Lesson Title	Using geometric views to show applications in mapping and construction
Length of Lesson	50 minutes
Created By	Shane A. Irvin
Subject	Accelerated Geometry
Grade Level	9^{th}-12^{th}
State Standards	2e. Determine the effects of rigid and non-rigid motion and composition when performed on objects on the coordinate plane
DOK Level	DOK2
DOK Application	Application, Action, Apply, Construct, Manipulate, Inquire
National Standards	1,2,7,8,9, & 10: Analyze characteristics and properties of two- and three- dimensional geometric shapes and develop mathematical arguments about geometric relationships
Graduate Research Element	Topographic mapping is imperative with my research in watershed delineation. Using geometric modeling will introduce the students to first stages of topography. Along with the graduate school element, research accrued at the University of Tasmania on the Sub-Antarctic region will be used creating this as an INTERNATIONAL lesson plan.

Student Learning Goal:
The goal for the lesson is to apply the study of isometric and orthogonal drawings within geometry to real world applications such as topography. The students will apply both drawing forms by both visual analysis and group inquiry. The basic isometric and orthogonal drawings will be supplied by the geometry book the students will be family with at the time of the lesson. This will allow an easy transition for certain students struggling with basic concepts.

Ultimately, the students will be responsible for forming a building or a form of geography with building blocks. They will then supply both an isometric and orthogonal drawing. The drawings will be used for assessment of the lesson as well as the involvement of inquiry into the lesson.

Materials Needed (supplies, hand-outs, resources):
Building blocks or some type of square block (sugar cubes, wood blocks, etc.). Topographic maps, Examples of orthogonal drawings (See attached), Geometry book, Writing utensil, paper

Lesson Performance Task/Assessment:
The lesson will require student involvement on questions at the beginning of the lesson. These questions will ask:

What is the difference between isometric and orthogonal drawings?
The difference between the two drawings is the method of projection. Isometric drawings show one projection at the horizon of the drawing, while orthogonal drawings show three views, including planar, front, and side views.

Where do you think you would see the different forms of drawings, what applications?
Isometric drawings are mainly seen in architecture and building design to get an almost three dimensional projection. Orthogonal drawings are found in equipment construction and system that must be assembled from many pieces. The three views allow a greater detail to prevent confusion on where things go.

Who can tell me what topography is?
Topography is the planar projection of the change in elevation.

What drawing form would topography be?
It is a form of orthogonal drawing because you form a planar view of the land.

Along with these questions, some of the classes will be asked to provide the instructor with a building or geographical design they create out of the building blocks as well as an accurate isometric and orthogonal drawing.

Lesson Relevance to Performance Task and Students:
The lesson provides a better understand of real world applications in the section they are in in geometry, which consist of drawing in different projections. By allowing the students to create their own formation and project it properly allows them to see from the ground up how topography is done as well as construction design.

Anticipatory Set/Capture Interest:
The students will be shown a drawing on the projector and asked what it is (it will be a tank in an orthogonal drawing, missing certain views). The instructor will then inform the students to start building using their imagination. Blocks will be passed out at this time (8 boxes [30-40 blocks per box]).

Guided Practice:
The instructor will immediately allow the students to start building using the blocks. During this time students can ask the instructor questions. The instructor will also

periodically interrupt the lesson to show different types of projects through maps and drawing the students have never seen before. The students will work through examples with the instructor. The first examples will come from the book and will allow the students to observe basics in the field of drawing the specific projections. During the building portion of the lesson the instructor will place different types of drawings including the topographic map. In this lesson the instructor will be using a topographic map of Heard Island in the sub-Antarctic to grab the students' attention (INTERNATIONAL RESEARCH CONNECTION).
Once the students have a grasp of the drawings, an orthogonal drawing will be put on the board and the students will then be asked:

What is the difference between isometric and orthogonal drawings?
The difference between the two drawings is the method of projection. Isometric drawings show one projection at the horizon of the drawing, while orthogonal drawings show three views, including planar, front, and side views.

Where do you think you would see the different forms of drawings, what applications?
Isometric drawings are mainly seen in architecture and building design to get an almost three dimensional projection. Orthogonal drawings are found in equipment construction and system that must be assembled from many pieces. The three views allow a greater detail to prevent confusion on where things go.

Who can tell me what topography is?
Topography is the planar projection of the change in elevation.

What drawing form would topography be?
It is a form of orthogonal drawing because you form a planar view of the land.

The students will then be introduced to topography. The instructor will show a picture of a topographic map and show it on Google Earth for the students to connect the drawing to actual pictorials.

Independent Practice:
Each set of three to four students will be given a box of blocks. The students will then be told by the instructor to use their imagination and construct something with the blocks. The only requirements include using all of the blocks and working as a team. The students will then be told that their construction will have to be drawn in an isometric and an orthographic projection. Throughout the lesson the teacher will challenge the students to try to build more and more difficult structures. At first the students will not pay attention to the toughness of their design. Once they start drawing some will need help or will have to redesign something simpler. As stated in the guided practice, during the building portion of the lesson the instructor will place different types of drawings

including the topographic map. In this lesson the instructor will be using a topographic map of Heard Island in the sub-Antarctic to grab the students' attention. The students will also have the opportunity to try and recreate the topographic map provided by the instructor using building blocks.

Remediation and/or Enrichment:

Remediation:

In situations that remediation is needed the student can see the instructor for one on one tutoring. The student can also be paired with a high performing student with full understanding of the lesson.

Enrichment/Extension:

In situations where there is full understanding, the lesson can extended by incorporating in requiring the students to complete both activities seen in Independent Practice. All of these extensions depend on the students' ability and knowledge of the subject matter. Individual IEP's will be supported.

Check(s) for Understanding:

Along with a building or geographical design they create out of the building blocks as well as an accurate isometric and orthogonal drawing, the classes will be asked to provide the instructor the answer again to the questions previously asked.

What is the difference between isometric and orthogonal drawings?

The difference between the two drawings is the method of projection. Isometric drawings show one projection at the horizon of the drawing, while orthogonal drawings show three views, including planar, front, and side views.

Where do you think you would see the different forms of drawings, what applications?

Isometric drawings are mainly seen in architecture and building design to get an almost three dimensional projection. Orthogonal drawings are found in equipment construction and system that must be assembled from many pieces. The three views allow a greater detail to prevent confusion on where things go.

Who can tell me what topography is?

Topography is the planar projection of the change in elevation.

What drawing form would topography be?

It is a form of orthogonal drawing because you form a planar view of the land.

Closure:

Once the students seem to grasp the concept, encourage them to commit to practice. Let them know that everything they see can be drawn and seen in these projections covered

in this lesson. Tell them to carry around a notebook and jot down drawings of everything they see. If they have trouble, take a picture or write down information and let the teacher know therefore the student can be helped with outside integration.

Possible Alternate Subject Integrations:
Subject can be incorporated into any drawing class as well as engineering drawing class.

Teacher Notes:
The instructor must be willing to alter the lesson depending on time limitations. This lesson is designed for one day but may be integrated into a multi lesson experience for the students.