University Learning in Schools

Mathematics

3D Geometry in the real world

Module Rationale

The Brilliant Club

Department for Education

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Module Rationale

Title of Module: 3D Geometry in the real world
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Module Rationale	
Why did you chose your particular theme (consider: **inspiration, ambition, creativity, new ways of thinking, pragmatism, tailoring research to exam requirements**)?	One of the reasons that 3D geometry was chosen is that although 2D geometry is an integral part of the national curriculum for Key Stage 3 Maths, the 3D side is comparatively underdeveloped, which leaves space for its exploration in a new unit. Thus, the tie to the existing national curriculum was one inspiration. Furthermore, this topic of 3D geometry is accessible (as it leads on from the 2D world) yet at the same time is challenging and fulfilling to study, because of similarities and differences with the 2D universe. One of the hardest things to “understand” is the rotational symmetry of a 3D shape, which is often not touched upon until the topic of

	group theory is taught during the first year of university mathematics. Therefore, this unit also serves to inspire the pupils to continue learning about geometry, and realise that there are higher dimensional objects to explore, as well as weird and wonderful things like hyperbolic geometry!
What did you hope to achieve? (i.e. what was your over-arching objective?)	The main objective is to link 3D geometry to the existing 2D (and 3D) geometry on the national curriculum, showing the similarities and differences, and to encourage further study (since there are only 6 lessons in this unit).
How did you decide on the time frame for your module? (To fit to a half-term? To fit with an assessment cycle? Based module on x number of lessons of y length over z number of weeks)	To fit into a single half-term (the fourth half-term of the school year, i.e. mid-February to Easter) with one lesson a week, it was decided that a fairly short unit of work lasting 6 lessons in total would be created. In the future, an attempt to enlarge it to 12 lessons in total (e.g. two lessons a week for a half-term, or one lesson a week over a whole term) could be a possibility, but this would require a large expansion of material for the unit.

Overview of Module What are the components?	
Lesson plans/rationale	For the module rationale, see page 1. For a summary of the lesson plans, see page 6 and the more complete version attached.
Presentations	Only short presentations are required by the teacher, for example to show what the assembled football looks like in lesson 1, and also to present the concept of rotational symmetry of 3D shapes (in whatever format the teacher deems appropriate). For the pupils, they will get the chance to carry out mini presentations (in pairs/threes/fours) in lesson 4, when they look at 3D shapes/nets of shapes that they have brought in. Furthermore, in lesson 6 the pupils will be doing presentations (as a group of three) to the whole class, showcasing the 3D shape that they have designed and created (from lesson 5 and finished at home).
Resources required for pupils (books, lab equipment, computer facilities, etc.)	The normal exercise books will be required for classwork, and computers (with internet access) will be needed for carrying out research for several of the homeworks. For lesson 4, the pupils will be required to bring in a 3D shape, or the net of a 3D shape, from home. This will then be studied

	in the lesson. Access to computers will also be useful in preparing the presentations for lesson 6, and for completing the "learning log/diary" of the design and creation process of the 3D shapes between lessons 5 and 6.
Resources provided in lessons by teacher (text extracts, images, journal articles, etc.)	Most resources will be provided by the teacher, including: • Vocabulary/knowledge rating sheet (to be given out and collected before lesson 1) • Nets of shapes (football, cube, square-based pyramid, cuboctahedron etc.) • Scissors, glue, sellotape (for folding the nets into 3D shapes) • Short string/coloured pencils (for the work on rotational symmetry) • WWW/EBI forms (for filling in and collection at the end of each lesson)

Unit overview
Individual Lesson Objectives, Key Questions and Key Concepts & Terminology
NB - This will be your final scheme of work (in medium-term plan form). By using this table, your scheme of work will fit into the proforma for dissemination.

Lesson	Objective	Key Question(s)	Key Concepts & Terminology
1	Folding a football from a sheet of paper	How do you fold a 3D shape out of its net (i.e. a new net which you have not seen before)?	Nets, polygons, polyhedra, football, cuboctahedron
2	Folding a cube from a sheet of paper, and summarising its properties	How do you fold a 3D shape out of its net, and how would you describe/summarise its main properties? What is meant by *rotational symmetry*?	Vertices, edges, faces, nets. Symmetry, rotational symmetry.
3	Folding a square-based pyramid/octahedron from a sheet of paper, and summarising its properties	How do you fold a 3D shape out of its net, and compare its main properties with other similar-looking 3D shapes?	Pyramid, octahedron and all those from lesson 2
4	Analyse a 3D shape or a net brought in from home, and compare with other 3D shapes/nets	How do you deconstruct a 3D shape into a net? How do you fold a 3D shape out of a new (not-seen-before) net?	Same as lesson 2

5	Design a new 3D shape	What properties do you want your 3D shape to have, and how do things like: • the shapes of the faces • the "building blocks" of the whole shape • the rotational symmetry all affect each other?	Same as lesson 2, plus presentation skills and diary-writing skills.
6	Group presentations of the newly designed 3D shapes	What makes an excellent presentation? What makes an excellent *mathematical* presentation?	Presentation skills

Evaluation
*What is the impact of the module? Consider the impact, if any, that planning, teaching and assessing the module has made on both **pupil** and **teacher** in each category:*

Impact	**On pupil**	**On teacher**
Subject skills learned		

New conceptual understanding or new ways of thinking		

Reflection		
Stop	**Start**	**Carry on**
What should be excised or not repeated?	What should teachers add to the module next time it is taught?	What aspects worked well and should definitely be repeated next time the module is taught?
