Periscope

See what is coming over the fence or around the corner with this simple periscope (not suitable for submarines).

Age Group: 8yrs + (scissors and craft knife required)

Method: Group activity (up to 15 per facilitator)

Level: Introductory

Duration: 15 min

Key Learnings: Light travels in straight lines, and flat mirrors will reflect light without distortion, but the image is inverted. By using two parallel mirrors facing each other at an angle, the inversion of the image will be cancelled out.

Materials and Equipment

* Periscope template on A3 card (I per participant)
* 50mm square acrylic mirrors (2 per participant)
* Scissors (1 per participant)
* Craft knife (1 per participant)
* Ruler (can be shared between a few participants)
* Glue or stickytape (hotmelt glue is best for fixing mirrors, if available)
* Felt pens, coloured pencils or stick ons for decoration (optional)

Preparation

 The facilitator should prepare for this workshop by making their own periscope using the instructions and materials provided. Note critical stages in gluing the device together, and advise the participants accordingly.

If hotmelt glue is used, note how long it takes for the glue to harden enough before final assembly of the tube can be done.

Have a rubbish bin ready for the waste card that will be generated.

Recommendations

 Depending on the age and skill levels of the participants, it might be wise to have a couple of extra copies of the template at hand if cutting errors make completion impossible. For this reason, it is a good idea to fix the mirrors *after* cutting out the template. Younger group members may benefit from assistance in fixing the mirrors to the template if hotmelt glue is used.

 Further learning could include designing and constructing a mega-periscope using recycled cardboard boxes (think of something that could be worn, sitting on the shoulders, or an inverted design like [this](http://www.fastcodesign.com/3038774/a-cardboard-mask-that-teleports-your-eyes-to-your-belly-button). ) The template pattern can be enlarged and adapted to suit, but larger mirrors would be required (see appendix for possible sources).

Workshop Outline

(5 min) Introduction

 Introduce yourself, welcome participants and deal with housekeeping.

 Ask participants if they know what a periscope is, and where it might be used.

 Demonstrate the concept of inversion by having participants look at themselves in a flat mirror, and touch their right ear. Which ear is the person in the mirror touching? This shows lateral inversion (swapping left to right). Discuss whether this could be a problem when a mirror is used in any of the examples of periscopes you identified, and suggest that this is something that could be investigated when they are finished making their own.

(5 min) Preparing the template

 Distribute template cards, scissors, rulers and craft knives.

 Explain that the solid lines represent cuts, and the dotted lines are to be scored with the craft knife, using the ruler as a guide to get a straight line. Supervise this as necessary. (note that when the periscope is assembled that the lines will be on the *outside* to take advantage of the scoring).

 Practise folding the periscope tube into shape, and point out that the mirrors will need to be fixed to the inside for it to work (this will avoid later confusion). Participants could mark where to fix the mirrors if required.

(5 min) Fixing and decorating

 Distribute the mirrors, and have participants fix them to the template with hotmelt glue, or stickytape. (If tape is used, try to keep it to the edges, so as much of the face of the mirror is as clear as possible).

 Decoration should be done before the template is glued into a tube.

 Fold the template into a tube, and glue or tape the tabs closed.

 Work with a partner to decide if the image you see when you look into the periscope is inverted.

Appendices: Mirror suppliers list (attached)

 Digital version of the template (attached)