**How do we see?**

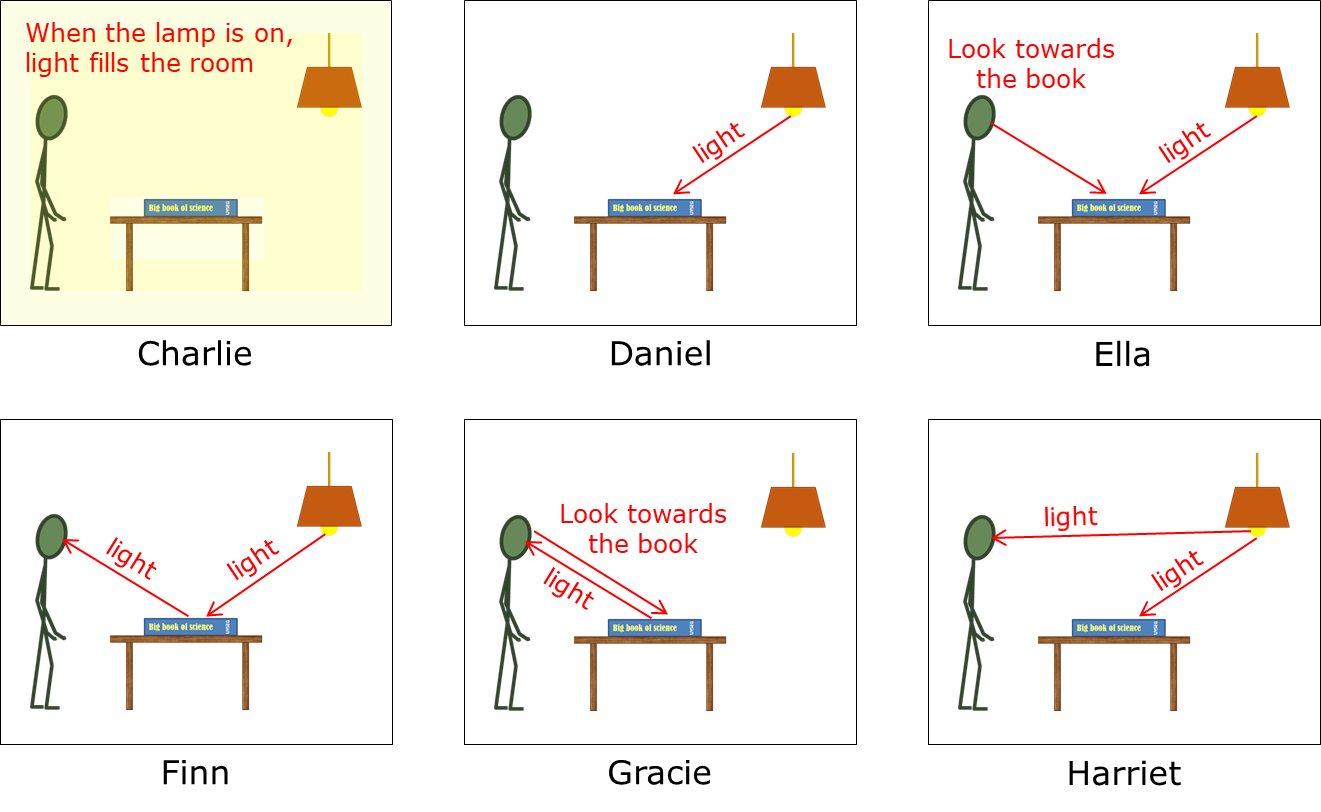
David is looking at a book on the table.

The book is lit by a lamp.



Some students are thinking about how David sees the book.

They draw diagrams to show what they think.



1. Who do you think is right about how David sees the book?

*Explain your answer*

1. What mistakes do you think the other students made?

*What would you say to them to help them to understand?*

*Physics > Big idea PSL: Sound, light and waves > Topic PSL2: How we see > Key concept PSL2.1: The ‘passive eye’ model of vision*

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| --- |
| **Response activity** |
| **How do we see?** |

**Overview**

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| --- | --- |
| Learning focus: | Objects are seen when light reflects off them into our eyes. |
| Observable learning outcome: | Illustrate how non-luminous objects can be seen when light reflects off them and enters the eye. |
| Activity type: | Talking heads |
| Key words: | Light, dark, ray |

This activity can help develop students’ understanding by addressing the sticking-points revealed by the following diagnostic question:

* Diagnostic question: In the dark

|  |  |
| --- | --- |
| **P** | **PRIOR UNDERSTANDING**  This activity explores ideas that are usually taught at age 5-11, to aid transition from earlier stages of learning. |

**What does the research say?**

To help students develop the scientific explanation that non-luminous object are seen because some of the light scattered off them enters the eye, it can help to remind students of how light reflects off a mirror before considering how objects reflect light from an obvious light source. Students can then be guided to apply this understanding to explain how we see non-luminous objects in more diffuse light (Allen, 2014; Driver et al., 1994).



*The progression in conceptions of vision encountered among 13- to 14-year-olds, towards that of a physicist (Guesne, 1985)*

Studies by Ramada and Driver (1989) and Andersson and Karrqvist (1983) found that just 31% of fifteen-year-olds (N=456 and N=166 respectively) described how a girl sees a book using the idea of light going from book to eye. Almost as many either used the non-explanation that ‘light helps us to see’ or gave no explanation at all. Anderson and Smith’s study (1986) showed that 6% of 10- to 11-year olds in their sample held the scientific view of vision, Boyes and Stanisstreet’s study (1991) showed this increases to 10% of 11- to 12-year-olds and 33% of over-14s.

This activity builds on the idea that a source of light is necessary to see an object by engaging students in debating which idea best describes how a book can be seen.

**Ways to use this activity**

Students should complete this activity in pairs or small groups, and the focus should be on the discussions.

Students should work together to follow the instructions on either the worksheet or the PowerPoint. Asking each group to complete one set of answers between them is helpful for encouraging discussion, but each member should be able to report back to the class. Listening in to the conversations of each group will often give you insights into how your students are thinking.

If there is disagreement when you take feedback, a good way to progress might be through structured class discussion. Ask one student to explain why they gave the answer they did; ask another student to explain why they agree with them; ask another to explain why they disagree, and so on. This sort of discussion gives students the opportunity to explore their thinking and for you to really understand their learning needs.

*Differentiation*

The quality of the discussions can be improved with a careful selection of groups; or by allocating specific roles to students in the each group. For example, you may choose to select a student with strong prior knowledge as a scribe, and forbid them from contributing any of their own answers. They may question the others and only write down what they have been told. This strategy encourages contributions from more members of each group.

**Expected answers**

1. Finn has the right answer. Light travels from a source, bounces off the object and enters our eyes. This is the only answer in which light can be detected by the eye that has information about the book.
2. Charlie’s idea is one held more often by younger children who provide no explanation for how they see, and who accept that ‘we see with our eyes’ as sufficient to account for vision.

Ella and Gracie are using an ‘active eye’ model of vision. They have adapted this to (wrongly) explain why light is necessary to see.

Daniel and Harriet have also recognised that light is necessary to see things. Harriet has also realised that light must enter her eye to see, but she has not understood that the light must come from the object she is looking at.

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Developed by Peter Fairhurst (UYSEG), from *York Science* activity PLC3.2b: How do we see?

Images: Peter Fairhurst (UYSEG), based on those in *York Science* activity PLC3.2b: How do we see?

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