**Levels 9/10 MEDIA ARTS Activity**

## Calculating Exposure and Aesthetics Using a DSLR

### Introduction to Numeracy in Media Arts

In Media Arts, students critically engage with communication theories and technologies, including creating and deconstructing hybrid analogue and digital media forms. The digital artwork, as a mathematical construct, has become a key component of students’ everyday lives, as there exists a personal entanglement on social, cultural, technical and biological levels (Thayne & West, 2019).

Media Arts tools are dominated by digital technologies; thus, numeracy knowledge and skills are needed in order for students to address broad curriculum outcomes in Media Arts (Grushka & Sellars, 2018). Students use multiple numeracy skills in their everyday planning, processual investigations, and creation and evaluation of media artworks. Relevant numeracy skills include calculating and estimating with numbers, as well as understanding and employing spatial reasoning, scale, proportion, ratios and time concepts.

Students work within defined digital spaces and understand quantitative technical values and their relationship to the production of aesthetic qualities and symbolic representations. They read and assess graphs, tables and diagrams, and may create graphical representations when creating media artworks (Australian Curriculum, Assessment and Reporting Authority [ACARA], n.d.). Students scrutinize effect and reception studies, and critique statistical and aesthetic information from a range of sources in order to form critical understanding of social issues, ideologies and representations. Students develop data literacy through becoming aware of the algorithms of social media, including how personal data are used by media and data collection organizations.

Students use Media Arts knowledge and numeracy skills to deconstruct and create artworks in a range of media forms and styles whilst considering, evaluating and comparing attributes of specific audiences, media forms, reception contexts and distribution networks. Students critically engage in technical experimentation by utilising digital software tools to produce, evaluate and refine media products in order to create meaning and communicate ideas (Mason, 2016).

Students manipulate and/or replicate conventional media forms (using ratios and geometry) and structures (using templates, timings, patterns and space). They also learn to assess defined audiences through demographic and behavioural statistics. Students identify and manipulate the symbolic and patterned orders of genre, codes and conventions. Topics that might be explored include camera angles, positioning, shutter speed, depth of field and framing. Students can consider and measure patterns of music/sound rhythm; calculate the intensity, quality and colour of light; and consider time via editing techniques of duration, measured on timelines, in the creation of meaningful and technically successful products.

Students gain skills and understanding in the production of digital products (e.g., film, social media pages). Students calculate the statistics of distribution networks, media forms and demographic information from different categories of audiences. Media forms and audiences are investigated and evaluated through ratings, censorship measurements and classification statistics. Statistics relating to media ownership, distribution and monopolisations are investigated and related to multiple media forms.

Students examine the historical and social contexts of media forms and products. They consider and compare changing social values recorded through media forms at various historic times and contextualise understandings through data and various communication models and theories in order to evaluate how media forms influence audiences and how audiences influence the media.

### Developing Numeracy Understanding in Media Arts

According to ACARA (n.d.), “The most relevant sub-elements of the numeracy learning progression for Media Arts are Comparing Units, Interpreting Fractions, Understanding Units of Measurement, Understanding Geometric Properties, Positioning and Locating, and Interpreting and Representing Data.” By utilising such numeracy skills, Media Arts students will be able to confidently produce and deconstruct media artworks and products, and make sense of how the media, in various forms, impact on their world. Students’ numeracy capabilities will be amplified when a teacher explicitly focuses on the numeracy skills relevant to the particular task at hand.

Students undertaking Media Arts studies compare units of measurement for various digital and analogue inputs and outputs suitable for the distribution of media products. Patterning is critiqued through the deconstruction of codes and conventions used to create narratives and convey symbolic meaning in various media forms. Visual representations, such as graphs and flowcharts of storylines, are used to explain the various cycles and components used in a range of media narratives, genres and styles.

Students explicitly interpret fractions when learning technical skills, such as using a Digital Single Lens Reflex (DSLR) camera. They understand that to render both high-quality technical outcomes and a successful aesthetic in their media arts outputs requires mastery of the technical equipment and processes used. Students learn to calculate exposure, lighting quality, aperture readings and shutter speed. These technical calculations are integrated with planned aesthetic outcomes, including measurements of tone, contrast and colour. Evaluation of frames per second is also required in both filmmaking and animation, and is related to motion speeds, the capture of movement and exposure and the duration of time.

Understanding geometric properties includes knowledge of ratios in media forms and investigations of composition such as various mathematical framing techniques, including the Rule of Thirds and the Golden Ratio. Students need to understand how to create media that fit pre-determined outcomes using technical language of production, such as a quality 300 Dots Per Inch (DPI) A4 poster print or a 20 cm x 25 cm photographic print. They also learn the aspect ratio relevant to numerous media forms and screens.

Understanding positioning and locations within a given measured frame of a camera or a physical set is imperative for students to successfully produce media artworks. Students calculate spaces and distances that will influence their choice of camera lens length, camera movements (including panning, zoom and dolly), and other object/equipment placement within a set. Measuring the quality, colour temperature, positioning, direction and strength of light is a basic consideration that students need to understand when creating photo-based media artworks. The measurement, monitoring, and creation of sound involve the exploration of quality, intensity and amplification via digital tools.

Students learn how to both read and create digital and graphic representations of statistics from various media sources. They critique dominant media discourse by analysing the production of statistics and create graphs from data sourced through their own research, including the nature of codes and systems embedded in algorithmic systems on digital media sites.

## Lesson Plan: Calculating Exposure and Aesthetics Using a DSLR

In this series of activities, students are introduced to the basic exposure controls of DSLR cameras. By the end of this project, students will understand how exposure calculations relating to the International Standards Organization (ISO), shutter speed and aperture can be manipulated to create planned aesthetic compositional effects and design element arrangements. Students will learn how to manipulate the three exposure controls to achieve correct exposure, as well as desirable and planned compositional aesthetic effects, in diverse lighting conditions.

Students will research, plan, experiment and produce images. Final images will be displayed in the classroom as a collaborative photo essay, with notes included regarding the settings used to take each image. The number of lessons needed for this project will depend on lesson length and level of the students undertaking the task.

### Prerequisite/Corequisite Knowledge: Media Arts

Students need to have and/or develop the ability to:

* use a DSLR in manual mode to control both exposure and aesthetics, including manipulating the ISO, shutter speed, and aperture by using calculations to achieve the correct exposure and desired visual effect
* use Photoshop to employ basic digital darkroom correction tools
* understand the importance of the production process in making media artworks
* use grid layouts to plan the composition of photographs
* understand the concept of photojournalism as a representation of reality and comprehend how a collaborative story can be told through images
* recognise design elements and principles
* investigate composition in regard to camera framing, angle, movement, position, and focus.

### Background Mathematical Skills and Understandings

Teachers of Media Arts are not expected to teach the mathematical knowledge and skills that students will draw upon 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 8.

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

* knowledge of fractions, including the ability to order fractions
* knowledge of the concept of time, including duration
* knowledge and use of negative and positive numbers on a number line (scale)
* knowledge of ratios
* ability to use and reference points on grids
* knowledge of enlargement/diminution transformations.

## Lesson Description

Learning to use a DSLR in manual mode is an important skill for students to develop in Media Arts. By learning to use the manual setting, students will understand how to select the values for the ISO, shutter speed and aperture in order to balance the light meter for the correct exposure. Correct exposure is important as, once the photograph has been taken, it is difficult to successfully adjust and correct either under- or over-exposed images, even with digital correction tools.

In this lesson, students learn that by manipulating exposure using the three exposure tools of ISO, shutter speed and aperture, they can control aesthetic outcomes and therefore enhance the composition and visual design of their photographs. See the Appendix for more information about the exposure controls.

### Resources Required

DSLR cameras (with manual settings), old Single Lens Reflex (SLR) cameras (the teacher can pick them up cheaply from garage sales or ask their students if they have old cameras at home or at their grandparents’ homes), tripods, layout templates, quality printer, A3 visual diary, magazines, internet access and composition sample images [Note: The visual diary is a record of process for all work. This ‘record of process’ should also form part of the assessment (Wolfe, 2011).]

### Teacher-Led Discussion

The teacher should introduce the three controls of exposure. The teacher should provide cameras on each table so that the students can manipulate the three exposure controls during the discussion. One camera for four students is suitable, and the old SLRs are ideal for this activity as students can dismantle them. The students should disconnect the lens from the camera body so that they can see how the aperture and shutter actually work, physically. As the teacher demonstrates the use of each control, the students should be provided with time to manipulate the controls and observe the physical workings of the cameras.

The teacher should write the range of values for each camera exposure control (ISO, shutter speed, and aperture) on the board and also draw a diagram of the aperture that relates to the f-stops, along with the scale of depth of focus (Jane, 2009). Students should copy these exposure scales into their visual diary for future reference.

### Activity 1: Sources of Inspiration

Students are to source the following images from either magazines or an internet search, place them in their visual diary, and label them (including citations).

Each student will be expected to locate nine photographs in which the following techniques are illustrated:

1. a large depth of field (f.16 or higher)
2. a medium depth of field (f.8 to f.11)
3. a shallow depth of field (f.5.6 or lower)
4. a fast shutter speed (1/1000 or faster)
5. a medium shutter speed (1/60 to 1/125)
6. a slow shutter speed (1/30 or slower)
7. a high ISO (1600 or higher)
8. a medium ISO (400)
9. a low ISO (100 or lower)

By completing this exercise, students will develop and demonstrate their understanding of how these exposure controls impact aesthetic effects of depth of field, movement and grain. Students can compare and evaluate each other’s work in small groups in order to ensure that all students understand the relationship between technique and aesthetic effects.

### Activity 2: Exposure Simulator

Students can work in pairs for this activity. First, the teacher should demonstrate the exposure simulator (<http://www.canonoutsideofauto.ca/play>) to the class by displaying it on the SMART Board.

The default exposure on the simulator has an aperture reading of f.8, a shutter reading of 1/60, and an ISO of 1600. The teacher can ask the students about the aesthetic effect of these values in the photograph before they take a picture and view the results.

Next, the teacher should instruct the students to activate the simulator themselves on their devices, whilst considering how they can capture a frozen frame of the toy plane’s propeller, using the exposure tools. The teacher should instruct the students to change the shutter speed whilst asking them if the shutter needs to be faster or slower than 1/60. As students move the shutter speed to a faster setting, they can see on the simulator that the light is reduced, and the light meter is showing that the picture will be under-exposed (not enough light). Students should be instructed to take the exposure (at 1/2000) and discuss how the picture is under-exposed (since there is not enough light). The exposure metre will read that the image is four f-stops under exposed. Thus, four f-stops of light must be added through manipulating either the aperture or the ISO.

The teacher should ask the students to calculate what aperture is required to increase exposure (f.2.8) and take an image. The image will still be underexposed by one f-stop. The image will also now have a very small depth of field.

Next, the teacher should instruct students to manipulate the ISO to increase sensitivity of the digital sensor by one f-stop. The teacher should ask the students what the ISO should be (3200) and take the image.

Once the class has discussed the outcomes, the teacher should give the students problems to complete in pairs using the simulator. The work should be written in their visual diaries. The teacher should reiterate to students that they must achieve a correct exposure by balancing the light meter.

Sample problems to solve:

1. I want my plane photograph to have a large depth of field such as f.22 but also have a frozen propeller. What f-stop, shutter speed, and ISO values should I use to achieve this outcome?
2. I want my plane photograph to have a large depth of field but a slight blurring of the propeller to represent movement. What f-stop, shutter speed, and ISO values should I use to achieve this outcome?

After the students solve the problems, the results should be discussed as a whole class. In particular, the teacher should highlight the visual grain and loss of saturation that occur when using a high ISO value.

### Activity 3: Kahoot Quiz

The teacher should create a multiple-choice Kahoot quiz with images and questions regarding the manipulation of the three exposure tools to visual effects, including some questions that require calculations (similar to the exposure problems in Activity 2). This quiz is a fun activity for students, and the teacher can gauge student understanding before moving on to the planning and production stages of this project.

### Activity 4: Individual Production

The students will continue to work in pairs to share cameras and assist each other during production phase. It is suggested that one class is used for production planning and the next class is used for students to complete the production of images. A further one or two classes can be used to finalise post-production and display.

The theme for the photographs is ‘the school’. The teacher should discuss what a photo essay is and explain how this collaborative project will culminate in a group display that is a photojournalistic account of the school. The teacher should discuss and provide examples of compositional rules such as the Rule of Thirds (<https://digital-photography-school.com/rule-of-thirds/>) and the Golden Ratio (<https://photographyhero.com/golden-ratio-photography/>). The teacher should also discuss the use of high and low camera angles as points of interest and emphasis. All images must be taken within the school grounds during the allocated time. Students should be reminded of behavioural and ethical expectations during the production stage.

Planning is an important part of the process so that students use their time efficiently during their production time. Composition templates (grids) will be provided in A4 size to assist students in planning their images and applying compositional rules. These rough sketches are not intended to be artworks in their own right, and they should contain text as descriptive information. On the plan, the students should also note the intended location.

The teacher should check the plans and discuss issues that may arise during production. Then, the teacher should allocate cameras and tripods to students. The teacher should discuss the difficulties of lighting when inside, due to low light, or outside, when the sun may be harsh. The teacher should also demonstrate the correct use of a tripod and remind students that they cannot hand-hold a camera when a shutter speed is slower than 1/60.

Each student will be expected to plan and produce a series of nine photographs in which the following techniques are illustrated:

1. a large depth of field (f.16 or higher)
2. a medium depth of field (f.8 to f.11)
3. a shallow depth of field (f.5.6 or lower)
4. a fast shutter speed (1/1000 or faster)
5. a medium shutter speed (1/60 to 1/125)
6. a slow shutter speed (1/30 or slower) (showing movement; this can be panning or object/person movement, but no camera shake is allowed)
7. a high ISO (1600 or higher)
8. a medium ISO (400)
9. a low ISO (100 or lower)

When students are taking photographs, they must record the exposure details (ISO, shutter speed, and aperture) used for each image. Students need to also record the light metre reading (ensuring that it is set to zero).

Students will download all of their images to their computer as jpeg or tiff files. They will print the photographs as three images on each of three A4 pages (one page for the images focussing on each exposure tool: ISO, shutter speed, and aperture) and secure the images in their visual diaries. Students will annotate the photographs with the exposure details and with an evaluation of visual effects that are evident. The students should finalise their annotations by addressing the following questions: What did you do? Why did you do it? What problems did you have? What successes did you have?

Students will then choose their favourite image to refine into a A4 print for display. The teacher will demonstrate the procedure for setting up a document in Photoshop (or an equivalent software program) and demonstrate the tools required (cropping, resizing, contrast, colour, saturation and text). Students will write the instructions in their visual diaries. Students will open Photoshop (or the equivalent software program) on their devices and set up the document as A4 (portrait or landscape) and the quality as 300 dpi to ensure a high-quality print. Students will then create a 10 mm border and import their chosen image into the bounded space. They may use the resizing tool or crop tool if needed.

Students should be restricted in their experimentation with the Photoshop tools of cropping, resizing, contrast and colour in order to keep the focus on the aesthetics created through the camera’s exposure tools. When manipulating contrast and colour tools in Photoshop, students will manipulate numerical values to alter the visual effects. They must keep a record of their manipulations in their visual diaries. Using text in a new Photoshop layer, students should insert the exposure details of their image, using an appropriate font style and size, in an appropriate place within the image for the audience to read. Images should be printed on quality A4 paper. These works can be then presented by the students and displayed in the classroom and used as a peer/teacher reflection discussion of exposure controls and aesthetic effects.

The lesson will conclude with students conducting a self-evaluation of their final work in their visual diary. The self-evaluation should cover:

1. evaluation of aesthetics (design elements and principles) and creation of meaning
2. evaluation of technical skills and knowledge
3. discussion of what they learned
4. discussion of what they found most difficult
5. discussion of what they found most rewarding.

## Table 1: Links to the Victorian Curriculum – Media Arts

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| Strand and Sub-Strand  (if applicable) | Content Description (Code) | Elaboration(s) |
| * Media Arts Practices | Develop and refine media production skills to integrate and shape the technical and symbolic elements in images, sounds and text to represent a story, purpose, meaning and style  (VCAMAM042).  Plan, structure and design media artworks for a range of purposes that challenge the expectations of specific audiences by particular use of media elements, technologies and production processes  (VCAMAM043) |  |

## 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 become aware of how artistic and aesthetic representations in media arts are developed through both production techniques and compositional techniques involving mathematical calculations. By participating in the project, students become aware of careers in photojournalism and the importance of numeracy skills in successful image production. Since the theme is the school, students connect to how they relate, both individually and as a group, to their own community and place. |
| **Application of Mathematical Knowledge**   * Problem Solving * Estimation * Concepts * Skills | In this project, students have the opportunity to engage with numeracy in order to create successful photographic images. They solve aesthetic problems by calculating exposure through the exposure tools of the camera, which involves evaluating percentages, fractions, scale and proportion. Students are also introduced to the mathematical rules of composition (Rule of Thirds and Golden Ratio). They discuss visual impacts of camera angles and framing relating to position and scale. |
| **Use of Tools**   * Physical * Representational * Digital | Students handle disassembled camera equipment to understand the workings of exposure tools in relation to numeric values on the camera controls of aperture, shutter speed and film speed (ISO). Students will use digital cameras and photo-editing software to create and display their artworks. In order to use these tools effectively, students need to vary numerical values that relate to qualitative visual effects. |
| **Promotion of Positive Dispositions**   * Confidence * Flexibility * Initiative * Risk | Students will become confident in calculating exposure times to render desired and pre-planned aesthetic results in their photographs. Confidence is built through the scaffolding of teaching and learning activities related to calculating exposure, starting from teacher demonstrations, moving to students physically and virtually exploring the exposure tools, and concluding by students planning and then producing works. Students are encouraged to explore multiple possibilities through their planning and pre-production tasks. Individual initiative is required for students to plan their images prior to production, calculate exposure values, capture their images, and record and evaluate their outcomes. |
| **Critical Orientation**   * Interpreting Mathematical Results * Making Evidence-Based Judgements | Whilst learning about the camera exposure tools, both physically and virtually, students continually reflect on and evaluate the calculations undertaken and the aesthetic and technical outcomes produced. The application of exposure values is evidenced in their photographic outcomes. All student processes are recorded by the students in their visual diaries to ensure that evidence of the student calculation and estimations recorded. Students are able to refine their calculations and gain a deep understanding of the processes followed, mistakes made, and skills learnt. Furthermore, students are expected to share and evaluate their own and others’ calculations and outcomes. |

## References

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