a card may show $2x + 3 =$ _____. The 1 which the marker rests on is now substituted for the x and the equation is then solved. The solution indicates the number of moves this marker can now be moved. In the case of the above equation the answer is 5. In the upper left corner of the card is the manner in which the marker can be moved, either diagonally or horizontal and/or vertical.

If the player had not thrown his color on the die, the play would have continued on to the next person. Once a person finally succeeds in getting a marker out of start, he may turn a card on each succeeding turn regardless of whether or not he happens to throw his color on the die.

Should the white on the die appear, the player takes a card and proceeds as normal. Afterward he is allowed a second turn.

A player may find his marker in the penalty box for incorrectly solving an equation, or moving his marker incorrectly. To redeem this marker a black must be thrown on the die.

The idea of sending another player's marker to the penalty box by catching an error, keeps the other students' attention focused on the game at all times. Players find themselves not only solving their own equations but also those of other players to make sure that everything is done correctly.

Allequator is more a game of skill than chance. Students begin to see that it is beneficial to keep some markers on positive positions while others are kept on negative positions. The advantages of markers on negative numbers can be seen in an equation such as $-x + 2 =$ _____. If a -8 were substituted for x then $- -8 + 2 = 10$, since a negative times a negative is a positive. If a +8 had been substituted, the equation would have been $- +8 + 2 = -6$ because a negative times a positive equals a negative. In this case the marker on -8 goes forward whereas the marker on +8 goes backward.

When all the markers have been moved from start and are on the playing squares, a player has to mentally solve four equations in order to see which marker has the greatest advantage in moving. He will want to be careful to choose the marker that will move the furthest or the one that will wind up in the finish area. It may be that he desires to send someone back to start. If this is the case he will want to look for the marker that will land in a square already occupied by an opponents marker.

At first a student may find himself overlooking some of the best moves, but as his skills improve both in the mechanics of the game and in the mathematics concepts on the cards, his game will improve. Once a student masters a set of concepts a new deck of cards can be substituted and a whole new game begins.

Allequator should be recognized and used by the teacher as an educational tool. Teachers using the game should set up evaluation procedures to see that learning is taking place. If this game or any other game fails to reinforce educational ideas it should be removed from the classroom.

Since Allequator in its early stages was beginning to show itself a possible valuable instructional device, a patent attorney was consulted to see what protection could be afforded the game. Since patents for games of this nature are both costly and difficult to apply, the next best source of protection was to use a copyright. But a copyright cannot be used until the material is printed and afterward offers only minimum protection. It then became necessary to have the game printed. Earlier, consideration had been given to selling the concept to a game company but these people are not overly eager to buy new ideas until they are tested, and to prove a new idea many game companies want to review the material without any real guarantee that the idea will not be taken and used without an acceptable agreement with the originator.

The first intent was to use the game in the classroom, so printing with a copyright notice seemed to be the next best procedure.

The game Allequator was then presented to school district personnel to see if there was a possibility of having the district do the printing. (Richland School District #400 has its own print shop.) After reviewing it, district administrative personnel decided the game was worthwhile endorsing and should be printed. An agreement was reached which gave the Richland School District enough copies of the game to supply their staff in return for doing the printing.

The preliminary work and the mechanics of the actual printing of the game board proved to be quite involved. The board was printed on two pieces of 11" x 17" paper fitted side by side to make the final board 22" x 17". Each 11" x 17" sheet required six runs through the press making a total of twelve runs for both sheets. Five colors plus black, each required a separate run through the press.

The multilith process of printing was used. This process uses photo negatives burned into a metal plate which in turn is used on the press to do the printing. A good original copy to be photographed was first needed and in this case the copy was drawn with black ink on large card stock. Numerals and letters already printed were then glued to the card stock. This eliminated a great deal of time otherwise required if the numerals and letters had to be drawn on by hand.

Next the alligator character was drawn on card stock with a felt pen and photographed so that it might be burned onto a printing plate. The name Allequator came from the words algebra and equations put together. Since Allequator was

closely related in sound to alligator and since the alligator cartoon character was already being used in the originator's classroom as a motivational technique, the name Allequator seemed quite appropriate.

Some 2,000 copies were printed with about 150 of these going to the Richland Public Schools and the remaining copies to the inventor. Not all copies were immediately made into game boards, but of those that were, the process became somewhat tedious. First the printed sheets were laminated with a clear plastic film to provide a playing surface that would last indefinitely. Next, the laminated sheets were glued to cardboard backing which kept the playing surface flat and uniform. The edges of the board were then taped to prevent fraying and the board was complete.

Two different cardboard backing materials have been used in the construction of the boards. The first, which was corrugated, came from the Boise-Cascade paper plant east of Pasco, Washington. The second was solid cardboard which came from Western Paper of Pasco. The solid cardboard was more expensive than the corrugated one but was more durable. The corrugated material became harder to tape along the edges and would bend along the ridges under pressure. However, both materials have their benefits; corrugated because it is cheap and light weight, solid because it is easy to tape and is durable.

Another problem was to find the parts for playing the game. These included 16 markers, one die, a set of cards, a

set of rules and a check sheet. The cards, rules and check sheets could be printed on the press or ditto machine and posed no real problem. But the markers and die were somewhat harder to locate. After trying several materials, a small wooden plug used by furniture makers for plugging screw holes was found to work adequately. When painted one of four different colors used on the board, each marker proved excellent for play.

At first it was thought that regular playing dies could be used but cost made them prohibitive. Regular dies were not ideal since a die with different colors on its various faces fit the game better. Finally half-inch cubes were cut from half-inch square wood stock and each of the six faces were painted a different color.

Packaging the game also became a problem which can be resolved but may be costly. For distributing the games to Richland school teachers the game parts (markers, die, and cards) were put in plastic bags. Additional uncut cards were given out in sheet form as well as the rules and check sheets.

Finally a district wide meeting was called for all mathematics teachers, both elementary and secondary levels, at which time the game was explained and distributed.

Copyright laws state that a copyright can only be filed for after the copyright notice has been affixed to the work and the work made available to the public. Application has been made for copyright.

For classroom use, Allequator should not be played more than once a week. Students may lose interest by becoming too familiar with a game and therefore it is suggested that this game be used with moderation. Allequator is designed so that different concepts can be taught with a simple change of deck cards. The following is a list of ideas applicable for alternate use on the cards.

$x + 1 =$ _____

$x - 4 =$ _____

$1 - x + 2 =$ _____

$-x + 8 =$ _____

$2x + 5$ _____

$2x + 1$ _____

$-3x - 4 =$ _____

$|- x| =$ _____

$|x| =$ _____

$|x-1| =$ _____

$- |x - 2| =$ _____

Compute answer to nearest whole number.

$\frac{2x}{3} =$ _____

$1/4x - 6 =$ _____

$-2/5x + 9 =$ _____

Card decks can be easily constructed by a teacher and be made to emphasize a concept currently being taught in the classroom. A good suggestion may be to reinforce ideas with a game of Allequator at the end of a unit. Another suggestion would be to let students check out the game for overnight use

possibly to be played with parents. Students find the game both interesting and challenging and involve the home.

APPENDIX

A L L E Q U A T O R

Number of Players: 2-4

Objective: Each player places four colored markers on a start position. His objective is to get 3 out of the 4 markers into the finish area of his own color.

Begin Play: Each player throws a regular die, the player with the highest number begins and the play continues around the board clockwise. The starting player now rolls the colored die. If his color appears he then moves out of the start position into the first square marked with a +1. Next, he draws a card and into the equation on the card inserts the value of his position which directly from start is the +1 his marker is resting on. He then solves the equation and moves the indicated number of squares from the solution on the card either diagonally or horizontally and/or vertically, whichever is indicated in the upper left corner of the card. Any marker in a playing position can be put into the equation on the card. The equations on the cards are chosen in such a way that answers may come up both positive and negative.

Notice each player has three directive lines of his color. A positive move must always be parallel to a line of a player's own color and toward the finish or perpendicular to and toward a line of a player's own color. A negative move must be parallel to but away from, or perpendicular but away from a player's own color.

Once a player has at least one man out of start, he may roll the die and draw a card. A player must use a play if possible. A play that would drive a player back into the starting position does not need to be used. However, a play that simply drives a player backward must be used if enough squares are available.

A player can send another player back to the start position by landing in his square. A player cannot be sent back to start if he is in a safety zone designated by a zero. Further, two markers cannot occupy one square.

Penalty: A penalty is assessed when a player incorrectly solves an equation or incorrectly moves his marker. The marker that was used to obtain the incorrect solution or was incorrectly moved is then placed in the penalty area. These markers may be redeemed by throwing a black on the colored die. If three markers land in a penalty area, that player is permanently excluded from play.

The white mark on the die is used to gain an extra turn. Each player throws the die and then turns a card in that order.

Finishing: To finish, notice that there are three sub-finish areas and one larger finish area. Only one marker may land in each of the sub areas (marked with a 4, 8, and a -5), but any number may land in the large finish area. All four areas are to be regarded as finish. The reason for the sub areas is to allow a greater number of possible moves in order to finish.

CHECK SHEET

CARD POSITION

	-9	-8	-7	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6	7	8	9
1																			
2																			
3																			
4																			
5																			
6																			
7																			
8																			
9																			
10																			
11																			
12																			
13																			
14																			
15																			
16																			
17																			
18																			
19																			
20																			
21																			
22																			
23																			
24																			
25																			
26																			

Diagonal Card No. _____ Time Limit _____	Diagonal Card No. _____ Time Limit _____
Diagonal Card No. _____ Time Limit _____	Diagonal Card No. _____ Time Limit _____
Horizontal and/or Vertical Card No. _____ Time Limit _____	Horizontal and/or Vertical Card No. _____ Time Limit _____
Horizontal and/or Vertical Card No. _____ Time Limit _____	Horizontal and/or Vertical Card No. _____ Time Limit _____
Horizontal and/or Vertical Card No. _____ Time Limit _____	Horizontal and/or Vertical Card No. _____ Time Limit _____