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| **Making a Pinhole Camera** | | | |
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| Making a pinhole camera inspired by the early photography of the Victorian era | | | |
| **Subject(s):** Science, Design and Technology, Engineering, Mathematics, History  **Approx timings:** 105-130 minutes |  | **Key words / Topics:**   * camera obscura * kings and queens * modelling and prototyping * pinhole camera * photography * technological inventions * testing * Victorian era | |
| **Stay safe**  Whether you are a scientist researching a new medicine or an engineer solving climate change, safety always comes first. An adult must always be around and supervising when doing this activity. You are responsible for:    • ensuring that any equipment used for this activity is in good working condition  • behaving sensibly and following any safety instructions so as not to hurt or injure yourself or others    Please note that in the absence of any negligence or other breach of duty by us, this activity is carried out at your own risk. It is important to take extra care at the stages marked with this symbol: ⚠ | | | |
| **Suggested Learning Outcomes** |  |  | |
| * To know what is meant by the Victorian era and the dates it covered. * To be able to make and test a pinhole camera. * To be able to explain how the pinhole camera works. | | | |
| **Introduction** |  |  | |
| This is one of a set of resources developed to support the teaching of the primary national curriculum. This resource was inspired by the theme of the Victorians. It supports the teaching of design and technology in context by making a pinhole camera based on early Victorian photography technology. | | | |
| **Purpose of this activity**  In this project learners will learn about early camera obscuras developed during the Victorian era. They will then make their own pinhole camera from a small shoebox, based on this early technology. Finally, they will test their camera and observe how it works.  This activity could be used as a main lesson activity to teach learners basic marking out and model making skills. It could also be used as part of a wider scheme of learning focussing on the history of design, technology and engineering, alongside other Victorian-themed IET resources. | | | |
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| **Activities** |  | **Teacher notes** | |
| **Introduction (5-10 minutes)**  Teacher to introduce the aim of the activity and the theme of the Victorians.  Teacher to use presentation slide 3 to briefly discuss what the Victorian era was, when it occurred and why it was such an important period of time.  **Making a Pinhole camera (100-120 minutes) ⚠**  Use presentation slide 4 to discuss the origins of cameras and photography in Britain and the United Kingdom. Explain that in Victorian times many women took up taking photos as a hobby.  Teacher to demonstrate, and learners to follow, presentation slides 5-14 to make their pinhole camera from a showbox or suitable alternative:   * Step 1 - Remove the top of the shoebox. Mark an 80 mm x 35 mm window on one end of the box. * Step 2 - Use a craft knife to cut out the window. **⚠** * Step 3 - Use scissors to cut out a 95 mm x 50 mm piece of wax paper for the camera screen. Cut from the top corner to avoid waste. **⚠** * Step 4 - Place the cut piece of wax paper over the window. Use parcel tape to stick it into place. * Step 5 - Turn the box around to the other end. Draw two lines, corner to corner, to find the middle point. * Step 6 - Push a pin through the middle point to make a small hole. Keep this as straight as possible. **⚠** * Step 7 - Put the lid back onto the shoebox.   Ask learners to test the camera by going into a dark room, turning on a lamp and pointing the camera towards it. Do not look directly into a light source. **⚠** Learners should see the light inverted upside down) on the screen. Teacher to explain how the camera works. |  | **Introduction**  Teacher could ask learners to write down five things that that they already know about the Victorians and/or the Victorian era.  The Victorian era is sometimes also defined as being between around 1820 and 1914, based on the defining characteristics of society at the time, rather than the exact dates of Queen Victoria’s reign as monarch. Either definition, or a mixture of the two, is historically accurate to use.  **Making a Pinhole Camera**  Pinhole cameras are a type of camera obscura with a very small hole instead of a lens. They present an inverted image of the object they are pointed at – however this version does not ‘capture’ the image. It could be explained to learners that to capture the image paper or film coated with chemicals is used instead of the screen, where the chemicals change colours when they are exposed to light. Learners could research the camera obscura and how it was developed.  All tasks must be carried out in accordance with the school’s risk assessments. Take care when using sharp objects such as a craft knife, scissors and pins. **⚠**  The measurements given in the steps given are based on a small 170 mm (L) x 120 (W) x 75 mm (D) shoebox – these could be adjusted for a bigger box (e.g. for a bigger window – steps 1-4).  Step 2 could be carried out by an adult..  In step 3 teacher could discuss sustainability issues when cutting to avoid wasting wax paper.  Step 4 creates the camera screen.  Step 6 creates the lens for the front of the camera.  When testing explain that the pinhole acts as a tiny camera lens. This allows the light to enter the shoebox, which is then focussed and projected onto the screen, creating an inverted image.  An example of a finished pinhole camera is shown on presentation slide 14. | |
| **Differentiation** |  | **Teacher notes** | |
| **Basic** |  | **Extension** | |
| * Pre-cut the window and screen for the pinhole camera. * Provide a list of websites for learners to investigate camera obscuras and how they work. |  | * Calculate the volume of the box used for the pinhole camera (possible maths-based extension). * Make an improved camera obscura with an adjustable lens and cover. | |
| **Resources** |  | **Required files** icon-docicon-pdficon-ppt | |
| * Cardboard box or shoebox * Wax paper * Parcel tape * Craft knife * Scissors * Pin to make the pinhole * Pencil and ruler |  | icon-ppt Primary Presentation – Making a Pinhole Camera | |
| **Additional websites** |  |  | |
| * **Britannica – Victorian era:** <https://www.britannica.com/event/Victorian-era> * **English Heritage – 7 ingenious Victorian inventions:** <https://www.english-heritage.org.uk/visit/inspire-me/victorian-inventions/> * **History of the camera and photography:** <https://www.adorama.com/alc/camera-history/> , <https://en.wikipedia.org/wiki/Thomas_Wedgwood_(photographer)> , <https://en.wikipedia.org/wiki/Camera_obscura> * **Ways to make a pinhole camera/camera obscura:** <https://www.youtube.com/watch?v=miuNl-O05Wo> , <https://www.youtube.com/watch?v=IJ2cUh0N1RI> , <https://www.youtube.com/watch?v=mqvwqweDk1I> | | | |
| **Supporting starter and plenary ideas** |  |  | |
| **Starters** (Options)   * IET Victorian themed activities – Victorian Timeline, Victorian Engineering Research or Light Bulb Experiment. * Use a mind map or spider chart to brainstorm important facts about how Victorian people lived. * Mix and match card game matching different Victorian engineering inventions to their names. * True or false quiz – what facts about the Victorians are true and which are not true. E.g. television was invented during the Victorian era – false – this happened in 1927. | | | **Plenary**   * Evaluate the outcomes of the making activity. What went well (WWW) and even better if (EBI). * Produce a word puzzle using key words from the activity E.g. wordsearch or crossword. * CLOZE/missing word questions to assess knowledge and skills gained. |

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| **The Engineering Context** |
| * Understanding about the history of engineering and design helps engineers to learn from past successes and mistakes. For example, learning about early photography us to understand the science behind these ideas and how this can be used and developed to make better products in future. |

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| **Curriculum links** | |
| **England: National Curriculum**  Design & Technology KS2   * use research and develop design criteria to inform the design of innovative, functional, appealing products that are fit for purpose, aimed at particular individuals or groups * generate, develop, model and communicate their ideas through discussion, prototypes * select from and use a wider range of tools and equipment to perform practical tasks   Mathematics KS1 and KS2   * measure and begin to record the following: lengths and heights * choose and use appropriate standard units to estimate and measure length/height in any direction (m/cm) to the nearest appropriate unit, using rulers * convert between different units of metric measure (for example, kilometre and metre; centimetre and metre; centimetre and millimetre)   History KS2   * the changing power of monarchs using case studies such as John, Anne and Victoria | **Northern Ireland Curriculum**  Mathematics and Numeracy KS1 and KS2   * know and use the most commonly used units to measure in purposeful contexts * appreciate important ideas about measurement including the continuous nature of measurement and the need for appropriate accuracy   The World Around us KS2   * interdependence of people and the environment and how this has been accelerated over time by advances in transport and communications * change over time in places * the causes and effect of energy, forces and movement * the effects of positive and negative changes globally and how we contribute to some of these changes |
| **Scotland: Curriculum for Excellence**  Technologies   * TCH 2-05a * TCH 2-09a, TCH 2-12a   Numeracy and Mathematics   * MNU 2-11a, MNU 2-11b, MNU 2-11c   Sciences   * SCN 2-11b | **Wales: National Curriculum**  Humanities   * I can recognise similarities and differences between people’s lives, both in the past and present   Mathematics and Numeracy   * I have explored measuring, using counting, measuring equipment and calculating, and I can choose the most appropriate method to measure   Science and Technology   * I can safely use a range of tools, materials and equipment to construct for a variety of reasons * I can make design decisions, using my knowledge of materials and existing products, and suggest design improvements * I can explore and communicate the basic properties of light, sound, electricity and magnetism |

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| **Assessment opportunities** |
| * Formal teacher assessment of cameras made. * Self/peer assessment of cameras made. * Informal assessment of numeracy and practical skills used. |