UNIT PLAN

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| Unit Title: Light up my life! | Stage: Stage 3 (Year 5) |
| Term: 3 | Strand: Physical World |
| Duration: 900 minutes (10 x 90 minute lessons) | Sub-strand: Light  Concept: Light from a source forms shadows and can be absorbed, reflected and refracted (New South Wales Board of Studies, 2012, p.66) |

RATIONALE

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| In the unit “Light up my life!” students will be exploring the concept that “light from a source forms shadows and can be absorbed, reflected and refracted.”  The values of wonder and curiosity stimulated in this unit link to real life experiences through the processes of Working Scientifically and Working Technologically. Through questioning, predicting, gathering data, drawing conclusions and explaining, students demonstrate an ability to work scientifically. By developing ideas, producing solutions, selecting appropriate tools and materials and evaluating, students are able to work technologically. Furthermore, the use of ICT supports and enhances students’ learning.  This unit uses a constructivist approach in accordance with the NSW K-10 Science Syllabus (2012) through hands on, student centred activities based on prior knowledge (Campbell, 2012) and by incorporating the 5E model proposed by Bybee (1989, as cited in Skamp, 2012). This approach to scientific inquiry follows the process of:   * Engage – creates interest and stimulate curiosity * Explore – provides hand on experiences of the phenomena * Explain – introduced to terms and current scientific explanations and justify claims in terms of evidence gathered * Elaborate - uses and applies concepts and explanations in new contexts and to connect concepts to real life * Evaluate – review and reflect on their learning   Throughout this unit the 8 Aboriginal ways of learning (*8 Aboriginal ways of learning,* 2014) is embedded to cater for Aboriginal and Torres Strait Islander students also allowing them to share their cultural knowledge and experiences.  This unit provides a guide to cater for all learning styles and abilities through assessing prior knowledge, catering for students’ interest, providing them with choice and individual, group and peer teaching opportunities.  This unit integrates Literacy, Numeracy, Creative Arts, History and a range of Science and Technology content strands. |

GOALS

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| KLA: Science and Technology  Outcomes & Performance Indicators:  **Physical World**   * **ST3-7PW:** uses scientific knowledge about the transfer of light to solve problems that directly affect people’s lives * classify materials as transparent, opaque or translucent, based on whether light passes through them, is absorbed, reflected or scattered * observe and describe how the absorption of light by materials and objects forms shadows, eg building shading * gather [evidence](http://syllabus.bos.nsw.edu.au/glossary/sci/evidence/?ajax) to support their predictions about how light travels and is reflected * research, using [secondary sources](http://syllabus.bos.nsw.edu.au/glossary/sci/secondary-sources/?ajax) to gather information about science understandings, discoveries and/or inventions that depend on the reflection and refraction of light and how these are used to solve problems that directly affect people's lives, eg mirrors, magnifiers, spectacles and prisms (New South Wales Board of Studies, 2012, p.66)   **Working Scientifically**  **ST3-4WS:** investigates by posing questions, including testable questions, making predictions and gathering data to draw evidence-based conclusions and develop explanations   * with guidance, posing questions to clarify practical problems or inform a scientific investigation * predicting what the findings of an investigation might be * with guidance, planning appropriate investigation methods to test predictions, answer questions or solve problems * deciding which variable should be changed and measured in fair tests while keeping everything else the same * working individually and collaboratively in conducting a range of appropriate investigation methods, including fair tests, to answer questions or solve problems * using equipment and materials safely, identifying potential risks * accurately observing, measuring and recording data using digital technologies as appropriate * using formal units and abbreviations for measuring and recording data * collaboratively and individually selecting suitable methods for gathering data and information first-hand and from reliable secondary sources * constructing and using a range of representations including graphs, tables and labeled diagrams * drawing conclusions and providing explanations based on data and information gathered first hand or from secondary sources * comparing gathered data with predictions and using as evidence in developing explanations of events and phenomena * using a variety of ways to honestly and accurately communicate ideas, explanations and processes including multimodal texts, labeled diagrams as well as written and oral factual texts as appropriate (New South Wales Board of Studies, 2012, pp.62-63)   **Working Technologically**  **ST3-5WT:** plans and implements a design process, selecting a range of tools, equipment, materials and techniques to produce solutions that address the design criteria and identified constraints   * testing the suitability of materials, considering whether the test was fair or not * developing a plan and specifications to guide production * using their plans and production sequences * for a design project, selecting and safely using a range of tools, equipment and related techniques to cut, edit, join, manipulate and shape materials and/or information * identifying the strengths and limitations of the process used * self or peer assess the final product by using the established design criteria (New South Wales Board of Studies, 2012, pp.64-65)   **Values and Attitudes**  **ST3-1VA:** shows interest in and enthusiasm for science and technology, responding to their curiosity, questions and perceived needs, wants and opportunities (New South Wales Board of Studies, 2012, p.16)  **Material World**  **ST3-13MW:** describes how the properties of materials determine their use for specific purposes   * describe how scientific and technological knowledge about the properties of materials can be used to inform decisions about use for their specific purposes (New South Wales Board of Studies, 2012, p.70) | |
| KLA: English  Outcomes & Performance Indicators  **EN3-1A:** communicates effectively for a variety of audiences and purposes using increasingly challenging topics, ideas, issues and language forms and features   * participate in and contribute to discussions, clarifying and interrogating ideas, developing and supporting arguments, sharing and evaluating information, experiences and opinions (New South Wales Board of Studies, 2012, pp.98-99).   **EN3-2A:** composes, edits and presents well-structured and coherent texts   * compose imaginative and informed texts that show evidence of developed ideas * compose increasingly complex print, visual, multimodal and digital texts (New South Wales Board of Studies, 2012, pp. 100-101).   **EN3-9E:** recognises, reflects on and assesses their strengths as a learner   * recognise that there is a language for discussing learning experiences * formulate questions for specific purposes e.g. to clarify and reflect * discuss and reflect on the roles and responsibilities when working as a member of a group and evaluate the benefits of working collaboratively with peers to achieve a goal (New South Wales Board of Studies, 2012, p.114) | KLA: Maths  Outcomes & Performance Indicators:  **MA3-18SP:** uses appropriate methods to collect data and constructs, interprets and evaluates data displays   * tabulate collected data, appropriate for data type, with and without the use of digital technologies * construct column and line graphs of numerical data using a scale of many-to-one correspondence, with and without the use of digital technologies * describe and interpret different data sets in context (New South Wales Board of Studies, 2012, pp.253-254)   **MA3-9MG:** selects and uses the appropriate unit and device to measure lengths and distances, calculates perimeters, and converts between units of length   * solve problems involving the comparison of lengths using appropriate units (New South Wales Board of Studies, 2012, p.223) |
| KLA: Creative Arts  Outcomes & Performance Indicators  **DRAS3.3:** devises, acts and rehearses drama for performance to and audience (New South Wales Board of Studies, 2006, p. 26) | KLA: History  Outcomes & Performance Indicators  **HT3-5:** applies a variety of skills of historical inquiry and communication   * identify different points of view in the past and present (New South Wales Board of Studies, 2012, p. 50)/ |

GOALS

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| Assessment – formative (during learning engagements)  Formative assessment will be constantly carried out throughout the unit. This will be completed through:   * Teacher observation * Discussion with students * Listening to students * Analysis of work samples * Performance assessment * Projects | Assessment – summative (at the end)  Summative assessment will be seen in lessons 5, 6 and 8. Rubrics have been developed for each of these lessons.   * In lesson 5 students summative assessment will be their information report on how the kaleidoscope works. * In lesson 6 the written component about the periscope will be a form of summative assessment. * Lastly, in the shadows lesson students’ tables, graphs and conclusions from the investigation will be assessed as a form of summative assessment. |
| Worksample – to show understanding and achievement of outcomes | |

STUDENTS

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| Number: There are 24 students in the class. | |
| Differentiation needs  In this unit learning experiences cater for a range of readiness levels and learning styles.  Lessons will be differentiated for students working towards, at and beyond the stage level and through the implementation of the Aboriginal 8 Ways of Learning.  Through higher order thinking questions and extension activities students working beyond stage level will be extended. Students working towards stage level will receive assistance through peer teaching, scaffolds, effective questioning, etc.  There will be an array of visual, kinaesthetic and auditory teaching techniques throughout the lessons to cater for different learning styles.  This unit provides students with opportunities to work in pairs, groups and as a whole class. Students will usually be grouped in mixed ability groups in order for peer teaching to occur, however, in some lessons students will be grouped with students of the same ability. At times students will work independently on tasks to ensure effective and reliable assessment takes place. | Skills, interests and prior knowledge  Lessons are adapted to reflect students’ interests, prior knowledge and alternative conceptions.  Prior knowledge of Stage 2:   * responsive to ideas and show interest in and enthusiasm for science and technology. * They appreciate the importance of science and technology in their lives * identify ways of improving techniques and methods used in their investigations and design tasks. * They can use a range of representations to document and communicate methods, techniques, findings, ideas and information, including digital technologies as appropriate. * follow instructions to plan and conduct a range of first-hand investigations * make and record observations, using formal measurements as appropriate and suggesting reasons why methods were fair or not. * They organise and identify patterns in data using provided tables and simple column graphs. * Students suggest reasons for observations and compare findings with predictions (New South Wales Board of Studies, 2012, pp. 50-53).   Prior knowledge of Physical World for Stage 2:   * **ST2-6PW** identifies ways heat is produced and that heat moves from one object to another * **ST2-7PW-** describes everyday interactions between objects that result from contact and non-contact forces (New South Wales Board of Studies, 2012, p. 54). |

LEARNING MATTER

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| Essential understandings  Students will learn about…  Science   * That light travels in a straight line * Mirrors will reflect light in different directions * Reflection * How objects reflect light into our eyes allowing the objects to be seen * Refraction * How kaleidoscopes reflect and refract light * Light waves * The electromagnetic spectrum * Opaque materials create shadows * How a periscope works * Opaque, translucent and transparent materials and their purpose * Absorption and that opaque materials turn light energy into heat energy * Opaque materials make shadows | Essential skills  Students will learn to…  Science   * Brainstorm * Use ray diagrams to show the reflection of light and that light travels in straight lines * Creates diagrams to show refraction * Record ideas about light travelling * Classifying objects * Question and predict e.g. students form questions about light and predicting what happens to a shadow when the distance between the light and object increased/decreased * Plan investigations * Conduct investigations * Record observations e.g. tables and graphs * Process and analyse data and information e.g. explain data and information gathered * Communicate e.g. through diagrams, report writing and oral discussions * Generate and produce ideas * Evaluate their investigation and results * Compare and contrast * Reflect on their own learning/self assess * Peer assessment |
| Essential understandings  Literacy   * Explanations * Information reports | Essential skills  Literacy   * Records ideas * Share ideas with others * Discuss observations * Uses talk to reason * Take part in discussions in pairs, groups or whole class * Reporting * Composing print, visual, multimodal and digital texts |
| Essential understandings  Numeracy   * Interpret results | Essential skills  Numeracy   * Tabulate and graph results * Measurement – lengths of shadows |
| Essential understandings  History   * Aboriginal culture and knowledge | Essential skills  History   * Acknowledge and respect different view points |
| Essential understandings  Creative Arts   * Conveying meaning through a drama piece | Essential skills  Creative Arts   * Compose a piece of drama |
| Related text-types  Explanations: Students will develop oral or written explanations for their findings in lessons 3-9. The students will need to identify how and why something occurs in each.  Information reports: Students will create an information report on a kaleidoscope in lesson 5. | |

LEARNING SEQUENCE

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| Learning engagements  WC- whole class  IND – individual  GRP- group | Resources & preparation | Outcome | Sign-off |
| **ENGAGE – LESSON 1**   * Discuss that this unit focuses upon the ‘Western’ science way of making evidence-based claims for why we have night and day. * Embed an Indigenous and Torres Strait Islander perspective to the unit by discussing why Indigenous people may have other explanations for the observed phenomenon of night and day, referring to the dreamtime and what they may be? (Relationship with using the sun and night stars as navigation, creation story, changing seasons, availability of food for specific ceremonies and learning about aboriginal law, reinforcing teaching of the law including how to behave and punishments for breaking the law – referring to ancestors of the sky). * Use ‘Poll everywhere’ with the iPads to allow students to anonymously post their ideas and preconceptions- DIAGNOSTIC ASSESSMENT. * Play YouTube video <https://www.youtube.com/watch?v=-61z3ZlFnpQ> of the concept of stars to engage students (Serrie, 2010). * Discuss the Indigenous story of the Sun-woman, Walu. (Option to dramatise this story, interlinking to Visual Arts). * Introduce students to the communal class KWL charts, addressing ideas brought to attention from the poll survey- DIAGNOSTIC ASSESSMENT. * Introduce students to their personal KWL charts in Science journals – leading their interest-based projects- DIAGNOSTIC ASSESSMENT. * Introduce students to the word wall. * This lesson incorporates the 8 ways of learning for Indigenous students as it includes non-verbal elements through the online poll and gestures/expressions in the dramatized story. Furthermore, it incorporates stories from The Dreaming so links to Indigenous culture and knowledge (*8 Aboriginal ways of learning,* 2014). | * “Poll everywhere” * iPads * youtube video * story of the Sun-woman * KWL charts * Word wall | ST3-7PW  ST3-4WS  ST3-5WT  EN3-1A  HT3-5  DRAS3.3 |  |
| **ENGAGE – LESSON 2**   * Turn off lights and send prepared shoeboxes (2cm hole cut in the lid; line the inside with pictures, bright paper etc) around the room for students to look in. Discuss what was seen. Most students say that there was nothing in the box. Have someone open the box, then show what is inside. Ask students to consider why they couldn’t they see it. * Explore the concept of light by introducing the following queries in a class-based discussion – continually addressing and adding to KWL charts- DIAGNOSTIC ASSESSMENT:   + What would life be like without light?   + What do you think our primary source of light is? (Sun)   *\*What we call light is actually a specific type of energy called ‘visible light’ the light that humans can see\**   * What are some of the things we do everyday that require us to use light?   + - Reading a book, crossing the street. * Light plays a role in some sophisticated technology.. What are some examples? (x-rays) * How do you think light works? How does it help us to see? (Direction of light) * What are some of the different examples of light? * In mixed ability groups students are introduced to exploratory activity boxes and work sheet. Students are provided with a box that contains a piece of lined paper, foil, baking paper, a mirror, a clear lid, a spoon and a cup of water. * They are also provided with 4 different forms of light: A) Standard torch. B) Laser. C) LED light and D) a candle. * Students are to use the observation table provided to document the type of light; the effect is has on the object provided and the transparency of them (Academy of Science, 2012). * Allow students 5-10 minutes to discuss and write down the observations made. * STUDENTS WORKING BEYOND STAGE LEVEL- tiered questions will be asked e.g. why is it important to determine the different effects light may have on materials? What is an example of one important aspect of this? * Class discussion-comparing findings, adding to KWL charts and applying what they have found by identifying where they have viewed this phenomenon in real life. * Students may also use iPads to document their findings through photos. * The hands on activity addresses the non-verbal part of the 8 ways of learning and therefore cater for Indigenous students (*8 Aboriginal ways of learning,* 2014). | * Shoeboxes * iPads * LED light * Torch * Laser * Candle * Lined paper * Foil * Baking paper * Mirror * Clear lid * Spoon * Cup of water * Word wall | ST3-7PW  ST3-4WS  ST3-5WT  EN3-1A |  |
| **EXPLORE and EXPLAIN – LESSON 3**   * In their science journals students write down all the things they know about reflections. Students then ‘think, pair, share’ their ideas with their partner. * Students then share their ideas in their groups of four, and pose “I think…” questions to make predictions about reflection, and create a simple definition. * Each group then shares their definition with the class, which the teacher writes on the board. * The teacher demonstrates light reflection by using the projector light and holding a small rectangle mirror in front of it, allowing the light to bounce to another point in the room. By tilting the mirror at different angles the teacher demonstrates that light reflects off shiny objects at the same angle it hits the object. * Multiple mirrors can then be used to bounce the projector light off each other to demonstrate how light reflects on multiple shiny objects. * Students will explore the concept of light reflection through four rotational activities. Students document their findings by taking photos of things they find interesting. * Rotational activities will include: * Table one: students are provided with a torch and 3 mirrors that they use to explore shining the torch light onto one mirror: demonstrating and exploring how light reflects. * Table two: Students are provided with multiple mystery objects, which are placed on the table in a box. One at a time, students sit underneath the table with a mirror. The other students in the group are to decide on an object from the box and place it in the middle of the table. The student beneath the table will use the mirror to determine what the object is by seeing the objects reflection. * Table three: Two mirrors and three stacks of multiplication cards (which are differentiated to student’s ability) are placed on a table. Students are divided into same ability partners. One student in the partnership picks a multiplication card (suited to their ability) and sticks it to their partner’s back. They are provided with a mirror. The other person also has a mirror, which they use to reflect into their partner’s mirror in order to see the equation on their back and answer it. Once all multiplication cards in that stack have been completed, students swap roles. * Table four: A curved line of masking tape is set out on the floor. Using a small mirror provided, one at a time, students must use the mirror to guide them along the curved line by looking at the line’s reflection in the mirror and not actually looking at the ground. * STUDENTS WORKING BEYOND STAGE LEVEL- an extension activity of looking at concave and convex mirrors and how it affects reflection. * STUDENTS WORKING TOWARDS STAGE LEVEL- peer teaching will be used. * Teacher leads discussion on students’ findings about reflection from each rotational activity. * Students are given the opportunity to add to or change their definitions of reflection from the start of the lesson. * The teacher then gives a scientifically correct definition of reflection and demonstrates using a ray diagram to show the reflection of light and how it travels in straight lines. * Students are to add the definition to the glossary in their science journal as well as copy down the diagram. The word reflection and its definition are then added to class word wall. * The teacher plays a video on reflection to reinforce law of reflection. <http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light-absorb-reflect-refract.htm> (Scholastic, 2014). * Students prepare a 1-2min presentation on reflection based on what they thought reflection was, what they now know reflection is and how they came to this conclusion by including photos they took when exploring. Students are given choice of how to present their findings eg. Oral, poster, drama, etc. – FORMATIVE ASSESSMENT. * Aboriginal students are catered for in this lesson as it addresses the idea of learning maps. Learning in this lesson is a journey through the beginning, middle and end where students use scientific learning to make predictions, explore and observe using their senses. Assessment is holistic by observing students understanding of reflection the whole way through the lesson (*8 Aboriginal ways of learning,* 2014). | * 1x rectangle flat mirror * 6x hand held flat mirrors * 1x convex mirror * overhead projector * 1x torch * masking tape * differentiated multiplication cards * ipads * sticky tape * video * IWB * Word wall * Science journal | ST3-7PW  ST3-4WS  ST3-5WT  ST3-1VA  EN3-1A  EN3-2A |  |
| **EXPLORE and EXPLAIN – LESSON 4**   * Discuss: Do we think that light travels in the same direction – in a straight line? What do we already know about transparent materials? Are we always able to see through materials? Why/why not? * Collaborative learning groups: * Ask students to make a comparison between 2 objects. The first being an empty cup, with a pencil in it and a second being a cup half full with water, with a pencil in it. * Ask groups to make observations looking through the side part of the cup. * Ask students to record observations as a labelled diagram, in science journal (teacher identifies aspects of diagram to include). * Diagrams of both objects. * Class discussion: (Ask students to report on their observations by adding to KWL charts and in discussion) * What did you observe before the water was added? * What did you observe after? * EXTENDING STUDENTS: What happens when you put a script of writing behind the cup of water? What could be the reasoning behind it magnifying? What are some examples of other objects that magnify? (Opportunity to introduce a student based interest project on optics). * Discuss refraction: What happens? Light speed changes as it enters the water (greater density) changing the direction of the ray. * STUDENTS WORKING BEYOND THE STAGE LEVEL: Add milk to the water to give it a cloudy affect – laser through the water to view. Referring to light – what happens to a beam of light when it passes through water? *Changes direction from air to water.* * The teacher provides the students with a definition of refraction and a ray diagram demonstrating what occurs. * Add the term refraction and its definition to the word wall. Furthermore, they will add the term and definition to the glossary in their science journals including the ray diagram. * Indigenous students are catered for as this lesson address the deconstruct/reconstruct part of the 8 ways as they pull apart all the knowledge they have gained and reconstruct it in a different way (*8 Aboriginal ways of learning,* 2014). | * Science journals * Word wall * Milk * Pencil * Water * Cups * Boxes * Jars * Coloured water * Torches | ST3-7PW  ST3-4WS  ST3-5WT  ST3-1VA  EN3-1A |  |
| **ELABORATE – LESSON 5**   * Students are asked to reflect on what has been learnt in the unit so far. Students will form mixed ability groups of four and develop a drama piece to demonstrate what happens when light is reflected and refracted. Each group will act out their drama to the class. Following each drama piece students will participate in a discussion to discuss how accurate the drama was. * Students will each create a kaleidoscope but do so cooperatively. The instructions will be displayed on the Interactive Whiteboard. * Students will then explore their kaleidoscope as well as other students’ to see what they do and how effective they are. * STUDENTS WORKING BEYOND STAGE LEVEL- effective questioning will be used to enhance their learning. For example, how could you improve the kaleidoscope? How could you else could you make a kaleidoscope? Why do some kaleidoscopes have different geometry to the images? They will be given a range of apps demonstrating kaleidoscopes shapes. E.g. Kaleidoscope. * STUDENTS WORKING TOWARDS STAGE LEVEL- Peer teaching will be used. * Students watch a Youtube video about how a toy kaleidoscope looks.   <https://www.youtube.com/watch?v=a_IOl72yfik>  (*Old World Kaleidoscope*, n.d.).   * A class discussion will be started to compare how the kaleidoscope in the Youtube video compares to the kaleidoscope they have made. * Students are asked to use their knowledge about reflection and refraction to discover how a kaleidoscope works. Students will discuss in pairs and then share their ideas with the whole class- FORMATIVE ASSESSMENT. * Students will then undertake their own research using the internet, iPads, laptops and books to find out how reflection and refraction make the kaleidoscope work, what happens and why. * Then the teacher will refer all of the students to the book “Manipulating Light” by Darlene Stille and read it to them. * Afterwards, students will write an information report about the kaleidoscope using information from the discussion and research. The students will be given the opportunity to present their findings in the form of their choosing e.g. PowerPoint presentation, written explanation with labelled diagrams. Each student must then present his or her report to the class. After each presentation the class will discuss what they think about the presentation, if they agree/disagree about anything and why – SUMMATIVE ASSESSMENT. * STUDENTS WORKING BEYOND STAGE LEVEL- will be asked to incorporate both written elements and diagrams to represent their findings. * The hands on activity and drama address the non-verbal part of the 8 ways of learning and therefore cater for Indigenous students. Indigenous students are catered for as this lesson address the deconstruct/reconstruct part of the 8 ways as they are given the final product and have to break it down into doable parts and reconstruct it (*8 Aboriginal ways of learning,* 2014). | * Toilet rolls * Sequins * Aluminium foil * Clear plastic cover * Cling wrap * Cardboard * Sticky tape * Scissors * iPads * Laptops/Computers * IWB * Word wall * Science journal | DRAS3.3  ST3-7PW  ST3-4WS  ST3-5WT  ST3-1VA  EN3-1A  EN3-2A |  |
| **ELABORATE – LESSON 6**   * Pose the question “can light move around corners?” * Students discuss their ideas as a class and make predictions for the answer to this question. * The teacher shows students an example of a periscope and asks students if they know what it is and how it is used in real life. * In their groups of four students are delegated a role of director, speaker, recorder or manager. * Students will make a periscope using the materials provided to them, their prior knowledge gained thus far in the unit and the example shown to them at the beginning of this lesson (Exploratorium, 1998). * STUDENTS WORKING TOWARDS THE STAGE LEVEL- if students are still struggling they can use an iPad to research how to make a periscope in order for them to complete the task. * Students sit under a desk and use their periscope to see a picture being held up behind them. * Students then explain what is happening using their prior knowledge, thinking of ideas of where this might be used in real life (if this wasn’t successfully answered at the start). * Students participate in a discussion about how their periscope could be enhanced. * STUDENTS WORKING BEYOND THE STAGE LEVEL- will see if it is possible to add extra mirrors to the periscope. * Students write a conclusion in science journals, answering the question “can light move around corners,” including how the periscope works- SUMMATIVE ASSESSMENT. * Indigenous students are catered for as this lesson address the deconstruct/reconstruct part of the 8 ways as they pull apart all the knowledge they have gained and reconstruct it in a different way (*8 Aboriginal ways of learning,* 2014). Furthermore, the activity is kinaesthetic which addresses the non-verbal part of 8 ways. | * recycled milk cartons * sticky/masking tape * two compact mirrors per group * scissors * pencils * rulers | ST3-7PW  ST3-4WS  ST3-5WT  ST3-1VA  EN3-2A  EN3-9E |  |
| **EXPLORE and EXPLAIN – LESSON 7**   * Students divided into mixed ability groups of four. Each group will be given a torch and asked to find objects in the classroom and shine the torch on each object for 30 seconds. Students will document their findings about what they see and feel in a table in their science journals. They must also take photos/videos for evidence. * Students will then discuss their results as a class and form possible explanations. They will also talk about if the light went through the object (refracted), bounced off the object (reflected) or stopped at the object. * The terms opaque, translucent and transparent will then be introduced to the class. * As a group, students will revisit their table and classify the objects they explored as either opaque, translucent and transparent. The class will then come back together and connect their iPads or cameras to the IWB. The teacher will have a prepared flipchart set up to classify the objects in the classroom the students took photos of as opaque, translucent or transparent. Students will click and drag the pictures to the appropriate heading. * Students will then be asked to create a list of objects outside of the classroom as either opaque, translucent and transparent and add them to their table. * Students draw a house in their science books. They will be asked to label what type of material are used for different parts of the house (e.g. brick- opaque) and why that type of material would be used. * Students will then be given a range of opaque materials (2 of each object). One object will be left in the classroom while the other will be placed outside in the sun. Students will need to compare what happens to the objects over a 20 minute time period by exploring the similarities and differences of these objects (heat and shadows) * The teacher will then introduce the term “absorption.” The students will be asked what they think the word means. Afterwards the teacher will give a scientifically correct definition of absorption and demonstrate using a ray diagram how light is absorbed and transformed into other types of energy. Students will be asked to think about how the objects from the start of the lesson and the objects outside the classroom have undergone this reaction. The word and definition of absorption will then be added to the word wall. Furthermore, the students will add the definition of absorption to the glossary in their science journal including the ray diagram. * Students move into their drama groups from the beginning of the lesson and create another drama piece on what happens when this reaction takes place. | * Torches * Ipads/cameras * IWB * Flipchart * Science journals | ST3-7PW  ST3-13MW  EN3-1A |  |
| **ELABORATE – LESSON 8**   * Pose the question “What will happen to the height of the shadow when we change the distance from the torch to the gluestick?” * Discuss the variables and how to make this a fair test. * Students complete their own investigation planner and predict what they think will happen. * Students carry out the investigation in cooperative groups by placing a piece of paper against a wall to show the shadow and show the height of it. Students will have a ruler placed beside the torch to measure the distance between the torch and the object. Students will then record on the paper how high the shadow was and the distance between the torch and the object. Repeat with measurements of 1cm, 5cm, 10cm, 15cm and 20cm from the torch to gluestick (Academy of Science, 2012). * STUDENTS WORKING TOWARDS STAGE LEVEL – sheets to record measurements of height will be lined to help students measure correctly. * Students tabulate their findings and draw a graph to represent the data collected in their science journals. * STUDENTS WORKING ABOVE STAGE LEVEL- will test distances (other than the ones provided) between the torch and the gluestick. * Students take photos using iPads or cameras at each stage to represent what is happening. * Students write down observations and results to form a conclusion and explain why the gluestick casts a shadow. * The investigation planner, tables, graphs and conclusion will be used for SUMMATIVE ASSESSMENT. * Aboriginal and Torres Strait Islander students will be accommodated in this lesson as it includes the aspects of learning maps, as the lesson has a beginning, middle and end and includes scientific learning, and non-verbal, through the kinaesthetic activities, from the 8 ways of learning. | * Torches * rulers * objects such as glue sticks * sheets with measurements * investigation planners * science journals | ST3-7PW  ST3-4WS  ST3-5WT  ST3-1VA  EN3-1A  EN3-2A  MA3-18SP  MA3-9MG |  |
| **EXPLAIN – LESSON 9**   * Excursion to the Powerhouse Museum for the “Glow Science Show” and to look at the Experimentations section of the museum. * The Glow Science Show is *“An engaging science show where students discover there are many different ways of generating light.”* (Powerhouse Museum – <http://www.powerhousemuseum.com/pdf/education/Primary_Schools_Program_2014.pdf>). In this show students explore fireworks, glow sticks and ultra violet light. * Students will complete a work booklet whilst at the Powerhouse Museum.   (Powerhouse Museum Primary Schools Program, 2014, p.10).   * If this excursion cannot be done, teachers can use the following lesson on light waves. * The teacher recaps what has been explored and explained in previous lessons. * Students complete research with a partner (of different learning ability) on light waves to explain how these work. * Students will find information from a range of websites and use these to help them explain how light waves work.   <http://science.hq.nasa.gov/kids/imagers/ems/visible.html>  <http://www.factmonster.com/dk/encyclopedia/light.html>  <http://www.sciencekids.co.nz/sciencefacts/light.html>   * STUDENTS WORKING TOWARDS STAGE LEVEL –will have a scaffold sheet that asks simple questions to be answered to make their research more effective. * STUDENTS WORKING ABOVE STAGE LEVEL–will receive a sheet asking them higher order thinking questions on light waves to challenge their thinking and extend their knowledge. * Students participate in a whole class Interactive Whiteboard activity distinguishing the high frequency waves and low frequency waves and ordering these. * Students will then perform their own research to explore the different colours in the electromagnetic spectrum and how they are formed. Students present their findings to the class in a format of their choosing- FORMATIVE ASSESSMENT. * New terms that come up during presentations will be added to the word wall and to the glossary students have in their science journals. * This lesson addresses the learning maps aspect of the 8 ways of learning as it has a beginning, middle and end and includes scientific learning. Therefore, Indigenous students are accommodated. | * Laptops/iPads * Internet * IWB * Cardboard * pens/pencils * paper * science journals | ST3-7PW  ST3-4WS  ST3-1VA  ST3-7PW  ST3-4WS  ST3-1VA  EN3-1A |  |
| **EVALUATE – LESSON 10**   * KWL chart displayed on the IWB. As a class students look back at the ‘what you know ’ and ‘what you want to know’ section of the chart. Students then brainstorm and adds ideas to the ‘what you learnt’ section. * Students are given an A4 piece of paper in which they are to fold into three equal sections. In each section students will describe what they learnt about reflection, refraction and absorption as well as drawing a labelled picture or diagram- SUMMATIVE ASSESSMENT. * Students complete a self-assessment on the back of the A4 sheet answering questions set by the teacher- SUMMATIVE ASSESSMENT. Possible questions to include are: * What did you enjoy most about the unit ‘light up my life?’ * What did you least enjoy about the unit light up my life?’ * What was your favourite topic and why? Eg reflection, refraction, absorption, shadows? * What is one new thing you now know about how light travels? * How was I an important member of my group? * I enjoy working individually, in pairs, small groups or as a whole class. Why? * The teacher conducts a game show style quiz about all content covered during the unit- SUMMATIVE ASSESSMENT. * Students are divided into table groups. Each group must come up with an animal sound for their buzzer to answer the questions. As the groups are of mixed ability no advantages are created. * The teacher reads out each question, which will also appear on the IWB through a PowerPoint (catering for visual and auditory learners). Once the teacher reads out the question, students make their animal noise to answer the question. The first group to make their noise will get to answer first. However, if they are wrong the other groups can make their animal noise again to answer the question correctly. * The teacher tallies points on the board and the group with the most points at the end of the quiz win. | * IWB * A4 pieces of paper * KWL chart * Game show PowerPoint | ST3-7PW  ST3-5WT  EN3-1A  EN3-9E |  |

RESOURCES

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| Text   * “Manipulating Light” by Darlene Stille * Story of the Sun-woman, Wall | Audiovisual   * Online Poll * Quiz * IWB activities |
| On-line  <https://www.youtube.com/watch?v=-61z3ZlFnpQ>  <http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light-absorb-reflect-refract.htm>  <https://www.youtube.com/watch?v=a_IOl72yfik>  <http://science.hq.nasa.gov/kids/imagers/ems/visible.html>  <http://www.factmonster.com/dk/encyclopedia/light.html>  <http://www.sciencekids.co.nz/sciencefacts/light.html>  [www.myschoolhouse.com/courses/O/1/36.asp](http://www.myschoolhouse.com/courses/O/1/36.asp) | Human   * Local Indigenous community member * Members of staff at the Powerhouse Museum |
| Place   * The classroom * The school yard * Powerhouse Museum | Materials/Real life items   * KWL charts * Word wall * Science journals * Shoeboxes * iPads * LED light * Torch * Laser * Candle * Lined paper * Foil * Baking paper * Mirrors – 1 rectangle flat, 6 hand held flat, 1 convex, 5 compact * Clear lids * Spoons * Plastic cups * Water * Overhead/data projector * masking tape * differentiated multiplication cards * sticky tape * IWB * Scissors * Milk * Pencils * Boxes * Jars * Food colouring (for coloured water) * Toilet rolls * Sequins * Clear plastic cover (eg. cellophane) * Cling wrap * Cardboard * Laptops/Computers * Recycled milk containers * Rulers * Cameras * objects for measuring shadows (eg. glue sticks) * sheets with measurements * investigation planners * work booklets for powerhouse museum |

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| **FORMATIVE ASSESSMENT RUBRIC** | **EXCELLENT** | **VERY GOOD** | **GOOD** | **WORKING TOWARDS** |
| **Understanding of Concept** | Students have a clear and concise understanding of the concept. | Students have a clear and developing understanding of the concept. | Students have a sound understanding of the concept. Further work needs to be done to reach a better understanding. | Students are working towards a sound understanding of the concept. |
| **Quality of Work** | Provides work of the highest quality. | Provides high quality work. | Provides work that occasionally needs to be checked/redone to ensure quality. | Provides work that usually needs to be checked/redone to ensure quality. |
| **Focus on the task** | Consistently stays focused on the task and what needs to be done. Very self-directed. | Focuses on the task and what needs to be done most of the time. | Focuses on the task and what needs to be done some of the time. | Rarely focuses on the task and what needs to be done. |
| **Problem-solving** | Actively looks for and suggests solutions to problems. | Refines solutions suggested by others. | Does not suggest or refine solutions, but is willing to try out solutions suggested by others. | Does not try to solve problems or help others solve problems. |
| **Working with Others** | Almost always listens to, shares with, and supports the efforts of others. | Usually listens to, shares, and supports the efforts of others. | Often listens to, shares and supports the efforts of others, but sometimes is not a good team member. | Rarely listens to, shares or supports the efforts of others. |
| **Working Scientifically** | Always demonstrates the ability to pose questions, make predictions, gather data, observe and form evidence-based conclusions & explanations. | Mostly demonstrates the ability to pose questions, make predictions, gather data, observe and form evidence-based conclusions & explanations. | Sometimes demonstrates an ability to pose questions, predict, gather data, observe and form basic evidence-based conclusions. | Working towards being able to pose questions, predict, gather data, observe and form basic evidence-based conclusions. |

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| **SUMMATIVE ASSESSMENT – SHADOWS** | **EXCELLENT** | **VERY GOOD** | **GOOD** | **WORKING TOWARDS** |
| **Data Collection** | Data was collected several times. It was summarized, independently, in a way that clearly describes what was discovered. | Data was collected more than one time. It was summarized, independently, in a way that clearly describes what was discovered. | Data was collected more than one time. Adult assistance was needed to clearly summarize what was discovered. | Data was collected only once and adult assistance was needed to clearly summarize what was discovered. |
| **Variables** | Independently identified and clearly defined which variables were going to be changed (independent variables) and which were going to be measured (dependent variables). | Independently identified which variables were going to be changed (independent variables) and which were going to be measured (dependent variables). Some feedback was needed to clearly define the variables. | With adult help, identified and clearly defined which variables were going to be changed (independent variables) and which were going to be measured (dependent variables). | Adult help needed to identify and define almost all the variables. |
| **Description of Procedure** | Procedures were outlined in a step-by-step fashion that could be followed by anyone without additional explanations. No adult help was needed to accomplish this. | Procedures were outlined in a step-by-step fashion that could be followed by anyone without additional explanations. Some adult help was needed to accomplish this. | Procedures were outlined in a step-by-step fashion, but had 1 or 2 gaps that require explanation even after adult feedback had been given. | Procedures that were outlined were seriously incomplete or not sequential, even after adult feedback had been given. |
| **Measurements** | Measurements are estimated, recorded and compared accurately. | Most measurements are estimated, recorded and compared accurately. | Some measurements are estimated, recorded and compared accurately. Further assistance is needed to improve skills in this lesson. | Measurements are rarely estimated, recorded and compared accurately. Further assistance is needed to improve skills in this lesson. |
| **Tables/Graphs** | Tables and graphs are correctly constructed incorporating all required elements. | Tables and graphs are mostly correctly constructed and incorporate most required elements. | Tables and graphs are constructed with some errors and some elements are not included. | Tables and graphs are incomplete and with many errors. Omits many elements. |
| **Conclusion/ Summary** | Student provided a detailed conclusion clearly based on the data and related to previous research findings and the hypothesis statement(s). | Student provided a somewhat detailed conclusion clearly based on the data and related to the hypothesis statement(s). | Student provided a conclusion with some reference to the data and the hypothesis statement(s). | No conclusion was apparent OR important details were overlooked. |

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| **SUMMATIVE ASSESSMENT – KALEIDOSCOPES/PERISCOPES** | **Excellent** | **Very Good** | **Good** | **Working Towards** |
| **Modification/Testing** | Clear evidence of troubleshooting, testing, and refinements based on data or scientific principles. | Clear evidence of troubleshooting, testing and refinements. | Some evidence of troubleshooting, testing and refinements. | Little evidence of troubleshooting, testing or refinement. |
| **Scientific Knowledge** | Explanations indicate a clear and accurate understanding of scientific principles underlying the construction and modifications. | Explanations indicate a relatively accurate understanding of scientific principles underlying the construction and modifications. | Explanations indicate relatively accurate understanding of scientific principles underlying the construction and modifications. | Explanations do not illustrate much understanding of scientific principles underlying the construction and modifications. |
| **Ability to Produce Solutions** | Students demonstrate an excellent ability to select a range of tools to manipulate and shape materials. | Students demonstrate a very good ability to select a range of tools to manipulate and shape materials. | Students demonstrate a sound ability to select tools to manipulate and shape materials. | Students do not demonstrate an ability to select a range of tools to manipulate and shape materials. |
| **Journal/Log - Content** | Journal provides a complete record of planning, construction, testing, modifications, reasons for modifications, and some reflection about the strategies used and the results. | Journal provides a complete record of planning, construction, testing, modifications, and reasons for modifications. | Journal provides quite a bit of detail about planning, construction, testing, modifications, and reasons for modifications. | Journal provides very little detail about several aspects of the planning, construction, and testing process. |

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| **Risk Management Proforma** | | | | |
| **Hazard Identification**  Type/Cause | **Risk Assessment**  Use Matrix | **Elimination or Control Measures** | | **Lesson** |
| Classroom Condition | 6  6 | * Teacher ensures floor is clear of any obstructing objects. (Masking tape on floor – make sure students are aware) * Bright enough lighting to allow safe access and exit. | | 1, 2, 3, 4, 8, 9 |
| Usage of candles/lasers/  torches | 9  6 | * Teacher ensures each group has a supervising adult at all times, in regards to the candles. Fire exits are clearly displayed. * Ensure students are responsible when handling sources of lights and are aware of students around them. | | 1, 2, 3, 4, 7, 9 |
| Accidents that may occur. | 8  6  5  6 | * Procedures in place to deal with spillages and breakages. E.g. water, blood from cuts, glass breaking. * Walk, do not run and hold onto handrails when on stairs or escalators to avoid trips and falls. * Stay behind safety barriers. * Do not enter ‘no access’ or ‘staff only’ areas. | | 2, 3, 4, 5, 6, 7, 8, 9 |
| First Aid | 7  6 | * Teacher and students aware of first aid procedures. * Students raise teacher awareness to first aid issues. | | 1, 2, 3, 4, 5, 6, 7, 8, 9 |
| Equipment | 7  7 | * Teacher ensures that all equipment is in good and safe condition for students to use. * Students are aware of correct procedures to operate equipment. | 1, 2, 3, 4, 5, 6, 7, 8, 9 | |
| ICT | 7 | * Students are aware of correct practices when using ICT equipment – including that of privacy. | 2, 3, 5, 6, 7, 8, 9 | |
| Sunburn | 4 | * Teachers remind students of importance of sun protection and students apply sunscreen, wear hats, etc. | 7, 9 | |
| Road Accidents | 7 | * Teachers and parent/guardian helpers supervise students when crossing roads and getting on and off buses. Supervision is essential on the forecourt of the Powerhouse Museum due to heavy traffic. | 9 | |
| Lost Students | 5  5 | * Teachers perform regular headcounts * Students briefed beforehand about what to do if they are lost such as find a Museum staff member or meet at an assigned point. | 9 | |
| Lost Property | 2  2 | * Teachers use cloakroom facilities for student’s bags. * Students place loose items in their bags before leaving them in the cloakroom. | 9 | |

N.B. 1 is a low risk and 10 is the highest risk.

References

*8 Aboriginal Ways of Learning.* (2014). Retrieved from <http://8ways.wikispaces.com>

Australian Academy of Science. (2012). *Primary Connections: Light shows.* Retrieved from <http://www.scootle.edu.au/ec/viewing/S7084/Light-shows-2012/resources/light_shows_comp_150.pdf>

Campbell, C. (2012). Learning theories relate to early childhood science education. In C. Campbell, & W. Jobling (Eds.). *Science in early childhood* (pp.25-34). Port Melbourne, Victoria: Cambridge.

Exploratorium. (1998). *Science Activity: Make a Periscope.* Retrieved from <https://www.exploratorium.edu/science_explorer/periscope.html>

Murdoch, K., & Hornsby, D. (1997). *Planning curriculum connections: Whole-school planning for integrated curriculum.* Melbourne: Eleanor Curtain Publishing.

Netting, R. (2007). *Visible Light Waves*. Retrieved from <http://science.hq.nasa.gov/kids/imagers/ems/visible.html>

New South Wales Board of Studies. (2006). *Creative Arts K-6 syllabus.* Retrieved from <http://k6.boardofstudies.nsw.edu.au/wps/wcm/connect/ce0d0525-fb53-44db-b4bb-f9d252549824/k6_creative_arts_syl.pdf?MOD=AJPERES>

New South Wales Board of Studies. (2012). *English K-10 Syllabus*. Retrieved from <http://syllabus.bos.nsw.edu.au/download/>

New South Wales Board of Studies. (2012). *History K-10 Syllabus.* Retrieved from <http://syllabus.bos.nsw.edu.au/download/>

New South Wales Board of Studies. (2012). *Mathematics K-10 Syllabus*. Retrieved from <http://syllabus.bos.nsw.edu.au/download/>

New South Wales Board of Studies. (2012). *NSW Syllabuses for the Australian Curriculum: Science K-10 (Incorporating Science and Technology K-6) Syllabus.* Retrieved from <http://syllabus.bos.nsw.edu.au/science/science-k10/>

*Old World Kaleidoscope.* (n.d.). Retrieved from <https://www.youtube.com/watch?v=a_IOl72yfik>

*Poll Everywhere.* (2013). Retrieved from <https://www.polleverywhere.com/free_text_polls/3tGNwUnk5QTcg8I/web>

Powerhouse Museum. (2014). *Primary Schools Program 2014.* Retrieved from <http://www.powerhousemuseum.com/education/>

Scholastic. (2014). *Studyjams.* Retrieved from <http://studyjams.scholastic.com/studyjams/jams/science/energy-light-sound/light-absorb-reflect-refract.htm>

Serrie, J. (2010). *Hubble Space Telescope Images & the Stars like Dust.* Retrieved from <https://www.youtube.com/watch?v=-61z3ZlFnpQ>

Skamp, K. (2012). *Teaching primary science constructively* (4th ed.). Melbourne: Thomson.

Smith, R. (2014). *Fun Light Facts for Kids - Sunlight, Color, Speed, Optics, UV, IR, Visible Spectrum*. Retrieved from <http://www.sciencekids.co.nz/sciencefacts/light.html>

Warner, M. (2014). *Playing with mirrors.* Retrieved from <http://www.teachingideas.co.uk/science/playingwithmirrors.htm>