PROJECT MATHS   Reflections on practices

TOPIC   Geometry
                      Types of Triangles

CLASS GROUP   1st year

DATE   29th of January 2016

SCHOOL   Carrick-on-Suir CBS
                      Co. Tipperary

Lesson delivered by Mary B Lenane.

For the lesson on [29/01/16]
At [CBS Carrick on Suir]
Class [First Year]
Teacher: [Mary Bridget Lenane]
Lesson plan developed by: [Maria Hally, Jimmy Meaney, Sean Ryan, Mary B. Lenane]

1. Title of the Lesson:

Types of triangles

2. Brief description of the lesson:

Students will come up with different ways of dividing a square into triangles using only 2 construction lines

3. Aims of the Lesson:

Long term goals;
- Students appreciate that mathematics can be used to communicate thinking effectively, through reflection, and expansion of mathematical relationships.
- Students will become independent learners.
- Students become more creative when devising approaches and methods to solving problems.
- Students discover that any problem can have several equally valid solutions.
- Build upon my students' enthusiasm for the subject by engaging them with stimulating activities.

Short term goals;
- Students will be able name the triangles and identify different characteristics of each type.
- Students will use appropriate language when describing triangles, i.e. right angle, isosceles and scalene.

4. Learning Outcomes:

- Students will name and describe the fundamental characteristics of the 3 of the main types the triangles in geometry.

5. Background and Rationale

What the students need to learn according to the syllabus;
- Synthesis and problem solving skills
- Students should be able to apply their knowledge and skills to distinguish the different triangles that can be drawn from a square.
- Students can analyse information presented verbally & translate it into mathematical form.

Difficulties students have had in the past with the subject matter;
- Recognising similar triangles in different orientations.
- Applying their spatial reasoning to problems posed.

The thematic focus of this lesson study
- Divide this square into triangles of any size using two construction lines.

6. **Research**
   - Junior certificate mathematics syllabus
   - Textbook
   - Instructional video from Drumcondra reflections on practice
   - http://www.ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Project_Maths/Syllabuses_and_Assessment/JC_Maths_English_2013.pdf
     (Please reference page 33 synthetic geometry and page 50 for definitions 20/21 on the above link)

7. **About the Unit and the Lesson:**

   - Students will draw triangles, using geometry instruments, and joining points to create triangles within the square the distinction between different triangles will become more visible.
   - Helps students realize how to distinguish between different triangles and be able to name them.
   - To reinforce their learning some students will be invited to the board to draw solutions on prepared squares on a flip chart.

8. **Flow of the Unit:**

   Handbooks would be useful here;

Lesson		# of lesson periods
1	Introduction to geometry. This lesson will involve students investigating & understanding: plane, points, lines, rays, collinear points, length of a line segment.	2
2	Introduction to angles. Angles as a rotation. Angles in different orientation. Naming angles. Terms: Perpendicular, parallel, vertical, horizontal	2-3
3.	Construction of triangles .Measuring angles. Introduction to the protractor. Naming triangles & drawing triangles- right angled, isosceles & scalene. Discovery theorem 3 and theorem 5.	2-3
4	Research lesson. Students divide a square into triangles using only 2 construction lines.	Research lesson
5	Discovery Theorem 2: In an isosceles triangle the angle opposite the equal sides are equal and converse.	1
6	Construction of triangles and the meaning of congruent triangles	2
7	Discovery Theorem 6: Each exterior angle of a triangle is equal to the sum of the interior opposite angles.	1

9. Flow of the Lesson

| Teaching Activity	Points of Consideration
This column shows the major events and flow of the lesson.	This column shows additional moves, questions, or statements that the teacher may need to make to help students. This column identifies what the teacher should look for to determine whether to proceed, and what observers should look for to determine the effectiveness of the lesson.
1. <u>Introduction (2-3 mins)</u> Outline that lesson will be on triangles in Geometry. Teacher asks students to name the various types of triangles, through questioning the class group, i.e. what do we call a triangle with 90 degree angle included; a triangle with 2 equal sides; a triangle with no equal sides.	As types are recalled, names and shapes are displayed on white board at different angles
2. **<u>Posing the Task</u>** **(7 mins)** Students will be given a blank worksheet with 6 squares drawn, 3 on each side of an A4 sheet. (**See Appendix 1. student worksheet**) Students will work independently to come up with different ways of dividing a square into triangles using only 2 construction lines per square. Take a square and using only 2 construction lines divide the square into triangles. Completed this in as many different ways as you can. A timeframe of 5 mins will be given. Equipment required: pencil, ruler & rubber. No questions will be answered during the task.	Students will be asked if they have any questions, they must ask questions prior to task. Appendix 1 will be distributed.
3. **<u>Anticipated Student Responses</u> (15 mins)** Students may draw two diagonals crossing at the midpoint forming 4 isosceles, right angle triangles 1 diagonal and line from vertex to midpoint of diagonal, forming a perpendicular with diagonal, thus forming 3 right angle triangles 1 diagonal and line from vertex omitting the perpendicular to the diagonal(many variations here)	Here the plan might describe how the teacher will handle the different student responses, <u>Especially incorrect solutions</u> Teacher refers students to task on worksheet. <u>Students who get stuck</u>

2 lines from adjacent vertices to midpoint of opposite side, forming 2 right angled triangles and 1 isosceles triangle 2 lines from adjacent vertices to any point on opposite side except the midpoint. Forming 2 right angle triangles and 1 scalene triangle Incorrect solutions- they may draw 2 lines and not stay within the triangle and therefore form a 4 sided shape within square.	Gentle reminder given to students to re read the task posed Students who finish early Teacher asks students to explore another method, if possible. Teacher requests a selected number of students to cut out their solution & be prepared to explain their solution to class. **(Please see appendix 2 for suggested solutions)**
4. Comparing and Discussing (3 mins) By observation, teacher will identify suitable sketches in predetermined order for board presentation. See attachment for preferred order of solutions.	What are the ideas to focus on during the discussion? Naming triangles & identifying characteristics of each type. What will indicate that students are benefiting from the discussion? Identifying the number of solutions that students have in common. Assessment of students work. Visual presentations & observers taking notes of student's solutions. Please see appendix two for evidence of students work.
5. Summing up (5-7 mins) Teacher will review objectives outlined at the beginning of class through oral questioning.	Students respond with appropriate language when describing triangles.

10. Evaluation
   See appendix 3 for observation template.

11. Board Plan

This section contains a diagram showing how work on the blackboard will be organized.
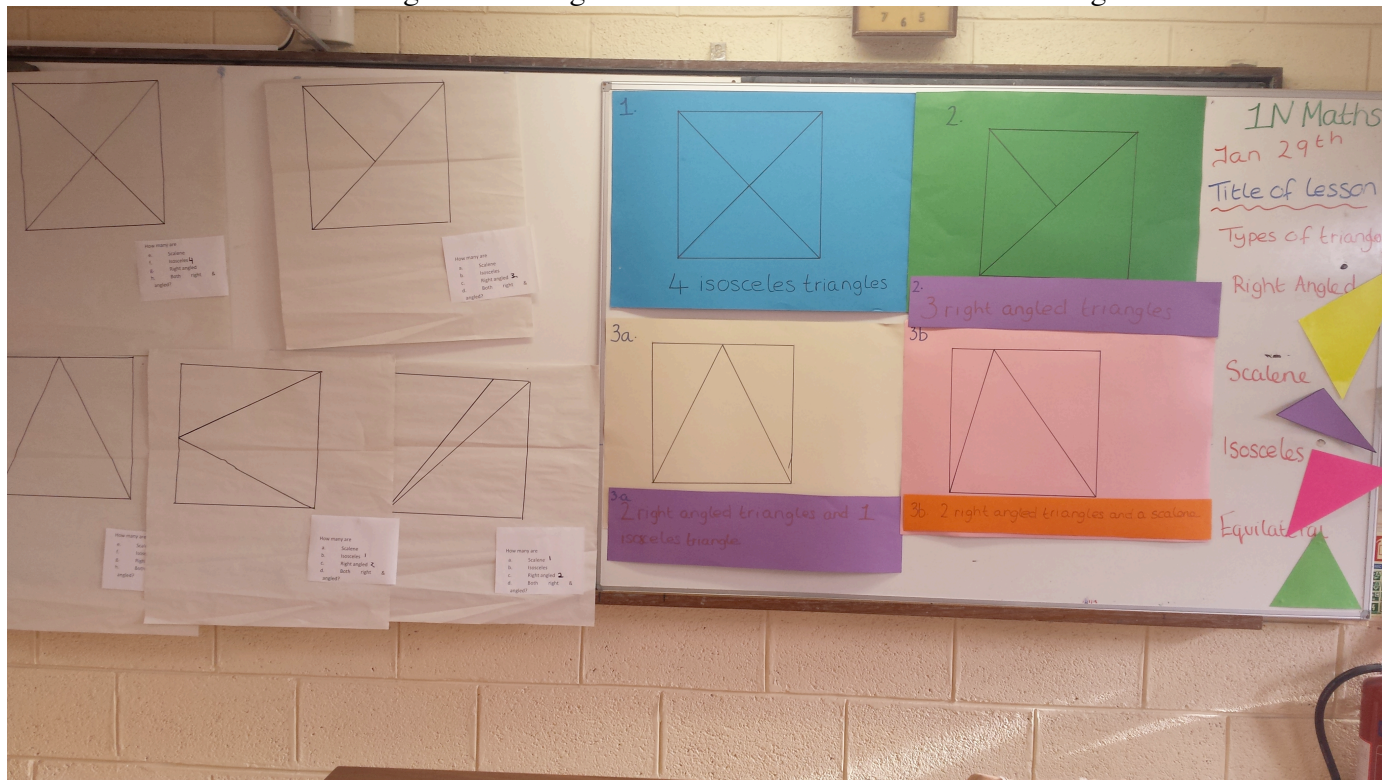
12. Post-lesson reflection

Major patterns and tendencies in the evidence

1. **Our first solution was the most common solution among students.**
   - Lesson criteria was understood by the majority of students.
   - Little time was given to reading instruction.
   - Some students forgot the instructions as they progressed. 1st/2nd/3rd were correct, then the remainder were incorrect for some students. Students ran out of strategies, they felt they had to do something.

2. **Observations or representative examples of student learning and thinking.**
   - Some students used their protractors to maintain accuracy.
   - For representative examples, see appendix 2.

3. **Common misconceptions, difficulties, confusion, insights & surprising ideas.**
   Misconceptions
   - Common mistakes were misinterpreting the lesson instruction. One student believed two construction lines were the minimum to be used.
   - Some students were unaware that triangles were the only shape permitted within the square, some produced quadrilaterals.

Difficulties
- Working independently did not suit some students.
- Lack of focus on instruction given as time elapsed.

Surprising Ideas
- Two students came up with a correct solution that we had not anticipated.

Ways that students achieve or not achieve the learning goals
- A lot of students made six attempts even if some were incorrect.
- One student did not construct any correct solution. This lack of focus that may have been due to external issues.
- Misreading of instructions given consequently resulted in a student not achieving learning goals.

How the lesson could be revised
- Get all students to read instructions themselves.
- The teacher then asks a student to state what the instruction requires them to perform.
- Lesson should be conducted in a standard classroom as opposed to a laboratory.

Implications for teaching
- Not all students engaged in independent learning. Different strategies need to be incorporated to develop problem solving skills. Nevertheless, independent learning is a skill that the teacher would encourage in the future so that weaker individuals can avail of an opportunity to think for themselves. Independent learning was appreciated by all learners. Students were more attentive to their peers and learned from them.
- Positive feedback was experienced by all students.
- Teamwork took place during class discussion to aid the weaker students presenting their solution at the board.
- Preparation of visual displays was time consuming. However, they were effective for purposes of teaching and learning.
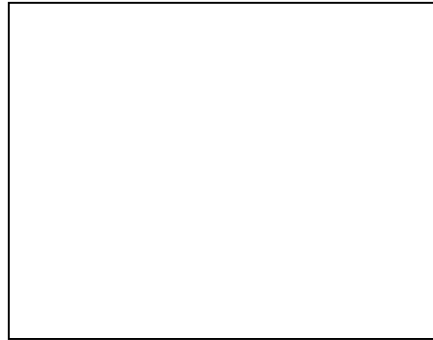- Inviting students to the board promotes peer learning.

Appendix1. Student worksheet

Divide the square into triangles of any size by drawing two construction lines.
Complete the blanks.

How many triangles have you made? _____
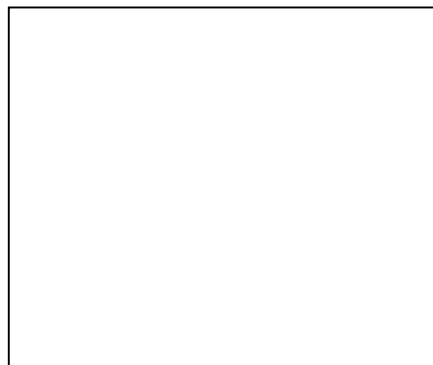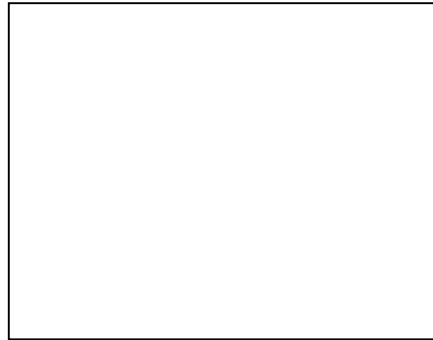
How many are:
a. Scalene   _____
b. Isosceles   _____
c. Right angled   _____
d. Both right angled & isosceles?   _____

How many triangles have you made? _____

How many are:
a. Scalene   _____
b. Isosceles   _____
c. Right angled   _____
d. Both right angled & isosceles?   _____

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Divide the square into triangles of any size by drawing two construction lines.
Complete the blanks.

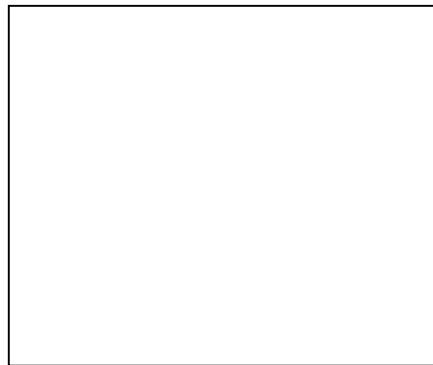How many triangles have you made? _____

How many are:
a. Scalene   _____
b. Isosceles   _____
c. Right angled   _____
d. Both right angled & isosceles?   _____
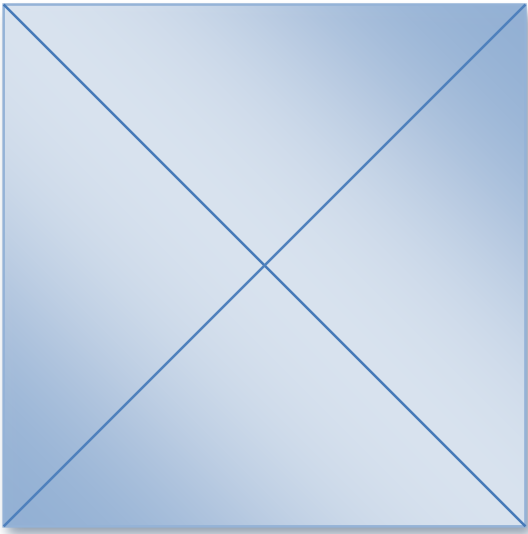

How many triangles have you made? _____

How many are:
a. Scalene   _____
b. Isosceles   _____
c. Right angled   _____
d. Both right angled & isosceles?   _____

How many triangles have you made? _____

How many are:
a. Scalene   _____
b. Isosceles   _____
c. Right angled   _____
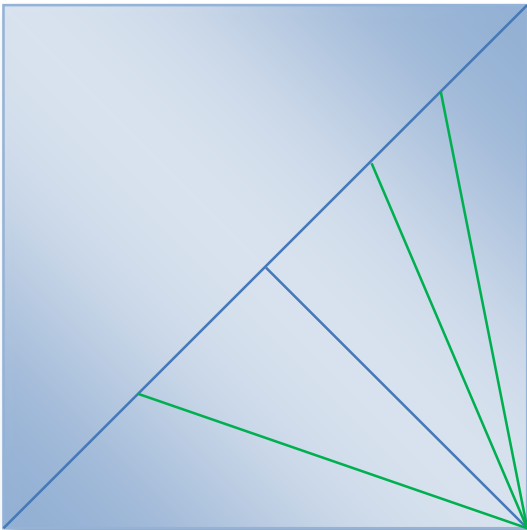d. Both right angled & isosceles?   _____

Appendix 2.

Anticipated student response 1

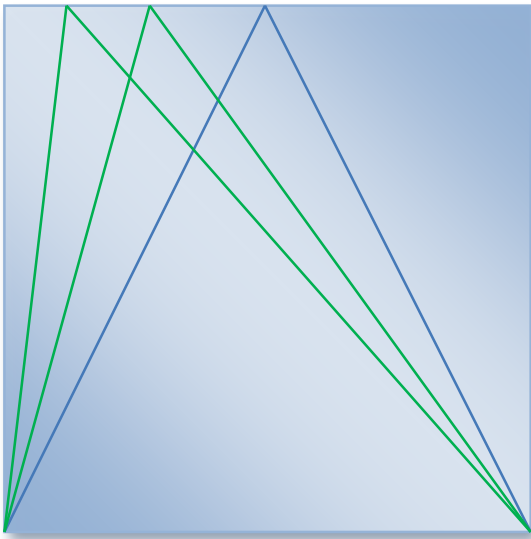2 diagonals crossing at midpoint forming 4 isosceles right angled triangles.

Anticipated student response 2

1 diagonal from vertex to midpoint forming 3 right angled triangles.

Green lines show variations omitting the perpendicular to the diagonal.

Anticipated student response 3

2 lines from adjacent vertices to midpoint of opposite side, forming 2 right angled triangles and 1 isosceles triangle.

Green lines show variations from vertices omitting the midpoint on opposite side, forming 2 right angled triangles and 1 scalene triangle.
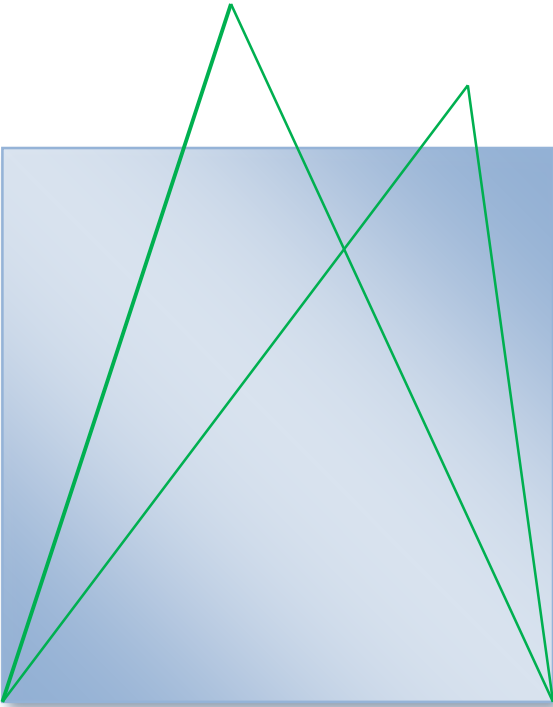
Anticipated student response 4
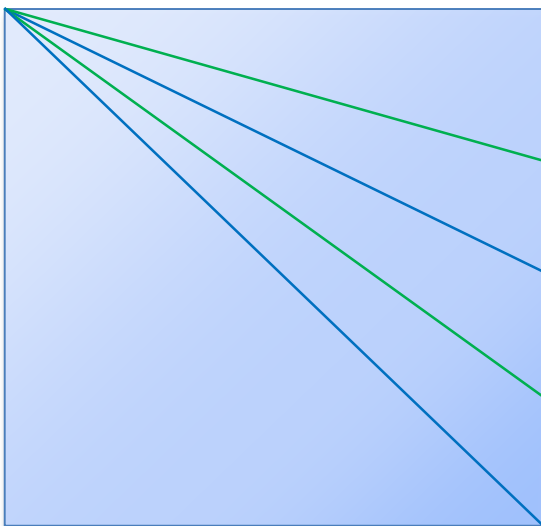
2 construction lines from the same vertex, one to opposite vertex and second to midpoint of opposite side forming 2 right angle triangles and one scalene triangle.

Green lines from vertex to opposite side forming right angle triangles and differing scalene triangles.
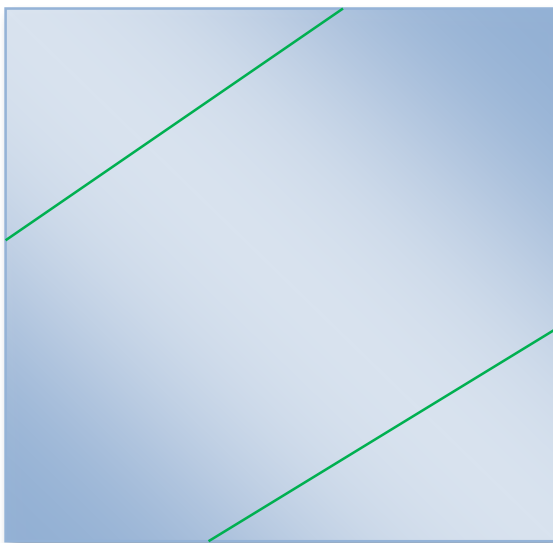
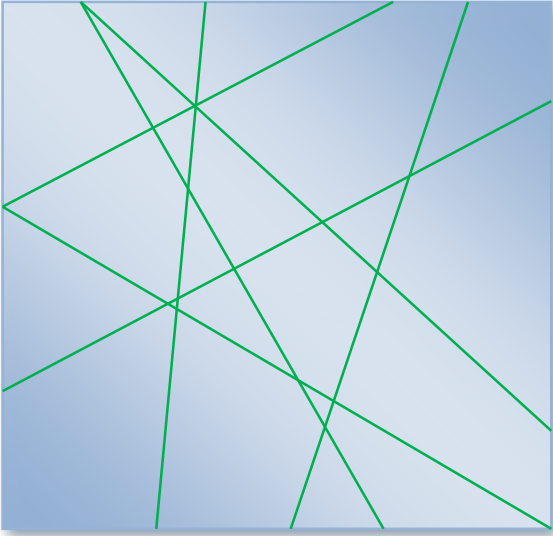**Anticipated student responses**

Incorrect responses 1

Student draws 2 lines not within the square; this forms a 4 sided shape inside square.

Incorrect responses 2

Students may draw 2 lines inside the square, forming 2 right angled triangles while also forming a 4 sided shape.

Incorrect responses 3

Students may construct more than 2 lines within the square to produce numerous triangles and 4 sided shapes.

Appendix3. Observation record

Observation document
Beginning of Lesson

		Student 1	Student 2	Student 3	Student 4	Student 5
Prior Knowledge and Posing the Problem -Tick Hands up -Is it the Same People answering?	(i) Scalene (ii) Equilateral (iii) Isosceles (iv) Right Angled					
Questions Write down questions posed. e.g. Do I Need a pencil/ ruler -Note What questions are asked by which pupil after the task is posed.						

During Lesson: Doing Task

	Student 1	Student 2	Student 3	Student 4	Student 5
(i) Questions asked to Teacher					
(ii) Questions asked to other Students -Whisper -Look at Neighbour -Comments -Conversation -Making Notes on Above for Each one -Stage of Problem Where they collaborate or not					
(iii) How Long Spent on Reading Time (Construction Understood)					
(iv) How Long Writing Time How were the construction activities					
Number of attempts Count					
Other Observations					

Lesson Discussion

	Student 1	Student 2	Student 3	Student 4	Student 5
Rate: Accuracy Yes- No-					
(ii) Rate: Students understanding of Types of problems: E.g. Names of Triangles					
Did pupils presentation promote Thinking and learning for that individual					
Did Pupils presentations and discussions promote the thinking and learning of other pupils in the group. (e.g. you might hear that is scalene etc)					
Other Observations					

	Student 1	Student 2	Student 3	Student 4	Student 5

Appendix4. Photos of student work.