Flipping Quadratics in the Algebra I Classroom

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FLIPPING QUADRATICS IN THE ALGEBRA I CLASSROOM

<u>Introduction</u>:

  With the development of the Common Core, more higher order concepts have become common in the math curriculum. We are now at a time of teaching Algebra to all students, even beginning as early as the middle school years. Since Algebra is a foundation for all math courses following it, it is imperative that students have a strong understanding of its concepts (Hegedus, Dalton, & Tapper, 2015). The Quadratics unit in Algebra can be a challenging topic for students since it is something with which they do not have much experience and it can be hard to make connections from the concrete to the abstract unless there are many visuals incorporated (Bassoppo-Moyo, 2010).

  In the last two years, my district has incorporated a one-to-one technology initiative that provides all students from grades seven through twelve with individual chromebooks. By creating a Quadratic unit that all Algebra 1 students can access online, it creates a digital classroom where students can quickly access lots of information focused by the teacher. Since the information is more visually and auditorily attractive than a traditional classroom, student motivation generally increases (Ozerbas & Erdogan, 2016). Technology makes it is easier to provide visual representations of the math content as well as ways for the students to interact with the mathematical objects by sliding parts and forming conclusions. Math becomes dynamic. Students can use many programs and tools such as Geometer's Sketchpad or the graphing calculator to investigate math concepts as well as explore changes by manipulating equations or objects (Hegedus, Dalton, & Tapper, 2015). These visual representations help to facilitate cognitive processing and construct deeper understanding. Since each student has their own device, they can work at their own pace making the curriculum more individualized for each

student (Hsin & Paas, 2015).

This project is in fulfillment of the MSET capstone project and will provide students with a teacher-created website for a quadratics unit that contains videos, practice problems, games and many more resources. Through the use of the flipped classroom, students during class time will be able work at their own pace as well as have more choices in the ways at which they practice the concepts. Students will watch teacher-created videos that explain the basic concepts as homework and then receive more individualized instruction in the classroom. This method allows the teacher more access to the students and time to correct misconceptions as well as facilitate whole class or group discussions (Sams & Aglio, 2017). Furthermore, students can work on the lesson using methods that support their learning styles. For the more intrapersonal learner, they can work individually on the lesson using online programs such as IXL that help to enhance their learning. For the interpersonal learner, they can work with a group of students to discuss the lesson and further explore it together. Many classroom activities can be created to further the learning while also supporting multiple intelligences (Gardner, 1983).

Preparing students to meet the demands of the 21st century requires the enhancement of student's creativity. The flipped classroom method frees up classroom time to guide students to explore more higher order problems by building off of the concepts learned in the video and exploring solutions to more unique problems. The use of many math technology programs and the graphing calculator help to facilitate experimentation with problems and allow the students to formulate their own solutions. Students become active participants in their own learning (Abdulrahman & Al-Zahrani, 2015). The overall impact of technology in the flipped classroom can help to increase academic performance and motivate students to take control of their

learning. As students take more control of their learning, they are better prepared to attack future problems. (Bhagat, Cheng-Nan & Chun-Yen, 2016).

Overall, by creating a Quadratics unit that builds off of teacher-created videos and provides technology activities for the students to explore the concepts, more students will be able to find success. All levels of learners will be able to find activities that help them navigate a difficult math topic. All the while, I will be able to facilitate the learning and provide my students with a more individualized instruction.

Objectives:

Leading up to this unit students have become very familiar with linear functions and their graphs. They have also begun to explore quadratic equations through multiplication of binomials as well as factoring. By the end of this unit, they will know how to predict the shape, location and direction of the parabola based upon its equation as well as use a variety of methods to solve a quadratic equation such as graphing, factoring and the quadratic formula. Real world problem solving applications will help to tie the unit together and make for a strong understanding of quadratic functions.

Lesson One:

- To identify parts of a quadratic function

Lesson Two:

- To graph quadratic functions of the form $y = ax^2$ and $y = ax^2 + c$
- To graph quadratic functions of the form $y = ax^2 + bx + c$
- To graph quadratic functions from real world scenarios
- To make predictions based upon quadratic graphs

Lesson Three:

- To solve quadratic equations by graphing

- To apply real world situations to the graph of a quadratic function

Lesson Four:

- To solve quadratic equations by using square roots

Lesson Five:

- To solve quadratic equations by factoring

Lesson Six:

- To solve quadratic equations by using the Quadratic formula (Charles, 2012)

Procedure:

This flipped classroom unit will guide students through the Quadratics unit of study over the course of approximately fifteen days. Through the use of my portfolio website, there will be teacher-created videos throughout the unit that students will be required to view for homework as well as take notes on the day before the in-class session. While in class, students will be able to choose from a variety of technology activities to enhance their learning. Through various technology resources students of multiple intelligences and learning styles will be able to find learning activities in which they feel most comfortable.

- Grade level: 8th grade Algebra I

- New Jersey Student Learning Standards for Algebra and Technology Standards Addressed:

    o 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.

o A.CED.2 Create equations in two variables to represent the relationships between quantities.

o F.IF.7.a Graph linear and quadratic functions and show intercepts, maxima and minima.

o A.REI.4a Use the method of completing the square to transform any quadratic equation in x into an equation of the form $(x – p)^2 = q$ that has the same solutions. Derive the quadratic formula from this form.

o A.REI.4.b Solve quadratic equations by inspection, taking square roots, completing the square, the quadratic formula and factoring as appropriate to the initial form of the equation. Recognize when the quadratic formula gives complex solutions and write them as a +/- bi for real numbers a and b.

o 8.1.8.a – Appropriately use the scientific and graphing calculator when solving problems and recognize if an answer makes sense.

o 8.1.8.D.1 Appropriate online behavior

o 8.2.8.E.4 Appropriate Technology terms

● General Lesson Format:

Each lesson will feature common elements of the flipped classroom, in class activities, assessment and homework.

o Prior to Lesson – Students will have watched the lesson video, answered questions throughout and taken notes. Each 7-10 minute video will provide an introduction to the lesson with important vocabulary, demonstrations on how to solve problems that progress in difficulty as well as any important key ideas.

o Lesson:

§ Start by going over homework video questions.

- § Students can select from various activities to practice problems. Independent or paired activities may include watching another video explanation, Quizlet, IXL, BuzzMath or Google Forms. Whole class activities may include Kahoot, Nearpod or Socrative.

- § The lesson will be wrapped up with an exit ticket in the form of a Google form, socrative.com, or a traditional paper and pencil question.

- § Homework will either consist of a video for the next lesson, practice problems on a worksheet or textbook, or IXL.

- o Assessment:

  - § Class participation

  - § Practice problems

  - § Homework

  - § Video check points through the use of Vizia

  - § Plickers

  - § Exit Ticket

  - § Quizzes

  - § Unit Test

- ● Software and Internet Resources:

  - o www.flip4math.com website

  - o IXL

  - o Buzz Math

  - o Geometer Sketchpad

  - o Google Classroom

- o Google forms

- o YouTube

- o Quizlet

- o Texas Instruments Graphing Calculator/Desmos

- o Khan Academy

- o Nearpod

- o Vizia

- o Screencast-o-matic

- o Kahoot

- o Socrative

- o Exit Ticket

- Essential Questions for the Unit:

  - o What are the characteristics of quadratic functions?

  - o How can you solve a quadratic equation?

  - o How can you use functions to model real-world situations?

- Throughout the unit, I will incorporate all levels of Blooms Taxonomy in order to
  challenge all of my students (Bloom, Englehart, Furst, Hill, & Krathwohl, 1956).

  - o Remember: Students will remember how the various numbers in the equation
    for a quadratic function determine the graph of the quadratic function. For
    example in $y = ax^2 + bx + c$ when the a > 0, the parabola opens upward but if
    the a < 0, the parabola opens downward.

  - o Understand: Students will understand that solutions to a quadratic function
    are the x-intercepts of the related function and that there can be two, one or no
    real number solutions. Students will understand that there are many ways to

solve a quadratic function.

o   Apply: Students will apply their knowledge of quadratic functions to

real-world problems.

o   Analyze: Students will make predictions based upon their graphs and

solutions to quadratic word problems.

o   Evaluate: Students will evaluate their solutions to determine if they are

reasonable.

o   Create: Students will create graphs based upon real-world scenarios as well as

create equations given quadratic graphs.

● Gregorc's Learning Styles that are incorporated into this unit (Gregorc, 1985):

o   Concrete Sequential:

▪   Organized, Routine

▪   Daily Schedule

o   Concrete Random:

▪   Real world problems

▪   Instinct to solve problems

o   Abstract Sequential

▪   Learning by watching the videos

▪   Various different sites to gather information

o   Abstract Random

▪   Personalized learning; choice

▪   Group work

Impact:

All of the video lessons, activities and resources for this Quadratic lesson will be centrally located on the Google Classroom website, which is publicly accessible via the Internet when given the access code. This will allow all of my students more time to individualize their learning by going back to videos and lessons when needed. My Algebra I colleagues as well as anyone who has Internet access, will able to implement this unit using the technology resources I have compiled. My goal is to take a difficult Algebra unit of study and make it more accessible and understandable for all. Through all of the technology resources students will be able to get constant feedback and find answers to their own questions at a faster rate because they will have access to many technology resources as well as the video lessons.

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