**How do we know?**

Dinosaurs lived on Earth a very long time ago. They have been extinct for millions of years.



We know a lot about dinosaurs and other organisms that lived and died so long ago.

Where does our knowledge of them come from?

|  |  |
| --- | --- |
| **A** | From photographs of the living organisms. |
| **B** | From observations made by people alive at that time. |
| **C** | From fossils of their remains. |
| **D** | From books and museums. |

*Biology> Big idea BVE: Variation, adaptation and evolution > Topic BVE1: Variation > Key concept BVE1.2: Changes in species over time – fossil evidence*

|  |
| --- |
| **Diagnostic question** |
| **How do we know?** |

**Overview**

|  |  |
| --- | --- |
| Learning focus: | The fossil record provides evidence that species change over time, but it is incomplete and there are limitations to the conclusions that can be drawn from it. |
| Observable learning outcome: | Recall that fossils provide evidence about organisms from long ago and their habitats. |
| Question type: | Simple multiple choice |
| Key words: | fossils |

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

**What does the research say?**

School biology curricula in various countries expect students to develop understanding from an early age that fossils provide evidence from which inferences about organisms that lived and died long ago can be made (e.g. AAAS Project 2061, 2009; Department for Education, 2013). Borgerding and Raven (2018) found that children as young as 6 years old commonly understood that inferences about body shape and size can be made from fossils, and that the locations in which fossils are found can allow inferences about the habitats of the fossilised organisms to be made.

However, students can struggle to appreciate what “long ago” means, as they find it difficult to understand geological timescales (Dodick and Orion, 2003). Research has suggested that children at age 10-11 find it difficult to appreciate the absolute ages of fossils and the species they relate to; for example, one study found that when children of this age were asked to estimate when dinosaurs lived, answers ranged from “1000 years ago” to “millions of years ago”, and this could be down to guessing due to the children’s limited understanding of large numbers (Trend, 1998).

**Ways to use this question**

Students should complete the question individually. This could be a pencil and paper exercise, or you could use the presentation with an electronic voting system or mini white boards.

The answers to the question will indicate whether students appreciate that our knowledge of dinosaurs and other organisms that lived and died so long ago comes from fossils, that humans were not alive at that time to record observations, and that the depictions with which students are most familiar (e.g. in books and museums) are not the source of our knowledge about these organisms but are themselves based upon evidence from fossils.

*Differentiation*

You may choose to read the question to the class, so that everyone can focus on the science. In some situations it may be more appropriate for a teaching assistant to read for one or two students.

**Expected answers**

C – From fossils of their remains.

**How to respond - what next?**

If there is a range of answers, you may choose to respond 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. Responses often work best when the activities involve paired or small group discussions, which encourage social construction of new ideas (meaning making) through dialogue.

If students have misunderstandings about the relative ages of fossils and the organisms from which they are formed, the following BEST ‘response activity’ describes a small-group discussion task in which students assemble a timeline using relative and absolute ages. It could be used in follow-up to this diagnostic question:

* Response activity: The year of life

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Developed by Alistair Moore (UYSEG).

Images: pixabay.com/AzDude (284554)

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