**Name:** Elizabeth Wood                     **Date:** March 17, 2015
**Grade Level:** Fourth                       **Classroom Teacher:** Miss Koon
**Unit Topic:** Algebraic Thinking            **BSU Instructor:** Mrs. Varner

**Unit Objective:** The students will **investigate** the relationship between growth patterns and expressions.

**Main Standard for the Unit:** Algebraic Thinking - 4.AT.6
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.

**Day One**
**Topic**: Ultimate Frisbee
**Subject**: Physical Education
**Indiana Standard**: 4.1 - Motor Skills and Movement Patterns
Students demonstrate competency in motor skills and movement patterns needed to perform a variety of physical activities.
**Indiana Indicator**: 4.1.2
Practice combinations of movement skills for specific sports.
        Example: Perform a catch, dribble, and pass with a ball to a moving partner.
**Resource: Website:**
Rosenburg, A., & Towne, C. (2007). Rhythms of life: Disc skills curriculum: Grade 3 - 7.
        Retrieved February 9, 2015, from http://www.usaultimate.org/assets/1/Page/ROL
        Disc Curriculum 8.31.2007.pdf
**Activity**: Ultimate Frisbee
"For the next ten days, including today, our class will be working with patterns and growing patterns. Patterns and growing patterns exist everywhere. They are in physical education, art, health, social studies, science, reading, and of course math. Today, we are going to start with a game. We are going to play Ultimate Frisbee."
Before we start the game, the students will be given the rules and instructions on how to play. First, the person with the Frisbee cannot move. He or she must pivot and pass it to one of his or her teammates. If the player who has the Frisbee moves, then there is a turnover, which means the other team takes the Frisbee. If the Frisbee hits the ground due to an incomplete pass or catch, it results in a turnover. Students must pass the Frisbee a total of five times in order to qualify to make a goal. The goals are on either side of the field. In order to score a point, a student must catch the Frisbee behind the goal line. If the player catches the Frisbee, then the team receives a point and their opponents receive the Frisbee. If the player does not catch the Frisbee, then there is a turnover. Students will be divided into four teams. Two teams will play on one half of the court in the gym, while the other two teams play on the other half. To start the game, the Frisbee will be tossed into the air at center court. The player who catches the Frisbee begins the game. After ten minutes, the teams will be given a quick water break and will get ready to play again. The teams will play a total of three games, which will allow them to play against everyone. Once all the games are over, we will discuss the process of Ultimate Frisbee. Through this discussion, the students will recognize that patterns are all around them

even in physical education. Today, they performed a pattern of stopping, pivoting, passing, catching, stopping, and so forth.

**Day Two**
**Topic**: Avoiding Health Risks
**Subject**: Health and Wellness
**Indiana Standard**: 4.4 – Students will demonstrate the ability to use interpersonal communication skills to enhance health and avoid or reduce health risks.
This standard focuses on how responsible individuals use verbal and non-verbal skills to develop and maintain healthy personal relationships. Students demonstrate refusal and conflict-resolution skills to enhance health and avoid or reduce health risks. Students describe feelings to strengthen interpersonal interactions and reduce or avoid conflict.
**Indiana Indicator**: 4.4.2
Show refusal skills that avoid health risks.
　　　Example: Tell in your own words how to refuse when offered a tobacco product.
**Resource: Textbook**
Bunting, L. (2007). *Harcourt health and fitness* (1st ed., pp. 186 - 279). Orlando, Fla.: Harcourt School.
**Activity:** Avoiding Health Risks
"Yesterday, we learned in order to play Ultimate Frisbee, there were certain rules or patterns that we had to follow. They included stopping, pivoting, passing the Frisbee, catching the Frisbee, stopping, and so forth. Today, we are going to identity patterns when refusing something that can destroy our health."
The class will be divided into eight groups. Two out of the eight groups will receive the same health risk including: medicines, drugs, tobacco, and alcohol. Students will be given about twenty minutes to research their health risk in their textbooks and on the Internet. Then, each group will be given a Post-it Easel Pad to write down the steps a person should take when offered medicine, drugs, tobacco, or alcohol. When each group is finished, we will hang their steps on the board. We will discuss some similarities and differences between the same health risks and all of the health risks. Through discussion, the students will realize that there is a distinct pattern when refusing something that can destroy their health.

**Day Three**
**Topic**: Tessellations
**Subject**: Art
**Indiana Standard:** 4.7 - Understand and apply elements and principles of design in personal works of art, utilizing a variety of media, tools, and processes
Students apply the elements and principles and distinguish varied lines, shapes, textures, colors, space, and the use of balance, proportion, rhythm, variety, repetition, and movement in works of art. They differentiate media and related visual characteristics and utilize appropriate media and processes in artwork, demonstrating safe and proper use of materials.

**Indiana Indicator**: 4.7.1
Apply elements (line, shape, form, texture, color, and space) and principles (repetition, variety, rhythm, proportion, movement, balance, emphasis) in work that effectively communicates ideas.
**Resource: Realia:**
Tessellation exploration pack from Educational Resources from Bracken Library at Ball
      State University. Call numbers: UDC 3366
**Resource: Website:**
The tessellation art of Robert Fathauer. (n.d.). Retrieved March 14, 2015, from
      http://mathartfun.com/shopsite_sc/store/html/Art/TessellationArt.html
**Activity:** Tessellations
"Yesterday, we identified patterns when refusing something that can destroy our health. Today, we are going to work more with patterns by creating our own tessellations." Students will choose one out of the eighteen different geometric shapes. Then, they will be challenged to cover the entire piece of computer paper without having any spaces. After about ten minutes, I will ask the students a series of questions including: "How many shapes did it take to cover the card?", "How many fit across?", and "How many fit up and down?" Then, I will explain this process is called tessellating. Once the class has an understanding of what a tessellation is, I will ask the class to cover another piece of computer paper, but this time using at least two different shapes. Additionally, I will require the students to use colored pencils to form a pattern in their tessellations. At the end of this activity, we will discuss how there are patterns in art. Additionally, we will explain how some artists, including M. C. Escher and Robert Fathauer, use tessellations to form patterns in their masterpieces just like everyone practiced today.

**Day Four**
**Topic**: Immigration
**Subject**: Social Studies
**Indiana Standard:** 4.3 - Geography
Students explain how the Earth/sun relationship influences the climate of Indiana; identify the components of Earth's physical systems; describe the major physical and cultural characteristics of Indiana; give examples of how people have adapted to and modified their environment, past and present; identify regions of Indiana, and compare the geographic characteristics of Indiana with states and regions in other parts of the world.
**Indiana Indicator:** 4.3.10 – Human Systems
Identify immigration patterns and describe the impact diverse ethnic and cultural groups has had and has on Indiana.
- E *pluribus unum* (out of many, one) http://greatseal.com/mottoes/unum.html
- Ellis Island was opened (January 1, 1892) during the administration of President Benjamin Harrison (Indiana's only President) http://www.history.com/topics/ellis-island
**Resource: Children's Literature**
Landau, E. (2008). *Ellis island*. New York: Children's Press.
**Resource: Website**

Ellis Island. (2015, January 1). Retrieved February 14, 2015, from
        http://www.history.com/topics/ellis-island
**Activity:** Immigration

"Yesterday, we created patterns through tessellations. Today, we are going identify the pattern of immigrants coming to the United States through Ellis Island by creating an outline."

Students will watch a short video on the process on how immigrants go through Ellis Island. Then, as a class we will read the book, *Ellis Island,* and discuss the similarities and differences between the video and the book. The students will then be placed into pairs to work on an outline and each pair will receive a copy of the dialogue in the video and a copy of the book. This outline will list each step that an immigrant had to take in order to live in the United States including: a description, how long he or she had to wait, where the person was located, and what happened if an immigrant does not complete the appropriate step. After all the groups have completed their outlines, I will ask some students to present their outlines. We will discuss that immigrants had to go through this process or pattern in order to make sure everyone was eligible to live in the United States and was documented. The students will come to the conclusion that without this pattern, immigrants could have arrived into the United States wherever they pleased and some could have even brought diseases, which could have harmed many people. Students will recognize that patterns are everywhere and are sometimes necessary to follow.

**Day Five**

**Topic**: Electric Circuits

**Subject**: Science

**Indiana Standard**: 4.1 – Physical Science

Design and assemble electric circuits that provide a means of transferring energy from one form or place to another.

**Indiana Indicator**: 4.1.3

Construct a complete circuit through which an electrical current can pass as evidenced by the lighting of a bulb or a ringing of a bell.

**Resource: App**

(2013). Building serial circuits (lite). (Version 1.1) [Mobile application software].
        Retrieved from https://itunes.apple.com/us/app/building-serial-circuits-
        lite/id464587198?mt=8

**Activity:** Electric Circuits

"Yesterday, we identified the pattern of immigrants coming to the United States though Ellis Island by creating an outline. Today, we are going to build an electric circuit by identifying it's pattern."

Students will receive their own iPad and will be instructed to find the app Building Serial Circuits (Lite). Then, I will instruct the students to try and build a circuit that will light the bulb. Students will have the options of using wires, switches, batteries, and light bulbs in order to construct their circuit. Once an individual has completed this task, I will ask him or her to build a more challenging circuit. Additionally, students will be asked to draw and label one of their circuits that worked properly on a piece of paper. After about fifteen minutes of playing on this app, we will discuss why or why not their circuits were or were not successful. Students will have the option of drawing one of their circuits on

the board and explaining their process of creating it. Once all the students who want to share their circuits present, we will discuss how these circuits follow a certain pattern in order to make the light bulb work. The students will tell me the patterns they discovered and will identify that there are even patterns in electricity.

**Day Six**
**Topic**: Patterns in the Main Events of a Story
**Subject**: Reading
**Indiana Standard**: 4.RL.2 – Key Ideas and Textual Support
**Indiana Indicator**: 4.RL.2
Describe a character, setting, or event in a story or play, drawing on specific details in the text, and how that impacts the plot.
**Resource: Children's Literature**
Capucilli, A., & Rankin, J. (2001). *Mrs. McTats and her houseful of cats*. New York: Margaret K. McElderry Books.
**Resource: Realia**
Unifix from Educational Resources from Bracken Library at Ball State University. Call numbers: UDC 3478
**Activity:** *Mrs. McTats and Her Household of Cats*
"Yesterday, we built electric circuits by identifying their patterns. Today, we are going to read *Mrs. McTats and Her Household of Cats* and distinguish the pattern of Mrs. McTats' cats."
Students will gather on our rug. Then, I will begin reading *Mrs. McTats and Her Household of Cats.* Throughout the story, I will be asking multiple questions about the characters, setting, major events, and the number of cats. Once the story is over, I will break the class up into pairs. Each pair will receive a copy of *Mrs. McTats and Her Household of Cats* and a bucket of Unifix Cubes. Students will be instructed to reread the story with his or her partner. Then, the students will use the Unifix Cubes to count the number of cats that Mrs. McTats started with and how many cats arrive at her door each time. Additionally, the students will be asked to color code the cats. For example, Mrs. McTats owns one cat at the beginning of the story. A student may represent that cat with a blue Unifix Cube each time. After about fifteen minutes, we will discuss the patterns that we noticed in *Mrs. McTats and Her Household of Cats* and how the students represented the number of cats with the Unifix Cubes. Thus, the students will identify that the number of cats that appear at Mrs. McTats' door arrive following a pattern.

**Day Seven**
**Topic**: Repeated Addition Within Growing Patterns
**Subject**: Math
**Indiana Standard:** 4.AT.4 - Algebraic Thinking
Solve real-world problems with whole numbers involving multiplicative comparison (e.g., by using drawings and equations with a symbol for the unknown number to represent the problem), distinguishing multiplicative comparison from additive comparison. [In grade 4, division problems should not include a remainder.]

**Resource: Realia**

Pattern blocks from Educational Resources from Bracken Library at Ball State University. Call numbers: UDC 3716

**Resource: Teacher's Guide**

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.

**Resource: Textbook**

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.

**Activity:** "T's" Birthday

"These past six days, we have experienced numerous patterns. Yesterday, we learned how to identify patterns in a story. Today, we are going to create an expression to represent how big "T" will be on his tenth birthday using pattern blocks, a T-chart, and pictures."

Before the students begin the activity, they will be divided into groups of three and each group will receive a data sheet. The data sheet displays "T's" growth from a baby to his second birthday. It also provides space to draw "T's" third, fourth, and fifth birthday, create a T-chart, produce a rule, and create an expression. First, the students will be asked to model "T" as a baby to his fifth birthday by using pattern blocks. Then, they will be instructed to draw "T's" third, fourth, and fifth birthday on their data sheet. Once their drawings are complete, the students will use their drawing to create a T-chart. Based off of the models, drawings, and T-charts, the students will produce a rule and an expression. Once all of the students are done with this task, I will ask each group to please write their expression on the white board. The class will discuss why each expression does or does not work for all of "T's" birthdays and how repeated addition is the same as multiplication. I will ask the class to explain what strategy worked the best for them to find their equation. Lastly, I will ask the class to find how big "T" will be on his hundredth birthday and prove to me why they know this will work. Through this activity and our discussion, the students will investigate the relationship between the models, drawings, T-charts, rules, and their expressions.

**Day Eight**

**Topic**: Area and Perimeter with Growing Patterns

**Subject**: Math

**Indiana Standard:** 4.M.4 - Measurement

Apply the area and perimeter formulas for rectangles to solve real-world problems and other mathematical problems. Recognize area as additive and find the area of complex shapes composed of rectangles by decomposing them into non-overlapping rectangles and adding the areas of the non-overlapping parts; apply this technique to solve real-world problems and other mathematical problems.

**Resource: Lecture**

Stump, S. (Director) (2015, February 23). Swimming pool problem. Lecture conducted from, Muncie.

**Resource: Realia**

Tricon square-inch tiles from Educational Resources from Bracken Library at Ball State University. Call numbers: UDC 3414

**Activity:** Swimming Pool

"Yesterday, we learned how one expression could relate to models, drawings, T-charts, rules, and expressions. Today, we are going to create two expressions that relates to a swimming pool."

Students will be working in groups of two. Each pair of students will receive a data sheet, which displays how big the swimming pool is in the first and second patterns. It also asks the students to model the first five patterns with Tricon square-inch tiles, draw the swimming pool's third, fourth, and fifth pattern, create a T-chart, produce rules, and create expressions on the data sheet. One rule and expression will represent the sidewalk around the pool and the other rule and expression will represent the water in the pool. Once the instructions are explained to the students, they will be given twenty-five minutes to work on the problem. Then, I will ask one person from their group to write their expressions on the board. The class will discuss which expressions work and why. We will also examine why different expressions can solve the problem the same way. Then, we will relate the expressions to the perimeter and area formulas. Throughout the discussion, students will be encouraged to justify their thoughts with the help of their models, drawings, and T-charts, which will further help the students understand the relationships.

**Day Nine**
**Topic**: Line Graphs with Growing Patterns
**Subject**: Math
**Indiana Standard:** 4.DA.1 – Data Analysis
Formulate questions that can be addressed with data. Use observations, surveys, and experiments to collect, represent, and interpret the data using tables (including frequency tables), line plots, and bar graphs.
**Resource: Lecture**
Koon, R. (Director) (2015, February 17). Pretzel and M&M problem. Lecture conducted
    from, Muncie.
**Resource: Textbook**
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.
**Activity:** Pretzel Sticks and Mini M&M's

"Yesterday, we created two expression to represent the growth of the perimeter and area of a swimming pool. Today, we are going to use pretzel sticks, mini M&M's, drawings, and T-charts to help us create expressions."

Students will be working in groups of three or four and will work with triangles, squares, pentagons, hexagons, or octagons. There will be two lower level groups that will work with triangles. One group will focus on the growth on the pretzel sticks, while the other group will focus on the growth of the mini M&M's. There will be two lower groups working with squares where one group focuses on the pretzel sticks and the other group on mini M&M's. Two average ability groups will be working with pentagons and will create one expression for the growth of the pretzel sticks and another for the mini M&M's. There will be one group of students who will work with hexagons and another group will work with octagons. Both groups will create two expressions. One expression will be for the growth of the pretzel sticks and another expression will be for the growth

of the mini M&M's. Once the students are divided into their groups and understand what expression or expressions they will have to create, I will hand out a data sheet for each group. On the data sheet is a list of instructions that each group will have to follow that corresponds with their shape and the expression or expressions they will have to identify. Each data sheet displays the first three patterns of their shape and asks the students to model the first five patterns with the pretzel sticks and mini M&M's. It also asks the students use a Post-It Easel Pad and markers to draw the first five patterns, create a T-chart, produce a rule, create an expression, and create a graph. If a group is focusing on both the pretzel sticks and the mini M&M's, then they will only be expected to produce two of the previously listed aspects. After about thirty minutes, I will ask each group one by one to bring their Post-It Easel Pad to the front of the class. Then, I will ask each group a series of questions such as "What patterns did you notice?", "Does your drawings match your T-chart?", "How does your drawings represent your expression?", and "How does your graph represent your expression?" Through questioning and class discussion, the students will investigate the relationship between the models, drawings, T-charts, rules, expressions, and their graphs.

**Day Ten**
**Topic**: Growing Patterns
**Subject**: Math, English/Language Arts, and Social Studies
**Indiana Standard:** 4.AT.6 - Algebraic Thinking
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 Standard:** 4.RV.1 – Learning Outcome
4.RV.1 Build and use accurately general academic and content-specific words and phrases.
**Indiana Standard:** 4.W.2.1 – Handwriting
Write legibly in print or cursive, forming letters and words that can be read by others.
**Indiana Standard:** 4.W.3.2 – Writing Genres: Argumentative, Informative, and
        Narrative
Write informative compositions on a variety of topics that –
- Provide an introductory paragraph with a clear main idea.
- Provide supporting paragraphs with topic and summary sentences.
- Provide facts, specific details, and examples from various sources and texts to support ideas and extend explanations.
- Connect ideas using words and phrases.
- Include text features (e.g., formatting, pictures, graphics) and multimedia when useful to aid comprehension.
- Use language and vocabulary appropriate for audience and topic.
- Provide a concluding statement or section.
**Indiana Standard:** 4.W.4 - The Writing Process
Apply the writing process to –
- Generate a draft by developing, selecting and organizing ideas relevant to topic, purpose, and genre; revise to improve writing, using appropriate reference materials (e.g., quality of ideas, organization, sentence fluency, word choice);

edit writing for format and conventions (e.g., spelling, capitalization, usage, punctuation).

**Indiana Standard:** 4.1 – Historical
Students trace the historical periods, places, people, events and movements that have led to the development of Indiana as a state.

**Indiana Indicator:** 4.1.9
Give examples of Indiana's increasing agricultural, industrial, political and business development in the nineteenth century.

Examples: Growth of railroads and urban centers, such as Indianapolis, South Bend, Evansville, Fort Wayne and Gary; President Benjamin Harrison; expansion of the educational system and universities; the growth of labor unions; and the start of Eli Lilly's pharmaceutical business

**Resource: Website**
Write from the beginning and beyond. (2012). Retrieved March 16, 2015 from
http://thinkingmaps.com/pdfdocs/see-inside/wftbb_exp.pdf

**Culminating Activity:**
"Yesterday, we used pretzel sticks, mini M&M's, drawings, models, T-charts, and graphs to help us explain our expressions. Today, we are going to read about the expansion of the educational system and universities. Then, we will write an informative composition about how Bob's mathematical work is incorrect, how to fix his problem, and why your solution corresponds correctly with the problem."

- Students will be asked to read the excerpt on the expansion of the educational system and universities.
- Students will review Bob's mathematical work on the expansion of the educational system and universities, including his drawings, T-chart, and expression.
- Students will identify where Bob went wrong in his mathematical thinking.
- Students will fix Bob's mathematical error.
- Students will write an informative composition that includes:
    - Explaining where Bob went wrong
    - Explaining what Bob's thought process was when he completed the problem
    - Stating the correct expression
    - Stating and justifying the relationship between the drawings and the expression
    - Stating and justifying the relationship between the T-chart and the expression.

**Rubric:**

|  | Meets Expectations | Basic | Needs Improvement |
|---|---|---|---|
| **Explaining Bob's Answer** | Student found where Bob made a mistake and explained Bob's thought process. | Student found where Bob made a mistake, but did not explain Bob's thought process. | Student did not find where Bob made a mistake and did not explain Bob's thought process. |
| **Finding the Correct Expression** | Student created the correct expression and showed work. | Student created the correct expression, but did not show work. | Student did not create the correct expression nor showed work. |
| **Identifying the Relationships** | Student stated and justified the relationship between the drawings and the expression and the relationship between the T-chart and the expression. | Student stated and justified the relationship between the drawings and the expression or the relationship between the T-chart and the expression. | Student did not state or justify the relationship between the drawings and the expression nor the relationship between the T-chart and the expression. |
| **Aspects of the Informative Compositions** | Student has a beginning, middle, and end, uses language appropriate for the audience and topic, and has supporting facts and details from the problem. | Student has a beginning, middle, and end and uses language appropriate for the audience and topic. | Student has a beginning, middle, and end. |
| **Mechanics and Grammar** | Student has four or less punctuation, spelling, or grammatical errors. | Student has five or six punctuation, spelling, or grammatical errors | Student has seven or more punctuation, spelling, or grammatical errors |