Unit Plan Reflection Paper

Over this last year, my approach to unit planning has changed dramatically in many different ways. At the beginning of the year, I used the textbook as a guide to design most of my units. I subscribed to the idea that the person who designed the textbook had a reason for structuring the units the way they did and who was I to question it. I, also, used many of the examples and activities from the textbooks. However, as I began to engage in different activities of unit planning, I began to question these practices. This questioning led to many changes in my unit planning practice. These changes range from small changes such as creating my own worksheets and examples instead of using the texts to large changes such as approaching my unit as a big idea I want the kids to learn, designing a task to assess these ideas, and then finally designing the lessons to explore these ideas. These changes directly impacted the mathematical understanding of my students.

In my first unit plan, my students did a unit about triangles congruence. For this unit I designed a project that required the students to complete two proofs about triangle congruence (a coordinate proof and a synthetic proof), Appendix A. This was one of my first attempts at creating the assessment prior to teaching a unit. Despite taking this important step of creating the students’ assessment first, I did not differentiate my unit from the textbook in my form of instruction. I took all my definitions from the book and I still had my students engage in examples that were drawn from the book, as seen in Appendix C. However, since that unit I have discovered the book does not always understand the best order of the lessons and they do not always know the best way to introduce an idea to the students. This understanding
came about, when I was teaching a different unit to my students. In the transformations unit, I pulled hands on activities from NCTM to supplement the books definitions of rotations, translations, and reflections. The students loved these hands on activities! Not only that, but they also appeared to do much better on their quizzes and tests after developing the skills themselves. This led me when designing my second unit plan to not rely on the book for definitions and problems, but to develop some of my own to help my students with the final assessment, Appendix B. One activity, I was especially proud of was the Pythagorean Theorem activity from NCTM that allowed the students to explore it as a relationship of areas, Appendix D.

This change is my view on how to approach the day to day lessons of a unit drastically impacted my students learning of the mathematics. In the first unit, I followed the book structure for teaching coordinate proofs. We discussed how to graph them, how to do the calculations and how to interpret what that meant base on our figure. However, the figure we used was an isosceles triangle. Since the students had other options in their project that did not involve proving a figure was isosceles. They struggled with how to apply the example to their assessment. This is evident in the student work in Appendix E. This particular student became confuse when he selected a proof that involved proving the triangle was a right triangle. As you can see, first he did not correctly graph the figure—evident from it has not been graphed he just drew a triangle. He also made significant errors in his calculations and did not have any explanation for how those calculations proved what he wanted to prove. I feel this is a direct result of the unit planning I engaged in. Although, I had a great conceptual activity for my assessment that really pushed the kids to think, the activities they engaged in during the unit
were more procedural and this negatively affected the students’ ability to complete the assessment.

In the second unit, however, my students engaged in an activity to develop Pythagorean Theorem on their own. They went through an activity on the computer using dynamic Geometry software that allowed them to change the sizes of the sides of the triangle; they discovered that the sum area of the squares formed by the legs of the triangle was always equal to the area of the square formed by the hypotenuse of the triangle. This activity was inspired by the article I read “Promoting appropriate uses of technology in mathematics teacher preparation” (Garofalo, J., Drier, H., Harper, S., Timmerman, M.A., & Shockey, T.). In this the article talked about how the students can better conceptualize the formula when they discover it themselves and how dynamic geometry software helps them accomplish the conceptualization. This change in the way I presented the lessons by not strictly providing notes and examples from the book benefited my students understanding significantly when it came to the final assessment. As you can see in Appendix F, when the student engaged in the wheelchair ramp activity she was able to assess that a right triangle was formed and then accurately apply Pythagorean Theorem to the problem. Similar to the previous student work, I had never given my students a problem like this before the assessment. However, she was able to apply what she had learned to a situation unlike anything she had experienced before. She also was able to assess the situation when I sent her to measure the stairs and due to her understanding of Pythagorean Theorem, based off this activity, she was able to figure out the best things to measure to be able to do all the calculations needed, Appendix G. I believe these two things are directly related because she in the dynamic Geometry software activity she had
to try different things in the process of developing the theorem. This translated to her work on the assessment task. She understood how the different sides of the triangle interacted and was able to figure out that she wanted to measure the height of each stair and then calculate the additional missing pieces. To me this demonstrates a deep understanding of the activity, which stems from my changes in the way I planned my units.

The other dramatic change in my unit planning between the two units was how I approached each unit. In the first unit, I created my assessment task and then planned the lessons I wanted to teach to ensure my students would be successful on my assessment. The order I planned to present the lessons mirrored that of the order the lessons were presented in the book. After I had created these lessons, I created my concept map, Appendix H, to help me see how each individual lesson was related. I did this to help me understand how to draw the connections across the units and help my students see the connections. These connections were useful to me to help me see how my individual lessons linked together. After seeing the connections, I felt I was better prepared to explain these connections to my students as we went through the unit. As you can see from my description of how I approached unit planning in that particular unit, I saw it in a very linear fashion. I had separate lessons that I wanted to culminate in the students being able to complete the assessment task. However, now I see that having the lessons developed in this manner makes the unit very choppy. The students are not sure where to go next since things did not build on each other and it jumped around when we discussed topics. I think this also contributed to the confusion in the student work in Appendix E. The fact that we jumped around, I believe lead to confusion about how exactly you complete
a synthetic proof and how exactly you compete a paragraph proof since they were presented at very different points in the unit.

With the second unit plan, I took a drastically different approach to planning my unit. I first began by reading articles online about different types of assessments. I found the article “Creative Writing in Trigonometry” by Julia Burns. This article inspired me to want to do writing with my students. I wanted to have the activity where they were assessed on how they presented the material to me not just if they could do the calculations correctly. After I developed my assessment task, I then went on to generate a concept map, Appendix I. This was a drastic change from the previous unit. I wanted to create the concept map first because it would allow me a chance to generate the big ideas and concepts my students would need to understand in order to successfully complete my assessment task. This was an idea that was introduced to me through my work with the Knowles Science Teaching Foundation. We spend a large amount of time in our first year as fellows discussing big ideas of content areas and how it relates to the teaching. This idea stuck with me and inspired me to do the same thing when creating the units for my students in my classroom. From using the concept map of big ideas, I was also able to break down how those big ideas relate to each other. This made my lesson planning experience for this unit very different from the previous unit. Unlike the previous unit, where I just followed the book for organizational structure, this unit I was able to organize the units in a way that made more sense in revealing the big ideas of the unit to the students. I also was able to build in the connections along the way between the different big ideas. This allowed for the unit to have a more cohesive flow to it and allowed the student to gain a deeper understanding of the big ideas of the unit.
This change in the fundamental approach I took to lesson planning greatly impacted the students understanding of the topics. In the first unit, the students spent a large amount of time on their projects, and still had some major misconceptions evident at the end. In the student work from Appendix E, he had many misconceptions regarding coordinate proofs. He first incorrectly graphed his triangle, not putting it in a coordinate plane. He also was unable to link his calculations back to explain how these showed what he was hoping to prove. I believe this is due to the structure of my unit planning because we discussed coordinate proofs at the beginning of the unit and did not discuss graphing much after that. We also spent a large amount of time discussing how different types of synthetic proofs relate to each other, but due to the linear nature of the lessons, we never went back to reinforce how this was similar to coordinate proofs when we explained the calculations. I believe if my unit planning had been different this student would have been more likely to make some of these connections on his own.

I believe this because in the student work from the second unit, Appendix F, the student was able to address all the different aspects of the unit she needed to use to solve the task. She recognized that she could create similar triangles to help her figure out how far horizontally the ramp must go to meet the Americans with Disabilities Act requirement after measuring the height of the location. She also then recognized she could use Pythagorean Theorem to figure out the length of the ramp. Finally she was able to recognize not only that a Trigonometric Ratio was needed to calculate the angle the ramp should be at, but she was also able to correctly identify the ratio need was tangent. I believe this was due to the circular nature of the unit. In each activity in the unit, I always connected it back to using stuff we had talked about
earlier in the unit. This adapted the students to automatically seeing the connections when they reached the assessment task. If I had not changed the way I unit planned, I would have not seen all those connections and then my unit would not have been developed in a way that allowed my students to see these connections as well.

Over the last year my unit planning has changed in many different ways. I now approach unit planning in a new way that has directly had a positive impact on my students learning. I know I will continue to learn new ways to unit plan and reflect on how those changes impact student learning. These reflections and changes to my unit planning method will directly benefit my students understanding of the big ideas in the unit.
Works Cited


Appendix A

Rough Draft Packet

Prove It!—Exhibition Requirements

You must submit the following items in your exhibition:

1. **Rough draft packet**
   - 💡 Coordinate Geometry Proof
   - 💡 Synthetic Geometry Proof (flowchart, paragraph, OR two-column)
   - 💡 Synthetic Geometry Proof (same proof in a different form)

2. **Poster—Coordinate Geometry Proof**
   - 💡 Clearly stated problem
   - 💡 Coordinate grid showing plotted points and figure
   - 💡 Calculations used to find side lengths and/or slopes
   - 💡 Concluding paragraph that explains how your calculations prove what you wanted to prove

3. **Poster—Synthetic Geometry Proof**
   - 💡 Clearly stated problem in Given/Prove format
   - 💡 A Geometric figure marked with the given information
   - 💡 Neatly written flowchart, paragraph, OR two-column proof
   - 💡 Neatly written flowchart, paragraph, OR two-column proof (**must be a different format than above**)

Remember, a proof is about making a mathematical argument and clearly communicating that argument. Your work should be neat and organized so it makes sense to someone even if you’re not there to explain it to them. Extra points for creative designs and pretty color-coded proofs!

Your project is due on 7 December 2011 at the beginning of class! You will have during class to work on this project on November 22\textsuperscript{nd} and December 5\textsuperscript{th} and 6\textsuperscript{th}. I will be available after school every day this week if you need extra time and/or help.
1. **Coordinate Geometry Proof**
   a. Select ONE Coordinate Geometry Proof that you will complete. Attach the proof you selected in the box below:

   ![Coordinate geometry grid]

   i. Have Miss Frederixon Initial Off on the proof you selected: 

   b. On the grid below, plot your points and connect them to make your figure.

   ![Coordinate geometry grid]

   c. What do you need to show in order to prove what you are trying to prove?
d. Use algebra to calculate the information you need (for example: side lengths and/or slope).

e. Write a few sentences to explain how your calculations above prove what you want to prove.

2. **Synthetic Geometry Proof**
   
a. Select ONE Synthetic Geometry Proof that you will complete. Attach the proof you selected in the box below:

<table>
<thead>
<tr>
<th>Have Miss Frederixon Initial Off the proof you selected:______</th>
</tr>
</thead>
</table>

b. Mark your figure with the given information.

c. Complete a flowchart, paragraph, OR two-column proof below.

d. Complete a flowchart, paragraph, OR two-column proof below. Be sure that you choose a different form for your proof than what you did on the previous page. For example, if you did a flowchart proof on the previous page, you could do either a paragraph or two-column proof below.

e. Which form of Synthetic Geometry proof is your favorite? Why?
Appendix B

Assessment Activity

The American with Disabilities Act sets regulations for wheel chair ramps. It says that the slope of a ramp cannot be steeper than 1:12. This means that for every one foot the ramp rises, at least 12 feet of run are required. The school district wants to build a ramp at the front of the school (where the stairs are) to accommodate students who are in wheel chairs. Your task is to write a letter to the school board to help them determine how long the ramp needs to be and what angle the ramp needs to be at to meet ADA regulations.

Rubric

<table>
<thead>
<tr>
<th>Criteria/Categories</th>
<th>Excelling</th>
<th>Succeeding</th>
<th>Developing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pythagorean Theorem Problem</td>
<td>10--------9.5--------</td>
<td>8----------7.5------</td>
<td>6----------3--------</td>
</tr>
<tr>
<td></td>
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</tr>
<tr>
<td></td>
<td>9--------</td>
<td>7----------</td>
<td>0----------</td>
</tr>
</tbody>
</table>

- The letter is mathematically accurate
  - The height of the stairs are correct
  - The length of the ramp is correct
  - The angle of the ramp is correct
- The letter is set up in a logical manner and the argument about how long the ramp needs to be is accurate.
- The letter is neatly written, grammatically correct, and everything is spelled correctly.
- The answer is presented in a creative manner that utilizes the story

- There are few mathematical errors, but mostly correct
- The letter is set up in a logical manner and the argument is mostly clear and easy to follow
- The letter is neatly written, has few grammatically correct, and minor spelling mistakes.
- The answer is presented in a manner that utilizes the story

- There are significant mathematical errors.
- The letter is not organized in a logical manner and is difficult to follow
- The letter is sloppy, there are significant grammatically correct, and significant spelling errors.
- Only the answer is given and there is no relation back to the story.

Total: ________/10pts

Comments:
Appendix C

Lesson Plan

Unit Topic: Congruent Triangles
Current Lesson Topic: Coordinate Proofs

Lesson Objectives:

- Discover Coordinate Proofs
- Discuss how to use them

Materials Needed:

- PowerPoint
- Coordinate Proof Worksheets

Lesson Activities:

- Guided Notes
- Coordinate Proof Worksheet

Introductory Routines: (announcements, homework review, etc.)

- Attendance
- Announcements
  - Check in Assignments from last two days
- Warm Up Problems
  - 

Schedule:

- Attendance/Announcements 5mins
- Warm Up/Notes 15min
  o Check in Assignments from last two days
- Coordinate Proof Notes 20min
- Work time on Proofs 15mins
- Practice Problems 5min

HOMEWORK: Worksheets, Due Friday end of hour
Appendix D

Lesson Plan

Unit Topic: Right Triangles and Their Properties

Current Lesson Topic: Pythagorean Theorem

Lesson Objectives:

- Be able to explain Pythagorean Theorem in relation to area
- Compute problems regarding Pythagorean Theorem

Materials Needed:

- Worksheet to do Pythagorean Theorem Work
- Homework Worksheet

Lesson Activities:

- Develop Pythagorean Theorem through Area Relationships

Introductory Routines: (announcements, homework review, etc.)

- Attendance
- Announcements
  - Complete worksheet

Schedule:

- Attendance/Announcements 3 min
- Launch Activity 5 min
- Travel Time to Library 5 min
- Pythagorean Theorem Activity 25 min
  - Complete worksheet
- Travel Time to Classroom 5 min
- Discuss Worksheet 8 min
- Discuss Chapter 8 Test 10 min
- Total 60 min

Launch:

- Have students brainstorm about Pythagorean Theorem? What is it used for?
  - \( a^2 + b^2 = c^2 \)
  - Used to find a missing side length of a right triangle
- We will be exploring, “How does this relate to area?”
Possible Solutions:

1. The area of Square III is the sum of the areas of Square I and Square II.
2. A and B squared are equivalent to the areas of square I and square II. This is because those squares form the legs of the triangle. C squared is equivalent to the area of square III since one side of square III forms the hypotenuse of the triangle.
3. Pythagorean Theorem shows the relationship between the areas of the squares formed by the legs and the area of the square formed by the hypotenuse.

Discussion/Connecting Questions:

1. Who wants to share their answer for number two?
   a. What do you mean by form the legs?
   b. What do you think he means by form the hypotenuse?
2. Who can share their answer for number three?
   a. Does anyone else have a different way of phrasing it?

Closing/Wrap-Up:

You guys did some good work today. I am glad that we were able to work so well in the groups. Tomorrow we are going to go to the computer lab to do some more exploration with the ideas we have been working on. Tonight you just have a little bit of homework that will be checked in first thing tomorrow.

Homework:

9.1 Homework Worksheet, Must answer all five questions for credit!

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**Student Activity Worksheet**

You know that the Pythagorean Theorem relates the lengths of the sides of a right triangle. But did you also know it is a relationship about areas? Use the following applet to complete the table by moving around point A and create different size squares.


<table>
<thead>
<tr>
<th>Area of Square I</th>
<th>Area of Square II</th>
<th>Area of Square I + Area of Square II</th>
<th>Area of Square III</th>
</tr>
</thead>
<tbody>
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<td></td>
<td></td>
</tr>
</tbody>
</table>
1. Use a calculator to see how the areas of Squares I and II relate to the area of Square III.

The area of Square III is ______________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________
__________________________________________________________________________________

STOP Check with Miss Frederixon before moving on!

(On Back of Worksheet)
The Pythagorean Theorem states:

In a right triangle with legs $a$ and $b$ and hypotenuse $c$, the sum of the square of the legs is equal to the square of the hypotenuse. That is $a^2 + b^2 = c^2$.

On the previous page, you should have notice that the area of Square I plus the area of Square II is equal to the area of Square III.

2. How do $a^2$, $b^2$, and $c^2$ relate the area of each square from the previous page? Briefly explain your thinking.

3. What is meant by the statement, “The Pythagorean Theorem is a relationship of areas?”
Appendix E

Proofs

ΔABC has coordinates A(9, 4) B(5, 7) C(2, 3)

A right Δ has 1 right angle
I have to prove that AB is perpendicular to BC using the Slope Formula.

Slope

\[ m = \frac{y_2 - y_1}{x_2 - x_1} \]

\[ \frac{4-7}{9-5} = \frac{-3}{4} \]
\[ \frac{-4}{5} = \frac{-15}{1} \]

I found the slopes and then multiplied them to get one.

Synthetic Proof

Given \( \angle DCA = \angle BCA \), \( \angle B = \angle D \)
Prove \( \angle A = \angle E \)

Statement

\( \angle DCA = \angle BCA \)
\( \angle B = \angle D \)
\( \angle C = \angle A \)
\( \angle CBA = \angle CDA \)
\( \angle A = \angle E \)

Reason

Given

Reflexive

SAA Postulate

CPCTC

Paragraph

We know that \( \angle DCA = \angle BCA \) and \( \angle B = \angle D \).
We also know that the Reflexive Property shows \( \angle C = \angle A \), and the SAS Postulate shows \( \angle CBA = \angle CDA \). I proved that \( \angle A = \angle E \) according to corresponding parts of congruent triangles are congruent.
Appendix F

Geometry
Creative Writing in Mathematics

Directions:

1. The American with Disabilities Act sets regulations for wheelchair ramps. It says that the slope of a ramp cannot be steeper than 1:12. This means that for every one foot the ramp rises, at least 12 feet of run are required. The school district wants to build a ramp at the front of the school (where the stairs are) to accommodate students who are in wheelchairs. Your task is to write a letter to the school board to help them determine how long the ramp needs to be and what angle should the ramp be at to meet ADA regulations.

\[ \tan \theta = \frac{x}{y} \]

\[ x^2 + y^2 = \text{ramp}^2 \]

\[ 48^2 + 4^2 = \text{ramp}^2 \]

\[ x = 43 \text{ feet} \]

\[ \theta = \tan^{-1} \left( \frac{48}{4} \right) \]

\[ \theta = 4.7480 \text{ degrees} \]

\[ \theta = 48.14 \text{ feet} \]

\[ \theta = 4.7480 \text{ degrees} \]
Dear Lansing School District,

As a part of the ADA, we have an important issue we need to address with you. One of your high schools, Everett High School, is lacking a handicap ramp in front of the school. My team came and measured the stairs in the front of the building, and we have some information we’d like to share with you.

Your stairs are 4 feet high, and each stair is 48 inches long. The ramp would have to be 48 feet long, and 4 feet high. The ramp would not be necessary in your designated location, you’d have to knock back the walls which is too much of a hassle. Everett has a ramp that the disabled can reach before they even reach the main doors, so we decided that it’s going under construction is inconvenient.

Thank you for your time and cooperation,

ADA
Student From Appendix F Working
Appendix H