# Levels 7/8 Visual Arts Activity

## Patterns in our World – Time Travelling with Patterns

## Introduction to Numeracy in Visual Arts

In the visual arts, students are engaged in making and responding, using “visual arts knowledge, understanding and skills to express meanings associated with personal views, intrinsic and extrinsic worlds” (Victorian Curriculum and Assessment Authority [VCAA], n.d.-a, para. 2). Students discover, experiment, and problem-solve through images and visual systems (visual perception, visual language, visual techniques, technologies, practices and processes) to explore and express the world (VCAA, n.d.-a). Traditionally, in Visual Arts learning, the focus is on embodied and experiential inquiry that combines spatial reasoning with “an understanding of how we can represent and communicate this knowledge through visual symbolic systems” (Grushka & Curtis, 2018, p. 423). The four strands of the Victorian Arts Curriculum (VCAA, n.d.-b) include content descriptors and elaborations for making and responding within Visual Arts learning. The four strands are:

* Explore and express ideas
* Visual Arts practices
* Present and perform
* Respond and interpret

When students make and respond in the visual arts, they explore and develop viewpoints, visual conventions, techniques and processes, materials, and information communication technologies. As makers and responders, students explore their roles as artists and viewers, and interact with artworks. Visual Arts students develop skills that are “transferable across learning contexts and support development of literacy and numeracy capabilities” (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.). A range of numeracy skills relevant to students’ understandings in Visual Arts Levels 7 to 10 (as preparation for Levels 11 and 12 Visual Arts) include the following competencies:

* Appreciating artworks across time and cultures (e.g., understanding how proportion, ratio, and measurement are fundamental art principles)
* Working with spatial thinking and number (e.g., through shapes, scale, proportion, and ratio as applied to 2D, 3D, and 4D)
* Considering mathematical concepts alongside aesthetic aspects (e.g., beauty, style)
* Ability to calculate, estimate, measure, plan, and create artworks (e.g., use of measurement to determine shape, pattern, location, and transformation)
* Capacity to extend and develop patterns, repetition, and relationships (e.g., to design a pattern that is repeated in various ways; block, brick and half brick, drop, diamond)
* Working with scale, proportion, and ratio to establish comparative elements (e.g., the scale of sculpture to a specific site)
* Positioning, locating, and sequencing of art elements (e.g., making a time-based work, such as a stop-motion animation)
* Using technical skills to develop mathematical thinking (e.g., use of linear perspective in drawings)
* Problem-solving through visuospatial reasoning (e.g., understanding and recognising spatial relations among objects and space)

Students acquire knowledge and skills in numeracy throughout their life span. In the visual arts from Levels 7 to 10, students continue to apply and build on their numeracy skills. For example, students might use percentages to measure glaze, or use units of measurement or additive strategies to determine the area of a sculpture or to design a template. Students extend their knowledge about concepts such as positioning and locating or measuring time when designing, making, or responding to visual artworks (e.g., measuring transitions in a stop-motion animation, proportion and perspectives in a still life drawing). The sub-elements for the numeracy learning progression within Visual Arts are: number patterns, algebraic thinking, positioning and locating, understanding units of measurement, comparing units (ratios, rates, and proportion), interpreting fractions, understanding geometric properties, and interpreting and representing data. For instance, students figure out how patterns bring predictability when using number patterns and algebraic thinking. By incorporating mathematical concepts, students are able to address issues with making and responding to artwork.

## Developing Numeracy Understanding in the Visual Arts

Numeracy encompasses knowledge, skills, behaviours, and dispositions (ACARA, n.d.). In the visual arts, students engage with numeracy in multiple ways and situations. For instance, in undertaking observational drawing of faces, objects, and landscapes, and in creating patterns, murals, sculptures, and installations, students work with geometry as well as scale and proportion. Relevant numeracy knowledge and skills are required for students to “research, plan, design, and evaluate” (ACARA, n.d.) their ideas and artistic responses. Through art activities, students use spatial reasoning skills to estimate relationships (proportions) between items (e.g., comparing human scale to objects, architectural buildings, and monumental sculptures).

Grushka and Curtis (2018) state that “the application of numbers in visual art/design learning involves observing, analysing, measuring, counting and considering relationships between numbers, shapes, forms and rhythms in order to gain spatial harmony and balance when making design works” (p. 424). Hogan (2000) suggests three types of knowledge to be a numerate person and to function as a “fluent operator” (Callingham et al., 2015, p. 551). These three types of knowledge can be adapted in the visual arts learning:

* *Mathematical* *–* knowing enough of the mathematical underpinnings to make sense of a situation (e.g., students use mathematical underpinnings to make sense of measuring the length and breadth of calico to mount it on a frame)
* *Contextual –* recognising mathematics in a specific context (e.g., compositional aspects and measurement in drawing still life and human figures)
* *Strategic –* having the inclination to use mathematics or to learn the necessary mathematics to understand deeply a given situation (e.g., hanging artworks at eye level to estimate audience viewing experience)

As visual learners, students need the capacity to use mathematics with confidence (e.g., in designing murals, students calculate the area of a given wall, amount of paint required, percentage of one colour to another, and scale of imagery in relation to human scale). As artists and viewers, students critique mathematical approaches to given problems (Hogan, 2000; e.g., use of perspective, angles, and the golden ratio to create an illusion of space and depth on flat surfaces). For instance, Grushka and Curtis (2018) suggest that “in working with images and other visual systems such as three-dimensional models,” students need to “develop their cognitive tools and diagrammatic knowledge” (p. 423) to guide their thinking from design to finished products.

Hill (2000) posits that teachers, in general, have a known reluctance to engage with numeracy. Garvis and Pendergast (2010) agree that art teachers can feel challenged to become involved in exploring and applying numeracy to arts education experiences. There is a need for art teachers to build their capacity and confidence in understanding and applying the three forms of knowledge (mathematical, contextual, and strategic) that Hogan (2000) suggests. Teachers need to identify numeracy demands across the curriculum in order to provide students with more extensive opportunities to transfer mathematical knowledge and skills to real-life contexts (ACARA, n.d.).

Furthermore, Sellars (2018) proposed an integrated framework to reflect “on the personal nature of numeracy that is cultivated in the specific, particular social and cultural circumstances and situations” (p. 27). This framework is closely related to Visual Arts in terms of making and responding in expressing individual meanings and intentions within the broader context of societies and cultures. By recognising the interconnected nature of mathematical knowledge with other learning areas, teachers can encourage students to make further connections to mathematical skills (ACARA, n.d.).

## Lesson Plan: Patterns in our World – Time Travelling with Patterns

In this lesson, students become time travellers as they find and explore patterns across time, place and context. Students develop numeracy and visual art skills as they become makers of, and responders to, patterns from different countries, eras, and social contexts. Although the theme of this lesson, Time Travelling with Patterns, can relate all four of the visual art strands, the primary focus is on the strands Respond and Interpret, Visual Art Practices,andExplore and Express.

Students apply their knowledge of pattern concepts and algebraic thinking while simultaneously analysing and exploring how patterns are formed through practical application (e.g., exploring patterns in ancient mosaic tiles). In the process, students use numeracy skills to identify patterns through discernible regularity in a group of numbers or shapes. Students develop an understanding of the predictability and generalisations of repeating art elements and the principles of design to then apply to their patterns.

An a/r/tographic approach (Irwin & de Cosson, 2004) informs this lesson. Students become artists, researchers, and teachers who share their art-making and responding with the class.
As a prerequisite to the lesson, students will need to explore naturally-occurring patterns and human-made patterns. In a tuning in activity, students engage as researchers to explore and document patterns from different times, stylistic inclinations, and cultural traditions. Students consider the social and emotional meaning of given patterns as well as issues of cultural respect. Next, students become artists as they use mathematical concepts as well as artistic skills, tools, and technologies to create patterns. At the same time, they experiment with various media, materials, and processes. As responders, students undertake a formal analysis of the patterns that they have researched and created. In a class discussion, students respond to the historical, cultural, and social aspects of these patterns and share the meaning, value, and significance of these patterns in their representations.

## Prerequisite/Corequisite Knowledge: Visual Arts

* Ability to research and document online resources (e.g., images, objects, artworks, or diagrams that feature patterns)
* Ability to use rulers, compasses, measuring tapes, and apps on iPads
* Ability to draw, document, and annotate ideas and sketches in a visual journal

## Background Mathematical Skills and Understandings

Visual Arts teachers are not expected to teach the mathematical knowledge and skills that students will draw on when engaging with this activity. The students will have learnt and should be adept with the required mathematical knowledge and skills to complete the activity. According to the Victorian Curriculum Mathematics, the required mathematical knowledge and skills should have been developed in earlier years of schooling, that is, by the end of Level 6.

For this activity, the background mathematical knowledge and skills needed to complete the activity are:

* Knowledge of regular and irregular 2D geometric shapes
* Identifying and describing patterns in context (artworks and nature)
* Identifying, describing, and creating (with or without technology) shapes that have been translated, reflected, and/or rotated
* Identifying, describing, and creating (with or without technology) line and rotational symmetries of 2D shapes
* Using stimulus materials (e.g., art forms from different cultures) to create symmetrical patterns, pictures, and shapes (with or without technology)
* Identifying the part of a pattern that is being repeated (i.e., the core)
* Copying, continuing, and extending 2D shapes to make patterns and drawings
* It should be noted that students may not be familiar with the following mathematical terms until Level 8: transformations, congruence, and tessellations.

## Lesson Description

### Tuning In

To start, the teacher asks students to form groups of three. Students explore patterns from the natural environment (e.g., leaves, cut fruit, flowers). They use iPads to find examples of patterns in the built environment (e.g., clothing, architectural design, logos, plates, crockery). Although students have developed previous knowledge of patterns in the primary years, in this lesson, the students revisit the everyday occurrence of patterns as an essential start to the time travelling theme. By examining artists’ use of patterns, students develop an understanding of how artists develop patterns in sophisticated and meaningful ways.

Students tune in to everyday patterns as the teacher provides the following prompts:

* Find a range of patterns from your natural and built environment (e.g., organic: spirals, tessellations, waves, meanders, stripes; geometric: brick patterns, block patterns, drop repeats)
* Identify different patterns in art (e.g., organic or geometric, structural or decorative, regular or irregular, positive or negative, repeating or random)
* Identify and name two-dimensional shapes that are used to create composite shapes in patterns
* Draw or photograph repeating patterns
* Redraw or digitally render a given pattern by first drawing a grid and framework for the pattern (e.g., spiral form, brick repeat form) and then add repeating elements through the use of select colours, line, shapes, symmetry, space, and scale
* Document all images and text-based information in your visual journal

### Time Travelling with Patterns as Researchers

Once students have completed their tuning in activity, they work in small groups to research patterns across time, place, and social contexts. Students are asked to take on the role of researchers as the teacher prompts them to search for, and document, images and information about:

* Patterns from different eras and styles (e.g., ancient Greek vases, ancient Egyptian funerary art, contemporary wallpaper, graphics that depict COVID-19, 1960s fabric design, 19th Century Wedgwood designs)
* Patterns made from different media (e.g., tiles, textiles, ceramics)
* Patterns from diverse cultural traditions (e.g., Indonesian sarongs, Fijian Tapa design, Japanese fabric printing, embroidery patterns in Indian outfits, such as Rajasthani and South Indian Kanjivaram sarees)
* The social and emotional meaning of these patterns (e.g., everyday, ceremonial, celebratory, national, decorative, symbolic, storytelling)
* Specific use of patterns by Aboriginal and Torres Strait Islander artists and the cultural safety and copyright protocols for such artwork (Australia Council, 2007)

Students then engage in a facilitated discussion as a whole class to explore the following prompts:

* How do patterns reveal ideas and views about the world?
* How might various audiences (people of different ages and cultures) view these patterns?
* What specific features occur in your chosen patterns from different cultures and times?
* What understandings have you developed about patterns used in artworks by Aboriginal and Torres Strait Islander peoples as well as about cultural and copyright issues?

### Time Travelling with Patterns as Artists

Students add their developing research and reflections to their visual journals. They use these visual journals as an ongoing resource as they take on the role of artists to create patterns. As inspired by their previous investigations, students may choose to work in a group or separately. Resources for making patterns are shared (e.g., Berk, n.d.). The teacher will ask students to:

* Use art and mathematics skills to design any selected pattern as inspired by their research and investigations (e.g., this might include a decorative pattern found in tiles from different cultures)
* Experiment with various media, materials, and processes to create their patterns (e.g., using a pencil with a compass to draw circles, a protractor to measure angles, or a French curve to measure curve ratio; using digital apps to create circles, angles, and Bezier curves)
* Experiment with various tools and techniques that can be used to create their patterns (e.g., stamps and stencils such as hole punchers, metal stamps, wooden moulds, templates, collaged paper shapes)
* Create a new use of their chosen patterns (e.g., designing a print on a t-shirt, screen-printing repeat patterns by adding a contrasting design element such as colour, shape, or texture)
* Document all their artworks and preparatory drawings in their visual journals (taking photographs of patterns explored and final pieces created)

Students then engage in a facilitated discussion as a whole group as they explore the following prompts:

* What artforms have you used to express ideas, concepts, and themes through your pattern?
* What skills have you built about materials, techniques, technologies, and processes while creating your pattern?
* What skills have you developed in planning and designing patterns and documenting the artistic practice?
* What problem-posing and problem-solving have you undertaken to develop given pattern strategies?

### Time Travelling with Patterns as Teachers

Students add their research and responses to their visual journals, which become a resource as they take on the role of teachers. Students share their developing knowledge to teach others in their class about their pattern creations.

Students undertake a formal analysis of their artwork using the student brief. Focusing on art elements and art principles, as well as historical, cultural, and social viewpoints, students discuss and share what they have learnt as part of the process to research and make their patterns. They engage in a class discussion about the mathematical processes undertaken to create their artworks. They collate all their artworks (sketches and final works) into their visual journal.

## Student Brief for Formal Analysis

### Art Elements through Patterns

* Use of lines (e.g., straight, curved, angular, flowing, horizontal, vertical, diagonal, contour, thick, thin, implied)
* Occurrence of shapes (how shapes are varied – organic or geometric, structural or decorative, regular or irregular, positive or negative, repeating or random)
* Evidence of light and value (source, flat, strong, contrasting, even, values, emphasis, and shadows)
* Use of colour (primary, secondary, mixed, contrasting, complementary, warm, cool, decorative, and values)
* Use of textures and patterns (real, implied, repeating, translation, and frieze)
* Space (depth, overlapping of shapes, and perspective)
* Time and motion (how patterns represent movement in some way through repetition, symmetry, and/or rhythm)

### Principles of Design through Patterns

* Unity and variety (e.g., a sense of harmony and wholeness in composition through the placement of patterns that generate unity; use of contrasting elements within the composition)
* Balance (symmetry and/or asymmetry in composition)
* Emphasis and subordination (emphasis: pattern draws attention to a focal point; subordination: minimising other compositional elements to draw attention to focal point)
* Scale and proportion (area, such as how patterns relate to each other in a compositional setting)
* Mass/volume (use of three-dimensional forms in patterns)
* Rhythm (the combination of art elements repeated, which involves the use of intervals or spaces between elements to give the user an impression of rhythm or movement)
* Function/setting (e.g., structural and decorative patterns in architecture)
* Interior/exterior relationships in patterns (vertical/horizontal, positive/negative spaces)

Table 1: Links to the Victorian Curriculum – Visual Arts

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| --- | --- | --- |
| Strand and Sub-Strand(if applicable) | Content Description (Code) | Elaboration(s) |
| Explore and Express Ideas | Explore Visual Arts practices as inspiration to explore and develop themes, concepts or ideas in artworks (VCAVAE033) | [Adapted Elaborations]Combine and adapt materials, techniques, technologies, and processes to explore ideasObserve and investigate how artists select and apply different Visual Arts techniques to make patternsExplore why artists have used specific stylistic qualities in their artworks (e.g., why an artist uses a particular style of expression in creating patterns based on historical and cultural affiliations) |
| Explore and Express Ideas | Explore how artists use materials, techniques, technologies and processes to realise their intentions in artworks (VCAVAE034) | [Adapted Elaboration]Investigate viewpoints by artists and cultures on patterns in different contexts and using different styles Explore how artists have used different materials and symbols to express cultural identity through patterns (e.g., symbols of Aboriginal and Torres Strait Islander people, Indian textiles, symbols in Greek vases)Research artworks that provide different ideas and concepts based on theories of design through patterns (e.g., the Mosaic tiles in Islamic art or Greek vases) |
| Visual Arts Practices | Experiment with materials, techniques, technologies and processes in a range of art forms to express ideas, concepts and themes in artworks [(](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAV035)VCAVAE035) Develop skills in planning and designing artworks and documenting artistic practice [(](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAV036)VCAVAE036)  | [Adapted Elaboration]Imagine and refine their visual and spatial expressions of the world, combining a variety of materials, techniques, and technologiesProblem-solve with increasing confidence to expand their repertoire of Visual Arts practices and skills (e.g., patterns used to make a mural)Develop and refine technical skills when designing and making patterns while employing safe and sustainable practices to annotate their art-makingReflect, modify, and evaluate their creation with patterns through consistent critical assessmentDiscuss how artists gain inspiration about patterns and develop individual styles (e.g., Yayoi Kusama, Lisa Waup)Extend technical competence when using selected techniques (e.g., registration in making repeated patterns)Research and investigate different art forms of a traditional or contemporary style to document and develop their own ideas in creating their own artworks with patterns |
| Respond and Interpret  | Analyse how ideas and viewpoints are expressed in artworks and how they are viewed by audiences [(VCAVAE038)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAR038) | [Adapted Elaboration]Critically analyse the intention within their artwork (e.g., visual conventions in the creation and patterns)Discuss and identify how historical, social, and cultural aspects have been represented in their patterns (e.g., the use of different cultures in expressing concepts of place and country) |
| Respond and Interpret | Identify and connect specific features of visual artworks from different cultures, historical and contemporary times [(VCAVAE039)](https://victoriancurriculum.vcaa.vic.edu.au/Curriculum/ContentDescription/VCAVAR039) | [Adapted Elaboration]Compare and contrast different visual images and interpretations of place and country from a range of viewpoints and contexts within their patternsAnalyse and examine the way that cultural experiences have influenced their expression of ideas and concepts in their artworksRecognise how different factors contribute to how visual artworks are judged to be meaningful by an audienceAnalyse how others have expressed historical and social value and influences in their artworks through patterns |

Table 2: Links to the 21st Century Numeracy Model (Goos et al., 2014)

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| Aspect of the Model |  How This Aspect is Addressed by the Lesson |
| Attention to Real-Life Contexts* Citizenship
* Work
* Personal and Social Life
 | Students will develop an understanding of how patterns can be found, applied, and represented in historical contexts and contemporary life in personally meaningful ways. |
| Application of Mathematical Knowledge* Problem Solving
* Estimation
* Concepts
* Skills
 | Students will develop skills in creating different types of patterns (e.g., repeated or frieze patterns using translation and symmetry, radial patterns, tessellations). Students will problem-pose and use methods and techniques used to create patterns in ancient and modern times (e.g., Eastern, Western, or Oceanic contexts). Students will acquire knowledge of the mathematical skills that artists employ across history and cultures to create their own patterns. |
| Use of Tools* Physical
* Representational
* Digital
 | Students will experiment with analogue and digital tools to create patterns (e.g., use of a pencil with a compass to draw circles, a protractor to measure angles, a French curve to measure curve ratio versus creating circles and angles, or Bezier curves ina digital program such as *Illustrator*). Students will apply various techniques and explore different ways to create patterns (e.g., stamps and stencils such as hole punchers, metal stamps, wooden moulds, templates, collaged paper shapes). |
| Promotion of Positive Dispositions* Confidence
* Flexibility
* Initiative
* Risk
 | Students will develop the confidence and ability to plan, calculate, estimate, and measure the patterns in a given space (e.g., a length of fabric, a turned pot, a carved lino print). Students will apply measurement (precision or the rule of thumb) to create repetition and positioning of pattern elements. Students will show preparedness to undertake trial and error design proofs in which they experiment with different aesthetic and mathematical concepts. |
| Critical Orientation* Interpreting Mathematical Results
* Making Evidence-Based Judgements
 | Students will develop an interpretive, evaluative, and analytical stance towards making patterns in artwork (e.g., they will discuss and evaluate the way artists have used mathematical concepts to create and use patterns). Students evidence their critical analysis in applying their decisions through art-making and responding (e.g., they make informed choices in creating their patterns while responding to aesthetics and mathematical concepts). Students use their critical orientation to numeracy to create, respond, and interpret a range of relevant numeracy skills in an informed way (e.g., using this knowledge and experience, they are better equipped to assess and engage with mathematical concepts towards other creations of artworks). |

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