Lesson Title	Relative Distance vs. True Distance
Length of Lesson	50 minutes
Created By	Corey Ladner
Subject	Pre-Algebra
Grade Level	$10^{th} – 12^{th}$
State Standards	4.a
DOK Level	DOK 2
DOK Application	Cause/Effect, Infer, Interpret, Distinguish, Make Observations, Relate, Compare.
National Standards	Geometry Specify locations and describe spatial relationships using coordinate geometry and other representational systems Measurement Apply appropriate techniques, tools, and formulas to determine measurements
Graduate Research Element	In my research, an understanding of relative distance and true distance is important for describing age and functionality of streams. As young straight path streams age into mature meandering streams their true distances increase in length. The meandering character and true distance of a stream affects flow velocity, travel time, and volume of water that the stream supports.

Student Learning Goal:
Students will solve real-world application problems involving length with the use of standard measurements. This lesson will focus on the concept of relative and true distance to develop the students' skills of measuring distance between two points and locating the midpoint of a line.

National Standards:
Geometry:

- Specify locations and describe spatial relationships using coordinate geometry and other representational systems

Measurement:

- Apply appropriate techniques, tools, and formulas to determine measurements

Materials Needed (supplies, hand-outs, resources):
Earth globe, nylon string, 12" rulers, yard sticks, pencils, topographic map of Starkville, Mississippi Quadrangle, painters tape

Lesson Performance Task/Assessment:
The students will be assessed on their understanding the difference between relative distance and true distance. As the assessment, Students will be presented with the task of properly measuring the relative distance, true distance, and midpoint of designed Hot Wheels racecar track. Refer to independent practice for details.

Lesson Relevance to Performance Task and Students:
The lesson provides the students with real world experience involving the practice of measuring straight line distance between two points, the actual distance of a simulated track, as well as the midpoint of the track.

Anticipatory Set/Capture Interest:
The teacher will capture the students' interest by first showing a map of Delta Airlines flight routes. The teacher will then initiate inquiry among the students by asking, "Why the flight routes are curved lines rather than straight lines from one location to the other?"

Note: airlines fly great circle routes because the earth is spherical shaped. Great circle routes are shorter in distance than flying straight to the destination by lines of latitude. The Teacher can use a string and a earth globe to demonstrate that the distance between two locations (e.g. distance from Mississippi to Afghanistan) along the lines of latitude is longer than the great circle distance.

Guided Practice:
After discussing great circle routes of airlines, the teacher will provide the students with definitions and explanations of relative and true distance. Next, using a topographic map of the city of Starkville, Mississippi, the teacher will create the scenario of a policeman and a fugitive racing towards an intersection from equal distances away. The intersection serves as a midpoint between the locations of the policeman and fugitive. In the scenario, the policeman and fugitive can only travel the same speed and they have the same measure of distance from the intersection. The student will make a prediction of whether the policeman will reach the intersection first and stop the fugitive or will the fugitive reach the intersection first and have a better chance of getting away.

Note: The topographic map only gives the relative distance to be traveled. Therefore, constructing a topographic profile of the two distances to be traveled allow one to incorporate the change in the topography of the road. The profile provides the true distance traveled on the road. Students will be given topographic profiles of the two

distances in order to measure which person (policeman or fugitive) will actually reach the intersection first.

Independent Practice:
Students will receive a hands-on project that allows them to practice the geometry skills of measuring the relative (straight line) distance and true (actual distance traveled) distance between two points. Student groups will be assigned to lines that have been constructed with painter's tape on the classroom floor. The lines will be constructed with unusual loops and curves similar the Hotwheels racecar tracks. Students will measure the relative and true distances of their assigned line, draw an illustration of their line, and mark the location of the midpoint on their line illustration.

Remediation and/or Enrichment:
Remediation:
In the case that remediation is needed the student can meet with the instructor for individual tutoring. The student can also be grouped with a higher performing student that understands the lesson.
Enrichment:
In situations where there is complete understanding and performance, the lesson can be extended by having the students use a road map to design their own weekend road trip and measure the total distance of the trip using map markers and measurement scales.

Check(s) for Understanding:
The teacher will check for understanding by asking the students the following questions:

- What differences did you recognize between the relative and true distances that you measured?
- Why is it beneficial for airlines to fly great circle routes?
- Why was the midpoint of your line more difficult to find compared to the midpoint of a straight line?

Closure:
The teacher will close the lesson by showing students how relative and true distance is applied to the science of freshwater streams. When streams are first formed they tend to be relatively straight similar to trenches, but as the stream matures in age like the Mississippi River, it forms extensive meanders (bends, curves), which causes the travel distance of the stream between two coordinates to increase. Furthermore, when environmental geologists are designing reservoirs on streams to store water for future downstream municipal use, it is important to know how much distance and time it will require to move an extract amount of the reservoir water downstream to the municipal consumer.

Possible Alternate Subject Integrations:
This lesson can be easily incorporated into high school algebra, physical science, and physics courses.

Teacher Notes:

Attachments:

INSPIRE_LP_Ladner_9.8.12_distance.ppt

The referenced Powerpoint presentation slides are to be used as an aid for the Anticipatory Set, Guided Practice, Independent Practice, and Closure sections.