Math 2100 Projects – Fall 2012

My project was over food/cooking and exercise/physical activity! For my project, first off, I did it over basic fundamentals of high school math and it was over no specific subject. It was fairly flexible, so it can be applied to most concepts or can be made into difference situations while using the same idea. I related food/cooking into math concepts by looking at it from a general point of view. Specifically, I targeted proportions and how to present them in a visual way to the students. I also incorporated proportionality. Both are big in high school and even college math. For my exercise/physical activity portion of the project, I related it to math based on the concept of graphing functions. I used the speed of people running along to represent slope and gave them a starting point and that was their intercept. That was the basic premise of my project.

I added a visual representation to each of my topics. For the cooking/food section, I made a pre-lab to introduce the students to the concepts of proportionality. My idea was that the teacher could make/bake something, such as cookies, and show the students how proportions work in the real world and see how it effects things. I also made a pre-lab to the physical activity/exercise portion and stated that the students could work with motion detectors in order to better understand the idea of slope, movement along a graph and how it speed effects the looks of the graph. I feel like it was a good way to incorporate technology along with their learning as well. I feel that these were both concepts that the students could really relate to and understand while learning at the same time. I hope that it helps everyone else as well as I think it will!

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"Going to Grandma's" is a project for the students to complete over a break. They will need to pay attention to the time while they travel to a family member's house and determine when they are accelerating, going at a constant pace, stopping, etc. Once they have determined all the necessary information, they need to create a position graph from their data. They will then need to formulate a velocity and acceleration graph from their position graph.

"Christmas Time" is a lesson on sequences. Each layer of an artificial tree has more branches than the layer above it. The students will need to take the given number of branches for each layer and caluclate an equation for the tree. They need to be able to find a recursive and explicit equation. They can then try it on their own Christmas tree at home if they choose (maybe for extra credit as not all children may celebrate Christmas?).

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Mandala

This form of art can be connected to practically every aspect that is geometry. Given that there would be no mistakes in the creation of a Mandala, a student could include virtually any shape within the parameters of the circle itself in a fashion that could generate art. The great thing about this particular sort of creating process is that the students would use the skills they would have already been taught regarding measuring shapes and using trigonometry. This

subject could spark a deeper interest in math for those who like art, history, or even if they just like seeing pretty pictures.

Matrices

A matrix is any rectangular formation of numbers or symbols to represent any amount of given equations. The size of the matrix is expressed by however many rows there to however many columns there are. Matrices are most often used to record and evaluate flow for a particular situation. One of the first examples given by my linear algebra teacher had to do with predicting the flow in and out of certain intersections at the Square.

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American Football and the Pythagorean theorem

American football is a game of angles. In most cases, math is used by coaches and players to take advantage of the opposing team. Some plays go wrong because of a simple adjustment, where that "simple adjustment" gives the player an advantage in mathematical terms because they changed their position and angle of attack. The Pythagorean theorem can be a great mathematical tool when a perosn wants to know the distance of a pass or a field goal. The Pythagorean theorem has been used for thousands of years by the Babylonians and Egyptians. In the classroom it is used to find missing sides of a right triangle. Therefore, the connection of a right triangle and the position of two objects on a football field can be made pretty easily.

Black Friday and Algebra

Black Friday is the official opening to the holiday shopping season. Many people across the United States participate in this event to take advantage of the low prices. Even though the prices are low, some people still would like to get their "bang for their buck". This can be done using algebraic thinking. From the shoppers to the cashiers, things are being calculated and most of these things could be writen into an equation. However, if a person is given the total (or f(x) value) first, then they will have to solve for unknowns. Therefore, shoppers and cashiers both come across algebaric situations every Black Friday.

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Major League Baseball and statistics have been are knotted together like America and apple pie. Statistics such as batting average and earned run average help managers make personnel decisions throughout the season. We will learn how to calculate various baseball statistics using averages and percentages.

Angry Birds has taken the mobile gaming world by storm since December of 2009. It's simple yet fun gameplay has helped it to sell over 12 million copies. What most don't realize is that the game is based on a flying bird with a flight path resembling a quadratic function. We will identify these parabolas and create functions to fit the path of the birds.

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I used the movies 21 and he tv show numbers. Both of these are two different cultures and in which hey use math two different ways.
In 21 project you could use this to teach lessons of probability and in Numbers project I would use this to teach students
the different ways mathematics plays roles in every day life subject to crimes and other things.

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Lesson One:
James Bond and Math.
In late November 2012 007 Skyfall came to theatres. The movie deals with secret agent James Bond as he must once again save everyone from impending doom. Real spies aren't always as flashy as Bond (though sometimes they are,) but the concept of a secret agent is still one that kids are familiar with and will think is really cool.
Real secret agents are usually at least passingly familiar with Cryptanalysis, figuring out how to analyze and crack secret codes. Very recently in fact MI6, Britain's intelligence agency, was hiring new spies and put out a very very complex code on the internet to tell potential applicants where to send their information.

Ciphers often use keys to encode the messages, and sometimes the encoding can be tricky. But simple ciphers can be talked about in a variety of classes. Frequency Analysis (which makes use of simple statistics) is an important concept that helped crack the Caeser Cipher, one of the oldest ciphers we've seen historically. A more complicated method of frequency analysis using Greatest Common Factor cracked what was for nearly 200 years considered the unbreakable Vigenere Cipher. These concepts are quite suitable for middle school students, and more complicated ciphers or cipher methods (RSA Cryptography, Elliptic Curve Cryptography) could be suitable for students in basic and even advanced high school courses, and in interdisciplinary studies with students who have an interest in computer science and even history.

Lesson Two: Fus Ro Math.

About a year ago in 2011 Bethesda Games released the video game The Elder Scrolls V: Skyrim. By December the game had shipped more than 10 million copies to retailers. At the end of the month the digital distributor Steam reported that nearly 5 million players were playing the game simultaneously. It is thus a rather safe bet to say that video games are popular.

But the geometry used in video games, everything from the art to the physics engines, can range from simple to complex and is suitable for everything from seventh graders just looking at dilations and translations on a coordinate grid, to high school students doing AP Physics and Honors Calculus. Crafting lessons that look at how sprites change as a player moves, or how rigid objects react when force is applied use coordinate geometry, algebra, pre-calculus, calculus, physics, and computer science. Video games offer a wealth of interesting, deep mathematics.

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My report is about two cultural activities, Brazilian Jiu Jitsu and a video game called League of Legends. Brazilian Jiu Jitsu tournaments have a point system that can be used when introducing multiple variable equations in mathematics. You can use the different ways points can be earned as a variable. When using League of Legends, there are stats that enhance the avatar you are playing. Using armor and percentages you can multiply and subtract to find how much damage is getting across.

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One of the activities I used for the project was Thanksgiving. I incorporated different prices for Thanksgiving products into a lesson over system of equations. It would be furthered developed by having the students pretend as if they are shopping for a Thanksgiving feast and giving them "money" with which to buy. To incorporate the systems of equations the students could be given different standards for different items, for example: you must buy twice as much turkey as ham or you can only spend $35 total.

My second activity was going to the Sixth Floor Museum, where records President Kennedy's assassination are on exhibit. I used this activity to develop a lesson on derivatives using physics (projectile motion). The lesson would be expanded by having the students act as detectives and giving them the basic equation for the distance a bullet at any given time; from there the students would answer different questions involving velocity and acceleration.

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 I related mathematics to football and basketball. I would use the Super Bowl to enhance deriving systems of equations to solve multi-variable problems for high school students. I would incorporate a multi-variable "real-world" problem that covers an actual Super Bowl where the students could look up the actual scores and connect how the score relates to a system of equations. To enhance or elaborate on a mathematics lesson about parent graphs and the way they look in a high school class, I would incorporate the motion of the ball or players in basketball. By the end of the lesson, the student will be able to connect the movements in basketball to the graphs of parent functions.

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For my project I used pumpkin pie and the movie theaters as my cultural events. Pumpkin pie is great to use when learning how to multiple or divide fractions. It can be used in measuring ingredients or trying to figure out how many slices of pie would need to give people. The movie theaters was great for using word problems. You could pose questions on how much the theater sold in tickets an concessions.

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My first part of the project is a parabola formed by kicking a field goal. I have the students compare kicking a field goal from far away and closer to the goal post. They compare how the shape of the parabola changes with the distance from kicking.

My second part of the project is probability of weather. I discussed the chance of rain, and the probability of natural disasters happening in certain parts of the world. They looked up real data from placed across the world and came up with probability of them happening.

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I used volleyball and the precision of angles to determine unknown heights and angles in a game. For instance, at what angle does a player have to spike the ball to land in bounds? Volleyball was very interesting to me because I used to play the sport and also I think it is a game of inches. If you are off by one degree or hit the ball a second too soon, the court is very unforgiving. The reason this lesson could be so fun is because you could simulate the data in the real world and show how percise math must be in a game like volleyball.

Papa Murphy's is a franchise owned company and while I was working last week I noticed how much data regression there is to the buisness. Every store is different and uses different data to determine ordering, labor, and maximum profits in the buisness. A teenage student can take interest and worth into creating their own buisness and determining factors themselves. This experiment could turn into a project or even a competition among the students to see who can keep their buisness running and maximize profit by how many employees they keep and how much food they make. Owning your own buisness is difficult, but knowing math and data regression models can make everything easier.

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    KITES&TRIG:I think the students would enjoy being outside and possibly would also enjoy the initial challenge of getting their kite to stay in the sky. After getting their kites to stay in the sky, I would ask the students to make a conjecture about the altitude of their kite. Next, I would ask that the students come up with ways to find the altitude of the kite using only a clinometer and the knowledge of the length of the string. Naturally, a teacher would hope the students would be doing something along the lines of [length of the line * cos(angle of elevation)]. I believe that having the students find the altitude of their flying kite would be a very appropriate and fun way to reinforce the concepts of trigonometry by applying them in real life. If the teacher wishes, the activity could also serve as an assessment in disguise (i.e. exposing students who are still struggling).

KIDNEYS, DRUGS, &EXP. FUNCTIONS: The goal of the lesson is to give students insight about how his/her body works while simultaneously becoming familiar with exponential function patterns and concepts.

The students will be asked to consider a hypothetical scenario where a pitcher of water is to represent blood in a body. Then they will be asked to consider that drops [of a non-specific amount] of food coloring put into the water represent 1000mg of some drug. The students will then be told to assume that every four hours the kidneys filter out about 25% of said drug. Next, the students will be asked how such an event could be modeled (pour 250ml out of the pitcher, replace 250ml of regular water). The students will be asked to calculate how much, at this point, of the drug is left in the bloodstream. After going through a number of examples where the time passed changes, the students will be asked to consider whether, as time passes, the food coloring ever truly leaves the water (no, but it gets asymptotically close to gone). After the demonstration, the students will complete table as hours since the drug was taken (x) and amount of drug still left in blood (y). Students will be asked to examine the data to look for a pattern and make a conjecture about what type graph it will be (exponential). Once students have graphed their data, they will be asked to consider how it relates to the pitcher demonstration. Following this exercise, I would ask the students to write an equation that fits the modeled data.

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I wrote my project on card making using a Cricut and playing hockey.

To use making a card while using a Cricut for a math lesson, you would use it for a lesson involving proportion. When using the Cricut, you don't always cut out how many inches you tell the machine. The machine makes the layers of your image proportional to the main part of the image. If you are making a Christmas tree, you would not want to make the tree topper as large as the tree itself because it would not be proportional.

To use hockey as an application of math, you would apply the ability to tell a what angle your teammate is up the boards if you were to pass the puck to him using the boards. You would use geometry and trigonometry to figure out the best angle to hit the puck at to allow the puck to reach your teammate who is closer to the goal in order to score.

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   The first part of my project is about the Thanksgiving football game, Cowboys vs. Redskins. The activity for this event will be about taking the score, making an equation using information known (6 or 7 points for touch down, 3 for field goals, and 2 for safety). Using the equation made, we can figure out all the possibilities of combinations that could have been played.
   The second part is about choreographing a dance routine, I will be using the Latin inspired Zumba workout. When choreographing a dance routine for Zumba, the choreographer must consider all the muscles that he or she wants to concentrate in and fitting it into a 4-5 minute song and using 8 counts

(or 3 depending on the song). The activity for this would be many things. For example, using the Zumba game on the Wii, or using a song, find a number moves you want to use in order to concentrate on abs, glutes, or just plain cardio, and vary them along the routine with some extra moves (like marching or clapping).

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Here is a quick explanation about my topics for the Modeling project.

"The first topic is centered around basketball. Some of the connections that I made were the business side of things and balancing costs versus income, as well as using the stadium seats as a model for multiplication, addition, and subtraction. My main focus though was on statistics. Statistics can be used in lessons on ratio, percentages, and even integers (plus/minus statistic). They can also be used as an example for those who are not math fans. At higher levels, students can be asked to make a statement about some topic, like who had the best individual performance in a basketball game, and be forced to use statistics to back it up. You don't have to use basketball, but it is one useful method.

The other topic talks about cake. It also relates to ratios and proportions, as well as a model for fractions. The main focus in my project though was using it as a model for volume and surface area. The main exercise that relates to this concept involves the students having to solve for how much frosting is needed to cover a certain sized cake. In this exercise, they are given how much frosting is required to cover a cake with different dimensions. Then, based on that, they must find how much frosting covers one square inch of cake. Finally, using that information, they can calculate the surface area that they need to cover, and multiply that by the unit rate."

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For my first topic, I chose to relate finding the volume of a sphere to the movie UP. I would have the students find the volumes of actual balloons (assuming they were perfect spheres) and then figure out haw many balloons it would take to lift a 100,000 lb house. I would provide them with how much weight Helium could lift per cubic ft. I would also have them find out how many balloons could lift them in the air.

For my second topic, I found the smallest quote in the Wizard of Oz that is a common math misconception. The scarecrow says "The sum of the square roots of any two sides of an isosceles triangle is equal to the square root of the remaining side." I would have the students explore why this statement is wrong based on the Pythagorean theorem.

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I choose to do the gaming tournament Dream Hack and more specifically the game Heroes of Newerth. They release a statistics sheet after the tournament showing different percents and number about the different heroes during the tournament. If you have a e-sports heavy class this could work to them how probability or percents work.

My other event was Black Friday. This can show students how discounts work and tell them exactly how much they are saving on an item which is a good life skill to have.

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For the first real world example, I chose to use the TV show Survivor. I went through and noticed every challenge the contestants face could be related to math in some way. I chose a challenge called Fly a Kite and related it to triangles. I had the student figure out how high a contestant's kite flew based on the distance the shadow was from the contestant and how much string the contestant used. For the first exercise, I had the time be exactly noon so the shadow would be directly under the kite. The second exercise had the sun hit the kite with an angle of 10 degrees so the kite's shadow is not directly underneath it. This required the student to relate it to SOH CAH TOA.

For the second real world example, I chose to use an example of a hot air balloon. I had the path of the hot air balloon be a quadratic function. Then I gave the student some coordinates containing the heights and distances the balloon was from the launch site. The student had to use these coordinate points to create an equation using their calculator. For the second exercise, the student had to use the equations they found for the first worksheet to find how far the pilot would land from his starting point.

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1. Weather Balloon
By making a weather balloon, you can demostrate volume of a sphere, converstions from cubic feet to liters or gallons of helium, and terminal velocity once the balloon bursts. Also, you can include a payload with a camera inside to take video or pictures. Then some students can program the camera to take pictures at a certain interval.

2. Colored Frosting
You can demostrate ratios with food dye and frosting. Only using the primary colors: red, blue, and yellow, students have to mix the food dye into the frosting to create all the secondary (green, orange, violet) and tertiary colors (red-orange, red-violet, blue-green, etc.). They would record the ratio they used to make orange and then adjust the ratio for when they make red-orange and yellow-orange. This way they visually she how the ratio affects the colors. You can bring in cupcakes for them to frost as well and they can make a color wheel.

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The cultural activity I plan to relate this back to would be the activity of completing a crossword puzzle found in a newspaper. For example, one of the clues may be 'derivative of 23' and then they would have to spell 'zero' in the crossword and make most (if not all) clues math intrinsic. It's obviously math, but everybody likes to engage in crossword puzzles and most crossword puzzles challenges thinking for whoever wishes to complete it.

I chose this activity because it would actually appeal to students as it would integrate learning with an activity that promotes critical thinking that they do every day when they pick up a newspaper. Ordinarily, when a high school student picks up a newspaper, it's usually not to read the articles; it's for them to complete either the crossword or read the comics.

The connection to Mathematics would be the clues that were included, and those clues would be made specifically for the math class that is taught. For example, an Algebra class clue would be 2x=5x-5, solve for x. A Geometry class

clue would be "name the parent function for x^2-5". An Algebra II class clue would be "name the conic section for $x^2+y^2=r^2$. All the clues would pertain to that class. For this activity for lessons, I would probably hand out a crossword to each student as the lesson begins (each crossword different [to prevent copying]) and use that as a participation grade/completion grade.

For example, if I was explaining Conic Sections that day with emphasis on Ellipses and Hyperbolas, the two main follow-up exercises would be: Give the analytical definitions of an ellipse and hyperbola, and the other one would be: Using the analytical definitions, derive the equations for a hyperbola and

I don't think there could be any negatives in taking this approach to teaching a lesson. Everything could be effective in taking this approach, as it gives students a chance to listen to the lecture and then write it down. I think using the crossword as a follow-up/participation grade would be a good idea as it promotes active listening throughout the lesson and decreases student's passive listening during the lesson.

The culture I plan to relate this back to would be the culture of watching a pop culture movie known as Mean Girls and I would use that to introduce idea of infinite limits and LHOP.

I chose this activity because it would actually appeal to students as it would integrate learning with an activity that they enjoy.

The connection to Mathematics would be the idea of infinite limits and LHOP

If I was explaining limits and LHOP that day, exercises would include lim x→0 of 1/x, and lim x→infinity of x^2/x^3, then finally I would have an exercise of lim x→0 of (ln(1-x)-(cos x)^2)/(1-(sin x)^

I don't think there could be any negatives in taking this approach to teaching a lesson. Everything could be effective in taking this approach, as it gives students a chance to listen to a lecture that sparks their interest.

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1. The teacher could use real data from the oil production industry to look for function patterns. The appeal to the students would be that everyone faces issues that deal with gas prices. Sixteen year old students are just getting their licenses and they hear the conversation at home from their parents. Data can be generated to model each type of function from real data found: http://lib.stat.cmu.edu/DASL/Datafiles/Oilproduction.html, because it is

exponential from the years of 1800 to 1980's. Also, a quadratic can be found at: http://inflationdata.com/Inflation/Inflation_Rate/Historical_Oil_Prices_Table.asp (from the year 1980 – current – you can see the parabola in the inflation rates – see below)

2. The teacher could use the Tour de France as an engage to qualitative graphing. Students could be introduced to the stages (types of terrains) of the bicycle race and be asked to graph their ideas of the position graphs of these different terrains. Then the graphs could be taken further to velocity and acceleration graphs. The appeal for the students is the athletes, such as Lance Armstrong, that are in the news and the fact that most all teens have ridden bikes over different types of terrain themselves. The information on the race can be found at: : http://www.letour.fr/le-tour/2012/us/overall-route.html.

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1: For the cultural event 'Red Bull Stratos' involving a 23-mile skydive, learners are to analyze data based on the dependence of the speed of sound to altitude. Applying their knowledge of function patterns and data regression they produce a function for the data. The skydiver's maximum free fall speed has been recorded as well as that speed's proportion to the speed of sound at that altitude, therefore the speed of sound at that altitude can be calculated. This is then plugged into the data function to calculate the altitude of the skydiver at his maximum speed.

2: The Doppler Radar is used as a basis for coding parametric equations and sinusoidal functions. A doppler radar can be observed online in order to find values such as its period and other necessary information to complete the parametric equation system for the radar's movement. This can then be converted into cartesian or polar coordinates.

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Throughout history, from the day human beings existed until now, math has always been using in everyday life experience such as counting money to buy clothes, dividing days and hours, etc... Many people don't like studying math at all, so as a future Mathematics teacher, I find math relates to everyday life and learning it is very helpful. Therefore, this project is to show some of the applications in Math that we use it in cultural activities and events. First of all, the Pythagorean Theorem is very useful in playing Baseball to calculate the distance from the catcher at home base to the second base, similarly from the first base to the third base in the field. The Pythagorean Theorem also can be used in fire rescues and in buying TVs... Secondly, I relate the "Linear Regression" to analyzing sell's quantity in doing business. Knowing how to graph linear regression will help business owners to predict the sell's quantity in the next quarter or for any month of the year if the selling rate continues to be increased steadily. In short, knowing that math relates to every day life experience will motivate students to learn and make the lessons more interesting and more powerful.