GraSUS AND MATHEMATICS IN THE CLASSROOM

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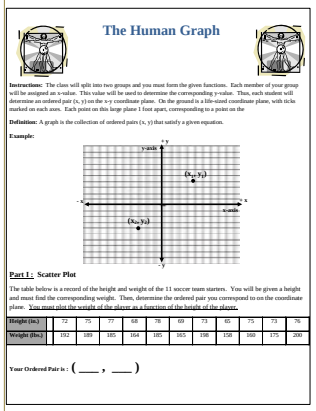
Introduction:

In order to foster a student interest in mathematics, we developed student projects aimed at various learning styles. We present two such examples, intended to enhance a related underlying lesson. In this case, the lesson is graphing lines and understanding how they intersect. The Human graph project was designed as a kinesthetic learning exercise, in which students actively "become" points on a line. On the other hand, the chess project focuses on visual learning, using the game of chess to visually stimulate the concept of a system of lines.



The Human Graph

Instructions: The class will split into two groups and you must form the given functions. Each member of your group will be assigned an x-value. This value will be used to determine the corresponding y-value. Thus, each student will determine an ordered pair (x, y) on the x-y coordinate plane. On the ground is a life-sized coordinate plane, with ticks marked on each axes. Each point on this large plane 1 foot apart, corresponding to a point on the

Definition: A graph is the collection of ordered pairs (x, y) that satisfy a given equation.

Example:

y-axis

(x_1, y_1)

x

x-axis

(x_2, y_2)

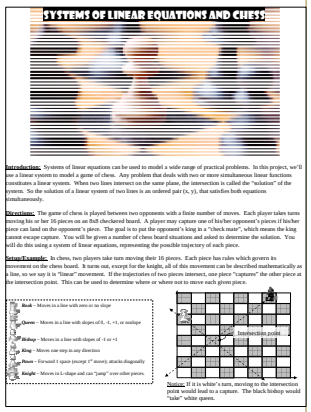
y

Part 1 : Scatter Plot

The table below is a record of the height and weight of the 11 soccer team starters. You will be given a height and must find the corresponding weight. Then, determine the ordered pair you correspond to on the coordinate plane. You must plot the weight of the player as a function of the height of the player.

Height (in.)	72	75	77	68	78	69	73	65	75	73	76
Weight (lbs.)	192	189	185	164	185	165	198	158	160	175	200

Your Ordered Pair is : (____ , ____)



SYSTEMS OF LINEAR EQUATIONS AND CHESS

Introduction: Systems of linear equations can be used to model a wide range of practical problems. In this project, we'll use a linear system to model a game of chess. Any problem that deals with two or more simultaneous linear functions constitutes a linear system. When two lines intersect on the same plane, the intersection is called the "solution" of the system. So the solution of a linear system of two lines is an ordered pair (x, y), that satisfies both equations simultaneously.

Directions: The game of chess is played between two opponents with a finite number of moves. Each player takes turns moving his or her 16 pieces on an 8x8 checkered board. A player may capture one of his/her opponent's pieces if his/her piece can land on the opponent's piece. The goal is to put the opponent's king in a "check mate", which means the king cannot escape capture. You will be given a number of chess board situations and asked to determine the solution. You will do this using a system of linear equations, representing the possible trajectory of each piece.

Setup/Example: In chess, two players take turn moving their 16 pieces. Each piece has rules which govern its movement on the chess board. It turns out, except for the knight, all of this movement can be described mathematically as a line, so we say it is "linear" movement. If the trajectories of two pieces intersect, one piece "captures" the other piece at the intersection point. This can be used to determine where or where not to move each given piece.

Rook – Moves in a line with zero or no slope

Queen – Moves in a line with slopes of 0, -1, +1, or nonslope

Bishop – Moves in a line with slopes of -1 or +1

King – Moves one step in any direction

Pawn – Forward 1 space (except 1st move); attacks diagonally

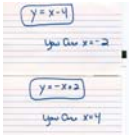
Knight – Moves in L-shape and can "jump" over other pieces.

Intersection point

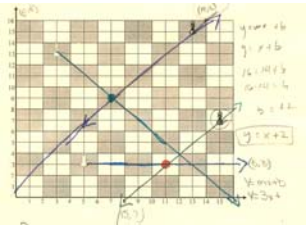
Notice: If it is white's turn, moving to the intersection point would lead to a capture. The black bishop would "take" white queen.

Methods:

In the Human Graph project, each student represented an ordered pair. They were each given an index card with the equation and an x-value. Then, they were to determine their unique ordered pair and find the corresponding point on the life-sized xy-plane.



In the Chess project, students were presented with chess "situations" and asked to determine the system that represented each situation. The solution to the system is where you would not want to move next.

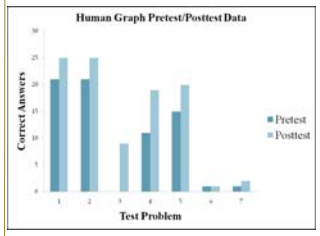


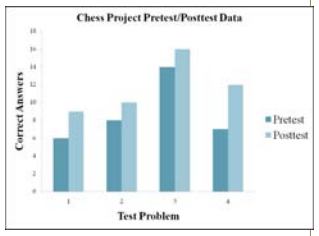
The Human graph project starts with a large coordinate axis made with tape on the floor. The ticks were measured at 2 feet intervals ahead of time. The class was divided into two, each group formed a line (one had positive and one had negative slope). Then, they formed the "system of lines" together as a class. They were then asked who was the intersection point…two students raised their hands and realized they had the same ordered pair in common.

Students were engaged in the chess project out of an interest in the game of chess. This was an activity that students enjoyed. The familiar game of chess was a great way to create a connection between systems of equations and something tangible.

Results:

Based on pretest/posttest data shown below, it was clear that students did retain some knowledge. Generally, students reacted quite well to both activities. The "Human Graph" project required well-behaved students who can follow simple and direct directions. In the chess project, the rules had to be clearly explained.





Conclusions:

It's clear from the data that learning did occur, however it seems as though the kinesthetic experience of physically interacting as intersecting lines contributed to greater overall learning. The students were equally interested in both projects, however there was a stronger positive feedback from the Chess activity.

In any given classroom, there is a mixture of students with different learning styles. In order to maximize learning potential, one must employ projects and lessons targeted at multiple learning styles.

Funding Source:

GraSUS-II is supported by the GK-12 program of the National Science Foundation (Project #DGE-0338128) and by North Dakota State University and The Center for Science and Mathematics Education.