



Your competence will be assessed as you complete the proctored objective exam. Once you pass the exam, you will receive a "Pass" on your Degree Plan for this Mathematics Pedagogy assessment. This course of study may take up to three weeks to complete.

Introduction

Overview

As you work through the course of study activities, be aware of potential student difficulties and your potential interaction with the math content. You should consider this course of study to be a culminating experience, one that requires you to synthesize what you have learned in the other mathematics pedagogy assessments you have worked through prior to this one. Be advised that the items on this assessment were written from the Van De Walle "teaching developmentally" point of view. Because that is the case, when you are confronted with items on the exam for which you feel an argument could be made for more than one of several pedagogical approaches, be sure to respond with what Van De Walle espoused.

There are several broad areas of mathematics pedagogy that this course of study covers. These include the following: appropriate technology usage; prerequisite skills; mathematical errors; attitudes and curiosity; teaching strategies; and grade-level appropriate topics.

This course of study has been designed to refresh your memory of what you have already learned about these topics so you will be successful on the 16-item objective assessment that covers these areas. Before requesting this assessment, you should have already passed the other math pedagogy assessments. This assessment covers some of the key elements of successful mathematics teaching. It is also presented in a multiple-choice or multiple-selection format. As you progress through this course of study, think to yourself about how you might ask multiple-choice questions about the material presented here. As a math teacher, you will create assessments of your own. Now is a great time to start practicing that skill. See if you can anticipate the sorts of questions you might be asked, and you will be that much more prepared for them when you take the exam.

Outcomes and Evaluation

There is 1 competency covered by this course of study; it is listed in the "[Competencies for Specific Teaching Practices: Mathematics Pedagogy \(AYC1\)](#)" page.

You will complete the following assessments as you work through the course of study.

Pre-Assessment

You will complete the following pre-assessment:

- PAYC

Objective Assessment

You will complete the following objective assessment:



- AYC1

Teaching Dispositions Statement

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

Preparing for Success

The information in this section is provided to help you become ready to complete this course of study. As you proceed, you will need to be organized in your studies, competent in the indicated areas, and ready to pass the final assessments.

Your Learning Resources

Enroll in or order the learning resources for this course as early as possible so as to give them time to arrive and give you enough time to become familiar with them.

Enroll in Learning Resources

You will need to enroll in or subscribe to additional learning resources as a part of this course of study.

You may already have enrolled in these resources for other courses. Please check the "Learning Resources" tab and verify that you have access to the following learning resources. If you do not currently have access, please enroll or renew your enrollment at this time.

Note: For instructions on how to enroll in or subscribe to learning resources through the "Learning Resources" tab, please see the ["Acquiring Your Learning Resources"](#) page.

CourseCompass

Enroll in the following CourseCompass course:

- "Teaching Mathematics Grades 5-12"

The following multimedia textbooks 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.

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.

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 can access the "Teaching Mathematics Grades 5-12" resource, e-books, MyEducationLab practice tests, and the above e-texts.

You are strongly encouraged to review the chapters you should have read for your prior math pedagogy assessments and to reflect upon the questions found at the end of each chapter. You will also be instructed in this course of study to take the chapter tests found at the end of each chapter of *Elementary and Middle School Mathematics* so as to get a better feel as to the types of questions you will encounter on the objective assessment.

Note: The resources you are using to master the competencies for this assessment will also be valuable as you prepare for future assessments and as you develop lesson plans to use in your classroom in the future. Therefore, it is highly recommended that you complete each activity contained in this document.

Other Learning Resources

You will use the following learning resources for this course of study.

Companion Websites

Also very useful are websites that reference older versions of *Elementary and Middle School Mathematics*. If you find that you need additional practice taking multiple-choice tests, the websites listed above contain additional chapter tests. If you go to the following websites, you can "jump to" any chapter to explore a variety of additional resources and also take practice tests.

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

Additional Preparation

There are many different learning tools available to you within your course of study in addition to the learning resources discussed above. Some or all of them may be very useful to you as your progress through this course of study. Take the time to familiarize yourself with them and determine how best to fit them into your learning process.

The following activities and information will help you as you work through this course of study.

Message Boards, Learning Communities, Study Notes, FAQs

Message boards, learning communities, study notes, and FAQs are available in every course of study.

Use the "[Additional Learning Tools](#)" page to review these tools.

The WGU Central Library

The [WGU Central Library](#) is available online to WGU students 24 hours a day. The library offers access to a number of resources, including over 60,000 full-text e-books; articles from journals, magazines, and newspapers; course e-reserves; and tutorials on how to use these resources and the library. The library also includes a reference service for help with research



questions or navigating the library.

For more information about using the WGU Library, view the “WGU Library: Finding Articles, Books & E-Reserves” video in the Student Resources section of [The WGU Channel](#).

Course Mentor Assistance

Course mentors are available to help you. Their job is to aid understanding in areas where you need to improve and to guide you to learning resources. Request their help as needed when preparing for assessments.

Course mentors cannot provide reviews of entire assessments. If you fail assessment attempts, review the provided feedback first, then ask the course mentor specific questions about what you can do to meet the competency standard. Request course mentor assistance as necessary in preparing for second attempts at objective assessments or performance task revisions. Mentors cannot guarantee you pass as they do not evaluate assessments; however, they can provide the assistance and advice necessary to help you succeed.

Mathematics and Technology

This section focuses on the appropriate use of technology in mathematics classrooms. Recall what you have already learned about graphing calculators, Microsoft Excel, Cabri, and the Geometer's Sketchpad. Also recall what you have learned about TI's calculator-based ranger and calculator-based laboratory. The use of appropriate technology in math classrooms is one of the National Council of Teachers of Mathematics' (NCTM) principles. You will now refresh your memory of how these powerful tools can be appropriately used in mathematics classrooms. You will need to know how and when to use technology in your classroom in order to be an effective math teacher.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

Appropriate Technology Usage

At the end of this topic, you should be able to describe how to determine whether (and when) students should use each of the educational technologies shown below, given specific curricular examples at different grade levels 5-12:

- graphing calculator
- Calculator-Based Laboratory or Calculator-Based Ranger
- Fathom or Microsoft Excel
- Geometer's Sketchpad or Cabri geometry

Prior Math Technology Assessment Tasks

Go back through your study notebook and the tasks you submitted for the math technology assessment. Read what you wrote about the appropriate use of these technologies in mathematics classrooms. Refer to this notebook throughout this course of study. Try to make connections between the math pedagogy assessments you have engaged in to date and the one for which you are currently preparing.



Educational Technologies

Review the following chapter in *Teaching Secondary Mathematics*:

- chapter 5 ("Using Technology to Enhance Mathematics Instruction")

Review the following chapter in *Elementary and Middle School Mathematics*:

- chapter 7 ("Using Technology to Teach Mathematics")

These chapters should help refresh your memory as to the current trends in teaching mathematics at the 5-12 grade levels.

Online Chapter Test and Review Questions

Take the online [chapter test](#) for chapter 7 ("Using Technology to Teach Mathematics") in *Elementary and Middle School Mathematics*.

1. Click on the "MyEducationLab Practice Tests" link found on the left-hand side of the Teaching Mathematics Grades 5-12 home page.
2. Once there, click on the "Chapter 7" link, and then click the "Chapter 7 Practice Test" link.
3. Click "Yes" when asked if you would like to take this assessment now.
4. Once you are done, be sure to submit your answers in order to receive your score. You will then be prompted to view your results. Do so by clicking the "OK" button.

Once you are done, click on the "Chapter 7 Review Questions" link. Record your answers to these prompts in your study notebook.

Prerequisite Skills

As you read the list of topics below, think back to your days as a student and try to imagine all that you should have known prior to beginning to learn a particular topic. How did you feel if you were asked to learn something new without possessing the prerequisite skills needed to learn it? At the end of these activities, you should be able to determine the prerequisite content knowledge and skills that students need to master in order to solve specific problems from each of the following branches of mathematics at different grade levels 5-12:

- Numbers and Number Systems
- Natural Numbers
- Whole Numbers
- Integers
- Rational Numbers
- Irrational Numbers
- Real Numbers
- Complex Numbers



- Algebra
- Euclidean and non-Euclidean Geometry
- Calculus
- Discrete Mathematics
- Statistics and Probability
- Measurement and Measurement System

Teaching Math Grades 5-12 Curriculum

In the [Teaching Mathematics Grades 5–12 website](#), click on the "Teaching Math Resource" resource link on the left-hand side of the page. Once you have accessed this link, click on the "Classroom Connections" folder and then on the "Classroom Connections" link. Review all of the material that is provided in the topic of "Prerequisite Skills."

- What kinds of teacher questioning were evident?
- Why did the teacher not provide the formula to start the lesson?
- Why are writing and talking aloud with peers good ways to explore ideas?
- What are characteristics for successful problem solving?

Then focus on the "Prerequisite" links found in cases 1 through 5, which you should now review. Record your reflections in your study notebook.

Understanding Mathematics

Review the following chapter in *Elementary and Middle School Mathematics*:

- chapter 1 ("Teaching Mathematics in the Era of the NCTM Standards")
- chapter 2 ("Exploring What It Means to Know and Do Mathematics")

Record your answers to the following questions in your study notebook:

- How do you respond to a statement that a student has learned the material for a test but is not prepared for related math topics?
- What does it mean to understand mathematics?
- What was a rationale for creating the NCTM reform standards?
- What are key features for "doing" mathematics?

Once you have finished this activity, take the online practice tests for both of these chapters and do the review questions for each chapter as well. Record your answers to these prompts in your study notebook.

Review of Misconceptions That Can Lead to Errors

As you study error identification, pay particular attention to which areas of mathematics and what aspects in those mathematical topics lead students to make errors. Given a hypothetical class and selected mathematics problems, you need to be able to



- identify most common errors,
- identify probable causes,
- verify causes,
- and identify ways to correct common errors.

How would these determinations be influenced if you were dealing with grades 5-9 and, alternatively, grades 7-12?

At the end of these activities, you should be able to

- identify the most common errors made by a hypothetical class of students on a given set of mathematics problems,
- determine the probable causes of their errors,
- specify how to verify the causes, and
- describe how to correct specific errors.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

Mathematical Errors, Misunderstandings, and Misconceptions

You should be able to identify errors in student responses that are likely to occur in different areas of mathematics. Mathematical misunderstandings, misconceptions, and errors occur frequently in grades 5-12. You should be able to identify misunderstandings and misconceptions that are likely to occur in different areas of mathematics. For each of the identified errors or misunderstandings, you should be able to recommend error-correcting procedures that meet the diverse needs of students between grades 5 and 12. Some of these areas include

- number and number systems,
- algebra,
- Euclidean and non-Euclidean geometry,
- calculus,
- discrete mathematics,
- statistics and probability, and
- measurement and measurement systems

Identifying student errors and anticipating misunderstandings about mathematical concepts aid instruction as well as assessment. Can you name several mathematical topics that are problematic for students? Record these in your journal. Add to this list as you complete the following activities.

Classroom Connections

In the previous topic, you reviewed the Teaching Mathematics Grades 5-12 "Classroom Connections" module. Return to this module by accessing the [Teaching Mathematics Grades 5–12 website](#), then clicking on the "Teaching Mathematics Resource" link on the left-hand side of the page. Once you have accessed this link, click on the "Classroom Connections" link. Review all of the material provided in the topics "Student Misconceptions," "Types of



Misconceptions," and "Addressing Misconceptions."

Can you identify the most common errors made by a hypothetical class of students on a given set of mathematics problems? How would you determine the probable causes of these most common errors? As you write in your journal, specify how to verify the causes of the most common errors. Also, describe how to correct those specific errors.

Case 2

At the [Teaching Mathematics Grades 5-12 website](#), click on the "Teaching Mathematics Resource" link on the left-hand side of the page. Once you have accessed this link, click on the "Case 2" link. Review all the material provided in the topic "Task: Case 2: Teaching Techniques-Case 2 Error Prediction."

Can you identify errors that are likely to occur in specific areas of mathematics? Write about this in your journal. Also reflect on how identifying these will influence your teaching.

As teachers incorporate problem solving in the classroom, errors inevitably emerge. Students working to solve problems will select methods that work and some that do not work. As a teacher, how will you recognize student errors? How can you work to help students recognize and correct these erroneous problem solutions? Record your ideas in your journal.

Encouraging Persistence and Improving Student Attitudes

If students do not persist with trying to solve a problem, they essentially quit. When that happens, learning does not occur. Obviously, as a teacher, you want to avoid such situations. What are some ways in which you can encourage students to persevere? How might students' attitudes toward and beliefs about math influence their persistence? Does mathematical curiosity play a role? How can you increase students' mathematical curiosity levels?

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

Attitudes and Curiosity

Upon completion of these activities, you should be able to describe a variety of techniques for motivating students to engage in mathematics, encouraging curiosity towards mathematics, and encouraging further mathematical explorations for grades 5-6, 7-9, and 9-12. Are student attitudes about mathematics linked to student success? If so, how? Can you cite research to support your claim?

Techniques for Encouraging Curiosity Towards Mathematics for Students in Grades 5-12

In the [Teaching Mathematics Grades 5-12 website](#), click on the "Teaching Mathematics" resource link on the left-hand side of the page. Once you have accessed this link, click on the links for cases 1-4 and watch the videos for these cases.

As you watch the videos, take notes on the various strategies that encourage math curiosity.



- What are the benefits to these approaches?
- How might you implement them in a math classroom?
- What is the effect of open-ended questioning?

Notice the expressions on the student faces as they truly engage in the lesson.

Encouraging Math Curiosity

Review the following chapters in *Elementary and Middle School Mathematics*:

- chapter 3 ("Teaching Through Problem Solving")
- chapter 4 ("Planning in the Problem-Based Classroom")
- chapter 7 ("Using Technology to Teach Mathematics")
- chapter 23 ("Developing Concepts of Exponents, Integers, and Real Numbers")

Takes notes and summarize the strategies for encouraging curiosity.

- Do you feel that different strategies are necessary for the upper grade levels? Why?
- How might you incorporate riddles into a lesson?
- Should you give out an answer to a math question? If so, when?
- Are there times when you would not do so?

Record your answers to these questions in your study notebook.

Once you have finished this activity, take the online practice tests for each of these chapters and engage in the review questions for each chapter as well. Record your answers to these prompts in your study notebook.

Pedagogical Strategies

In this topic, you will learn how to encourage flexibility and persistence in approaching multiple solution strategies. A good attitude about students' mathematical ability can affect their performance, and you will learn strategies to help students develop a positive attitude. These strategies cut across mathematical content and build a foundation for a student's success in your math classroom as well as in future mathematics courses. How students feel about their ability to do math often affects their performance. In this topic, you will learn strategies for helping build positive attitudes in math students. Record your answers to the following questions in your study notebook:

- How did you feel about your math ability when you were a secondary student?
- How did this affect your success in mathematics?
- How can you use this experience to help others' attitudes about mathematics?

Attitudes to Improve Student Success

Review the following sections in chapters 3 and 7 in *Elementary and Middle School Mathematics*:



- "The Value of Teaching Through Problem Solving"
- "Attitudinal Goals"
- "Benefits of Calculator Use"

Once you have finished this activity, take the online practice tests for both of these chapters and do the review questions for each chapter as well. Record your answers to these prompts in your study notebook.

Teaching More Effective Lessons

Review the following chapter in *Teaching Secondary Mathematics*:

- chapter 3 ("Teaching More Effective Lessons")

Dispositions and Attitudes Video and Reflection

At the [Teaching Mathematics Grades 5-12 website](#), click on the "Teaching Mathematics" resource link on the left-hand side of the page. Once you have accessed this link, click on the link for "Dispositions and Attitudes." Review all of the material that is provided in this topic. As you watch the videos, take notes on which of the teacher's behaviors might positively impact a student's disposition or attitude towards math. Record your reflections in your study notebook.

Selecting Grade-Level Appropriate Topics

It is important for you to be able to select problems and topics that are not too easy or too difficult for your students. The topics and problems should challenge students in expanding their zone of proximal development but should not cause frustration and defeat. Part of being able to select appropriate problems is knowing what prerequisite skills are necessary prior to attempting to learn the new material.

Competencies covered by this subject

602.5.1 - Teaching Methods-Mathematics (Secondary)

The graduate provides effective, research-based mathematics instruction.

Grade-Level Appropriate Topics

In this topic, you will review some of the NCTM standards for various grade levels in an attempt to get a better handle on what topics and approaches to teaching those topics are appropriate at various grade levels. As you engage in the materials, think about the following questions:

- What are different ways in which you might approach teaching similar topics to different grade levels?
- How might student skills, knowledge, and dispositions influence how you choose to teach a particular topic?

Record your answers to these questions in your study notebook.

Middle- and High-School NCTM Standards

The following websites list the standards for mathematics for grades 6-8 and 9-12. Each of the links gives an overview of the standards for that grade range.



- [Overview: Standards for Grades 6-8](#)
- [Overview: Standards for Grades 9-12](#)

Then, either by following the link at the bottom of the page or from the left-side menu, review the standards in each of the following strands:

- Number and Operations
- Algebra
- Geometry
- Measurement
- Data Analysis and Probability
- Problem Solving
- Reasoning and Proof
- Communication
- Connections
- Representation

Reviewing these websites may help you better understand the type of mathematical topics that are appropriate for middle school and high school math students. What strands do you see that are common to both grade bands? How might your approach differ for teaching a similar topic to different grade levels? Record your answers to these questions in your study notebook.

Geometry and Probability

You will now spend a little time focusing on teaching some particular topics so as to be able to provide students with concrete examples of the teaching developmentally approach advocated by Van De Walle. First, you will examine an approach used to teach the formula for the circumference of a circle.

Teaching Geometry

At the [Teaching Mathematics Grades 5-12 website](#), click on the "Teaching Mathematics" resource link on the left-hand side of the page. Once you access this link, click on the link for "Case 2." Review all of the material that is provided in this topic. As you watch the videos, reflect upon the following questions:

- How does the class discussion around body-part ratios engage the students' interest?
- Why did the teacher not give the circumference formula to start?
- What question did the teacher ask to elicit student predictions about the ratio between the diameter and the circumference of a circle?
- How did the teacher get the students to respond to each other's guesses?

Record your answers to these questions in your study notebook.

Teaching Circumference

Read the following chapter in *Elementary and Middle School Mathematics*:

- chapter 19 ("Developing Measurement Concepts")



The circumference of any circle is about 3.14 times as long as its diameter. Why is the exact ratio, described by the Greek letter pi, considered irrational? Why is this concept difficult for some students to grasp? Record your answers to these questions in your study notebook.

Once you have finished this activity, take the online practice tests for this chapter and do the review questions for the chapter as well. Record your answers to these prompts in your study notebook.

Teaching Probability

View "Teaching Math Resource" on the [Teaching Mathematics Grades 5-12 website](#), and review case 4. Review all of the material that is provided in this topic. Record your answers to the following questions in your study notebook:

- What is meant by a favorable outcome?
- What is a tree diagram?
- What is an area model?
- What does the shaded area represent in the area model?
- How would you use these models to calculate the probability of flipping two coins and getting heads on both tosses?
- How do these models help students to understand compound probability?
- What is the benefit of empirical data
- How do you connect the concepts of theoretical and empirical probability values?

Probability

Review the following chapter in *Elementary and Middle School Mathematics*:

- chapter 22 ("Exploring Concepts of Probability")

Suppose you are playing with a fair coin toss. Can you expect the odds of coming up heads to change if you get three heads in a row? What does this mean, that the probability can be calculated? How do you distinguish between theoretical and empirical probability? Record your answers to these questions in your study notebook.

Once you have finished this activity, take the online practice tests for this chapter and do the review questions for the chapter as well. Record your answers to these prompts in your study notebook.

Final Steps

Congratulations! You should be proud that you have worked through all the subjects, topics, and activities that have gotten you to this stage. Your hard effort and diligence will be rewarded by passing the upcoming assessments. In following this document, you have completed the Specific Teaching Practices: Mathematics Pedagogy Course of Study. Savor your accomplishment!

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. As a result of what you have learned in this domain, you should now feel confident in your ability to use technology appropriately, identify misconceptions that might lead to errors, encourage student persistence, identify necessary prerequisite skills, and be able to tailor your lessons to various age groups via the selection of appropriate topics and problems.

Throughout this course of study, you have been asked to record thoughts, reflections, or questions in your study notebook. Review these notes now and make a list of areas that are still unclear to you. You may want to revisit the online chapter tests available for particular areas in which you are still struggling. Again, think about how you might be asked to demonstrate your competence on these topics via multiple-choice or multiple-selection items. Attend the scheduled review sessions. You might attend the review immediately after completing the requirements set forth in this document or as you are preparing for the AYC1 or AYC2 examination. Bring your notebook with index cards, assignments, and notes to the review session.

Also, be sure to review your study notebook and all your submissions in TaskStream in the other math pedagogy assessments. You may also find it helpful to review the e-reserve articles to which you have been directed earlier in your studies.

Assessment Information

Take the pre-assessment for AYC1. This should be scheduled through your Degree Plan.

This pre-assessment will give you a good idea of whether or not you are adequately prepared for the exam. Access the "Coaching Report" from your Degree Plan and revisit topics in this course of study in which you may need extra practice. The learning resources all contain additional exercises that you can practice in each topic area. Another way to check your comprehension of topics is to start with blank paper and write down your understanding of the topic. Write it as if you were explaining it to a student. Once you have confidence in your new knowledge, you may want to talk to your mentor about whether you should take the pre-assessment again.

Once you have passed the pre-assessment and have confidence that you are ready for the AYC1 objective assessment, talk to your mentor about scheduling it.

Accessing Pre-Assessments

Follow these directions to receive [access to pre-assessments](#).

Accessing Objective Assessments

Follow these directions to receive [access to objective assessments](#).

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](#).