Ray Holt
EDCI 502
Motivational Framework Lesson Plan
Mathematics – Algebra I (circle, circumference, radius, diameter, word problems, rotation demonstration)

This is an Algebra I class which consists of 8th, 9th and 10th grade students. All 8th grade students are on the fast track and 9th and 10th grade students have taken Transitional Algebra once or twice. Majority of the class is 9th and 10th. The class is organized into Learning Groups of four. Most classes have five or six Learning Groups. Each Learning Group group has at least one good Algebra student as a leader. Handouts are rare in order to save paper and most notes are written on the Promethium Board for the students to copy to their notebook.

Content Standards: My Cooperating teacher requested the lesson be based on the Mississippi Framework. In the Mississippi Framework the concepts are introduced in 6th -7th -8th. In Common Core they are introduced in 6th -7th. I don't think I would make any changes to my lesson based on one or the other standard. Area, radius and diameter will be introduced to the students the day before by my Cooperating teacher.

Mississippi Framework
7-8.PA.MEA Measurement
7-8.PA.4 Understand measurable attributes of objects and apply various formulas in problem solving situations.
7-8.PA.4.a Solve real-world application problems that include length, area, perimeter, and circumference using standard measurements.
Geometry: Area and perimeter: word problems (Eighth grade - Q.16)
Geometry: Circles: word problems (Eighth grade - Q.19)

7-8.PA.4.c Use formulas and/or appropriate measuring tools to find length and angle measures (to appropriate levels of precision), perimeter, area, volume, and surface area of polygons, circles, spheres, cones, pyramids, and composite or irregular figures.
Geometry: Area (Eighth grade - Q.15)
Geometry: Circles: calculate area, circumference, radius, and diameter (Eighth grade - Q.18)

Common Core

Grade 7. (3) Students continue their work with area from Grade 6, solving problems involving the area and circumference of a circle and surface area of three dimensional objects.
Geometry 7.G Draw, construct, and describe geometrical figures and describe the relationships between them. Solve real-life and mathematical problems involving angle measure, area, surface area, and volume. Know the formulas for the area and circumference of a circle and use them to solve problems; give an informal derivation of the relationship between the circumference and area of a circle.

Establishing Inclusion:

The established Learning Groups of four appears to work well in including all students. Strong students are encouraged to help weaker students and often an entire table of four is rewarded and supporting the weakest student is encouraged. During the appropriate time I plan to include all students in measuring the diameter of a wheel by providing small robot wheels to all students.

Developing Attitude:

During my presentation of circles I will include a bicycle wheel, plate, coin, and hat, one of which should include the interest of most students. I will use these objects to show the different parameters of a circle. I will emphasize that π is the ratio of circumference to diameter and is the same for all circles.

Enhancing Meaning:

I will be interacting with the students at several places in the lesson. When I discuss the circle objects I will be asking them questions. I will do three problems on the board and I will be asking for input as to the steps of the problems. I will have an in-class set of problems for the students will work. They will be able to interact withing their Learning Centers to work the problems. Some are formula problems, some definitions, and some real-world word problems.

Engendering Competence:

During the in-class exercises I will be able to walk the room and see how the students are doing on the various problems. Students know to work within their Learning Groups and for each member to help each other. If all Learning Center members are confused and need help then they raise their hands. During the robot demonstration students will be measuring diameter and calculating circumference. During this time I will be able to measure their competence to the material and to reinforce any confusion.

Learning Objectives:

Students should be able to recognize the different parameters of a circle; radius, diameter, circumference.
Students should be able to know what π is and how it is calculated.
Students should know how to calculate radius, diameter, circumference, and area of a circle given just one of the parameters.
Students should know the relationship between circumference and rotation.
Students should know the relationship between rotation and distance.

Assessment Strategy:

There will be several places during the lesson where I will be able to assess the students. During my demonstration I will be asking questions. During my example problems on the board I will be asking questions. During the in-class exercises I will be observing and asking questions. Students will also be asking questions during this time. During the robot demonstration students will be calculating answers in expectation of the robot movements. All of these places in the lesson I will be able to assess if the students are learning the basic names, formulas, and calculations. If I sense they are weak on one aspect of the lesson I will be able to reinforce the lesson at that time.

Description of Lesson Flow:

When the students enter the room they will immediately begin copying the vocabulary words from the board. There will be five vocabulary words. This is expected to take five minutes after the bell rings. Next I will show them several circle formulas and a circle diagram on the board and I will ask them to write them in their notebooks. This should not take more than five minutes. When this is completed I will demonstrate several 'circle' objects. These will be a bicycle wheel, a plate, a coin, and a baseball cap. I will show and discuss the radius, diameter, and circumference of each. I will ask questions to assess their level of

understanding. If time permits I will ask them to find other circle objects in the classroom. Emphasis will be made on the relationship between radius, diameter and circumference. Next the students will be given a handout with 12 problems. Six problems will be exercises using the formulas. Three problems will be "fill in the blank" vocabulary questions and three problems will be real-world vocabulary problems. The students will work in their Learning Center groups and will help each other with the problems. Students are expected to discuss the problems and then to work them individually. Students will be highly discouraged to just copy answers from other students. This in-class exercise will be handed in. The final 10-15 minutes of the class will be a demonstration of a real-world problem. Each students will be handed a small robot wheel and will be asked to measure the diameter of the wheel. Then they will be asked to calculate the circumference of the wheel. I will then explain to them that one rotation of the wheel is equal to one circumference distance. I will then have them calculate the distance for 1, 2, 2.5 and 3 rotations. Using a working robot I will have it pre-programmed to move 1, 2, 2.5, and 3 wheel rotations along a tape measure on one of the desks. Students at that desk will then determine the actual distance the robot traveled for each rotation number. I will ask the students for several reasons why the calculated distance and the traveled distance are not exactly the same.

Materials:

Circle Objects: Bicycle wheel, plates, coin, baseball cap
Measuring Devices: Rulers (one per table), Tape Measures (taped on one table)
Wheels: One small robot wheel for each student (approximately 24)
Other: LEGO NXT Robot, robot charger, masking tape
Promethium Board and pointer/marking stick
Handouts: a) Class exercises as handouts b) Rotation and distance worksheet

Time	Activity	Anticipated Student Responses	Teacher Response	Justification
5 min	Bell Ringer: Vocabulary words will be on a Promethium page and the students will be asked to record them in their notebooks. Words will be circle, center of circle, radius, diameter, circumference, pi (π).	I expect all students will write down the required information. Some students will have to ask for a pencil or paper. Students are tested frequently on vocabulary.	Pencils are sold for 25 cents and paper must be borrowed from another student.	Students expect to have some activity when they enter the room. This helps them to get organized quickly and to be quiet.
5 min	Formulas: Write formulas on the board. Ask students to copy the formulas and the circle chart in their notebooks.	Most students will probably be familiar with the formulas. Some will be confused with π.	Where necessary I will explain and show the parameters of a circle and how they relate in the formulas.	Formulas are the foundation of working with a circle.
10 min	Pre-Assessment: Show bicycle wheel, a plate, a coin and ask students to describe the radius, diameter and circumference of each. Emphasize that all circle objects have the same parameters. Pi (π) will be explained.	I expect about 50% of the students to fully understand all concepts and 10% to not understand at all. The rest will know some answers. Learning Center teams will work together with stronger students helping weaker students.	I expect to explain all circle parameters twice. I will then point out the parameter items and ask for the name.	My purpose of this pre-assessment is to make sure all students are shown the correct locations for radius, diameter and circumference. From experience the bicycle wheel is the most interesting to the students.
10 min	Example Problems: Work three problems on the board. One solving for circumference, one diameter, one radius.	A few students to be confused with radius and diameter, however, I expect most will have not problems. Some will be confused with π.	If necessary I will show the circle objects and explain again the radius, diameter, and circumference.	Working examples will help the students understand the relationships between the circle parameters.
10-15 min	Exercises: Handout class worksheet with 12 problems. Two set of three problems solves for circumference, diameter and radius. Six word problems are included.	Students will work together in their teams to complete the problems. I expect all but 2 or 3 teams will complete the exercises in the time limit.	Exercises not completed will be assigned as homework.	Students learn the application of circle parameters and formulas when they use them repeatedly in exercises.
10 min	Real-world hands-on demonstration exercise using a LEGO Robot. Students will be introduced to wheel rotation using circumference. Each Learning Center team will receive two wheel sizes a measuring devices. They will be asked to measure the wheel diameters and calculate the circumference and distance a robot will travel based on wheel diameters.	I think the students will find the robot and the demonstration of the wheel-distance calculations interesting.	I don't expect to finish all four wheel-distance calculations before our time is up. However, I do expect the students to be able to understand the concept.	Application of the measurement of a wheel parameter to a real-world problem.