Elizabeth Wood

Problem-Based Lesson Plan: Whole-Class Instruction #1

SECTION 1: CONTENT AND TASK DECISIONS

Learning Objectives:

Students will create an expression that represents the growth pattern of the letter "T".

Indiana Mathematics Content Standard:

<u>4.AT.6:</u> Understand that an equation, such as $y = 3x + 5$, is a rule to describe a relationship between two variables and can be used to find a second number when a first number is given. Generate a number pattern that follows a given rule.

Indiana Mathematics Process Standards:

<u>4.PS.1:</u> Make sense of problems and persevere in solving them

<u>4.PS.2:</u> Reason abstractly and quantitatively

<u>4.PS.6:</u> Attend to precision

<u>4.PS.7:</u> Look for and make use of structure

Students will receive pattern blocks in order to make sense of the problem by exploring growth patterns. They will also allow the students to make use of the structure of the problem. Students will make a T-chart, which will help in preserving them to solve the problem. Through the use of pattern blocks and answering questions, students will reason with the problem and find the correct number pattern.

Task and Materials:
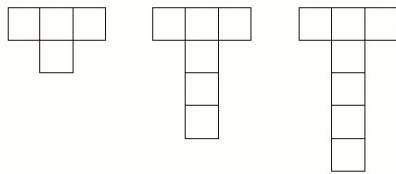
<u>Task:</u> I will present the first "T" and the following statement: The first "T" is a baby "T". Every year the "T" grows bigger and bigger. The first and second year are also represented. How big will the "T" be when it reaches 10 years old?

<u>Materials:</u> Pattern blocks, overhead projector, graph paper

<u>Bibliographical References:</u>

Walle, J., Karp, K., & Bay-Williams, J. (2004). Exploring what it means to know and do mathematics. In *Elementary and middle school mathematics: Teaching developmentally* (8th ed., pp. 23 - 28). Boston: Allyn and Bacon.

Wickett, M., Kharas, K., & Burns, M. (2002). Letter patterns: Building with color tiles. In *Lessons for algebraic thinking, grades 3-5* (pp. 118 - 138). Sausalito: Math Solutions.

Rationale:

I picked the letter pattern task because it allows students to develop their mathematical concepts and procedures. Students already have a basic conceptual understanding on how growth patterns work because of the lesson they had with Miss Mary. However, students will continue developing their conceptual knowledge by using pattern blocks. Students will also improve upon their mathematical language. Additionally, students already have a basic procedural understanding on what the rules and procedures are and how to follow them along with the symbolic representations. Through this task, students will develop these skills through a more complex problem and experience a new strategy for learning how to solve their problem.

SECTION 2: THE LESSON

Before:

- **Activate prior knowledge**
  - What is a pattern?
  - How do you know something is a pattern?
  - What is a prediction?
  - How do we write the letter "T"?
- **Be sure the problem is understood**
  - How many tiles does the baby "T" have?
  - How old is the baby "T"?
  - In what year do we have to find how big the "T" will be?
  - How would you describe the problem in your own words?
  - Is there anything you do not understand about the problem?
- **Establish clear expectations**
  - I expect students to work in groups of three.
  - I expect the students not to ask me a question unless both the student and his or her partners do not know the answer.
  - I expect students to utilize the pattern blocks appropriately.
  - I expect students to complete a T-chart based on the pattern growth.
  - I expect students to draw at least "T's" third, fourth, fifth, and the tenth birthday.
  - I expect students to create an expression that represents the growth pattern.

During:
- **Let go**
  - When the students ask me how to solve a problem, I will not give them the answer. Instead, I will answer their question with a question.

- When the students ask me if they are right or wrong, I will not tell them yes or no. Instead, I will ask the students, "What do they think?" I will also follow up with, "Why?"
- **Listen actively**
  - I will look the students in their eyes.
  - I will nod my head when the time is appropriate.
  - I will smile to show encouragement and that I am listening to them.
- **Provide appropriate support**
  - What do we need to find out?
  - What information do we have?
  - What are you thinking?
  - What are your ideas on what to do next?
  - Can you explain your reasoning for (previous step)?
    - Why is this step true?
  - How is this problem different from Miss Mary's problem?
    - What was the next step in the iguana problem?
    - Do you think it can work here? Why?
  - Can you describe a strategy we might try to answer this question?
  - Can you summarize what you have already accomplished?
  - Can we make a model to show that?
  - How many tiles does it take to build (blank) years?
  - What patterns do you notice on the T-chart?
  - What patterns do you notice with your pattern blocks?
- **Provide a worthwhile extension**
  - Each pair of students will pick their own letter of the alphabet.
  - The students will draw and model the first three years of the letter on paper and with pattern blocks.
  - The students will complete a T-chart to the tenth year.
  - The students will create an expression that represents the growth pattern.
  - The students will share their letter, chart, and expression to the group next to them.
  - The students will explain to the other pair of students how they reached their expression.

After:
- **Promote a mathematical community of learners**
  - I will ask students to share their strategies on how they found their expression.
  - I will ask those students to come to the board to write down their expression and explain it to the class.
  - I will ask these students questions to further comprehend their strategies.
    - What did you do first?
    - Why did you decide to do this?
    - How did you utilize your T-chart?
    - How did you utilize your pattern blocks?
    - What was your thought process on (blank)?
    - Why did you decide to use this method?

- How did you create your expression?
- How do we prove that your expression is correct?
- Do you think this expression will work with other numbers?
  - Why or why not?
    - How many tiles will the "T" have when he turns twenty?
- Where did you get stuck and what helped you get unstuck?
  - I will ask the class if they agree with the students' expression.
  - I will ask other students to share their strategies.
    - Does anyone have the same answer, but a different way to explain it?
  - I will ask the class to compare and contrast the students' strategies and expressions.
    - How are the strategies alike?
    - How are the strategies different?
    - Is this true for all cases?
- **Listen actively without evaluation**
  - I will look the students in their eyes.
  - I will nod my head when the time is appropriate.
  - I will smile to show encouragement and that I am listening to them.
  - I will not look disappointed or make any other face when a student answers wrong.
- **Summarize the main points**
  - What were some of the patterns that you noticed either with the pattern blocks or the T-chart?
  - How did the T-chart help us make a prediction for the "T" when it turned 100?
  - How do we know if our expressions were correct?

SECTION 3: ASSESSMENT

Observe:

I will walk around the room to observe that the students are working through the process correctly. I will observe the students modeling "T" growing over the years with their pattern blocks and then writing it down on paper with their T-charts. With the pattern blocks, I will be looking to see if their models grow each time by one. In the T-chart, I will be observing to see if the students have the correct numbers in each cell. Then, I will listen and guide students in the right direction when it is time to create their expression. For example, I will be listening for "it is a pattern," "the 'T' gets longer by one," "you add one," "you add five to the number of years to get the number of tiles," etcetera. Once the pair of students has an expression, I will ask the students to prove to me that it works. I would like the students to indicate that they plug in the number of years and the number of tiles into their expression. If the expression does not work, the students will be asked to pick their own letter and creating a problem using the exact same format with "T."

Ask:
- What did you do first?
- Why did you decide to do this?
- How did you utilize your T-chart?
- How did you utilize your pattern blocks?
- What was your thought process on (blank)?
- Why did you decide to use this method?
- How did you create your expression?
- How do you prove that your expression is correct?
- Do you think this expression will work with other numbers?
  - Why or why not?
- Where did you get stuck and what helped you get unstuck?