

Web 2.0 Tools for Mathematics

<http://go.wfu.edu/ncctm2013/>

Mathematics Education Faculty and Students
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Introduction to Algebraic Equations - *Wordle* - Kristen McGahan

Arithmetic and Geometric Sequences - *Pixton* - Kathryn Norcross

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Systems of Equations - *ShowMe* - Allison Steel

Quadratic Functions - *Educreations* - Chelsea Parish

Polynomials - *Blabberize* - Jennifer Mastin

Modeling Reflections - *VoiceThread* - Leah McCoy

Web 2.0 tools are web applications that allow the user to create, collaborate, and communicate. Most are engaging and easy-to-use. This is a good context for the in-depth problems and projects that promote the understanding required by the Common Core State Standards.

Questions or problems, please contact Dr. Leah McCoy <mccoy@wfu.edu>

Kristen McGahan

TOPIC: Introduction to Algebraic Equations

This activity serves as an introduction to algebraic expressions and equations. Students may have seen some of the concepts previously but this unit on linear equations is a segue into other types of functions. It includes one variable equations, slope, forming linear equations, and graphing linear equations.

COURSES: Foundations of Math I, Math I

COMMON CORE CONTENT STANDARDS:

- A-SSE: Seeing Structure in Expressions
 - 1. Interpret expressions that represent a quantity in terms of its context.
 - a: Interpret parts of an expression, such as terms, factors, and coefficients.
 - 3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

Web 2.0 Tool: Wordle

www.wordle.net

Wordle is a free web 2.0 tool where teachers and students can create “word clouds”. They can either enter the text in or paste a URL of some article/blog to create a Wordle. The words that show up more often than others will appear larger in the Wordle. Once the Wordle is created one can change the font, style, and color of it. There is also an option to print the Wordle or save it to the public gallery of the site.

Vocabulary in Mathematics

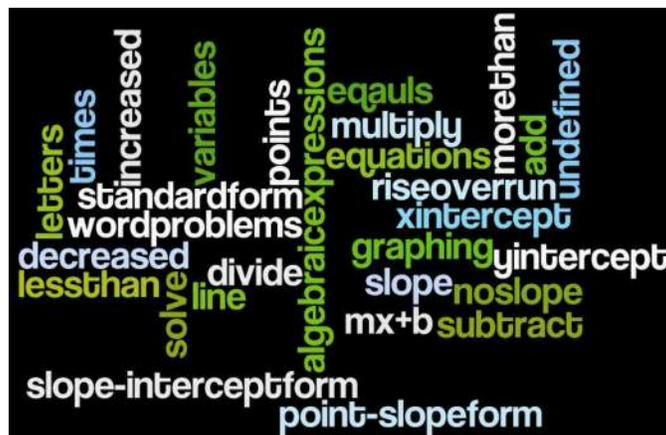
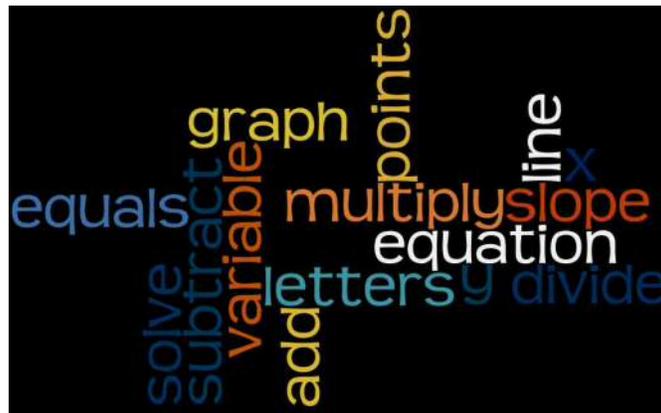
There are often vocabulary terms posted in the classroom during each unit; these are sometimes called “word walls”. Wordle can provide another way to discuss and examine the vocabulary used in the mathematics classroom. In mathematics education it is important to make the connection between symbols, formulas, and the explanations/meaning in words.

Standards for Mathematical Practice:

- 2. Reason abstractly and quantitatively
- 6. Attend to precision

Learning Activity

- Introduce Wordle to the class.
- Give the students a brief description of the upcoming unit and have them work in pairs to write down as many words or expressions that they think might be a part of the upcoming unit. Then they will create and save a Wordle with those words.
- The day before the unit test the students will repeat the process, listing all the words and expressions they have learned throughout the unit. They will use them to create a second Wordle.
- They will then pull up both of their Wordles and discuss similarities and differences. They will select words or expressions from the second Wordle and define them, including mathematical examples.
- The students and teacher will then come together as a class to discuss all of the Wordles and the similarities/differences between them.

Example of Student Outcome:

Kathryn Norcross

TOPIC: Arithmetic and Geometric Sequences

- Students will be able to recognize and describe arithmetic and geometric sequences in a real world context.
- PROBABLE COURSE(S)
 - Algebra I, Algebra 2
- COMMON CORE CONTENT STANDARDS
 - HSF-BF.A.2 Write arithmetic and geometric sequences both recursively and with an explicit formula, *use them to model situations*, and translate between the two forms.

WEB 2.0 TOOL

- **Pixton**
- Pixton.com



- DESCRIPTION
 - Pixton is an online tool that enables students and teachers to create their own comic strip using a simple click and drag interface. Users can animate characters and change settings and backgrounds to create a realistic comic strip.

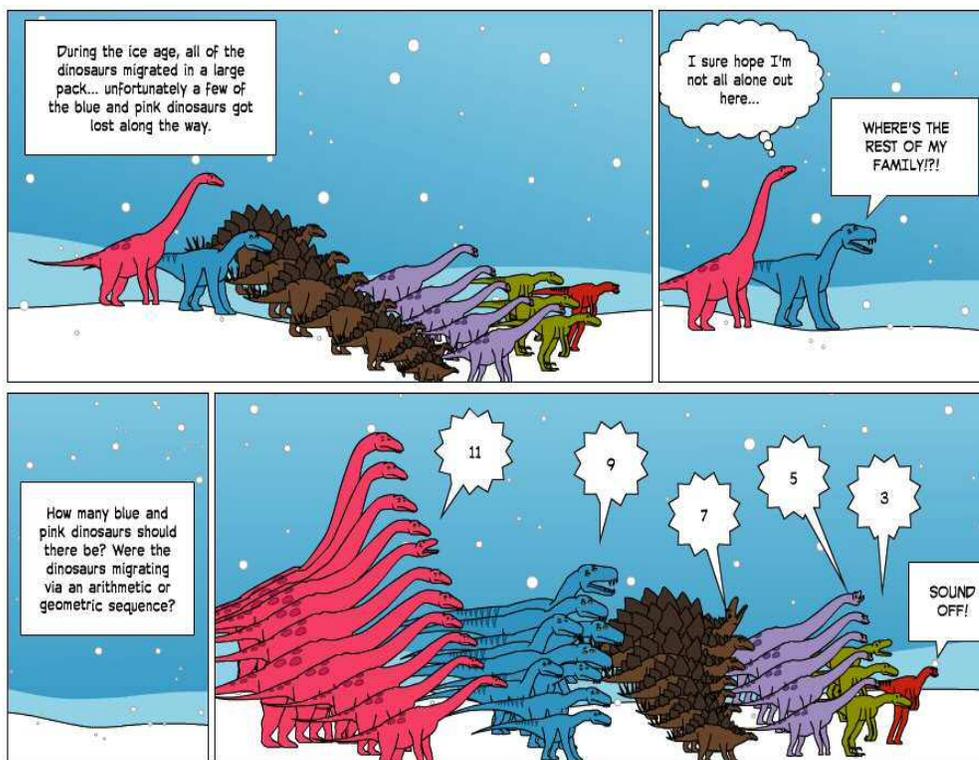
PEDAGOGICAL FEATURE

- Pixton can enhance a lesson by giving students the opportunity to creatively demonstrate their knowledge of a topic and communicate word problems in a visual manner.
- COMMON CORE STANDARD(S) OF MATHEMATICAL PRACTICE
 - 3. Construct viable arguments and critique the reasoning of others

DESCRIPTION OF LEARNING ACTIVITY

- Students will use *Pixton* in groups to generate an arithmetic or geometric sequence, of their own creation, and will then present their comic strips to the class the next day.

EXAMPLE OF STUDENT OUTCOME



Nicholas Stewart

TOPIC: Career exploration

- Students, working in pairs, will investigate careers that substantially draw on mathematics.
- COMMON CORE CONTENT STANDARDS will vary by individual poster.

WEB 2.0 TOOL

- **Glogster**
 - Web tool used to create online posters
 - www.glogster.com

PEDAGOGICAL FEATURE

- Collaborative learning (working in pairs).
- CCSS Mathematical Practice 5: Use appropriate tools strategically.
- 21st Century skills: Real world connections.

DESCRIPTION OF LEARNING ACTIVITY

Students in the class, working in pairs, will design a poster using **Glogster** that illustrates an occupation in which math contributes a major role. The student groups will select an occupation and clear it with the teacher to avoid multiple students producing a poster for the same occupation.

The requirements are listed below.

- (1) A statement of the occupation title, e.g. structural engineer, a list of prerequisite academic training, and expected average yearly salary.
- (2) Sections of the poster should be devoted to two software tools that the profession regularly uses. These could simply be links to those software tools with appropriate labeling.
- (3) A section should portray a type of graph used in this profession.
- (4) A text section or text box of the poster, taking up no less than one quarter of the poster, should be included that describes “a day in the life” of that occupation. To flesh out this section, each student will need to research the occupation by perhaps visiting professional societies, associations, etc., which provide information about your chosen occupation.

Simulated example of student outcome: An investigation into the occupation of structural engineer which was of interest to my fellow group member and me.

URL of final poster:

<http://www.glogster.com/nickstewart5/structural-engineer/g-6kdlmq6vciov881loqp97ps>

Structural Engineer

An engineer whose job is to ensure the safety of buildings and other structures. You will need to earn an advanced degree. The average yearly salary is \$85,000.

Two software tools that the profession uses are StruCalc 8.0 and RISA 3D used to maintain standards and codes as plans are formalized.

A graph modeling wear and tear is below

Stress = force per unit area
strain = lengthwise pull

What can go really wrong?
(Tacoma Bridge, 1910)

A Day in the Life and a Caveat

A structural engineer would be based in an office building and depending on specialization might be required to make site visits/inspections to existing structures or ones under construction. Attention to detail is critical as buildings and other structures have to be constructed to precise specifications and failure to do so can result in injury or even loss of life. The picture above and to the right is a testimony that even though the bridge in question was certified to withstand winds up to 120 mph, a 45 mph crosswind with very distinct characteristics set up a resonance in the bridge which then collapsed. So attention to detail and considering subtle and unusual events is critical to being a successful structural engineer.

Allie Steel

TOPIC: SYSTEMS OF EQUATIONS

- Students will be able to solve systems of equations and use them to create and solve a problem.
- PROBABLE COURSE: Algebra II
- COMMON CORE CONTENT STANDARD:
 - A-CED.3 Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or non-viable options in a modeling context.

WEB 2.0 TOOL: *ShowMe*

- ShowMe is a free iPad application that can be used to create tutorials. This app includes an interactive white board and it allows the user to record voice-overs that play while the writing is displayed. ShowMe also allows the user to insert photos, move and resize them, and draw on them. ShowMe creations can be made public or kept private. Public ShowMes can be viewed online (on a tablet or computer) by anyone. Private ShowMes can be shared directly with others.
- <http://www.showme.com/>

PEDAGOGICAL FEATURES

- This lesson strengthens students' abilities to solve systems of equations and to apply this skill to a real-world problem. The students' computational skills and mathematical understanding will benefit from the fact that they are not told which method to use when solving the systems. They must be familiar enough with the decontextualized variables to be able to choose a method (graphing, substitution, elimination). The students then must contextualize the algebra when they create a word problem. Their ShowMe projects will demonstrate their reasoning and how well they are able to switch between the system of equations and the words of the problem.
- COMMON CORE STANDARD OF MATHEMATICAL PRACTICE
 - 1. Make sense of problems and persevere in solving them.
 - 2. Reason abstractly and quantitatively.
 - 3. Construct viable arguments and critique the reasoning of others

LEARNING ACTIVITY

- Divide into pairs.
- Be given a system of equations (one per pair).
- Create a ShowMe project.
- Solve the system of equations on the interactive whiteboard (all work should be shown).
- Narrate the problem.

- Design a word problem that fits their system of equations.
- Upload at least one picture onto ShowMe that coincides with their word problem.
- Record themselves as they verbally explain how they selected the word problem and how they would solve it.
- Translate their results from the original system so that they use the same language as the word problem.

EXAMPLE OF STUDENT OUTCOME. <http://www.showme.com/sh/?h=JNih52e>

$$\begin{array}{r} x+y=44 \\ + (x-y=24) \\ \hline 2x+0=68 \\ 2x=68 \\ \boxed{x=34} \end{array}$$

$$\begin{array}{r} x+y=44 \\ 34+y=44 \\ \boxed{y=10} \end{array}$$



The WFU football team played their homecoming game against UMD. The 2 teams scored a total of 44 points. The Demon Deacons won by 24 points. How many points did the Terrapins score?

$$\begin{array}{r} x+y=44 \\ x-y=24 \end{array}$$

Earlier we found $x=34$
and $y=10$.

The Terrapins
scored 10
points.

Chelsea Parish

Topic: Completing the Square

- Students will be able to find the maximum or minimum value of a function using the completing the square method in a real world application problem.
- Course: Algebra II
- Common Core Content Standards
 - A-SSE.3. Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.*
 - a. Factor a quadratic expression to reveal the zeros of the function it defines
 - b. Complete the square in a quadratic expression to reveal the maximum or minimum value of the function it defines.

Web 2.0 Tool: Educreations. <http://www.educreations.com/>

- How to use
 - Project may include Writing/text/pictures and Recording
 - May be shared by Email, Link, Social media

Pedagogical Features

- Develop a deeper understanding of the material
- Group communication skills
- Form of assessment
- Common Core Standards of Mathematical Practice
 - 1) Make sense of problems and persevere in solving them
 - 6) Attend to precision

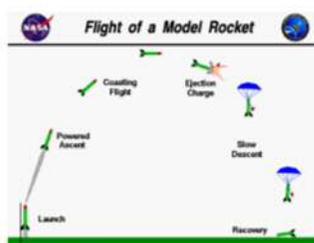
Learning Activity

- Students will work in pairs using the application Educreations
- They will create a lesson that demonstrates their understanding of completing the square using a real world application problem that finds the maximum or minimum of the equation.
- Their final project should include written or typed work, a picture, and a voice narrated audio recording
- The students will save their work and share it using the link to post it to our class Edmodo page

Example of Student Outcome



Completing the Square



$$y = -16x^2 + 96x + 3$$

$$y = -16(x^2 - 6x) + 3$$

$$y + (-16)\left(\frac{9}{4}\right) = -16\left(x^2 - 6x + \frac{9}{4}\right) + 3$$

$$y - 144 = -16(x - 3)^2 + 3$$

$$y - 144 = -16(x - 3)^2 + 3$$

$$y = -16(x - 3)^2 + 147$$

$$(3, 147)$$

Jennifer Mastin

Topic: Polynomials

This activity is intended to be used for students to demonstrate their knowledge of key polynomial features including intercepts, factorizations, and end-behavior.

PROBABLE COURSES: Algebra 2 or Math 2

COMMON CORE CONTENT STANDARDS:

- A.APR.3. Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.
- F.IF.7.c. Graph polynomial functions, identifying zeros when suitable factorizations are available, and showing end behavior.

Web 2.0 Tools

- Blabberize: www.Blabberize.com
 - A free presentation tool that allows the user to upload a picture then add a mouth and sound to make the picture talk.
 - An account must be made in order to save the video
 - Videos can be made public or private and tagged based on the content
 - Videos can be shared by a url, embedded into a web page, or downloaded as .mpg files
- WolframAlpha: www.wolframalpha.com
 - A multipurpose computational tool
 - I used the site to create a nice looking graph by just typing in the function
- Vocaroo: www.vocaroo.com
 - A free online voice recording tool

COMMON CORE STANDARD OF MATHEMATICAL PRACTICE

- 3: Construct viable arguments and critique the reasoning of others
- 5: Use appropriate tools strategically
- 6: Attend to precision

LEARNING ACTIVITY

- In pairs, students will be given a factorable polynomial and will be asked to do the following to create a demonstration of their content knowledge:
 - Graph the polynomial using an online graphing utility such as WolframAlpha and save the picture
 - Record a 30-second description of the polynomial including the original function, its factored form, x and y-intercepts, and end behavior
 - Create the presentation in Blabberize by:
 - Uploading the graph
 - Placing the mouth anywhere on the graph
 - Uploading the mp3 voice file
- The completed videos would then be shared for the class to view and discuss at the end.

Link to completed project: <http://blabberize.com/view/id/1031484>

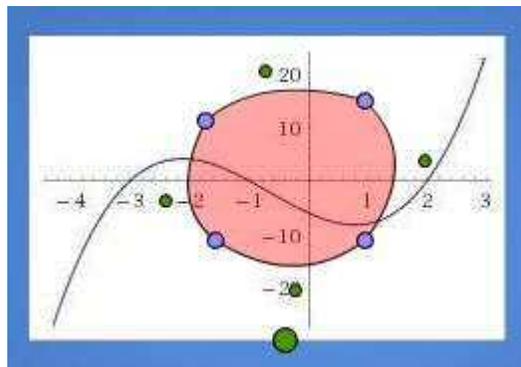


Figure 1: Positioning the mouth

Leah McCoy

TOPIC: Modeling Reflections

- Students will be able to
 - Play an online pool game, noting bank shots.
 - Model the pool table and shots using Geogebra.
 - Explain the path of the cue ball in a bank shot using reflections
- PROBABLE COURSE: Math 2
- COMMON CORE CONTENT STANDARDS
 - G-CO.2. Represent transformations in the plane using, e.g., transparencies and geometry software; ...
 - G-CO.5. Given a geometric figure and a rotation, reflection, or translation, draw the transformed figure using e.g. graph paper, tracing paper, or geometry software.
 - G-MG.1. Use geometric shapes, their measures, and their properties to describe objects.

TOOLS

- Free Pool Game: <http://www.coolmath-games.com/0-poolgeometry/>
- *Screencast-o-matic* to capture screen video: <http://www.screencast-o-matic.com>
- GeoGebra to model the geometry: <http://www.geogebra.org/>
- *VoiceThread* to present report. <http://voicethread.com> (APP also available)

PEDAGOGICAL FEATURE

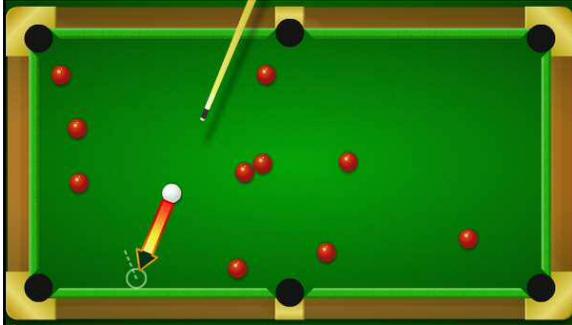
- Students will work in collaborative groups. They will explore the pool shot problem, explain bank shots, and model a solution in *Geogebra*. They will communicate their results in *VoiceThread*.
- COMMON CORE STANDARDS OF MATHEMATICAL PRACTICE
 - 3. Construct viable arguments and critique the reasoning of others.
 - 4. Model with mathematics.
 - 5. Use appropriate tools strategically.

DESCRIPTION OF LEARNING ACTIVITY

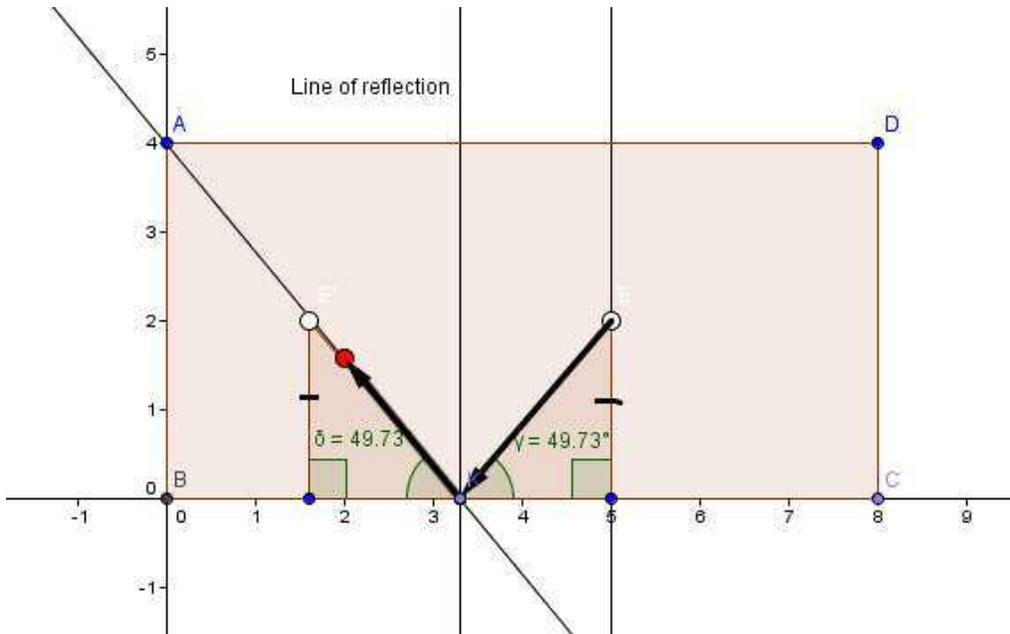
- Student groups will first play online pool game, noting bank shots.
- They will record a shot using *Screencast-o-matic*.
- They will then model the pool table and shot in *Geogebra*, using right triangles and reflections to predict and then confirm the shot.
- Last, they will use *VoiceThread* to create their report. It will include video and voice description of their reasoning.

EXAMPLE OF STUDENT OUTCOME

From Coolmath:



From GeoGebra:



In VoiceThread:

The explanation that demonstrates the group's understanding of the model includes, first, the game being played in Coolmath, with narration. The second part is the GeoGebra model, again with voice narration explaining the model.

Lagniappe -- Angry Birds Problem

Students were asked to copy a screen shot from Angry Birds, paste it into Geogebra, and program a curve to hit the target.

The following example used sliders to experiment with the parabola.

