Planning Commentary

**1. ​ Central Focus**

a.​ Describe the central focus and purpose for the content you will teach in this learning segment.

The central focus for this three-day learning segment is for students to understand congruent figures and be able to make clear, evidence based proofs about congruent triangles.

​b. ​Given the central focus, describe how the standards and learning objectives within your learning segment address

• conceptual understanding

• procedural fluency

• mathematical reasoning and/or problem solving skills

Conceptual understanding happens when the students are shown exactly what the definition of congruent figures are, and then relate the information they know about congruent figures to the definition. Students will understand why the postulates and theorems that they learn about work for congruent triangles. The worksheet on day2 for hypotenuse leg asks questions that can only be answered with conceptual understanding of the topic. Students will also be taught the importance of proofs and understand that each statement needs a reason and what appropriate reasons are.

Procedural fluency is shown mostly in the third lesson. The third lesson has the students use the information that they learned in the other lessons to create proofs. Since the lessons starts from basic statements and reasons in the first two days, to proofs with missing statements and reasons that the student must fill in, to finally writing a proof on their own, allows the student to practice and understand the steps that go into creating a proof. Students will be taught in steps what needs to be included in proofs. They will know to start with given statements then see what else they need to conclude before they can conclude their final statement with evidence.

This segment really focuses on reasoning and problem solving skills. This beginning lessons help the students to discover how to use many different ideas to make statements and how to support them. They have to explain every statement they make. They also have to figure out what needs to be stated and explained in order to get to the final conclusion that they want. They learn problem solving skills to complete proofs like beginning with stated information, looking at what they need to conclude at the end, and figuring out what else they have to do to get to that conclusion. They also solve problems using the information they learn about triangle congruencies. They learn that this way thinking they use to solve proofs, is how they make and support an argument.

c. ​Explain how your plans build on each other to help students make connections between facts, concepts, and procedures, and to develop their mathematical reasoning and/or problem solving skills to deepen their learning of mathematics.

  The lesson segment starts with students understanding one definition of congruent figures dealing with a sequence of rigid motions. To build on this, the students learn different ways to show congruent triangles, but also sees how they relate to the definition they have learned. The first two lessons focus on learning criteria of triangles that can have them be concluded as congruent. However, this criteria also incorporates information that they have learned in previous topics. After practicing this new information in concrete ways, they then solve problems using this new information about congruent triangles. Then the third lesson allows students to be able to use a lot of different information they have learned in clear complete proofs. The proofs show mathematical reasoning since every statement has to be supported with a reason. It also helps with problem solving skills because students have to figure out which of the criteria can be used to solve a particular proof and how to get from the beginning to the end in a way that is clear and supported with reasons. They incorporate concepts and facts into their solution, but explain each one with a reason. Proofs are very important in mathematics and this lesson segment will help teach deductive reasoning which is important in mathematics.

**2. ​Knowledge of Students to Inform Teaching**

For each of the prompts below (2a–c), describe what you know about your students with respect to the central focus of the learning segment.

Consider the variety of learners in your class who may require different strategies/support (e.g., students with IEPs, English language learners, struggling readers, underperforming students or those with gaps in academic knowledge, and/or gifted students)

a. Prior academic learning and prerequisite skills related to the central focus—What do students know, what can they do, and what are they learning to do?

​ Prior to this learning segment, students would have practiced transformations in the plane which allows them to understand the definition of congruence. They also would have studied and proved theorems about lines and angles and bisectors. These theorems are used in the proofs. Also students would have studied properties of triangles. Students would know how to name angles, and how to name corresponding parts of figures which needs to used in the statements they make throughout the learning segment. Although students would be new to creating congruent triangle proofs, the statement and reasons that they use to create them will be things that they have practiced before.

b. Personal/cultural/community assets related to the central focus—What do you know about your students’ everyday experiences, cultural backgrounds and practices, and interests?

The students are made up of education majors with concentrations in mathematics and science. The five of them that are concentrating in mathematics would have a lot of experience with creating proofs and also would have knowledge in geometry. The ones who are concentrating in science might not be able to use specific geometric properties as easily as those studying math, but would also have experience in proofs.

c. Mathematical dispositions—What do you know about the extent to which your students

• perceive mathematics as “sensible, useful, and worthwhile”

• persist in applying mathematics to solve problems

• believe in their ability to learn mathematics

  Since this class is made up of students studying math and science, the students should be persistent to use mathematics to solve problems. The ones studying math will obviously know how important and useful mathematics is. Also the ones studying science will know how important mathematics is in their concentration and see how useful it is. This specific topic will be illustrated as being important by relating it to Sherlock Holmes, using it to solve problems the students can relate to, and by viewing a website that shows the important of congruent triangles. The students will also see how the way of thinking for geometric proofs, and having statement and reasons are important. Since the class is made up of students who study math and science, they should have some confidence in their ability to learn mathematics. Since the proofs start with fill in the blanks, students will have lots of examples and be able to correctly give a corresponding statement to a reason or vice versa which will give them confidence that they can produce a proof on their own.

**3.​ Supporting Students’ Mathematics Learning**

Respond to prompts below (3a–c). As needed, refer to the instructional materials and lesson plans you have included to support your explanations. Use principles from research and/or theory to support your explanations, where appropriate.

​ a. ​Explain how your understanding of your students’ prior academic learning, personal/cultural/community assets, and mathematical dispositions (from prompts 2a–c above) guided your choice or adaptation of learning tasks and materials.

Knowing that the students would have been familiar with what was being taught and used math regularly influenced my learning tasks. I knew that although they might be familiar with theorems and postulates used in this lesson, it would be beneficial to have them see where they came from and practice using them. I chose the website with careers to show how important a single geometric topic is, and how many of the jobs they would be looking of going into uses the concepts that they were learning. I also chose the video from Sherlock Holmes to show that being able to think and prove statements the way a geometric proof does is something that is really beneficial. They would be able to relate to the process because they have completed argumentative essays, and completed proofs before, but might not have realized how important this process is.

b. ​ Describe and justify why your instructional strategies and planned supports are appropriate for the whole class and students with similar or specific learning needs. Consider students with IEPs, English language learners, struggling readers, underperforming students or those with gaps in academic knowledge, and/or gifted students.

            This class does not have students with specific learning needs. However it consists of people studying math and others that are studying science and although use math, may not be as comfortable with geometric properties and ideas. I had the students who study science work with the students who study math during activities. For students that are struggling, there are proofs that they will be able to complete since I give proofs with just missing statements and reasons that need to be filled in. If the student still has hard time there can be a list to choose from. Since they will be able to complete some of these they will not lose confidence. The students who are more advanced might find the proofs with missing statements easy, but it will be good practice before they are able to create their own proof. Although this might be difficult for even the average student at first, they can talk with others and figure out what they think should be done, and the students who can complete it on their own will feel very accomplished.

 c. Describe common mathematical preconceptions, errors, or misunderstandings within your content focus and how you will address them.

One preconception would be that congruent would just mean equal but this lesson will focus on why the parts of the triangle that are equal make two triangles congruent and what the real definition of congruent triangles are. As for the proofs, there are a couple common errors or misunderstandings that are addressed in Mdu Ndlovu’s article “Pedagogical implications of students’ misconceptions about deductive geometric proofs”. This article describes errors that students have while doing proofs such as listing properties of geometric shapes, making correct inferences in any order, or restating or supplying own given alone makes a proof. These can come about from lack of vocabulary, or from lack of the deductive though process that takes place to create a proof. This article also addresses ways teachers can fix these problems from intervention and making sure the students know the information they need to know in order to complete the proofs. In my lesson, there will be a strong emphasis that each statement needs a logical reason, and examples of which ones are which. Also, since the first proofs that the students complete just have them fill in blanks, they will be able to see the steps needed to complete the proofs. I will make sure that if a student uses an incorrect reason, that they understand what the reason actually means and can fix their mistake. The lesson segments will be building up to a proof from each specific step so that these errors are less likely to be made.

Ndlovu, Mdu. (2012). Pedagogical implication of students’ misconceptions about deductive geometric proof. Retrieved from <http://www.academia.edu/3253925/Pedagogical_implications_of_students_misconceptions_about_deductive_geometric_proof>

**4. ​Supporting Mathematics Development Through Language**

a. ​ Language Demand: Language Function. Identify one language function essential for students to learn the mathematics within your central focus. Listed below are some sample language functions. You may choose one of these or another more appropriate for your learning segment. Compare/Contrast, Conjecture, Describe, Explain, Prove.

Within this learning segment, it is essential that students are able to prove in order to learn the mathematics within the central focus.

​ b.​ Identify a key learning task from your plans that provides students with opportunities to practice using the language function. In which lesson does the learning task occur? (Give lesson day/number.)

Students practice this language function during lesson 3.

​ c.​ Additional Language Demands. Given the language function and task identified above, describe the following associated language demands (written or oral) students need to understand and/or use.

• Vocabulary and/or symbols

• Mathematical precision (e.g., using clear definitions, labeling axes, specifying units of measure, stating meaning of symbols), appropriate to your students’ mathematical and language development

• Plus at least one of the following:

• Syntax

• Discourse

​ Within this learning segment students must be able to use a lot of academic language. They must understand and know how to name angles and triangles with the correct correspondence. They will know how to write angles, lines, with the corresponding parts in order. They must also understand difference between equal and congruence. They will have to be able to make their statements verbally and write their statements in the correct way with the correct symbols. By writing and explaining a proof they are using they are also able to explain what they did and how they got there while including correct academic vocab. The students use discourse to communicate this with others.

​d.​ Language Supports. Refer to your lesson plans and instructional materials as ​needed in your response to the prompt.

• Describe the instructional supports (during and/or prior to the learning task) that help students understand and successfully use the language function and additional language identified in prompts 4a–c.

During lessons one and two students create a chart with a new terms, their definition, and a picture representation of each concept. When mentioning angles, students will have to write and name the angles in the correct way and read them in the correct way. Students are reminded of vocabulary they will need to complete the proofs that they have learned before and the new material in the chart they created.

**5. Monitoring Student Learning**

Refer to the assessments you will submit as part of the materials for Task 1.

a. Describe how your planned formal and informal assessments will provide direct evidence of students’ conceptual understanding, procedural fluency, and mathematical reasoning and/or problem solving skills throughout the learning segment.

The students assessments review what they learned throughout the day and let the practice it. The conceptual understanding is assessed by seeing the students correctly writing out the answers and making the right statements. It will assess that the students know their definitions and can recognize properties of angles. During and after the first lesson, the students are assessed on recognizing three triangle congruincies and then the next day it will combine new ones and the old ones. Then the last day they will have to use a lot of different information together. The problem solving skills are assessed by asking the students how to get to an answer and having them describe it. It is also assessed when the students complete the sheets where they have to write statements and reasons by checking that the students have correct reasons explaining each statement. ​

b. Explain how the design or adaptation of your planned​ assessments allows students with specific needs to demonstrate their learning. Consider all students, including students with IEPs, English language learners, struggling readers, underperforming students or those with gaps in academic knowledge, and/or gifted students.

Although there are no students with special learning needs there are many different ways that students can be assessed. The homework sheet has many problems and the third homework has problems of different difficulties where even if a student cannot correctly get the last part they can still excel on the earlier ones. There will be assessments in the class from the completion of the worksheets and by questions. Students will be asked to explain answers they have or statements they make. Students can show their learning from writing or speaking in class when they have to give explanations and reasons.