Reasoning and Proof: Conditional Statements
An Accelerated Geometry Lesson

By Carol T. Benson

Comments:

In the past, I would lecture on the content of this lesson, and then have students find converse, inverse, and contra positive of mathematics statements. With this activity, students have the opportunity to experience many more conditional statements with their converses, inverses, and contra positives. This activity had students much more actively involved than the tradition version.

General description of content:

This lesson provides an introduction to the concept of proof. The students have examined conjectures, but have not learned the vocabulary of conditional statements. They need to understand and appropriately use the terms: hypothesis, conclusion, conditional statement, inverse, converse, and contrapositive. These terms and applications of them will be used throughout geometry proofs. This topic is generally challenging for some students.

Objectives:

Content – Students learn the different forms of a conditional statement. They learn the relationship between the four types and their truth values. They learn to create converses, inverses, and contrapositives of given statements.

Technology – This will be the second time that students have participated in a discussion board. They will improve their skills in contributing to the Blackboard shell discussion board and in using netiquette.

Role of the teacher:

As a teacher, I first provided a PowerPoint illustrating the concepts of the lesson. Then my role was to assist students in their use of technology and to mentor them in their development of statements. By using technology to introduce the content and then to provide the instructions (found at the end of this lesson plan), I modeled the use of technology to the class. In this sense, I was also serving as a model in the use of technology to the ISU students observing in my class.

Learning activities:

Students were shown a powerpoint defining and illustrating conditional statements, inverses, converses, and contrapositives. Then they were asked to create their own conditional statements – one related to mathematics and a second with real-world context. These statements were posted on discussion board of the course Blackboard shell. Following the posting of the conditional statements, students responded to the statements created by others by submitting the inverses,

converse, and contrapositive to three different conditional statements. This activity provided many opportunities for students to create and view the statements submitted by others, fostering a strong understanding of the four types of statements.

Instructions provided to students on the Blackboard course shell:

For this discussion board, you and your partner working as a team must

1. post at least one conditional statement related to mathematics and one that is not. Each may be written in if-then form or in some other form. (e.g., If a figure is a square, then it is a rectangle. or All squares are rectangles.)
2. respond to at least one math and one non-math posting with the converse of the conditional statement
3. respond to at least one math and one non-math posting with the inverse
4. respond to at least one math and one non-math posting with the contrapositive.

Note that each of these must be different postings. Please remember your "netiquette" and be polite in all postings.

Student reaction:

Students responded positively to this activity. Many of the students were very creative in their conditional statements. All submitted all four entries requested. After this and another discussion board activity, one student wrote in her response log (submitted to the digital dropbox) that she would like to use the discussion board for every chapter.

Sample student submissions:

- if you don't wear your glasses then you will not see better
- if there are supplementary angles, then a ray bisects them
- If you don't drop an apple, then it won't fall
- If an object isn't a triangle, then the sum of it's angles isn't 180 degrees
- if three points are not on a line then they are not coplanar
- if you don't have a computer than it is not a dell
- If you do lock your motorcycle than somebody will not steal it.

Laptop implications:

This lesson required all students to have access to the internet. The laptops provided the opportunity for students to engage in dialog, to develop their own reasoning, and for all of this to happen in a short amount of time.

Learning standards:

National Council of Teachers of Mathematics –

- Reasoning -- provide opportunities for your candidates to make and evaluate mathematical conjectures and arguments, and to validate their own mathematical thinking.

- Connections -- provide opportunities for your candidates to demonstrate an understanding of mathematical relationships across disciplines and connections within mathematics
- Communication -- provide opportunities for students to use both oral and written discourse between teacher and students and among students to develop and extend their mathematical understanding.
- Technology -- use appropriate technology to support the learning of mathematics.
- understand the role of axiomatic systems and proofs in geometry

National Board for Professional Teaching Standards –

- Commitment to Equity and Access. Accomplished mathematics teachers value and acknowledge the individuality and worth of each student; they believe that all students can learn and should have access to the full mathematics curriculum; and they demonstrate these beliefs in their practice by systematically providing all students equitable and complete access to mathematics.
- Learning Environment. Accomplished mathematics teachers create stimulating, caring, and inclusive environments. They develop communities of involved learners in which students accept responsibility for learning, take intellectual risks, develop confidence and self-esteem, work independently and collaboratively, and value mathematics.
- Technology and Instructional Resources. Accomplished mathematics teachers are knowledgeable about and, where available, use current technologies and other resources to promote student learning in mathematics. They select, adapt, and create engaging instructional materials and draw on human resources from the school and the community to enhance and extend students' understanding and use of mathematics.