Capstone Project Proposal

Tools for Developing Instruction
Practicum in Learning Theory

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Spring 2017

Introduction

       I teach at Northern Highlands Regional High School in Allendale, New Jersey. I have been teaching mathematics for six years, four of which have been at this school. I began my teaching career at Station Camp High School in Gallatin, Tennessee, immediately after graduating from Vanderbilt University in 2011. My uses of and preferences regarding technology have evolved slowly throughout my teaching career.

       While teaching at Station Camp in Tennessee, I was issued a laptop, in addition to the desktop in my classroom, a document camera, and shown how to use a set of clickers. However, my favorite piece of technology was my SMART Board. Almost every classroom in the school had one. I had learned how to use it during student teaching, and I thought they were one of the greatest teaching tools available. I felt this way because I taught multiple sections of Algebra 1 each day and this allowed me to reuse my lessons without having to rewrite everything on the whiteboard for each class. In addition, I loved being able to save the notes from each class so that I could post them on my website for students to use as a resource. I occasionally used some of the interactive features of the SMART Board along with Texas Instruments graphing calculator software, but did not dig too deeply. My school did not put much emphasis on radical technology innovation, so I viewed my practices as worthy.

       When I moved back to New Jersey and began teaching at Northern Highlands, I went through a period of massive change. As a Ridgewood High School graduate, I thought I knew what to expect at Northern Highlands. By any standards, Northern Highlands is one of the best schools around, not to mention years ahead of Station Camp and any school I had previously encountered in Tennessee. However, the teachers here did not appear to use much technology that was impressive by my standards. There were only a handful of classrooms with SMART Boards, and many teachers showed no interest in them. No one had laptops, there were only desktop computers in each room, connected to the school network, where we were to access and store all files. I shared a classroom with another teacher, so my desk was at the

back of the room. Because of this, it took several weeks for the technology team to install a computer for me. I spent most of these early weeks running back and forth from my classroom to the math department office, where there were extra computers and a printer.

I taught in multiple classrooms, so I was constantly afraid of showing up to a class without my materials. Because not all of the rooms had a SMART Board, it seemed like a waste of time to create multiple lessons on the same topic in order to teach both with and without the board. As a result, I accepted that I would have to join in the culture of teaching through creating handouts and using a document camera, thus causing more trips to the printer and copier. I had never much liked the idea of a document camera because I feel as though it limited my mobility. I prefer to move about the classroom to maintain my energy level, as well as keep my students engaged. Unfortunately, I had to give that up so that I could work with what I was given. Despite all of this, we were constantly encouraged and pushed to incorporate as much technology as possible.

As the years have gone by, I have found myself in more classrooms with SMART Boards and made the time to utilize them. However, I have not consistently gone back to the way I originally started my teaching career. I used to think that a SMART Board was the best technology around, but my coworkers do not share that opinion. As a result, I have tried out other technologies that they recommend – such as educational videos, online graphing applets, Desmos, and GeoGebra, to name a few. We received Microsoft Surface Pro's during my third year at Northern Highlands, and many teachers like to wirelessly project their devices and use OneNote for their lessons so that they can teach from anywhere in the classroom. Personally, I have not had the time or interest to explore this very far.

At the start of the current school year, we adapted Canvas as our new learning management system, and went one-to-one with all of our students also receiving a Surface Pro. Northern Highlands is a wealthy community, so I am sure that most students have personal laptops at home; however, the school's issuing of devices encouraged all students to regularly carry around their tablets and explore how they can improve note taking and learning electronically. I have been extremely

impressed by many of my students who excel with technology, but also found ways to guide those students who need more help. This movement has made it much easier for me to incorporate technologies into my lessons, as I no longer have to plan in advance how I will get computer access to my students. I more freely encourage my students to get online and explore the content through new pathways. I am constantly looking for new ways to expand upon this and allow my students to take more initiative in their own learning. I think that effectively using technology in my classroom will teach my students ways they can improve their education and lifestyle by learning to appropriately utilize their resources.

Northern Highlands Regional High School receives students from Allendale, Upper Saddle River, Ho-Ho-Kus, and Saddle River, New Jersey, which are all affluent suburbs. Residents are employed primarily in executive, professional, and managerial positions. The current student population is 1354, and about 93.4% of the Class of 2016 went on to attend a four-year college after graduating. Class periods are 57 minutes long and operate on a four-day rotating schedule, so each class meets three or four times in a week. There are eight periods in total, but only six of them meet on a given day. Full-time teachers are scheduled to teach five classes out of the eight. According to the School Report Card Performance Report of 2014-15, the vast majority, about 83%, of students are white, about 10% are Asian, and the rest are Black, Hispanic, Pacific Islander, or biracial. About 11% of the students are classified as special education and less than 1% are considered economically disadvantaged.

My project will consist of a unit for my Algebra 2/Trigonometry classes. I have three sections, with a total of 65 students in tenth and eleventh grade. I have two students with Individualized Education Plans, three students with 504 Documents, and three students who have been issued a plan by our Intervention and Referral Services team. None of these students receive modified assignments; most of their accommodations involve longer testing periods and extended due dates.

Objectives

The topic of my project will be a unit titled "Exploring Families of Functions, Transformations, and Inverses." This is an essential unit in the Algebra 2 curriculum that has foundations in prior learning, but greatly develops and expands students' knowledge of six different families of functions. The unit takes place over about two months of instruction and can be broken up into three main parts, shown below. There will be several assessments, both formal and informal, throughout the unit. I will be using Canvas as my platform.

Part 1) What are Functions?

　　　[About 3-4 instructional days plus review/practice]

- o Defining a function and determining if a relation is a function
- o Finding Domain and Range
- o Evaluating a function given its equation and/or graph
- o Using correct function notation
- o Identifying characteristics given a graph
- ➢ Quiz

Part 2) Parent Functions and Transformations

　　　[About 7-8 instructional days plus review/practice]

- o Exploring parent functions using graphing calculators and/or software
- o Comparing and contrasting the families of functions
- o Exploring transformations using Desmos (online graphing software)
- o Summarize and draw conclusions about the effects of the different transformations through equations and graphing
- o Applying transformations to real world contexts
- o Graphing transformations given function equations
- o Graphing transformations given function graphs
- ➢ Test

Part 3) Function Operations and Inverses

[About 8-9 instructional days plus review/practice]

- o Evaluating function operations from given equations
- o Evaluating function operations from given graphs
- o Evaluating compositions of functions using equations and graphs
- o Applying function compositions to real world contexts
- o Discovering Inverse Functions through graphs
- o Determining whether a function has an inverse function (one-to-one)
- o Finding inverse functions from equations and graphs
- o Verifying inverses from given equations
- ➢ Test

Procedure

Software and Internet resources

- o Canvas
- o Desmos
- o Pearson Prentice Hall online textbook resources
- o Google Drive
- o MathBitsNotebook
- o Kuta Infinite Algebra 2 software

Grade levels

- o 10th and 11th grade

Standards addressed – NJ Student Learning Standards for Mathematics

- o NJ-SLS-Math F-IF A. 1-2: Understand the relationship between domain and range for all functions and use proper notation to define, evaluate and interpret in terms of a context.
- o NJ-SLS-Math F-IF B. 4-5: Interpret key features of graphs and tables according to various models, as well as sketch graphs given features or verbal descriptions of relationships.

- NJ-SLS-Math F-IF C. 7-9: Graph functions by hand or by using technology to be able to identify and compare key components such as intercepts, maxima, and minimum for parent functions.
- NJ-SLS-Math F-BF A. 1-2, B. 3-5: Combine functions using various operations and compositions in order to distinguish transformations of parent functions and verify inverse functions.
- NJ-SLS-Math A-CED A. 1-3: Create equations and inequalities when given graphs, tables, or real-world situations in order to represent different models and relationships between two quantities.

Assessment

- Daily classwork and/or homework
- Quizzes
- Tests
- Classroom exit slips

Can it be duplicated

Yes

Teacher Tips

During the exploration activities, students should not be given too much direction. They should be encouraged to experiment and write down any observations they have.

Include one or two 'brainy-bits' for each lesson plan in your unit.

Part 1)

- Gregorc's Learning Styles: concrete-sequential will appreciate the order and structure of my instruction
- Gregorc's Learning Styles: abstract-sequential will analyze the big picture of activities and make choices independently before finalizing conclusions

Part 2)

- Gregorc's Learning Styles: abstract-sequential will analyze the big picture of activities and make choices independently before finalizing conclusions
- Gregorc's Learning Styles: abstract-random will balance group dynamics and appreciate the realistic, contextual aspect of tasks

Part 3)

- Gregorc's Learning Styles: concrete-random experiment with patterns of inverses; will not be afraid of getting wrong answers and appreciate trial-and-error problem-solving
- Gregorc's Learning Styles: abstract-random will balance group dynamics and appreciate the realistic, contextual aspect of tasks

Gardner's Multiple Intelligences

- Verbal/linguistic: note-taking and group discussions; recalling and using appropriately all vocabulary terms; able to articulate effectively all reasoning
- Mathematical/logical: reasoning deductively, recognizing patterns, thinking logically about problems; noticing connections between graphs, equations, and families of functions; linking to the problems in context
- Visual/spatial: all visual aspects of graphing lessons; identifying key features on graph; generalizing patterns visually and creating a mental sketch of the graphs
- Bodily/kinesthetic: connect with the realistic problems and physically act out what is taking place
- Interpersonal: discussing topics and make decisions with other students
- Intrapersonal: forming their own opinions and ideas regarding activities and lessons; reflecting on learning and articulating ideas with others
- Existential: appreciate how the results apply to real life; curious about future implications of new learning and where else it will apply in the real world

Impact

Creating this unit in Canvas will allow me to organize and build off my current resources and create lessons that can be used for years. I will reflect upon student outcomes and use assessment data to improve future instruction. My students will learn to take more initiative over their learning and explore new pathways to success. Because my unit will be completely accessible electronically, it can be shared and employed by teachers across the country.

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