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EDTC 631 (Brains)
Midterm Presentation Notes
Fall 2015

1. Graphing Quadratic Functions

2. Overview/Target Audience

- 9th grade math class
- CP Algebra 1 course

I teach two CP Algebra 1 classes at Northern Highlands Regional High School. They each have about 15-22 students and the lesson is designed for one 57-minute period. My lesson has been designed to interest and reach all of the unique learning styles and intelligences present in my classroom every day.

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3. Goals and Objectives

Students will be able to:

- Find the x-intercepts of a quadratic function using the Quadratic Formula and find the vertex
- Graph a quadratic function in standard form by finding the x-intercepts and the vertex
- Find the maximum/minimum and other relevant information from a parabolic curve representing a real-life situation.

4. Desired Outcomes

- Strengthen student skills in using the Quadratic Formula
- Deepen student understanding in the various aspects of the Quadratic Formula
- Use this knowledge to find key characteristics of the graph of a quadratic function in Standard Form
- Real-life examples using parabolic curves

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5. Evaluation and Assessment

- Formative assessment of participation during whole-class discussion, practice, and closure
- Practice problems and contributions to group work
- Ability to recap and explain how parabola is formed and key points are determined by the Quadratic Formula
- Group-generated conclusion to real-life question and short summary turned in as exit slip
- Unit Assessment

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6. Brainy Bits

7. Brains: Neurons

- Dendrites
- Axon & Myelin Sheath
- Mirror Neurons

While my students are engaged in my lesson, the **neurons in their brains will be working to process all of the information that is being received**. Information travels through the neurons **using the dendrites** to receive impulses from other neurons and to pass them along using **a long fiber called the axon**, protected by the **myelin sheath**, and then **across the synapse** to other neurons. "Learning occurs by changing the synapses so that the influence of one neuron on another also changes" (Sousa, 2011). Students are able to learn new material when their brain responds to these changes. One type of neuron, the **mirror neurons**, work to plan movements by firing just before an anticipated action is to take place because they "allow us to **recreate the experience of others within ourselves**" (Sousa, 2011). Mirror neurons will help my students to **internalize what they are learning** so they can later recreate the steps they have observed me teach to them.

Image Credits: http://webspace.ship.edu/cgboer/neuron.gif

8. Brains: Cerebral Lobes

An effective lesson should aim to **stimulate all four of the cerebral lobes**: frontal, temporal, occipital, and parietal.

In a math class, the **frontal lobe** will be easily relied on for **higher-order thinking and problem-solving skills**, in addition to other tasks involving emotions and self-will. My students will be using their frontal lobes to **make connections** across different aspects of not only my lesson, but also the entire unit in which we are working. They are tasked with connecting their knowledge of Quadratic Equations, the Quadratic Formula, graphing, and real-world problem-solving.

The students will also need their **temporal lobes** to **recognize the graphs** they are observing and to access parts of their long-term memory. In addition, the temporal lobes will also aid in speech production while the students are participating in class and group discussions. At the end of the lesson, the temporal lobe will be activated while the students are **listening to the YouTube music video** and following along with the lyrics.

The **occipital lobes**, which deal with visual processing, will be crucial for my students to **identify the images** and graphs they see and **connect them to prior learning experiences**.

Lastly, the students' **parietal lobes** will guide them through several parts of the lesson to help **perform calculations and support spatial orientation** when considering the different representations of parabolas. (Sousa, 2011)

Image Credits: https://mttellek.files.wordpress.com/2011/06/brain-lobes.gif

9. Brains: Limbic System & Sensory Input

The limbic system is comprised of several components that perform different tasks, which are very important to emotional processing and memory (Sousa 2011).

The **thalamus** is involved in receiving a variety of messages involved in cognitive processes. All **sensory information** besides smell is sent first to the thalamus where **past experiences determine how important the information is** and therefore if and how the information is stored. Each student's thalamus will receive a lot of sensory input at the start of class, including my instruction as well as any background noises or other distractions. However, as class continues, the **sensory register will block out any unnecessary information and the students will be better able to focus on viewing my instruction**, speaking about the lesson with each other, and listening to my teaching as well as each other's conversations and the YouTube video.

As the thalamus is controlling sensory input from outside the brain, the **hypothalamus** is helping to control and regulate hormones and bodily functions to **maintain homeostasis**. The hypothalamus is crucial because it affects my students' **ability to focus, and therefore, their ability to learn**. If they are hungry, cold, etc. and the hypothalamus is unable to regulate the body, then my lesson will be lost on them.

While my students are able to focus and take in sensory information, the **hippocampus** is needed to take information regarding facts, objects, and places **from the working memory to long-term storage**. However, the hippocampus "is susceptible to stress hormones that can inhibit cognitive functioning and long-term memory," so it is crucial for my teaching to **support a low-stress environment**. I will help to maintain this by giving careful, clear direction and answering any questions that arise throughout the lesson.

Lastly, the **amygdala** is concerned with **emotions** and some believe it stores or encodes the emotional components of long-term memories (Sousa, 2011). "The interactions between the amygdala and the hippocampus ensure that we remember for a long time those events that are important and emotional" (Sousa, 2011). As a teacher, it is paramount to keep lessons from being dry and **instead infuse positive emotions in the classroom** regularly so my students can walk away with not only a good experience but also stronger memories they will keep with them.

Image Credits: http://img1.mxstatic.com/wallpapers/3803ee048ee81b7d06cca21c664cac5e_large.jpeg

10. Sense and Meaning

- When you throw a ball, how can you determine its maximum height and when/where it will hit the ground?
- While swinging on a swing, how can you find the horizontal length of your path?
- How can you find the maximum height of a stream of water when sprayed out of a hose into the air?

It is important to **pique students' interest** when teaching something new, so I will use these questions to give meaning to the lesson. Because meaning "is a very personal thing and is greatly influenced by...experiences," (Sousa, 2011), I use a **variety of examples** so that each student can connect with at least one of them. I know that my students will be able to **make sense of the lesson based on prior learning** experiences that have built up to this topic mathematically, but they need to **attach meaning to it in order to ensure long-term storage**. **"What was meaningful for us as children may not be necessarily meaningful for children today"** (Sousa, 2011). In addition to asking these questions, I will also have students generate examples of realistic parabolic curves in the introduction as well as closure, and use a YouTube music video to show them same-age peers who have created a song all about our topic.

Image Credits:
http://scsgr10math.wikispaces.com/file/view/Untitled.png/182712585/800x480/Untitled.png
https://education.ti.com/en/timathnspired/~/media/Images/Activities/US/Math/Algebra%20II/Modeling%20with%20a%20Quadratic%20Function/hero.png

11. Primacy-Recency

12. ***Prime-Time 1:***

- How do we use the Quadratic Formula to find the x-intercepts of a Quadratic Function?
- What do the x-intercepts and the vertex represent on a graph of a ball's trajectory through the air?
- How could we find the vertex?

Prime-Time-1 is crucial to the **development of new material** because "we tend to remember best that which comes first," (Sousa, 2011). I will start the lesson by **summarizing** what we have been learning about solving quadratic functions using the Quadratic Formula. I will **correct any misunderstandings** and reinforce good habits of mind. I will then **show the students an image** of a baseball's path through the air that is transposed onto a coordinate grid. They will recognize its shape as a parabola, and I will ask them to tell me where the baseball **begins and ends its path** and we will identify these two points as the x-intercepts, which they can solve for using the Quadratic Formula. Then, I will ask them to identify where the baseball is at its **maximum height** - which we call the vertex - and show that it is equidistant between the two intercepts. We will go over **how to find the vertex** using two methods: finding the average of the two intercepts; and using -b/(2a) (part of the Quadratic Formula). I will present the information **very clearly** because "it is important, then, that **only correct information be presented**," (Sousa, 2011) so that students do not retain misinformation. They will be given a few short examples to try on their own so that I can assess their understanding of the lesson.

Image Credits:
https://upload.wikimedia.org/wikipedia/commons/thumb/d/d9/Parabola_features.svg/2000px-Parabola_features.svg.png

13. ***Down-Time***

- Group work with real-life parabolas

During Down-Time, I will put my students into **heterogeneous groups** each with a different real-life parabola about which to determine **key information** and to **answer contextual questions**. This will help to **reinforce** what was learned in Prime-Time-1 and give students the opportunity to **discuss their thoughts** with others. Down-time is an important time for students to "practice new learning or to discuss it by relating it to past learnings" (Sousa, 2011) They will be **practicing what they have newly learned regarding graphs while also strengthening what they have previously learned about the Quadratic Formula**. The students will also be reminded to use their **graphing calculators** as an additional resource to double-check their calculations and observe the graph on its own (without the image).

Image Credits: http://www.mathwarehouse.com/geometry/parabola/images/real-world-parabolas/parabola-real-world4.jpg
http://www.cdn.sciencebuddies.org/Files/5348/7/football-parabolic-trajectory_img.jpg
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14. ***Prime-Time 2***

- Group presentations and discussion of findings
- Reflect on links between formula and graphs
- YouTube video of Quadratic Formula song

In Prime-Time-2, this is "the learner's last opportunity to attach sense and meaning to new learning," so it is vastly important that students are given the opportunity to **reflect and refine their understanding** of the lesson. During this time, the groups will show the class what they have determined on their graphs and explain how they found their results to the questions. We will discuss the common threads across all groups and then I will give the students a few minutes to reflect on their new learning and ask any questions they may still have. Each group will then be asked to **write a short summary** on what they have learned, which will be turned in as an **exit slip**. At the end, we will again reinforce the Quadratic Formula by watching a **YouTube music video**. By playing this song numerous times throughout the unit, I am hoping that the song will stick in their head so that they can correctly remember the formula and its uses across the entire unit.

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15. Pedagogy

16. Gregorc's Learning Styles

When creating my lesson, I ensured that I was utilizing the different learning styles outlined by Anthony Gregorc (1985).

- **Concrete-Sequential** learners will appreciate the **order and structure** of my instruction in Prime-Time-1. They will also be successful during Down-Time because they learn best when they are able to **depend on others** to complete a task. It is important for me to make sure the groups on task and working toward a goal, because these learners struggle when there is a lack of focus.
- **Abstract-Sequential** learners will want to **analyze the big picture** of the activity and consider their **decision-making independently** before giving their final answers. They will take advantage of the Down-Time to formulate their opinion and lead their group's discussion.
- **Concrete-Random** learners will **test different values** in order to see what will give them the correct x-intercepts and maximum or minimum value. They will not be afraid of getting the wrong answers and will appreciate **trial-and-error** problem-solving. It will be difficult for them to explain their work to others, so I will make sure all groups are heterogeneous to help balance this out.
- **Abstract-Random** learners will **balance out group dynamics** and keep everyone on task. They will appreciate the realistic, contextual aspect of the task but will have trouble giving specific reasons for their answers. They will be utilized when the group needs to **make decisions and plans** for what to do if they make any errors in their calculations and **evaluating their final results**.

Image Credits: http://www.incredibleart.org/files/images/gregorc.jpg

17. Gardner's Multiple Intelligences

Howard Gardner refined the traditional definition of intelligence to describe not only a person's thought process, but also the materials and values that are presented throughout the entire learning experience and their impact on a person's unique intelligences. He has named nine multiple intelligences: ***verbal/linguistic, mathematical/logical, visual/spatial, musical, bodily/kinesthetic, interpersonal, intrapersonal, naturalist,*** and ***existential***. I have found worthwhile places in my lesson for each of them.

The **verbal/linguistic** intelligence will be activated throughout various parts of the lesson, but specifically in **note-taking** and **group discussion**. These learners will recall and use appropriately all **vocabulary terms** and be able to **articulate** effectively their reasoning with others. For example, they will be able to recall the words "x-intercepts" and "vertex" and describe them both in context and on a graph. They will do well to help their group **write the summary** during the closure portion of the lesson.

The **mathematical/logical** intelligence will be deeply utilized and developed in this lesson, as in most in my classroom. They are able to **reason deductively**, **recognize patterns**, and **think logically** about a problem. These students will quickly notice the **connections** between the graphs, equations, and Quadratic Formula, as well as the links to the problems in context. They will pick up on the patterns and be able to explain mathematical details to their peers.

The **visual/spatial** learners excel at **creating mental images** and appreciate any visual aspects of a lesson. This intelligence will be activated when the students see the **real-life parabolas** and have to identify key features on the graph. They will also use their internal abilities to generalize patterns visually and create a mental sketch of the graphs before looking on their graphing calculator.

The **musical** intelligence is the ability to recognize tones, rhythms, and music. These learners will be excited to see a **YouTube video** that incorporates the Quadratic Formula and methods of solving Quadratic Equations. They will follow along with the beat in the music which will help them to remember the formula, to give meaning to, and to connect with the topic.

The **bodily/kinesthetic** learners are those who benefit from physical activities and movement. They will connect with the realistic problems they are given because they will be able to **act out physically** what is taking place (such as demonstrating a watering hose or throwing a ball) which will help them to **understand the context** and its connection to our lesson. In addition, they will appreciate moving around the classroom to form their groups and present their findings.

The **interpersonal** intelligence is activated when students are able to **recognize each other's** feelings, motivations, and intentions. The interpersonal learner is successful when working with others to discuss topics and make decisions together. These students will enjoy working in groups during Down-Time and **collaborating** on their answers to the questions. They will be successful in **sharing their ideas** with the class and learning about each other's findings.

The **intrapersonal** learners are successfully able to understand their own feelings and motivations. These students will enjoy forming their own opinions and ideas regarding the lesson and the group exercises. They will be able to **reflect on their learning** and articulate their ideas clearly with others. They also benefit from the closure portion of the lesson, as they can think back over what they have learned and how it applies to Algebra as a whole.

The **naturalist** intelligence is displayed in the love of nature and the ability to recognize and categorize objects in nature, such as plants and animals. These learners will enjoy the **realistic, natural contexts** in which I present the graphs. They will be able to visualize how the situations unfold and their **implications in nature**, as well as any additional factors that might need consideration (such as wind affecting the ball's trajectory, etc.).

The **existential** learners have the capacity to comprehend deeper thoughts about human existence and life in general. These students will appreciate the **introduction questions** and how their results apply to real life. They will be curious about **future implications** of their new learning and where else they will be able to apply what they have learned in this lesson to the real world.

Image Credits:
http://1.bp.blogspot.com/_ds4Lydb5PeQ/Rf8DfRK66QI/AAAAAAAAACA/H9f6F05STEg/s1600-h/wheel.gif

18. Technology

- Projector
- Document Camera
- Graphing Calculators
- YouTube

Technology is ever-changing in the world and especially in our classrooms. In some ways, our students are miles ahead of us in terms of technology usage, but I thrive on teaching them about resources with which they are unfamiliar or intimidated. I regularly use the **projector** and **document camera** to take notes, post answers, work out examples, and display student work. I will utilize these in my lesson during the Prime-Time-1 and 2 stages for both my **direct instruction** and the **students' presentation** of results/wrap-up. It is important for me to model correct problem-solving, but also for students to see the work of their peers. The students will also be utilizing their **graphing calculators** to examine and manipulate the different aspects of their quadratic equations. As a teacher of 9th-grade students, I am often the first person to show them how to use the more complicated features of their calculators. I make it a point to use them regularly as a resource and motivate the students to explore all the capabilities to broaden their knowledge. Lastly, the most familiar technology tool in this lesson is **YouTube**. I have bookmarked a variety of video tutorials and music videos to use throughout the year, and this lesson uses a music video of the Quadratic Formula not only to help the student to remember it, but also to **add a layer of creativity** and fun to the unit. I always appreciate when I hear a student singing quietly during a test to jog their memory.

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http://www.educationworld.com/images2/sections/technology.gif
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