



This course of study outlines the sequence of learning activities to help you develop competence in the subject area of Mathematics Technology. Your competence will be assessed as you complete a series of performance tasks (DGT1). This course of study may take up to three weeks to complete depending on your educational background, work experience, and the time you are able to dedicate to your studies. Consult with your mentor if you wish to accelerate through this course of study. Completing your assessments within the required timeline keeps you on pace for satisfactory academic progress and graduation.

## Introduction

This course of study will help you not only strengthen your math thinking and communications skills but also develop problem-solving strategies and computer skills. Consider the value of engaging your students in math and computer applications. When possible, plan your instruction around big ideas rather than isolated skills. As you work through the course of study activities, be aware of potential student difficulties and your potential interaction with the math content.

### Overview

You will now continue your study of mathematics pedagogy. This assessment, DGT1 for the Mathematics Technology course of study, is a performance assessment that focuses on the construction of original lesson plans using appropriate research-based, age-specific pedagogies. Specifically, this course of study focuses on the appropriate use of technology in mathematics classrooms. Do you know how to use a graphing calculator? Do you know how to use Microsoft Excel? There are several great dynamic geometry software packages available. Have you ever used Cabri or the Geometer's Sketchpad? Texas Instruments' (TI's) calculator-based ranger and calculator-based laboratory are two excellent real-world data-collection devices. Have you heard of or used these before? If not, fear not; you will soon learn how to effectively incorporate these technologies into your lesson plans.

You will need to infuse these technologies into selected mathematics teaching topics that include proofs, graphing calculator usage, dynamic geometry software, data collection and analysis, and the use of appropriate justifications within pedagogy. The use of appropriate technology in math classrooms is one of the National Council of Teachers of Mathematics' (NCTM) tenets. You will now explore how to go about harnessing the power of these tools to capture students' attention and to motivate them to learn.

### Pre-Clinical Experiences

In Foundations of Teaching, you completed some video-based pre-clinical experiences (PCEs). In Effective Teaching Practices, you will find that a PCE is a more hands-on experience. The PCE tasks in this domain require a minimum of 30-40 hours of in-school observations and reflections; in addition, you will be asked to teach actual lessons that require planning and presentation. You will need to analyze practice as it relates to educational theory, reflect upon your own practice, record these thoughts, and draw conclusions about your application of these



theories.

## Pre-Clinical Experience: Cohorts

As the need arises, you will be able to attend weekly pre-clinical experience cohorts, which have the primary purpose of allowing students from the DOT, DMT, and DGT assessments to collectively discuss issues that arise during the completion of PCE tasks. The cohorts are also meant to provide a venue for open and active discussion with regard to clarification of task requirements, implementation of relevant mathematics pedagogy in the classroom, and any other relevant issues. What is great about these cohorts is that everyone benefits. While you are requesting clarification with regard to a specific PCE task, you will also have an opportunity to learn about future PCE tasks in the DOT, DMT, and DGT assessments. Another benefit to attending these cohorts is that it will serve as preparation for the mandatory demonstration teaching seminar that will appear later on in your program.

*Note: Prior to starting the first section, "Preparing for Success," you should carefully read through the requirements of this course of study with the intent of acquiring an overview of what is expected of you. Such an overview will ensure that you are prepared for the pre-clinical experiences found throughout this course of study.*

## Be the Successful Mathematics Teacher

### URL:

#### Study Skills Self Help Information

<http://www.ucc.vt.edu/stdysk/stdyhlp.html>

Whether you are initiating, changing, or expanding your career, what you learn throughout your mathematics program will help you internalize your skills and abilities and transfer your love and knowledge of math to your students in the classroom.

- **Get the Tools You Need:** Enroll in Teaching Mathematics Grades 5-12 from the course of study.
- **Build Your Motivation and Confidence:** If you are not already a teacher of record with your own classroom, spend time substituting and tutoring in schools. Get to know firsthand the challenges and joy of working with young students. As a teacher, you will need to know how to help your students learn and demonstrate competence in math. If you are interested, view videos to help you develop confidence in your abilities.
- **Apply Math to the Real World:** Enjoy learning how to apply your knowledge and skills. From consumer math to calculus, most students want the question "why do I need to know this?" answered. The texts and resources that you will have in your mathematics programs are rich with applications. Do not skip them. People come to math with different strengths and approaches. Building upon what you already know through your real-life experiences will inspire and enhance your creativity in teaching.
- **Maximize Your Time:** Test your prior knowledge. WGU allows candidates, under certain conditions, to accelerate through the program. This course of study has pacing suggestions to keep you on track with SAP. However, if you already have mastered the



concepts and can move faster, please do so. Set goals, make a plan, and reward yourself often. Getting a degree is challenging, so make a plan that works for you.

*Note: Please be aware that some of the TaskStream math graders are using Macs, which evidently do not process Microsoft Equation Editor information in the same way that PCs do. Plan to submit PDFs when equations or graphs are involved and verify that all looks well prior to submission; this will eliminate the potential of problems.*

## Competencies

This course of study covers the following competencies:

### Competency: Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

### Competency: Number Systems and Algebraic Structures

The graduate understands the real number system and its relationship to the complex number system; understands important algebraic structures; and understands the significance of functions in the study of number systems.

### Competency: Geometry (MS)

The graduate understands synthetic, analytic, and transformational geometries and their relationship to measurement, and understands how geometry and measurement develop from intuitive investigations to formal arguments.

### Competency: Precalculus

The graduate understands and applies the principles of trigonometry; mathematical modeling; and logarithmic, exponential, polynomial and rational functions.

## Teaching Dispositions Statement

Please review the [WGU Statement of Teaching Dispositions](#)

## Required Learning Resources

- Teaching Mathematics Grades 5-12 from Pearson. Enrollment in this resource provides you with access to the following e-texts:
- Posamentier, A. S., Smith, B. S., & Stepelman, J. (2010). *Teaching secondary mathematics: Techniques and enrichment units* (8th ed.). Allyn & Bacon. ISBN: 9780135000038.
- Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7th ed.). Allyn & Bacon. ISBN: 9780205573523.

## Preparing for Success

To successfully complete this course of study, you need the appropriate resources to help with



your learning. You should also prepare a calendar to schedule time devoted to your studies. Share your calendar with family and friends so they are aware of your obligations.

## **Acquire Learning Resources**

Arrange to obtain the learning resources listed in the "Required Learning Resources" section so there will be no delay in your studies. These items are essential for you, as this document will guide you in the use of these materials. Some of these items must be shipped to you, so be sure that your mailing address information is current. If you click on your name in your Degree Plan, you can check your contact information.

### **Enroll in Teaching Mathematics**

- [CourseCompass](#)

Enroll in the Teaching Mathematics Grades 5-12 learning resource found in your Degree Plan. You may have already accessed this resource for other courses of study. If you have not, you do not want to wait until you are ready to study only to discover there is a technical problem preventing your access to these valuable resources. These are independent study courses provided to you by WGU through enrollment under the Degree Plan resource title "Teaching Mathematics Grades 5-12."

The multimedia textbooks below are included and contain videos, practice problems, and quizzes.

- Posamentier, A. S., Smith, B. S., & Stepelman, J. (2010). *Teaching secondary mathematics: Techniques and enrichment units* (8th ed.). Allyn & Bacon. ISBN: 9780135000038.
- Van de Walle, J. A., Karp, K. S., & Bay-Williams, J. M. (2010). *Elementary and middle school mathematics: Teaching developmentally* (7th ed.). Allyn & Bacon. ISBN: 9780205573523.

After enrolling in this course, you will be e-mailed access information to the Pearson CourseCompass website. You will be sent a link to the site with your username and password. When you log in to this website, you access the Teaching Mathematics Grades 5-12 resource, e-books, MyEducationLab, practice tests, and the above e-texts.

*Note: Should you desire hard copies of these e-texts, the WGU Bookstore has these books available for immediate purchase and delivery. You may shop at other online bookstores, but be sure to order early and use the correct ISBN to get the correct edition.*

### **Access the Companion Website**

- [Elementary and Middle School Mathematics Companion Site](#)

If you find that you need additional practice taking multiple choice tests, the website listed above contains additional chapter tests. You can "jump to" any chapter to explore a variety of



additional resources and also take practice tests.

## **Purchase an Appropriate Calculator**

- [TI Connectivity Kit](#)

*Note: This activity is only necessary if you do not already own an appropriate calculator.*

The TI-84 Plus graphing calculator; its predecessors TI-82 Plus, TI-83, or TI-83 Plus; or equivalent calculators of other brands are recommended. Graphing calculators that have built-in computer algebra systems (CAS) are not allowed on objective assessments, so it is recommended that you do not use such a calculator while working on the mathematics activities and topics. To download the TI screenshots to your computer, you will need a TI Connectivity Kit, available at the above URL.

## **Accessing Performance Tasks**

- [TaskStream](#)

To request access for the performance tasks, follow these steps:

1. Log in to your MyWGU Student Portal.
2. Go to the "My Degree Plan" tab.
3. In the list below "Course Details," find the assessment you are working on.
4. In the "Assessment Scheduled Date" column, click "Schedule Now."
5. A new window will come up. If there are other considerations you would like to inform the Assessment Delivery Team about, discuss them in the "Other Considerations" box that appears and then click "Continue." If not, simply click "Continue."
6. A request will be sent to your mentor for approval.
7. Once your mentor has approved your request, our Assessment Delivery Team will open the tasks required for the assessment in TaskStream. You will log in to TaskStream to receive the instructions, see the rubric, and submit your assessment for grading.

## **Access the WGU Library**

This course of study utilizes resources located in the WGU Library E-Reserves, with articles available for you to download. Follow these directions for [accessing the WGU Library E-Reserves](#).

## **Participate in the Message Board**

In the lower right-hand corner of the course of study screen there is a message board area. Throughout your studies, you will want to follow the questions, observations, and responses of



the other students and the expert advice of the course mentor. If you have questions of your own, do not hesitate to use this resource to get those answered as you develop your competence.

Get into the habit of visiting the message board on a regular basis. Read the posts covering the topics you are studying. Post your ideas about the topics as well as any questions you have. Where other students have posted questions, feel free to reply with any answers or information you have to contribute. This is important for the development of your competence in this course of study.

Take advantage of the learning opportunities through communication with your course mentor and other students. This is a way to ask questions and get concepts clarified by your peers and by the course mentor. Watch for announcements of web conferences and other opportunities to meet your peers online. You can learn substantially more when working with others than you can learn in isolation.

### **Take Study Notes**

It is suggested that you create a paper or digital notebook for your study notes as you go through this course of study. Use organizers or dividers to separate your work. You may want to include a glossary, study notes, topics to revisit, and helpful websites.

One of the features of the web-enabled course of study is a "Notes" element in the lower right-hand navigation area. This feature allows you to keep notes organized by topic. You should get into the habit of using it throughout the course of study. You have the ability to take these notes online through the web-enabled course of study.

A notebook makes your learning more active. It also provides an excellent source of important materials to review prior to demonstrating your competence through the assessment. Whenever prompted throughout this course of study to reflect upon what you have learned, record your answers, thoughts, and reactions in your notebook.

## **Educational Technologies**

The use of appropriate technology in math classrooms is advocated by the NCTM. In fact, the Technology Principle is one of the core principles espoused by the NCTM. You will now begin to explore how to go about harnessing the power of technology tools to capture students' attention; empower students mathematically, and motivate students to learn. Why would you want to use technology to teach math? Are there times when its use is perhaps not appropriate? When might that be?

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

### **Educational Technology Overview**

After completing the following activities, you will be required to construct an original lesson plan





using appropriate, research-based, age-specific pedagogies with a focus on exploring how to solve systems of linear equations involving two equations with two unknowns by using selected educational technologies. You will be able to

- describe how to fully integrate a variety of educational technologies with clear and easy-to-follow directions for students;
- discuss the visual and computational advantages of using a variety of educational technologies in the constructed lesson;
- demonstrate the three possible types of solutions that can be obtained from a system of two equations with two unknowns;
- construct graphical representations that support the aforementioned assertions with regard to the three possible types of solutions;
- explain how the content can be applied to other mathematics or to real-world examples; and
- construct a learning environment that has students discover, develop, derive, and conceptually understand how to solve systems of equations with two unknowns using selected educational technologies.

Reflect upon these skills and abilities as you engage in the upcoming materials. Ask yourself about your comfort level with technology. You are attending an online university, so presumably you feel fairly comfortable using technology, but you may not have ever done so in a math classroom. What challenges do you foresee as you embark upon this technology integration journey? What issue do you envision your students might have?

### **Using Technology to Enhance Mathematics Instruction**

Read chapter 5 ("Using Technology to Enhance Mathematics Instruction") in *Teaching Secondary Mathematics*. Record any questions or reflections you have in your study notebook. You may also want to check the message board for this topic to see what others have posted about this. Interact with others who have posted there by answering questions or posting your own.

*Note: There are 125 enrichment units for the secondary school classroom in Teaching Secondary Mathematics. It is recommended that you go to the table of contents on pages vii-viii to identify the enrichment units that are most commensurate with the requirements set forth in the upcoming performance task. A review of these units may help to stimulate ideas for the lesson plan that you need to construct for upcoming performance task. For this section, you should focus on those units that employ technology to explore relevant topics (e.g., enrichment unit 11).*

### **View Teaching Math Resource: Case 5**

- [CourseCompass](#)

After logging in to the Teaching Mathematics Grades 5-12 website, click on the "Teaching Mathematics" resource link found on the left-hand side of the page. Then click on the "Case 5"



link and review all of the material that is provided in this topic. This series of links presents you with snippets of video from a real-world mathematics class and then asks you to reflect upon various aspects that you saw in the video. Record any questions or reflections you have in your study notebook. You may also want to check the message board for this topic to see what others have posted about this. Interact with others who have posted there by answering questions or posting your own.

## **Solving a System of Equations Using Technology**

- [Gaussian Elimination](#)
- [Systems of Linear Equations: Definitions](#)

These web resources will show you how to solve a system of equations using an appropriate method (i.e., Gaussian elimination) and recognize the different types of solutions that you can encounter. The specific topic you will teach will naturally depend upon the curriculum being taught in the classroom in which you are placed. Be sure to consult with your cooperating teacher as you determine the topic which you will teach.

## **Creating Meaning for and With the Graphing Calculator**

Read the following journal article, available in the WGU e-reserve:

- Doerr, H. M., & Zangor, R. (2000). Creating meaning for and with the graphing calculator. *Educational Studies in Mathematics*, 41(2), 143-163.

In this activity, you will focus on the appropriate use of educational technology (i.e., a graphing calculator or a computer) to solve a problem. An example is supplied below of resources for using technology to teach the mathematical topic of systems of linear equations. What you actually teach for the upcoming performance task, however, will depend on what is being taught at the school in which you were placed. What follows is an exploration of the possible types of solutions that you may acquire from a system of two linear equations with two unknowns. Symbolically, if  $x$  and  $y$  are the two unknown variables and  $A$ ,  $B$ ,  $C$ ,  $D$ ,  $E$ , and  $F$  are any real constant, the system of two linear equations with two unknowns becomes the following:

- $Ax + By = C$
- $Dx + Ey = F$

You will need to be able to solve for both  $x$  and  $y$  using an appropriate graphing calculator. There are three types of solutions that can be obtained from such a system of linear equations. What are they? The best way to think about this is to think about it graphically. You have two lines on a Cartesian plane where you are attempting to identify the different ways in which the lines can be positioned. You should first solve this linear system of equations by hand and then use an appropriate graphing calculator or software program.





## Graphing Calculators

- [Graphing Calculators](#)

Which graphing calculator should you use? The Texas Instrument (TI) 83 or 84 series of graphing calculators are recommended, since they are the ones used most often in middle schools and high schools. Instructions on how to perform calculations are provided in most manuals that come with the graphing calculator when you purchase it.

## Math With Microsoft Excel

- [Help for Excel 2007](#)
- [Excel Tutorial](#)
- [Graphing With Excel](#)
- [Physics Laboratory Excel Tutorials](#)

Which software program should you use? This is a much more difficult question to answer than which graphing calculator you should use. There are many to choose from. If you are using Microsoft Office Suite, then you will probably have access to Excel. With a little creativity, you can use Excel to explore the three types of solutions. If you go to the web resources shown above, you will find a wealth of information on Excel. These web resources will provide you with the basics. One of the easiest ways to use Excel to solve a system of equations is to use matrices.

As you engage in these materials, reflect and record your thoughts about the following questions:

- What are advantages to using technology to teach mathematics?
- What are the potential disadvantages?
- What connections can you make between this content and other mathematics or real-world examples?
- What are ways in which you can help students discover, develop, and derive mathematical concepts?
- In what ways can you help students construct their own understandings of the desired content and skills?

## Graphing Calculator Versus the Computer, Part I

You will soon be asked to teach how to use the graphing calculator and the computer to solve a given problem from the secondary mathematics curriculum. As you are guided through an exploration of provided learning tools, you should ponder the following questions with the intent of constructing and internalizing the desired understandings. These understandings were previously identified under prior learning topics.



- What are ways in which you can help students integrate technology in selected mathematics lessons?
- In what ways can you help children construct their own understandings of desired content and skills using technology?

## **Graphing Calculator Versus the Computer, Part II**

The following are some prompts for you to consider:

- What are the similarities and differences between the potential use for a graphing and a scientific calculator?
- What is the equation for a line?
- Lines can be graphed on a Cartesian plane where the x-axis is the abscissa and y-axis is the ordinate. Describe in your own words what the slope (i.e., change in  $y$  value over change in  $x$ ) and the abscissa intercept represent.
- What does it mean for two lines to be parallel? How many solutions exist for this case? Explain.
- What does it mean for two lines to intersect each other? How many solutions exist for this case? Explain.
- What does it mean for two lines to coexist in the same region of space (in other words, two lines that lie on top of each other.)? How many solutions exist for this case? Explain.
- For the aforementioned three cases, how could you use a graphing calculator or software program to explore the existence of solutions for each set of linear equations?
- What connections can you make between the employed technologies and the mathematics content that is explored in this activity with real-world applications?

Recall that the actual topic that you end up teaching will be determined by what is being taught at the school in which you are doing your PCE placement.

## **PCE Performance Task**

- [TaskStream](#)

## **PCE Performance Task Overview**

See TaskStream DGT1 task 602.5.1-06 for detailed instructions. Contact the supervisor of your school placement to arrange to observe a secondary mathematics teacher teach students to use a graphing calculator or the computer to solve a given problem from the secondary mathematics curriculum. Write a description (suggested length of 1/2 -1 page) of the delivery of the instruction you observe.

Contact the supervisor of your school placement to arrange to teach a small group of six to ten secondary mathematics students. Using a prescribed lesson plan template, develop an original 20-30-minute lesson plan (submit this as an attachment to this task) in which you teach students



how to use a graphing calculator or the computer to solve a given problem from the secondary mathematics curriculum.

*Note: You will need to meet with the classroom teacher before the PCE to determine which problem(s) to teach and to discuss which teaching strategy or strategies might be most effective.*

The classroom teacher must observe your instruction and complete the observer checklist found in TaskStream. (The observer will submit this checklist to WGU through the account in TaskStream.) You will need to provide the observer a copy of your lesson plan to review before this observation.

### **TaskStream Task Clarifications**

This task will help to facilitate initial teacher-candidate-teacher collaborations in the field to promote an introduction to a selected teaching dynamic. You will be required to communicate directly with the teacher on record in an approved school to facilitate the downstream construction and implementation of an appropriate lesson plan. You will also be responsible for completing an observer checklist found in TaskStream and completing a guided reflection protocol form. Throughout this task, you should ponder the advantages and disadvantages to using technology in the secondary mathematics curriculum and relevant real-world applications.

## **Data Analysis of Real-World Data**

Technological tools now exist that are specifically designed to gather real-world data. These tools can be used in math classrooms to explore physical phenomena. Students seem to really enjoy "getting their hands dirty," so to speak, as they collect their own data. This allows them to take ownership of the problem-solving process and can be a great motivator.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

### **Mathematical Modeling**

There is a lot to digest here, so take your time and try to recall the techniques that you will review. You have very likely been exposed to these concepts before but perhaps without the context that will now be provided. If you have trouble following along, just think how confusing this could be to a student. How might you help break this information apart into more easily-digestible pieces? What prerequisite skills must be mastered prior to moving on to new material? How will you ascertain whether or not your students have gained those skills?

After completing the following activities, you will be required to construct an original lesson plan using appropriate research-based, age-specific pedagogies for which the focus is on using selected educational technologies to construct mathematical models to be used to make future



predictions. You will be able to

- provide appropriate data collection and management strategies;
- describe how to fully integrate a variety of educational technologies with clear and easy-to-follow directions for students;
- lead students who are unfamiliar with linear regression through the steps to fit a line using least squares. *Note: Middle grades students should be led to rely on technology for the computationally intense learning, while high school students may be led through the technology, the hand computation, or both;*
- assess the quality of a mathematical model using simple statistical measures;
- construct graphical representations that support the aforementioned assertions;
- make future predictions using the obtained mathematical model;
- discuss mathematical factors that might make the aforementioned predictions inaccurate;
- discuss real-world factors that might make the aforementioned predictions inaccurate; and
- construct a learning environment that has students discover, develop, derive, and conceptually understand how to use selected educational technologies to construct mathematical models to be used to make future predictions.

## Using Technology to Enhance Mathematics Instruction

Read chapter 5 ("Using Technology to Enhance Mathematics Instruction") and chapter 6 ("Assessment") in *Teaching Secondary Mathematics*.

*Note: There are 125 enrichment units for the secondary school classroom in Teaching Secondary Mathematics. It is recommended that you go to the table of contents on pages vii-viii to identify the enrichment units that are most commensurate with the requirements set forth in the upcoming performance task. A review of these units may help to stimulate ideas for the lesson plan that you need to construct for upcoming assignment. For this section, you should focus on those units that employ technology to explore relevant topics (i.e., enrichment units 119 and 122).*

Record any questions or reflections you have in your study notebook. You may also want to check the message board for this topic to see what others have posted about this. Interact with others who have posted there by answering questions or posting your own.

## Linear Regression Overview

- [Scatter Plots and Regressions](#)
- [Linear Regression and Excel](#)
- [Ask Dr. Math: Archives](#)

Review the material contained in the first two above web resources about regression. These



web resources will provide you with the basics with regard to linear regression, least squares method, scatter plots, and mathematical modeling. What is mathematical modeling? Mathematical modeling allows you to construct mathematical relationships that can be used to make predictions about the real world.

You should think about mathematical modeling as consisting of

- construction of research questions,
- data collection and management,
- results,
- analyses,
- conclusions, and
- future predictions.

### **Construction of Research Questions**

Before you undertake any investigation of real-world phenomena, you need to be very clear about the question(s) that are the focus of the investigation. What specific research questions are being investigated?

### **Data Collection and Management**

What methods will be used to collect the data? How much data will be collected? In what ways will you manage the data? Spreadsheets (e.g., Microsoft Excel) are a wonderful way to manage large sets of data. Graphing calculators can also be used to organize data in much the same way that a spreadsheet is used.

### **Results**

What specific quantitative measures do you want to use to explain the real-world data that you are studying? For instance, quantitative measures of central tendency (i.e., mean, median, and mode) and dispersion (i.e., variation, standard deviation, and range) are often used.

Mathematical modeling approaches use the least squares method to construct a best fit line  $y = mx + b$  where  $m$  and  $b$  are the best-fit slope and  $y$ -intercept, respectively.

### **Analysis**

When performing a linear regression, you must assess the quality of the generated linear model  $y = mx + b$ . There are a variety of statistical methods that can be used to make such an assessment (i.e., correlation, coefficient of determination, etc.). A quick way to make such an assessment is to use the generated linear model to make future predictions. For high and low values for  $x$ , does the predicted  $y$  make sense? Another quick way to make such an assessment is to superimpose the generated linear model onto a  $y$ -versus- $x$  scatter plot of the actual data. How close are the data points to the superimposed linear model?

### **Future Predictions**

If the generated linear model is assessed as being credible, you should be able to use the model to make relevant future predictions. Two related concepts involve interpolation and extrapolation. What is interpolation? What is extrapolation? What role do these concepts play in making future predictions? The third web resource above should help to clarify these concepts.



Explore the links found on the third web page above and use them to refresh your memory of linear regression, interpolation, and extrapolation.

### Linear Regression Applet

- [Resources for Teaching Math](#)

Above is a website that allows you to experiment with linear regression techniques and processes.

In this activity, you will need to perform a linear regression using technology.

Brainstorm ways in which you can help students discover, develop, and derive the mathematical concepts that are associated with this activity. In what ways can you help students construct their own understandings of the desired content and skills?

### Study Notebook Assignment

- [U.S. POPClock Projection](#)
- [Lesson Plan](#)

This is a "homework" assignment. You will not need to submit this activity to TaskStream. Rather, you will create this in your study notebook.

You will need to use the lesson plan template at the link above to construct an original lesson plan to promote an understanding of how linear regression can be used to make future predictions using U.S. census data. The lesson plan should include an appropriate title, relevant definitions, a purpose, lesson objectives, pre-instructional techniques, instructional procedures and strategies, and anticipated discourse. You will use selected technologies to construct a linear model that can be used to make future predictions. If you were to implement the lesson plan you created, would your students have fun? How can you construct the desired classroom dynamic so that students will enjoy learning? If you can make this a fun lesson, it is predicted that students will be much more likely to be engaged.

1. Using the lesson plan template at the link above, create an original lesson plan to assist the learning of linear regression and its application to projecting U.S. census data into the future.
2. Include directions for retrieving historical national population estimates from the U.S. Census Bureau for each 10-year period from 1900 to 1990 from the U.S. Census Bureau POPClock projection at the website listed above.
3. Lead a student who is unfamiliar with linear regression through the steps to fit a line using least squares. *Note: Middle grade students should be led to rely on technology for the computationally intense learning, while high school students may be led through the*





*technology, the hand computation, or both.*

4. Apply a linear regression to population growth forecasting.
  - a. Use it to predict the population of the United States in 2010 and 2020.
  - b. Discuss mathematical factors that might make those predictions inaccurate.
  - c. Discuss real-world factors that might make those predictions inaccurate.

## **Data Analysis of Real-World Data**

How do you learn how to use these data collection devices and software tools? Are there benefits to using such technologies? Can you identify several benefits? One of the benefits of using these technologies is that how you use them can be adapted quite easily for students with special needs or with learning-style preferences. How can these technologies be adapted? The best way to address this question is to identify a special need or learning-style preference and then make the appropriate connections.

After completing the following activities, you will be required to construct a description of how to use appropriate research-based, age-specific pedagogies for which the focus is on the analysis of real world data using a variety of educational technologies. You will be able to

- explain how selected educational technologies can be used to enhance a mathematics curriculum;
- explain the importance of appropriately integrating these technologies into a mathematics curriculum;
- explain the benefits and potential drawbacks of the technologies' use;
- provide research that supports the aforementioned assertions;
- adapt such practices to include students with special needs or learning-style preferences;
- construct student projects that incorporate the use of a variety of educational technologies that emphasize data collection, data analysis, and the use of both; and
- construct a learning environment that has students discover, develop, derive, and conceptually understand how to use selected educational technologies that emphasize data collection, data analysis, and the use of both.

### **Enriching Mathematics Instruction**

Review chapter 5 ("Using Technology to Enhance Mathematics Instruction") and read chapter 7 ("Enriching Mathematics Instruction") in *Teaching Secondary Mathematics*. Record any questions or reflections you have in your study notebook. You may also want to check the message board for this topic to see what others have posted about this. Interact with others who have posted there by answering questions or posting your own.

### **Data Collection and Analysis**

#### **URLs:**

#### **Texas Instruments' CBL2 (Calculator-Based Laboratory)**

[http://education.ti.com/educationportal/sites/US/productDetail/us\\_cbl\\_2.html](http://education.ti.com/educationportal/sites/US/productDetail/us_cbl_2.html)



### **Texas Instruments' CBR2 (Calculator-Based Ranger)**

[http://education.ti.com/educationportal/sites/US/productDetail/us\\_cbr\\_2.html](http://education.ti.com/educationportal/sites/US/productDetail/us_cbr_2.html)

### **Fathom Dynamic Data**

<http://www.keypress.com/fathom/>

### **Microsoft Office Online**

<http://office.microsoft.com/en-us>

### **Microsoft Excel**

<http://office.microsoft.com/en-us/excel/FX100487621033.aspx>

There are a variety of educational technologies that can be used for data collection and analysis. In this activity, the data collection devices that you will learn how to use include Texas Instruments' CBL2 (calculator-based laboratory) and Texas Instruments' CBR (calculator-based ranger). To find out more about how to purchase these devices, go to the web resources shown above for Texas Instruments.

In this activity, the data analysis software tools that you need to learn how to use include Fathom and Microsoft Excel. To find out more about how to purchase either software tool, go to the web resources shown above.

*Note: You are not required to purchase these products, but rather, research their appropriate use in mathematics classrooms. You may want to search Google Scholar or the WGU Library for articles that reference the use of these tools in math classrooms.*

Brainstorm ways in which you can help students discover, develop, and derive the mathematical concepts that are associated with this activity. In what ways can you help students construct their own understandings of the desired content and skills?

### **Performance Task 602.5.1-44**

**URL:** <http://www.taskstream.com>

Follow the directions in TaskStream in order to complete performance task 602.5.1-44.

Design an electronic slide presentation in which you discuss some of the technology tools available for real-world data collection and analysis.

You will need to research the classroom use of real-world data collection devices (calculator-based laboratory and calculator-based ranger) and data analysis software (Fathom or Excel). You will construct an electronic slide presentation that explains how these devices can be used to enhance the secondary mathematics curriculum.



## Dynamic Graphing Tools

People have come a long way since the days when straightedge and compass rulers were the only tools used in a geometry class. Nowadays, there are several exciting dynamic geometry software programs available for use. These programs allow you to create geometric figures that can be rotated, stretched, shrunk, reflected, etc. Thus the objects become dynamic in the sense that they can be moved and manipulated, with the results immediately seen and available for further investigation. Why would such a program be useful? What are the potential drawbacks to allowing students to use such software?

Competencies covered by this subject

### 202.2.1 - Geometry (MS)

The graduate understands synthetic, analytic, and transformational geometries and their relationship to measurement, and understands how geometry and measurement develop from intuitive investigations to formal arguments.

### 602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

## Dynamic Graphing Tools

What are the potential benefits of using dynamic geometry software? Are there any potential issues surrounding its use? If so, what might they be? Have you ever used this sort of software? If so, was it easy to use? Did you find it difficult to learn how to use it? What are some of the major differences between the use of such software and more traditional geometry teaching methods?

After completing the following activities, you will be required to construct an original lesson plan using appropriate research-based, age-specific pedagogies for which the focus is on transforming selected geometric objects using dynamic geometry software. You will

- become familiar with a variety of dynamic software packages;
- be able to distinguish between static and dynamic geometry problems;
- use a variety of dynamic geometry software packages to create geometric objects;
- understand what it means to mathematically transform a geometric object;
- use a variety of dynamic geometry software packages to reflect, rotate, and translate geometric objects;
- be able to provide a comprehensive discussion of the instructional procedures used to engage students; and
- construct a learning environment that has students discover, develop, derive, and conceptually understand how to use selected educational technologies that explore the use of selected dynamic geometry software.

### Using Technology to Enhance Mathematics Instruction

Review chapter 5 ("Using Technology to Enhance Mathematics Instruction") and chapter 8 ("Extracurricular Activities in Mathematics") in *Teaching Secondary Mathematics*. Record any questions or reflections you have in your study notebook. You may also want to check the message board for this topic to see what others have posted about this. Interact with others who have posted there by answering questions or posting your own.



*Note: There are 125 enrichment units for the secondary school classroom in Teaching Secondary Mathematics. It is recommended that you go to the table of contents on pages vii-viii to identify the enrichment units that are most commensurate with the requirements set forth in the upcoming performance task. A review of these units may help to stimulate ideas for the lesson plan that you need to construct for upcoming performance task. For this section, you should focus on those units that employ technology to explore relevant topics (i.e., enrichment units 25, 111, and 114).*

## **Static Versus Dynamic Geometry**

- [Geometric Shapes and Figures](#)
- [Figures and Polygons](#)

Review the material contained in the web resources listed above covering relevant geometry topics. These web resources should provide you with an overview of the field of geometry and also basic geometric shapes. You should combine this knowledge with the terms *static* and *dynamic*. It is recommended that you look up the terms *static* and *dynamic* in any dictionary and make the appropriate connections.

## **Dynamic Geometry Software**

- [Geometer's Sketchpad](#)
- [Cabri Geometry II Plus Evaluation Version Download](#)
- [Dynamic Geometry Explorations](#)
- [Teacher's TV: Using Dynamic Geometry](#)
- [National Library of Virtual Manipulatives](#)

Oldknow, A. (2003). Geometric and algebraic modeling with dynamic geometry software: The Geometer's Sketchpad V.4 and Cabri Geometry II plus. *Micromath*, 19(2), 16-19.

The web resources shown above should be helpful with making the distinction between these terms. The first site above has a free demo of Geometer's Sketchpad. The second site above provides a free demo of Cabri. Interact with the many dynamic geometry explorations linked at the "Dynamic Geometry Explorations" website. At the "Teacher's TV: Using Dynamic Geometry" website, view the "Demonstrating Dynamic Geometry" video.

There are many types of "transformations" in mathematics. The three transformations that must be explored in this activity include reflections, rotations, and translations. You should first clearly define each transformation and then be able to apply them to selected geometric objects. Conduct an Internet search for geometric transformations if you are unclear as to what is meant by this term.



The "National Library of Virtual Manipulatives" website above will provide you with a variety of interactive dynamic geometry programs that will allow you to interact with and better understand reflections, rotations, and translations. Go to the "National Library of Virtual Manipulatives" URL and scroll down the screen until you see the links entitled "Transformations-Reflection," "Transformations-Rotation," and "Transformations-Translation." These dynamic activities were constructed for pre-K-2nd graders, grades 3-5, grades 6-8, and grades 9-12. It is predicted that you will have fun with these programs. Yes, even adults can play with them.

How do you learn how to use these software programs? One way to learn how to use them is to actually "play" with them. These programs come with detailed instructions on how to use them. Once you get them downloaded, you should just play with them. The more you experiment with creating and transforming selected geometric objects, the more proficient you will become.

Brainstorm ways in which you can help students discover, develop, and derive the mathematical concepts that are associated with this activity. In what ways can you help students construct their own understandings of the desired content and skills?

Read the journal article listed below, available at the WGU e-reserve. Reflect upon the following questions: What is a static geometry problem? What is a dynamic geometry problem? The terms *static* and *dynamic* have very specific meanings in mathematics. You need to be clear about the specific meanings of these terms.

### **Performance Task 602.5.1-45**

- [TaskStream](#)

For this task, you will create a lesson plan in which you teach students how to use dynamic geometry software to explore interactive geometric designs. You may use Geometer's Sketchpad or Cabri Geometry, or you may use one of the following free resources:

- [GeoGebra](#)
- [Google SketchUp](#)

## **Conclusion**

Congratulations! You have completed a rigorous course of study focused on the study of selected mathematics technology topics. These topics included the pedagogy of how to teach students such varied topics as

- proofs,
- graphing calculators,
- computers,
- interactive data collection devices, and
- dynamic geometry software.



At this point, you should be commended for all of your hard work in making it this far in your program. Great job!

## **Transfer and Application to Work**

How does the study of these topics apply to your profession? As a math teacher, you need to know not only the content that you will be required to teach but also how to teach that content. A greater emphasis is being placed on the appropriate use of technology in math classrooms, so it is important that you be able to do so and be able to teach your students to do the same. The activities and performance tasks found in this course of study were designed to help you develop your abilities to do all of these things.

## **Next Steps**

If you have come this far in the course of study, you will have by now submitted responses to the seven tasks that make up the DGT1 assessment. The full details and instructions for each of the task prompts are found in TaskStream. Your submissions will be graded, and if they are found to have met the requirements, a "Pass" will appear on your Degree Plan for the assessment. If your responses are found to need improvement, they will be returned to you for revision.

### **Accessing Performance Assessments**

You should have completed the tasks as you worked through this course of study. If you have not completed the tasks in [TaskStream](#), do so now.

- DGT1

For directions on how to receive access to performance assessments, see the "[Accessing Performance Assessments](#)" page.

## **Feedback**

WGU values your input! If you have comments, concerns, or suggestions for improvement of this course, please submit your feedback using the following form:

- [Course Feedback](#)

### **ADA Requirements**

Please review the [University ADA Policy](#).