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From the Didactic to the Heuristic Use of Analogies in Science Teaching

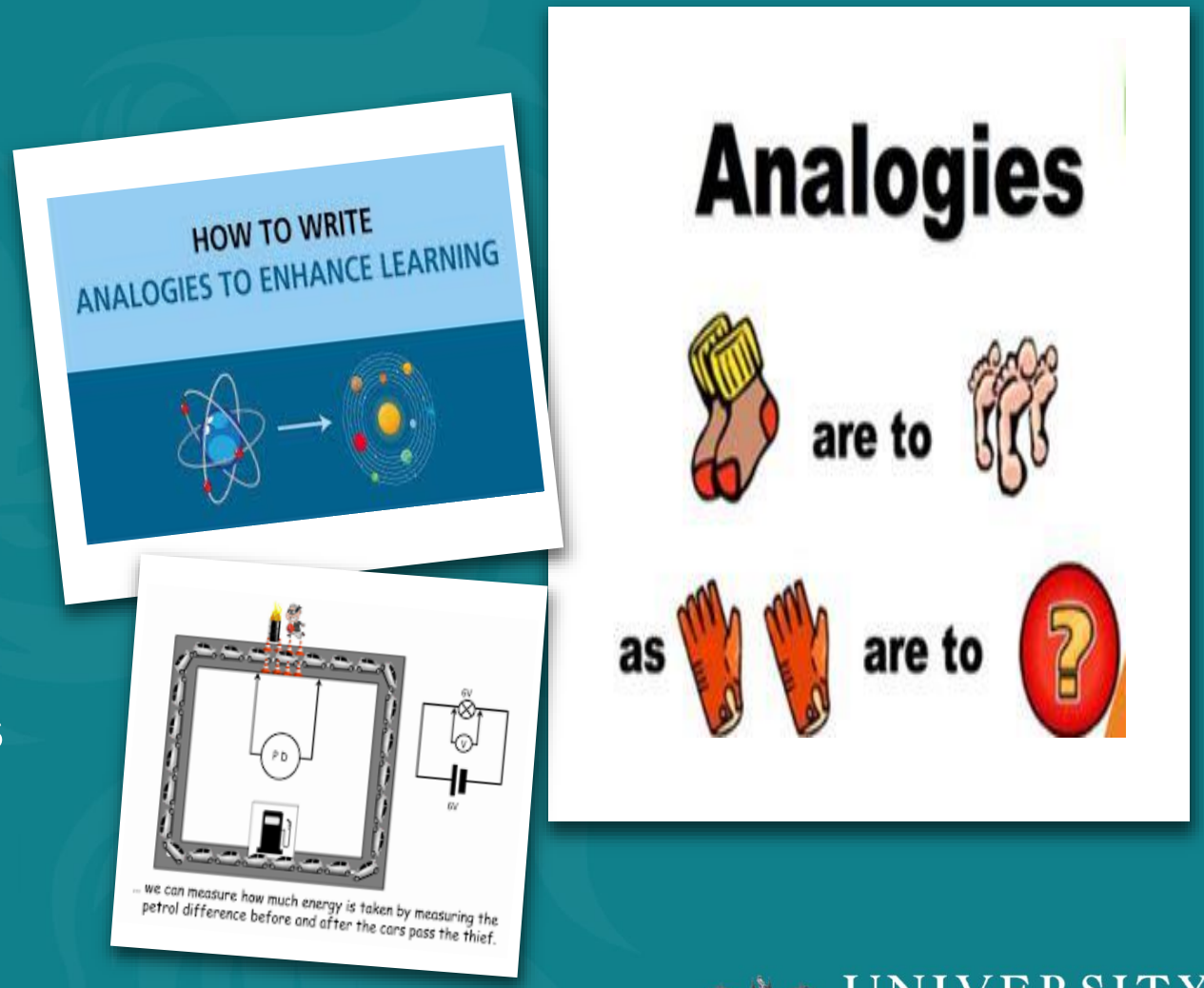
The Seminar focus

- The Didactic Use of Analogies

Teacher and Student Generated Analogies

- The Heuristic Use of Analogies

Student Generated Analogies



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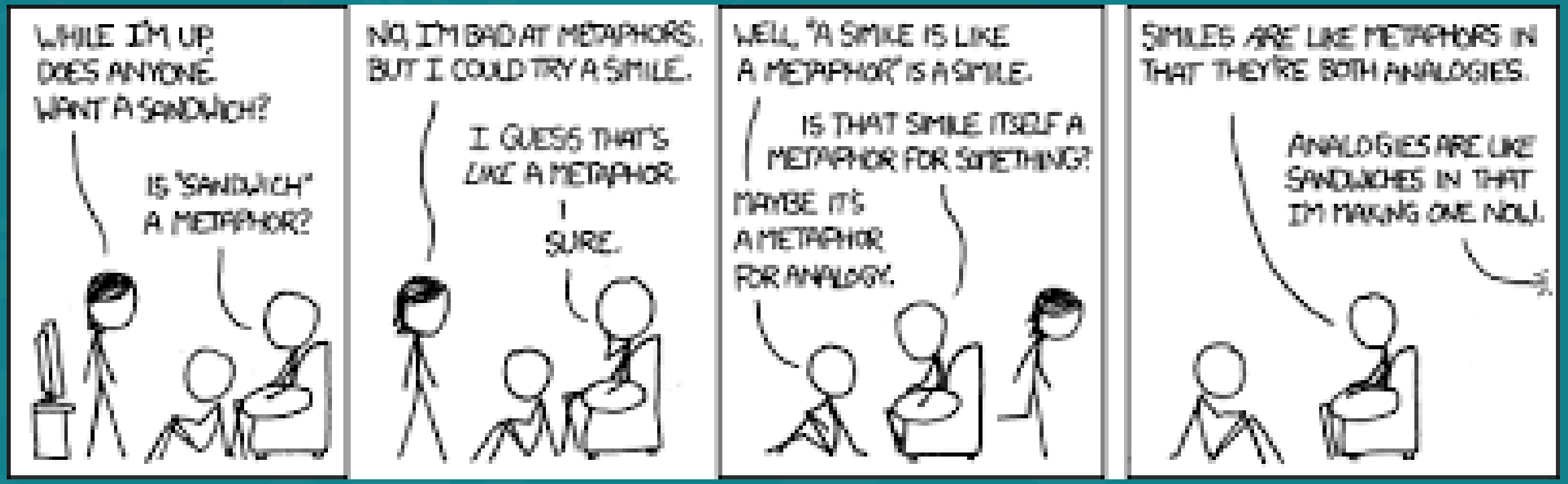

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Analogy

Analogy → relations between two (or more) things that are compared

Analogies have two main components:

the base and ***the target.***

the known situation which forms the basis to approach the target.

the unfamiliar situation that is under examination.

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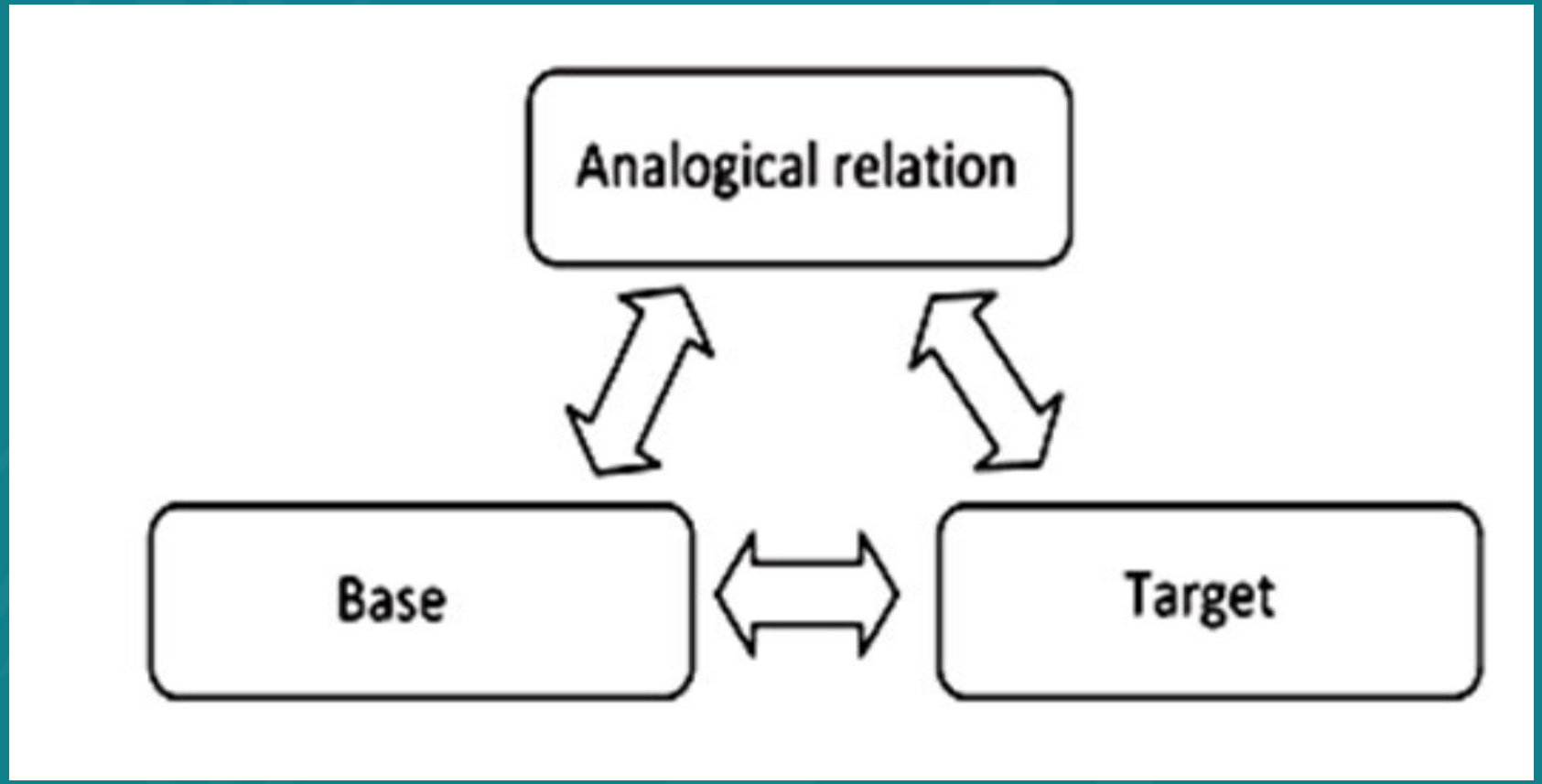

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Analogies are valuable as tools for reasoning and understanding

Better understanding of novel situations/phenomena and abstract concepts by allowing to see similarities between the unfamiliar and the familiar, between what is new and what is already known (Fotou & Abrahams, 2016).

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The Didactic Use of Analogies- Teacher Generated Analogies

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The Didactic Use of Analogies- Teacher Generated Analogies

A double-Edged Sword (Fotou & Abrahams, 2015).

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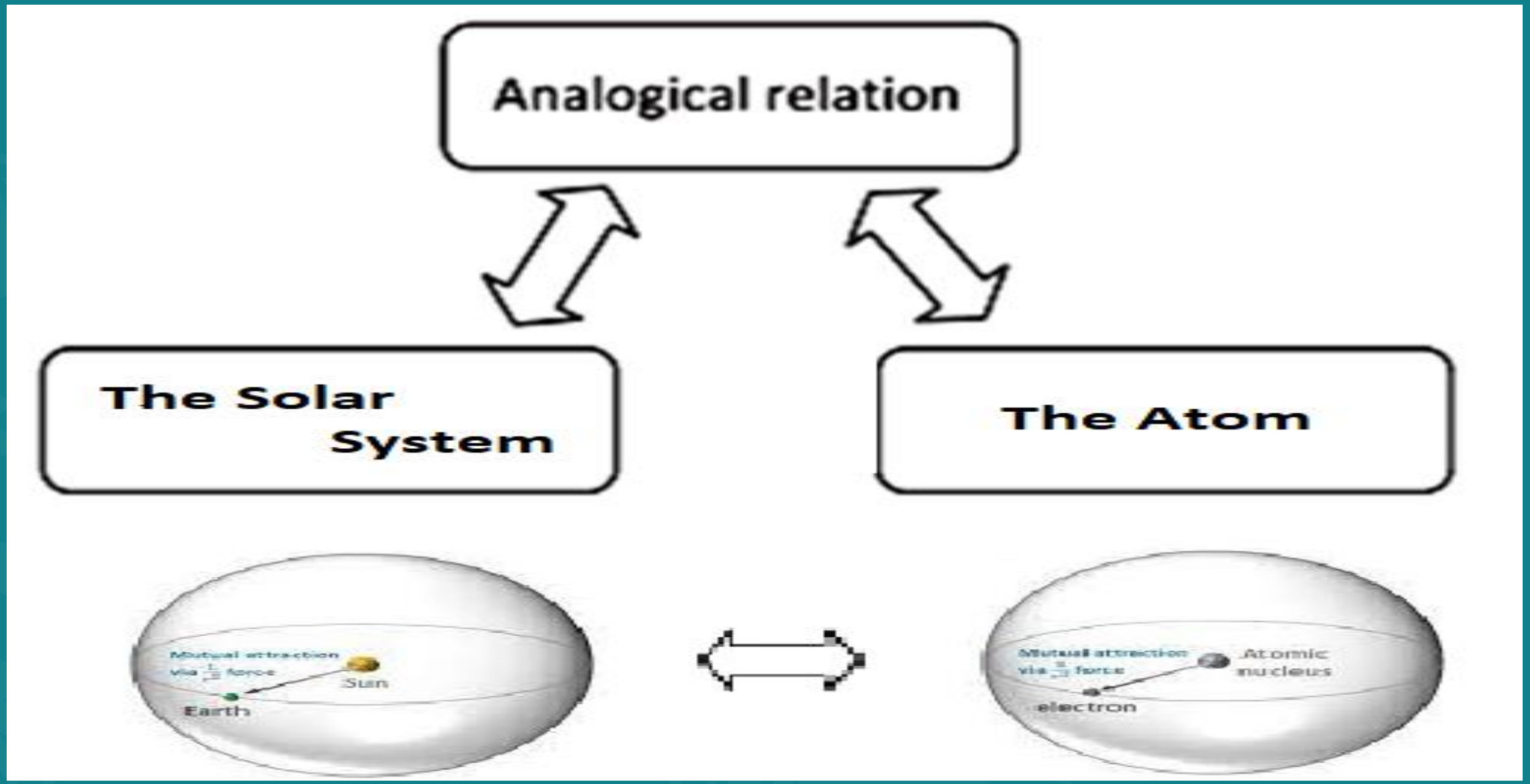

1. No or Underdeveloped knowledge of the base domain

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The base

A wide pipe resists less the flow of water than a narrow one and has more water flowing through

A narrow pipe resists more the flow of water than a wide one and has less water flowing through

The target

The circuit with the thicker wire has more current flowing through

The circuit with the thinner wire has less current flowing through ($I_1 < I_2$).

The water in the base situation is at the same pressure in both water tanks just like the applied potential difference has the same value in both circuits.

2. Analogy pushed too far/limitations not made explicit

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The Didactic Use of Analogies- Student Generated Analogies

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A self-generated analogy: An analogy that is created by the individual

A self initiated analogy: The analogy is spontaneously generated (without any provocation).

An analogy generated when students are prompted

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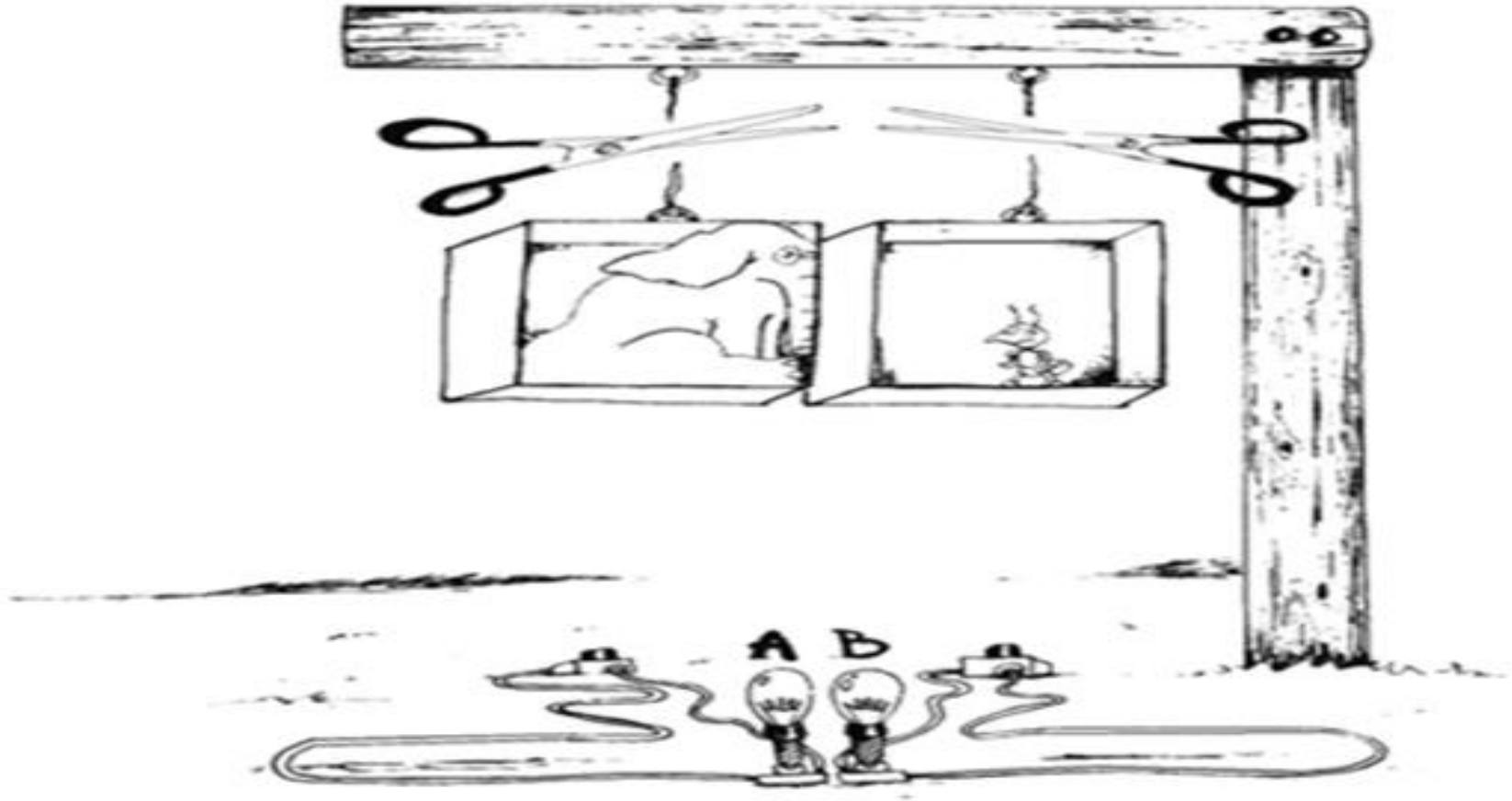

If the ropes shown in the figure are cut at the same time, will the bulbs be switched on at the same time or will one of them be first?

A) Both at the same time *B) Bulb A first* *C) Bulb B first*

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I think this is like when you have a ball and a feather. I have seen a ball falling faster on the ground than a feather. I have answered that the box with the elephant in it will fall faster, since the weight in it is greater and there is a greater force in that box than in the other one with the ant in it. The heavier always goes faster as in the case with the feather and the ball.

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As this response exemplifies, their responses showed that their unique prior knowledge, mostly experientially grounded, influenced the understanding of the ***novel*** situations as well as the analogy they generated to approach it and make their predictions.

The Didactic Use of Analogies- Student Generated Analogies

Student Self Generated analogies can serve as a diagnostic form of assessment revealing both the misconceptions students might hold as well as the prior knowledge upon which these are founded (Fotou & Abrahams, 2016, 2021).

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The Heuristic Use of Analogies- Student Generated Analogies

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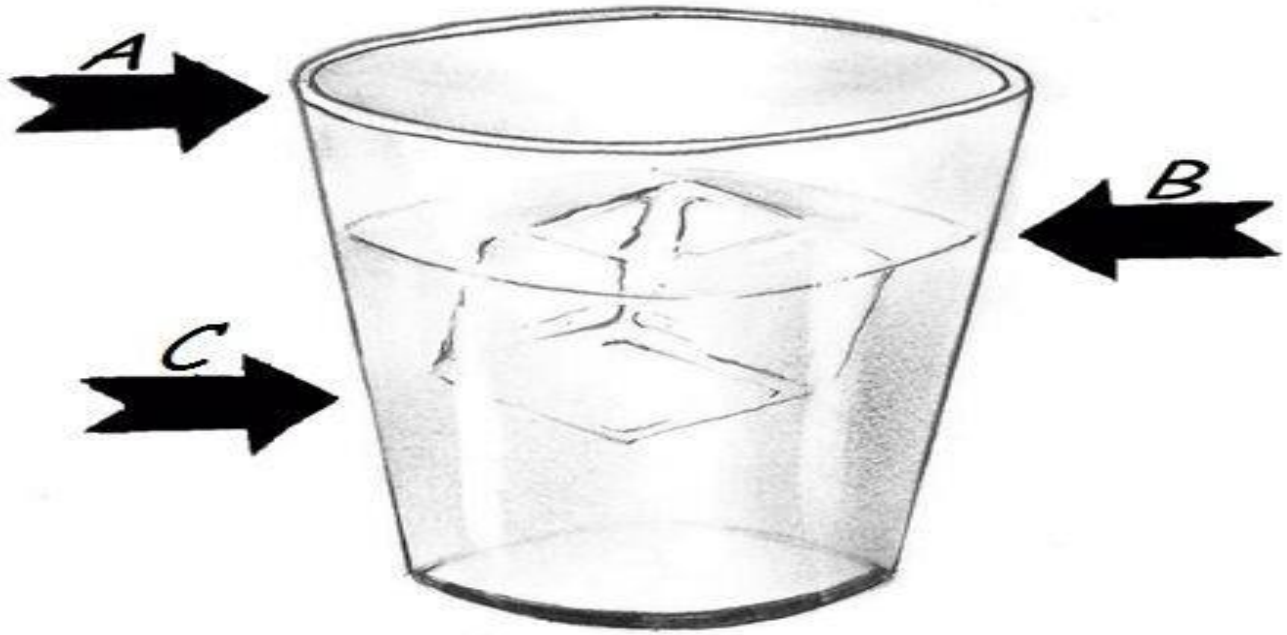
Student Generated Analogies, although frequently leading to erroneous predictions, do have the potential to lead to scientifically compatible predictions and understanding the new and unknown.



When the ice-cube melts, which of the three arrows will point at about the same level as the water level in the glass?

A) Arrow A B) Arrow B C) Arrow C

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I have answered B because if the ice cube, which is already in the water, is removed, the level will drop and if we put it back it will go back to level B therefore, when it will melt the level will remain the same. I mean that the water from the ice replaces the volume it held in the glass of water. ***It is like the case in which space is left when we use a scoop to take out an amount of sugar from a sugar vase****. When this amount is taken out the space is refilled and the level of the sugar in the vase decreases but in this case we do not take out the ice cube or the water coming from it. It melts but the water refills its space.*

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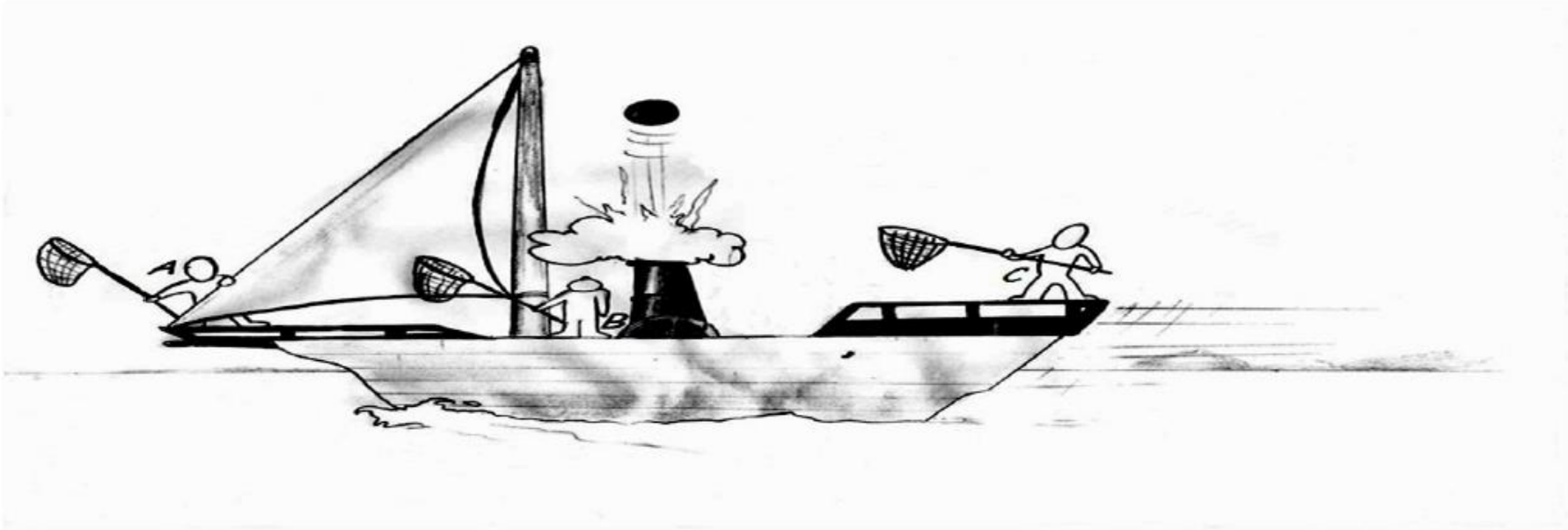

While the ship keeps on moving at the same speed, the cannon fires a ball (as the figure shows).

Which person is more likely to catch the ball?

A) Person A *B) Person B* *C) Person C*

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I answered that person B is more luckily to catch the cannonball. I believe that as long as the boat continues moving at the same speed the cannonball does the same and this is why it falls at the same point from which it was fired. It the same with being in a bus and we toss a pen in the air. It lands in the same in the same spot, in our arms.

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- As the origin of the word heuristic (εὑρίσκω-heurískō, “I discover/find”) an heuristic use of an analogy enables the students to creatively use a familiar situation to generate expectations with respect to their outcome by transferring aspects from the base to the target.

- For the teachers, such student generated heuristic analogies can be productively used in the process of introducing/teaching new concepts/phenomena with the base situations and the knowledge they mobilise when drawing them

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Student Generated heuristic Analogies

Analogies *more likely to be familiar to other students' repertoire and knowledge system than that of their teachers and thus more effective?*

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Thanks for Listening

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References

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