

## Graphic Organisers in Education

### **Abstract**

Visualisation of information is a key technique to enhance learning. Information is commonly displayed in the form of a diagram to make it easier to understand.

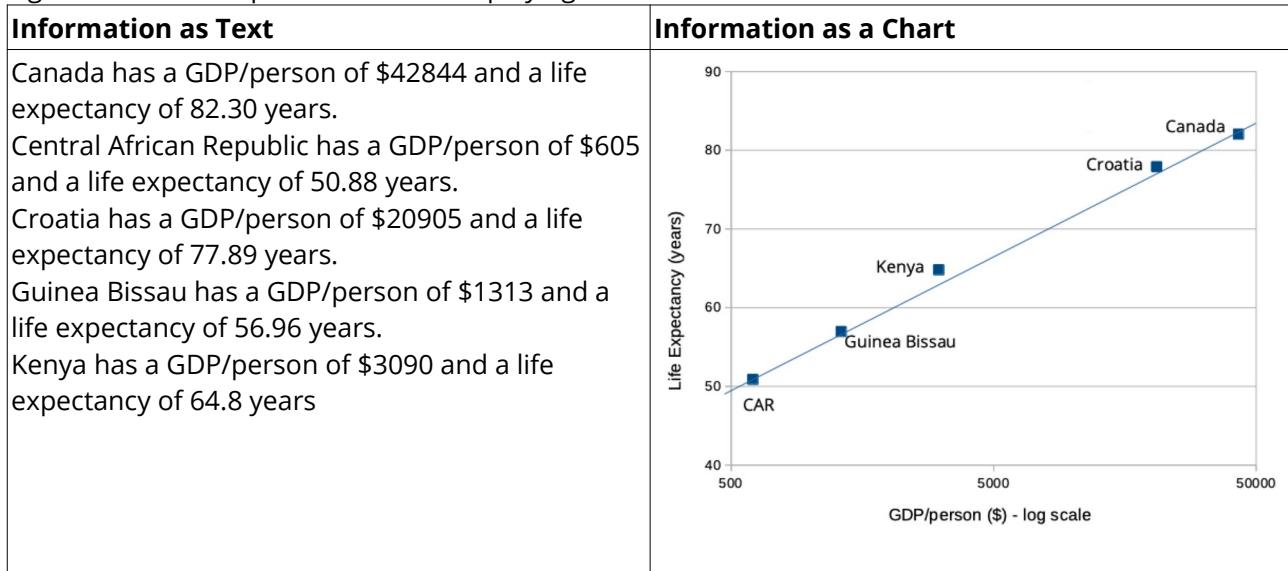
A **graphic organiser** is a diagram which visualises relationships between facts, concepts, or ideas. Endoxa Learning uses diagrams called **argument graphs** to represent arguments, rather than paragraphs of prose. It therefore acts as a graphic organiser for arguments, with similar benefits as those used in other parts of education.

### Using Diagrams in Education

Visualisation of complex information is very common in education and elsewhere. Diagrams of many different kinds are used because they are often simpler for students to understand than presenting information as blocks of text or numbers.

A familiar example is a chart. Charts are used to represent numerical information. There are various kinds, such as bar charts, pie charts, scatter charts, and so on. It is clear that using a chart to represent numerical information can promote learning by making it easier to understand – see fig. 1.

Fig. 1: Charts are superior to text at displaying numerical information



Charts are so commonplace that it is hard to remember that they were once an invention. There are no pie charts carved on the walls of Egyptian pyramids and no one was plotting data on x-y axes before Descartes. The axes, the data points and every other part of a scatter chart are a graphical convention that was once invented and then taught to students. (And took a while before it became accepted.) This is true for all forms of data visualisation.

Nowadays diagrams representing information are widely used within education. There is a lot of theory and practice supporting their use, in particular dual coding theory.

### Problems with Argumentative Prose

Arguments are normally written as prose in essays and books. These sources consist of nothing but text, which makes them hard to grasp – just like the data in Fig. 1. But the problem for the student is actually much worse than that. For example, if a student is studying Philosophy, they might read the first three chapters of Paley's *Natural Theology* – a classic statement of the argument from design. There are over 10,000 words, making up about 360 (rather long) sentences. But where is the argument? Is it

all of these sentences, or just some of them? If the teacher asks the student to explain Paley's argument from design succinctly, how do they extract it from the text?

Fig. 2: Opening passage from Paley's "Natural Theology" (1802)

*IN crossing a heath, suppose I pitched my foot against a stone, and were asked how the stone came to be there; I might possibly answer, that, for any thing I knew to the contrary, it had lain there for ever: nor would it perhaps be very easy to show the absurdity of this answer. But suppose I had found a watch upon the ground, and it should be inquired how the watch happened to be in that place; I should hardly think of the answer which I had before given, that, for any thing I knew, the watch might have always been there. Yet why should not this answer serve for the watch as well as for the stone? why is it not as admissible in the second case, as in the first? For this reason, and for no other...*

In fact, prose is not a particularly good medium for representing argument. In a typical passage of argumentative prose, some of the sentences are part of the argument, but others are doing other jobs such as giving supporting facts or context, or are merely fluff which is padding out the writing. Worse, the overall structure of the argument is not explicit; arguments are usually highly branched, but prose is linear. The inferences used by the steps of the argument are typically signposted by signal words such as "therefore" and "so", but the way those inferences work is not specified. There is no simple way to inspect whether the reasoning is valid, all the necessary premises are present, and so on. Together, these problems make it very difficult for students to read argumentative prose and understand the arguments. This has long been recognised in the literature:

*"...argumentative prose contains many more sentences than just the propositions that are part of the argument, but also... proceeding necessarily linearly, the prose obscures the inferential structure of the argument."*<sup>1</sup>

If a way could be devised to visualise arguments, it could simplify the student's task and improve learning. This would have to fulfil several criteria: i. concentrate on the sentences which are part of the argument, making their relationships clear; ii. make the overall structure of the argument clear; iii. make the inference steps explicit.

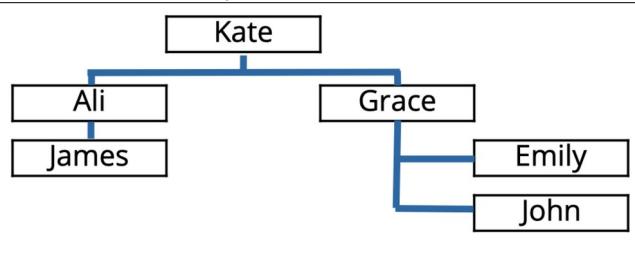
### **Graphic Organisers**

A graphic organiser visualises relationships between facts, concepts, or ideas using a diagram. Common examples are: a Venn diagram, a timeline, a flowchart, a mind map, or a story board.

Different types of graphic organiser deal with different kinds of information. Some are used to represent relationships between pairs of objects and these are typically drawn with boxes representing the objects and lines or arrows representing a relationship between them. A typical example is an organisation chart.

Fig. 3: An organisation chart is a graphic organiser for work-relationship information

An organisation chart is a familiar graphic organiser for work relationship information. The boxes represent people and the lines represent the "supervisor/subordinate" relationship, with supervisor placed above subordinate.

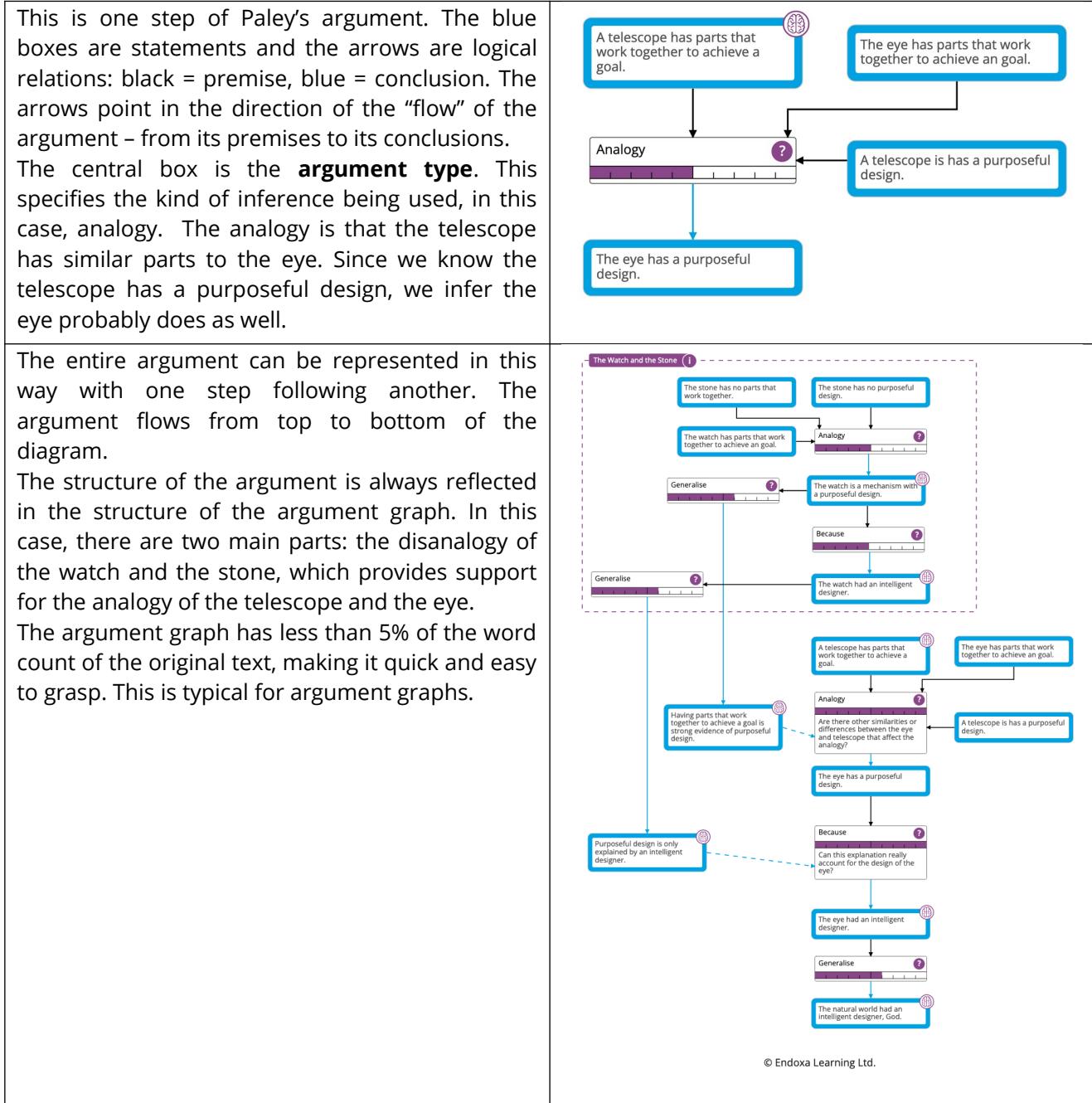


The key to a good graphic organiser is to shift some of the cognitive load of understanding from reading text to looking at the graphical elements. For example, in the organisation chart, once it is understood that a supervisor box is placed above their subordinate's box and connected to it by a line, then any organisation can be understood instantly. It's lot quicker than reading the information as text. Flow charts and mind maps are organised in a similar way.

### **The Argument Graph – A Graphic Organiser for Argument**

A similar approach can be used for arguments. An argument can be represented as a system of logical relationships between statements. The statements go in the boxes and the arrows show the logical relationships, such as being a premise or a conclusion.

Fig. 4: Argument graph of Paley's design argument



The criteria for an effective graphic organiser are met by the argument graph:

- i. It only shows statements which are part of the argument and the amount of text is reduced enormously; the logical relations between statements are shown by the arrows.
- ii. The structure of the argument is immediately clear.
- iii. The inference used in each step is specified using the argument types.

Once students have learned the meaning of the boxes and arrows, they can learn more effectively from an argument graph in Endoxa Learning than from a purely textual source. They can also use the graphical platform to create their own arguments.

This isn't just a theory. There is a lot of academic research into visualisation of argument showing that students' essay-writing and critical thinking performance improves if they study using argument diagrams rather than only from text-based sources – see our [white paper](#) for a selection of academic references.

In summary, the argument graphs in Endoxa Learning are a powerful graphic organiser for arguments, helping students grasp the material and giving them a visual medium in which to think further about it.

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#### References

1. Eftekhari, M. et al. (2018) Effectiveness of computer-assisted argument mapping for comprehension, recall, and retention *ReCALL* 30(3): 337–354. 2018