First Year Mixed Ability Geometry

For the lesson on 29/11/16
At Beech Hill College, Laura Mc Manus First Year class
Teacher: Laura Mc Manus
Lesson plan developed by: Laura Mc Manus, Caitriona Mullen, Barbara Gleeson, Paula O Connor, Emma Tormey, Louise Boyle

Title of the Lesson: **What's your angle?**
Strand 2 **Geometry**
Year Group: **First Year**

1. **Brief description of the lesson:** Consolidating Geometry skills learned so far in an unseen problem.

2. **Aims of the Lesson:**

The aim of the lesson is that students:

- Can apply previously learned knowledge and skills.
- Will learn how to reflect on their work.
- Learn how to listen to others.
- Work in groups effectively and stay on task.
- Recognise that there is more than one strategy to solve a problem.
- Increase self confidence in presenting their work to the class.
- Develop literacy and numeracy skills.
- Develop use of correct mathematical terminology.
- Use geometry equipment accurately

3. **Learning Outcomes:**

As a result of studying this topic students will be able to:

- As a result of this lesson students will be able to:
- Adapt previously acquired knowledge and apply it in an unfamiliar context. Think critically and decide what needs to be done.
- Present and discuss options on approaches with their peers, using the correct vocabulary. They will learn to listen to and if necessary point out faults in rationale backing up opinions with facts.
- Co-operate to learn creatively by exploring a diversity of strategies to solve a problem.
- Feel confident in using any ideas to approach a conundrum.
- Present findings to an audience.

4. Background and Rationale

PISA reports for many years highlighted the lack of knowledge Irish students had in space and shapes. Our method of teaching was often rote and while this has its place in any educational system, it left many students poorly equipped to deal with any variation in questions. Project Maths has come a long way towards improving this. Geometry is one of the easily applicable strands of the maths course to everyday life, and PISA encourages discovery and independent learning in classrooms, making this type of question ideal for our purposes.
These students' learning is a level 2, a semi-formal. Therefore it would be expected that they can use some of the formally learned axioms and theorem statements, and combine this with intuitive methods to work. Having completed the CIC in first year and covered two dimensional shapes in third year, this lesson is a good starter and link to constructions.
Ordinary level students who learn by rote often forget what they have learned when they move on. This question affords them the opportunity to use any knowledge they have from any area of maths to solve possible problem.
Keeping in mind that that in real life accurate measurements can be taken and used we have constructed this shape using GeoGebra, with line and angle sizes accurate, allowing anyone the possibility to practice accurate measurements.

5. Research

The following have been consulted for the purposes of compiling this lesson:
PISA 2009 Executive summary
https://www.oecd.org/pisa/pisaproducts/46619703.pdf
PISA 2012 Executive Summary
http://www.keepeek.com/Digital-Asset-Management/oecd/education/pisa-2012-results-what-makes-a-school-successful-volume-iv/executive-summary_9789264201156-2-en#.WHQHcxuLTIU#page1
Primary Schools Maths Curriculum
http://www.ncca.ie/uploadedfiles/Curriculum/Maths_Curr.pdf
Junior Certificate Mathematics Syllabus
http://www.ncca.ie/en/Curriculum_and_Assessment/Post-Primary_Education/Project_Maths/Syllabuses_and_Assessment/JC_Maths_English_2013.pdf

6. About the Unit and the Lesson

According to the teachers Handbook for Third Year "In first year we were experimenting and using words. In second year we start to problem solve in concrete situations and then in third year we prove things." This is applicable to unseen problems.
This lesson will involve the use of any or all axioms learned to date, as well as the measuring skills learned drawing constructions.
As well as just measuring angles students, if observant will identify that the parallelogram is constructed of 4 isosceles triangles, the middle two of which, themselves, make a parallelogram.
They should appreciate the importance of accurate measurement and that observational data should always be backed up by mathematical rigour.

Working through the shapes and angles students should discover different ways of solving the same problem.

7. Flow of the Unit:

Lesson		# of lesson periods
1	• Terminology, Types of Angles	3 x 36 min.
2	• Measuring and drawing angles	2 x 36 min.
3	• Angle calculations	6 x 36 min.
4	• Triangles	4 x 36 min.
5	• Applying previous knowledge in an unseen context	1 x 36 min. (Research Lesson)

8. Flow of the Lesson

Teaching Activity	Points of Consideration
Teaching activities and students anticipated answers	Points of consideration
Revision of angles Revision of triangles Revision of parallelograms Revision of theorems.	Quickly show images of each
Posing the task: Turn over the page in front of you. Your task is to find the size of all angles in the shape. There are lots of ways to do this. You can use your books, calculators, and geometry equipment, each other to solve this. What you cannot use is any of the teachers in the room.	If students work individually, encourage them to try a group or pair. If they only measure angles suggest they try an alternative method. Encourage them to back up affirmations with theory.
Student work	Circulate and observe. Note any interesting approaches
Class discussion: Ok. How did you get on? Did anyone measure the angles with a protractor? Did anyone cut the shape out and fold it over? Excellent	Invite appropriate student to explain what they did?

What about using our Geometry rules?	

9. Evaluation

What is your plan for observing students?

- One teacher per table of four students.
- One teacher photographing overall flow of the class.
- Teacher will circulate around the class to observe different methods.
- Teacher will identify students to ask to present their work.

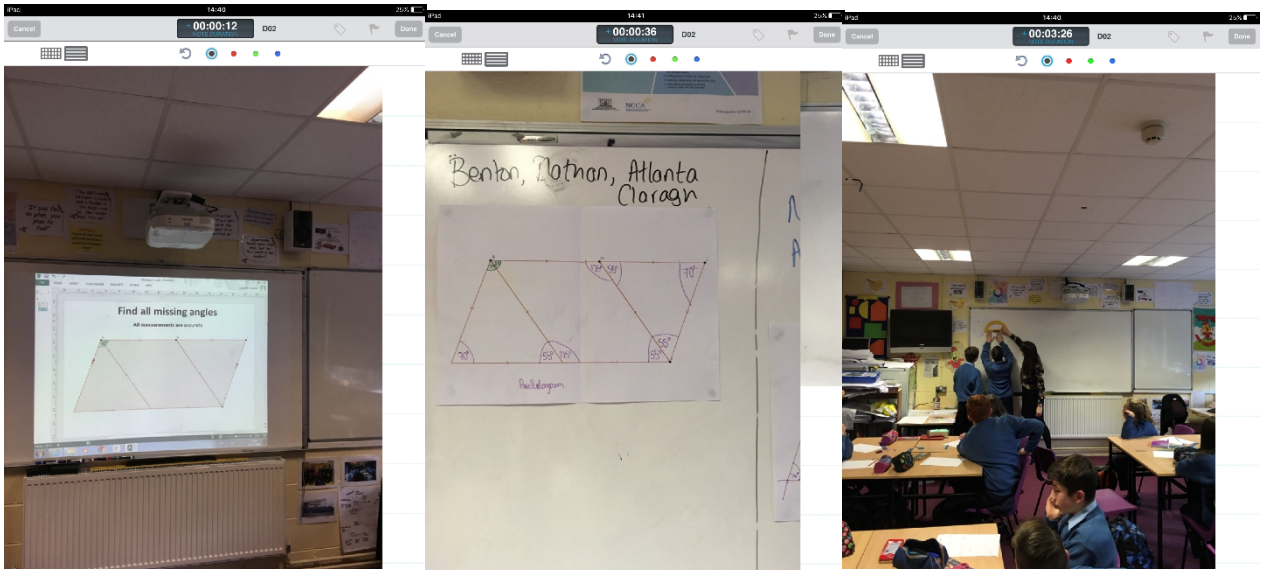
What observational strategies will you use (e.g., notes related to lesson plan, questions they ask,)?

- Each teacher has a copy of the seating plan and they will use this to identify various methods used.

What types of student thinking and behaviour will observers focus on?

- Methodology being used.
- Was there a predominant method?
- What was more common (Group or individual work).
- Group dynamics – Did everyone take part or did one student do all the work.
- Was there discussion among the groups and a general consensus?
- Reasoning – Were they using mathematical reasoning, theory, terminology, any alternative methods?
- Did they make use of the geometry equipment?

10. Board Plan:



11. Post-lesson reflection

What are the major patterns and tendencies in the evidence? Discuss

- It was evident that the students had a good knowledge and understanding of basic geometry. It was also evident that they could apply their knowledge in an unfamiliar situation. Students were also very confident and competent in their use of mathematical terminology associated with this topic. The majority of students immediately applied their prior knowledge of the different types of angles to solve the problem. Only 1 group made use of the geometry set for measuring. No group used the scissors to cut the shapes out. Some groups extended the lines and made use of their knowledge of corresponding angles.

What are the key observations or representative examples of student learning and thinking?

- It was observed that some students although confident in their work were not confident enough to present and explain their work. Students were very focussed and worked well in their group. Students had a tendency to stop once they had solved their problem and not try to solve it another way. High levels of problem solving strategies were demonstrated. Students used prior knowledge learned in primary school that was not covered during this topic to solve the problem. The presence of multiple teachers in the room did not seem to faze the students. The

boys tended to be more confident to present their solution. Within one grouping of 4 the students had initially paired up but joined together when they encountered difficulties. All students were very attentive to all the presentations.

What does the evidence suggest about student thinking such as their misconceptions, difficulties, confusion, insights, surprising ideas, etc.?

- Students seemed to have a very clear understanding of geometry and the task at hand knowing how to proceed at solving the problem. This was not unexpected as this was a top stream class group.

In what ways did students achieve or not achieve the learning goals?

- All learning goals as set out were achieved.
- Applied previously learned knowledge and skills by solving the problem even using knowledge learned in primary school that had not been directly addressed in this topic to date.
- Learned how to reflect on their work critically evaluating it and discussing with their peers.
- Learned how to listen to others both within a group and when someone was presenting.
- Worked in groups effectively and stayed on task.
- Recognized that there is more than one strategy to solve a problem by observing other groups methods and showed their understanding that mathematical methods are the most time efficient.
- Increased self confidence in presenting their work to the class. Every group presented their method for solving the problem.
- Developed literacy and numeracy skills. This group already had a high level of literacy and numeracy skills which they eagerly portrayed.
- Geometry equipment when employed was used accurately.

Based on your analysis, how would you change or revise the lesson?

- Would have been much better to have one copy of the problem on the page as some students thought it was two different problems on the page.
- A much larger diagram for the board would have been preferable.
- Actively encourage the students to use alternative methods to solve the problem.

What are the implications for teaching in your field?

A very enjoyable experience however would be difficult to sustain this on a daily basis. Excellent for introducing a topic or revision at the end of a topic. Good for peer learning. Great for building confidence. Lessons like this would require a minimum of 45 minutes for students to fully benefit from this type of lesson study and achieve all aims.

Find the value of all angles in the following shape.