Unit of Study: Scratch – Space & Geometry, Patterns & Algebra
Year: 6

Design Team	Unit Duration	Lessons & Hours	Start Date	Completion Date	Unit Review
• Jane Harris • Peter Sutton	8 Weeks	10 lessons 7 hours	DD/MM/YY 16/09/2008	DD/MM/YY 03/12/2008	DD/MM/YY

What is the big understanding?	• Learning develops when students are part of a community which share and create knowledge using powerful tools and powerful processes.

What is the purpose of ICT within this unit of study?	• To enable students to: • explore - develop mathematical thinking in the Scratch learning environment @ both CIS and online; • plan - create and share mathematical knowledge from playing (consuming, deconstructing and remixing) templates and games; • do and share - design, build and remix a game to share understanding about position, geometry, and patterns and algebra; • review - publish the games designed and developed by individuals in the CIS gallery on the Scratch website and invite comments and remixes from the Scratch community.

ICT Outcomes	• Students demonstrate a sound understanding of technology concepts, systems and operations. • Students use critical thinking skills to plan and manage projects creatively using technology tools to solve problems and develop innovative products. • Students value opportunities technology affords to facilitate collaboration with peers to support individual learning.

Unit Outcomes	• Discusses and evaluates common uses of technology demonstrating an understanding of ethical issues. • Uses technology competently and confidently. • Applies and adapts existing knowledge to generate new ideas and technology products. • Understands that increasingly complex procedures can be assigned to multiple inputs. • Understands the needs of multiple audiences and critically evaluates the validity and effectiveness of each other's work in meeting these.

Assessment	**Pre-Assessment Task(s)** • None
	Post-Assessment Task(s) • For interested students I am setting up a virtual Scratch Club with other international schools in HKG.
	Year Level Moderation The year team has reviewed the assessment tasks Yes Moderated samples of the assessment task are located in the following location: R:\Maths R-6\Scratch Pilot\project exemplars • **Experiencing Difficulty** Yes • **Beginning to develop** Yes • **Developing as expected** Yes • **Exceeding expectations** Yes
	Rubric(s) • Unit R:\Maths R-6\Scratch Pilot\assessment rubrics

Integration	**Subject Area**: Maths	**Subject Area:** Art
	Subject Area:	**Subject Area:**

	Week 1	Week 2	Week 3	Week 4
Learning and Teaching Activities	Introduction to the Scratch site. Introduction to the Scratch environment & vocabulary. Deconstruction of the Fries Machine game & introduction to the idea of remixing. Discovering the Cartesian Plane; positive & negative coordinates. This investigation should be linked to art so students design costumes for sprites / tessellating tiles by hand to reinforce this understanding.	Review understanding from previous lesson - Cartesian Plane, negative & positive coordinates. Use lesson 2 on Scratch site as a starting point to introduce specific blocks; motion, control, looks. Introduce building & developing a script by deconstructing the existing script. Look at the project tags & define translation, tessellation & position. If necessary Google search using correct Boolean operator. Challenge: Create a new costume for each sprite and continue the script? What do we need to understand before we can do this? Begin with existing costume then edit to customise. Copy costume into each sprite - does this necessarily tessellate? Why / why not? Homework task - this will require a USB key so the Scratch project can be taken home. Scratch letter home in Year 6 and ICT blurb added to newsletter before Thursday.	At the beginning of the class, students should log-on to the Scratch website and set up an account. Make a note of user names and passwords in diaries - teachers collect user names. Review understanding from previous lesson Load up the examples and review them as a group. Some students may not wish to share - this is okay at this stage. What problems/difficulties did you have? How did you overcome them? Talk about symmetry in tessellating patterns. How can more complex costumes be made to tessellate with more than one line of symmetry? Edit and rotate to fit the patterns together. Challenge: Develop the scripts to make other tessellated hexagons which change costume and move in a systemetic way across the stage. What do we need to understand before we can do this? Movement. Glide to - position: double click to find out exact coordinates. Control. Wait - number of seconds. Looks. Change costume - what the sprites look like.	Review challenge from previous lesson. Load up the examples and review them as a group. What problems/difficulties did you have? How did you overcome them? Talk about systematic and organised movements - how could the movements reflect an understanding of symmetry? What would look elegant? How could the project be more impacting? Challenge: finish developing the project so there are two tessellated hexagons then script for the sprites translate into different positions on the stage. The project should then be uploaded to the Year 6 gallery on the Scratch website. NB: students will work at their own pace and level to complete the final two challenges. More able students will take the basic design brief further, adding more costume changes, translate and tessellate sprites into various symmetrical patterns and add music.

	Week 5	Week 6	Week 7	Week 8
Learning and Teaching Activities	How would you build a script to move the Scratch cat in a square? What are the properties of a square? Which two motion blocks would you use to develop the script? Motion. Move ? steps; Turn 90 degrees. What do you notice about the blocks - is there a pattern? Introduce the Control block - Repeat. How many times are you repeating? Look for the link between motion blocks. This is called a procedure. Can you add position to the script so you draw the square in Quadrant I? What do you already know about the coordinates in Quadrant I? Start single stepping. If you wanted to draw the square in both Quadrant I and II what would you do to develop the script? What do you already know about the coordinates in these Quadrants? How can you make this more efficient, rather than having to build each procedure from the beginning? Duplicate. Why are the squares not truely reflected across the y-axis? Two students can model walking in a square; imagine one is a reflection in a mirror. What happens when you see things in a mirror? Watch how they turn. What do you have to do to the script to make sure your sprites make a reflected turn?	Review and share what was learned last week. The groups will be starting to differentiate out - allow students to cluser. Why are squares still not reflected across the y-axis? Where does the Scratch cat begin moving from? Would this be the same direction if you reflected the movement in a mirror? Which motion block do you need to add to the script? Motion. Point in direction 90. Challenge: can you build a script to reflect the Scratch cat across both the x- and y-axis so it draws a square in each Quadrant? What do you already know about the coordinates in each of the four Quadrants? What do you already know about movement and reflection? If you wanted to rotate the Scratch cat to draw four squares rather than one, what do you think you would need to do? Control. Repeat. Embed the procedure to draw one square inside another repeat. How many times does the cat repeat the squares? Talk about adding rotation between the procedures. How many degrees would the cat have to turn between each procedure? Why would it be 90 degrees? What would happen if you wanted to draw eight squares?	Review and share what was learned last week? Although students will be working in clusters, have the group share to allow problems to be shared and solved by peers rather than teacher-lead. What do you think the formula for calculating the angle of turn around a point is? What did you find out last session? Scratch cat rotating in a full circle = 360 degrees. How many squares did it draw? 4 or 8. Angle of rotation = 360/n where n = number of shapes drawn. Challenge: can you develop the script to draw a different rotating shape in each of the four Quadrants? What do you already know about reflecting procedures across axis lines? What do you already know about calcualting the angle of turn, as well as the angle of roatation around a point? Can you devleop and remix the script so there are two sprites drawing different shapes at the same positions? Can you make the colours different?	Review and share what was learned last week in the group before breaking out into clusters. The clusters will be working at different levels and on different challenges. Challenge: can you script for different pen sizes? Can you script for a fifth rotating shape to be drawn in the centre of the stage? Can you design and script for a background? Can you add music to the project? Can you script for added features or surprises - press a key and the shape grows, press a key and it plays a specific note? This is the finall assessment piece and should be posted to the Year 6 gallery on the Scratch website. NB: the assessment rubrics will be posted on MoonGate at the beginning of week 5.

Vocabulary	Scratch environment: sprites, stage, scripts, blocks, costumes, single stepping Programing concepts: repeat procedure, embedded procedure, forever, if, until, broadcast Mathematical concepts: reflection, rotation, translation (flip, turn, slide), coordinates, Cartesian Plane, positive, negative, angle, degree, polygon, tessellation.

Student Descriptors	**By the end of this unit** Most students will: Understand how to build a script. Understand how to use a range of blocks in Logo language – repeat, penup, pendown, setpc, move etc – and use them to build procedures. Understand how to plan the steps involved in building a procedure and understand the importance of collaboration in building, editing and remixing programs. Understand what co-ordinates are and what happens to them in each of the four quadrants of the Cartesian Plane. Understand how to write procedures which demonstrate rotation, reflection and translation and be able to calculate the correct angles of turn. Understand how to define and embed procedures. Understand how to personalise projects by adding sound, music, backgrounds, etc. Some students will not have made as much progress and will: Know how to build a program using a range of blocks in Logo language. Be working to develop their understanding of procedures. Be working to develop their understanding of co-ordinates and the Cartesian Plane. Be working to develop their understanding of reflection, rotation and translation. Know what a procedure is. Some students will have progressed further and will: Understand how to plan the steps involved in writing more complex, embedded procedures. Understand that scripts can be broken down into recursive sequences. Understand how to work with co-ordinates to demonstrate reflection, translation and rotation of any shape across any line of axis. Understand that procedures can contain variables and that variables do not follow a set pattern.

Resources	**Web sites, Video clips, Children's literature, Other** • http://scratch.mit.edu • http://scratch.wik.is/Support • http://scratch.mit.edu/forums/viewforum.php?id=31

Teacher's Evaluation	• To what extent did students achieve the learning target(s)? • What action could be taken to strengthen student learning and assessment? • What student-initiated inquiries arose from the learning?	**Review and Action** •