**Lesson Title:** Introductions to Functions

**Unit Title:** Understand the Concept of a Function and use Function Notation

**Teacher Candidate:** Maira Carmona

**Subject, Grade Level, and Date:** Algebra 10th grade, February 25, 2014

**Placement of Lesson in Sequence**

This lesson is based on introducing functions to students. Students will learn what domain and range mean in functions. This lesson comes after learning ordered pairs, axioms, writing equations, and absolute value inequalities. For example, students already know how to plot points, graph, and have already worked with axiom rules before. They have already seen all this in Algebra 1. This time students will be introduced to functions along with learning function notation.

**Central Focus and Essential Questions**

The central focus of the lesson is to engage students in learning functions through a modeling activity that will make it fun for them to learn. Students will learn that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. Some essential questions that are part of this modeling activity include describing the patterns that students observe and making predictions based on those observations.

**Content Standards**

CCSS.Math.Content.HSF-IF.A.1: Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If *f* is a function and *x* is an element of its domain, then *f(x)* denotes the output of *f* corresponding to the input *x*. The graph of *f* is the graph of the equation *y=f(x).*

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| **Learning Outcomes** | **Assessment** |
| Students will understand that a function assigns to each element of the domain exactly one element of the range.  Students will determine whether a relation is a function.  Students will identify function notation. | Students will be assessed throughout the lesson. They will work on a modeling activity. The worksheet will be used to assess how students are doing. I will be walking around checking their thought process on the answers. For formative assessment, students will have the opportunity to share their thought process on a chart on the whiteboard and be involved in a whole class discussion. |

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| **Learning Targets** | **Student Voice** |
| I will understand that a function assigns to each element of the domain exactly one element of the range.  I will be able to determine whether a relation is a function.  I will be able to identify function notation. | Students will discussing their answers to the worksheet with a partner and then as a class.  Students will have the opportunity to share their thought process on a chart that will be up on the whiteboard. |

**Prior Content Knowledge and Pre-Assessment**

Students have already worked with ordered pairs, axioms, writing equations, and absolute value inequalities before. For example, students already know how to plot points, graph, and have already worked with axiom rules, too. They have already seen all this in their Algebra 1 course. However, students have not been introduced to functions yet. Students’ assessments have shown they are ready for the next step. Students are tenth graders in algebra 2.

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| **Academic Language Demands** | | |
| **Vocabulary & Symbols** | **Language Functions** | **Precision, Syntax & Discourse** |
| * Function * Domain * Range * Input * Output | * Students need to be able to know and use correct math terminology in order to understand the concepts presented in this lesson. * Students will need to understand that *f(x)* denotes the output of *f* corresponding to the input *x*. * The modeling activity given asks for the least reading level. The instructions are clear and concise including the terminology introduced. | **Mathematical Precision:**  Students will be asked to input a value in for x into the function of the modeling activity to obtain an output.  By the end of class they should have had enough practice and have an idea of the process.  **Syntax:** Students will be asked to describe the process they used to get to their answer.  **Discourse:** Students will reflect on their work by answering the questions on the worksheet. |

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| **Language Target** | **Language Support** | **Assessment of Language Target** |
| Students will be able to justify their answers using the correct terminology. | Students will use informal language to describe the observed process. I will guide them through the symbolic notation so that they continuously hear and begin using the correct terms to describe their questions. | Students will be assessed based on the answers given on their worksheet. I will read the terminology used.  Students will also be assessed based on the information they share to write on the chart on the board. |

**Lesson Rationale (Connection to previous instruction and Objective Standards)**

Students have worked with ordered pairs, equations, and graphing before; however, this time they will learn functions. They will be given enough feedback on their misconceptions and led to the right path in order to successfully complete the worksheet.

**Differentiation, Cultural Responsiveness and/or Accommodation for Individual Differences**

To accommodate for differences in mathematical ability students will be receiving feedback from me. Students will be working individually when filling in the chart on their worksheet, but then they will work in groups to discuss and compare their answers. Then, there will be a whole class discussion and students will write their thought/answers on a chart on the board to explain their reasoning. This is a great activity for all students, especially for English Language Learners (ELL) since they get to experience and see how mathematics is embedded in problems that involve real world models. Students can use their own language or informal language to come up with the symbolic notation. Also, it will be easier for students to learn the new vocabulary as the teacher introduces it within the context of the lesson.

There is one student with special needs; thus, following the requirements in IEPs and 504 plans, this student will be given extra time to complete the activities. I will be checking up on the student to make sure he slowly but surely is keeping up. I will be aware of students’ body language and questions in order to achieve the highest level of understanding from them. Students will also have the opportunity to assess each other’s thinking since they will be sharing their ideas in groups and with the class as a whole.

**Materials – Instructional and Technological Needs (attach worksheets used)**

Materials: String, scissors, pencil. The worksheet is attached.

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| **Teaching & Instructional Activities** | | | |
| **Time** | **Teacher Activity** | **Student Activity** | **Purpose** |
| 10 min | There will be a short lesson in the beginning. I will explain the learning targets of the day. I will also explain to students to think of a function as a set of ordered pairs where no two elements have the same first elements. I will hand in the worksheet to be completed, string, and scissors to each student. | Students will listen to the short lesson and receive the materials needed. | Students will receive a short introduction of what it is that we will be working on (learning targets). Students will be handed the materials needed in order to complete the modeling activity. |
| 30 min | Students will be asked to follow the steps on their handout. The activity is called ‘Number patterns from cutting string’. Students will be asked to fold a piece of string in half and make one cut. They have record on their table the number of pieces they end up with for every cut they make. Students will follow the same process for 2, 3, 4, and 5 cuts. Students will be asked to answer the questions on their worksheet.  I will introduce the concept of function using their informal language by using the correct terminology.  Students will be asked to get in groups and share their answers. Then, they will come up to the board and write their answers on a chart.  I will be holding a whole class discussion and have students ask questions whenever needed. I will also be walking around listening to their discussions. | Students will make the cuts needed following the instructions on their worksheet and record their answers on the table. Then, they will describe the patterns they observe and predict the number of pieces with 6, 7, and 8 cuts.  They will get in groups and discuss their answers. Then, they will come up to the board and write on a chart their answers/predictions.  Students will also be part of a whole class discussion. Extra time will be given to those students with special needs. Students will ask any questions for guidance. | Students will share their answers in groups so that they can have a classmate’s perspective, too, and help each other. Walking around will help me assess how students are doing and clear any misconceptions.  For formative assessment, I will assess students based on their worksheet and their answers to the questions when discussing in groups and on the chart. I will find out if they are on the right track. |
| 10 min | I will be wrapping up the lesson. I will make sure students were able to fill out their worksheet completely. I will ask students to put the materials they used away. | Students will clean up their area. They will turn their worksheets in to me. | Assess how students did, clear up their misunderstandings, and move on to more practice problems. |

There will be a benchmark assessment at the end of the unit.

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**Number Patterns from Cutting String**

Fold a piece of string in half. While it is folded, make 1 cut. How many pieces of string do you have? Continue with another piece of string folded in half, making 2, 3, 4, and 5 cuts. Complete the table below.



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| # of cuts | 0 | 1 | 2 | 3 | 4 | 5 |
| # of pieces |  |  |  |  |  |  |

**Questions**

1. Describe patterns that you observe in the table.

2. Without cutting the string, use the pattern from the table to determine the number of pieces for 6 cuts, 7 cuts, and then 8 cuts. Describe how you use patterns in the table to do this. [Find more than one way to extend the table.]

3. It is possible to predict the number of pieces given the number of cuts? Describe in words how to determine the number of pieces for 20 cuts.

4. What if you had 21 pieces, how many cuts did you make? Describe how you solved this problem.

Cramer, K., (2001) Using Models to Build Middle-Grade Students' Understanding of Functions. *Mathematics Teaching in the Middle School.* 6 (5),.