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# On the Role of Analogies Beyond Their Didactic Purpose

# Analogy

Analogy  symmetrical 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.

Analogies are valuable as tools for reasoning and understanding



better understanding of new situations by allowing to see similarities between the unfamiliar and the familiar, between what is new and what is already known (Goswami, 1992; Kim & Choi, 2003).

# Analogies

- Provided for didactic purposes
  - Spontaneous
  - Self-generated

# Examining students' predictions in novel situations

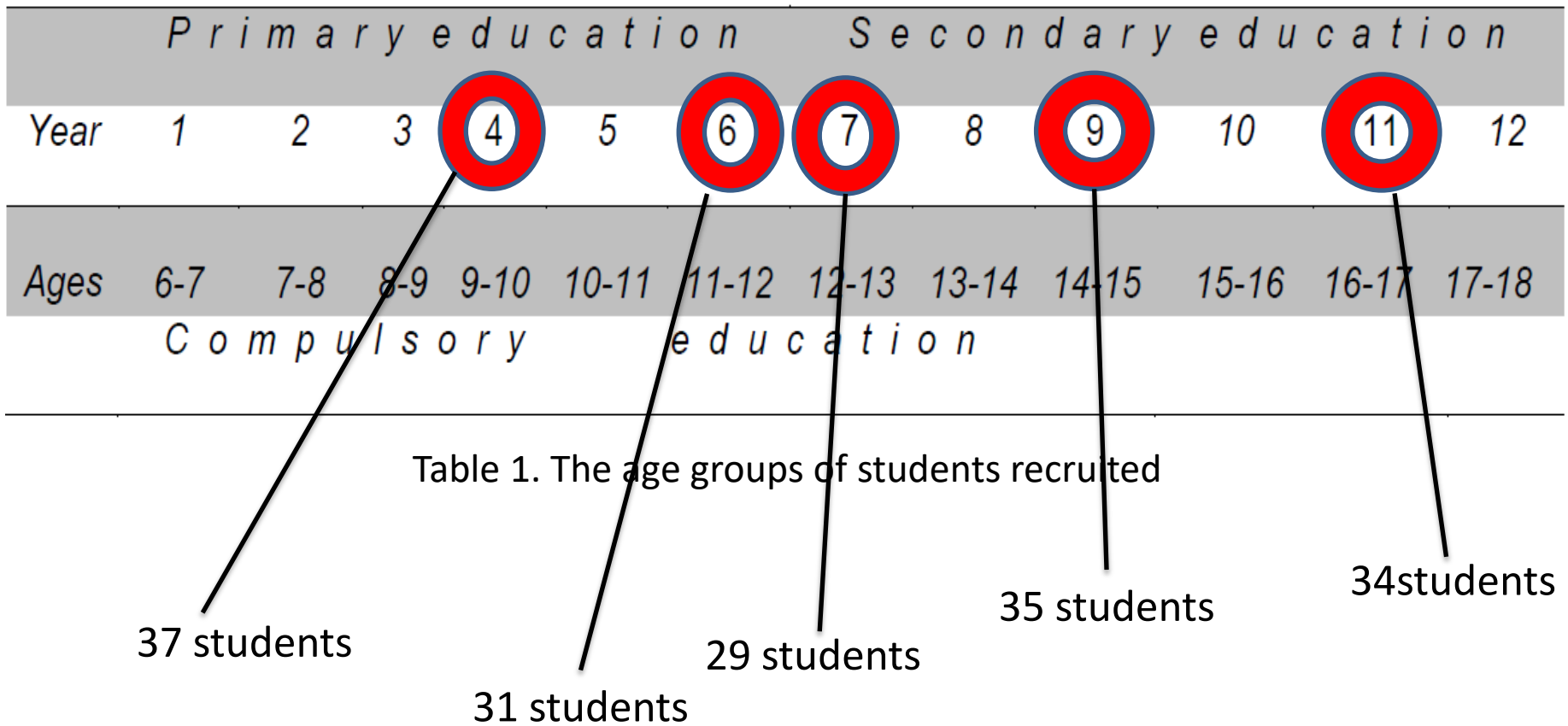
# The research questions:

- a) What predictions do students make about novel situations?
- b) How do students of different ages make predictions about novel situations?
- c) To what extent do students generate analogies in order to make their predictions?
- d) To what extent do students of different ages draw upon similar analogies?

# Methods

- Multi methods - combination of interviews and questionnaires.
- Ten different schools, one single class from each.

- A sample of 166 students:







# Study Results

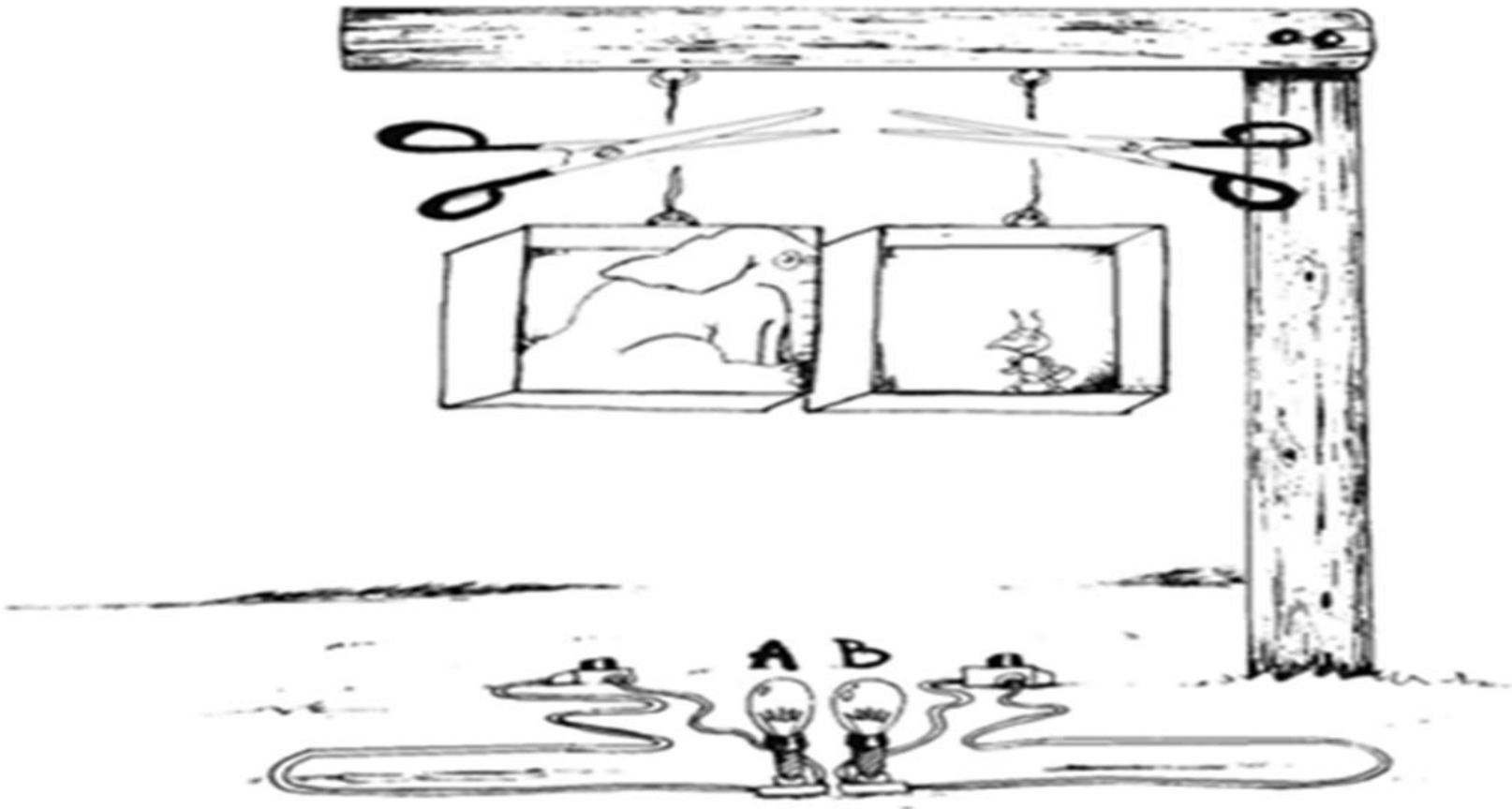
- 226 correct answers out of the 996 predictions ( $\approx 23\%$ ). There was not statistical significant difference between students' predictions and their age.
- Many of the students (4/9 at least) self-generated analogies in order to familiarise themselves with the novel situations they were presented with and make, in this way, a prediction.
- Statistical analyses demonstrated no interaction between age and the use of analogies.
- The vast majority of the analogies identified (87%) were spontaneously generated.

# Diagnosing misconceptions through self-generated analogies



The analogies revealed that students held a variety of ideas which were inconsistent with the scientific account.

# Weight and gravity novel situation



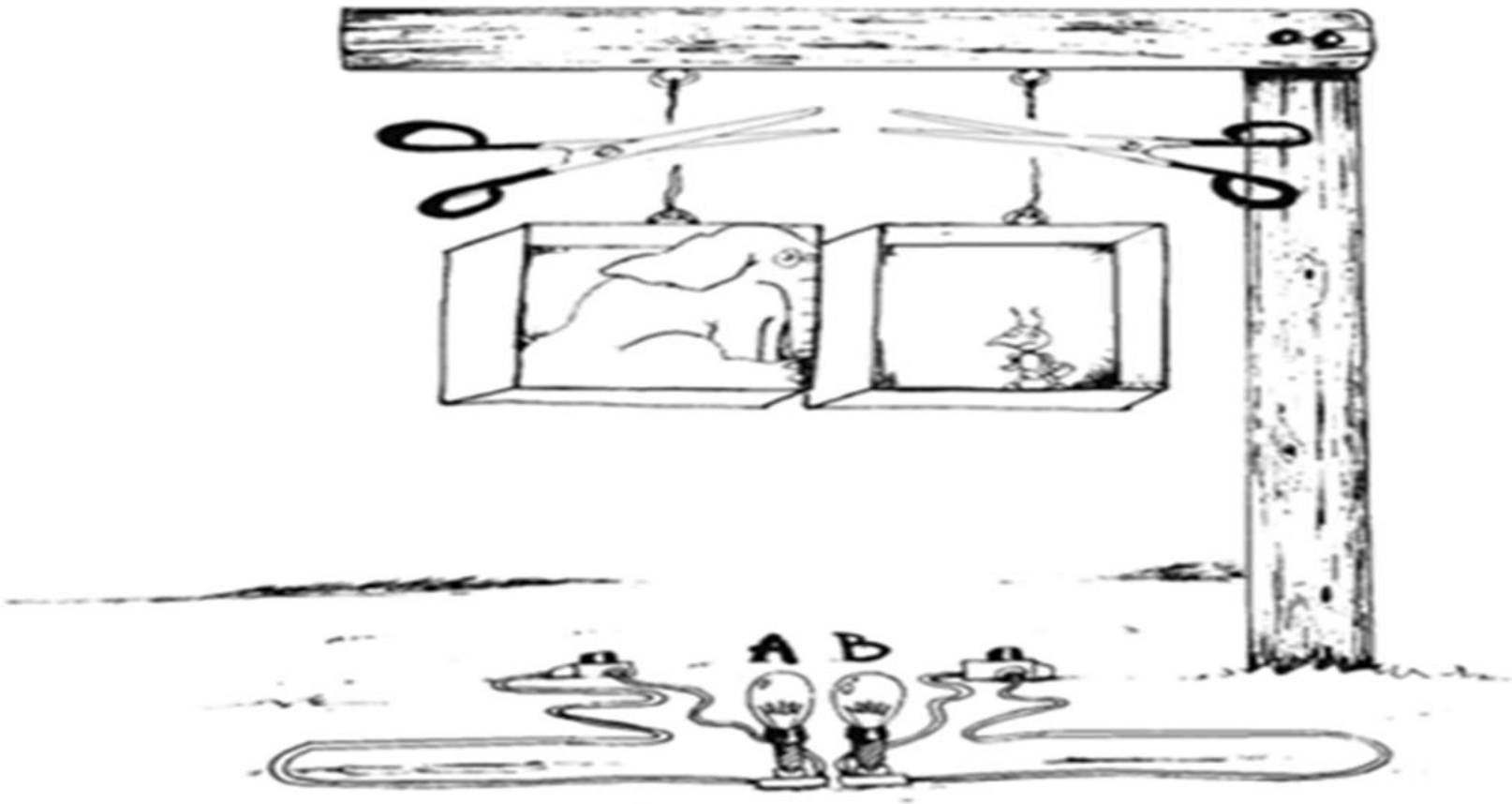
*If the ropes shown in the figure are cut at the same time, will the bulbs be switched on at the same time or will one of them be first?*

*A) Both at the same time*

*B) Bulb A first*

*C) Bulb B first*

# Weight and gravity novel situation



*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*

2%

2 out of the 3

87%

117 out of the 144

11%

3 out of the 19

Students made their predictions by reasoning on the basis of self-generated analogies which were drawn on similar and, in many cases, identical everyday life experiences.

Consider, for example, the following response given by a 17-year-old student in this novel situation:

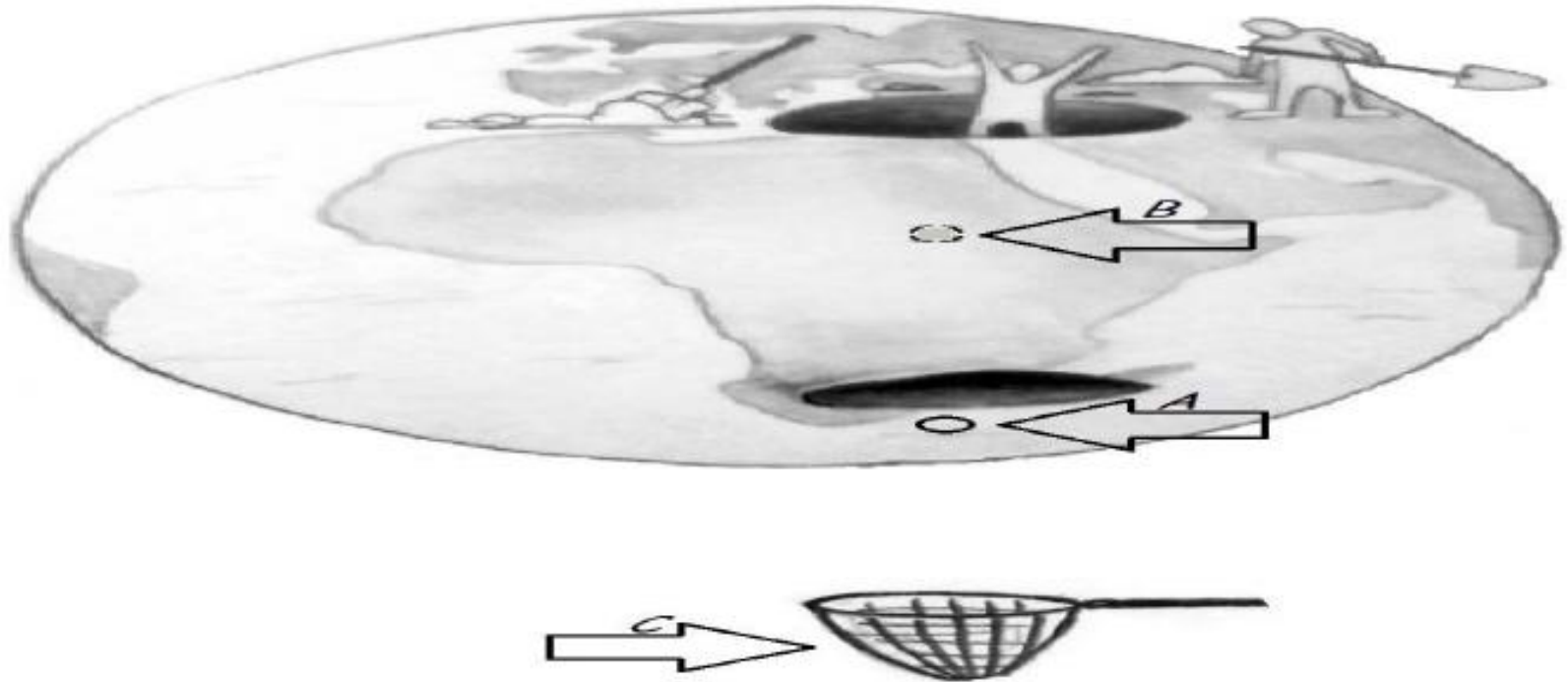
*“I think this is like when you have a ball and a feather. I have seen a ball falling faster on the ground than a feather. I have answered that the box with the elephant in it will fall faster, since the weight in it is greater and there is a greater force in that box than in the other one with the ant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

# Heavier always goes faster misconception

It is from a very young age students had seen objects of different mass, like bricks and pebbles or olives and olive leaves –to name a few of the analogies they self-generated- which were left to fall from the same height reaching the ground in different times.

In these analogies students articulated a rather common misconception that has been reported in many previous studies with students of similar ages. According to this misconception, the heaviness of an object is seen as being related to its falling speed - a view that is even held by university undergraduate students (e.g., Gunstone & White, 1981).

# Objects falling in holes dug into the Earth



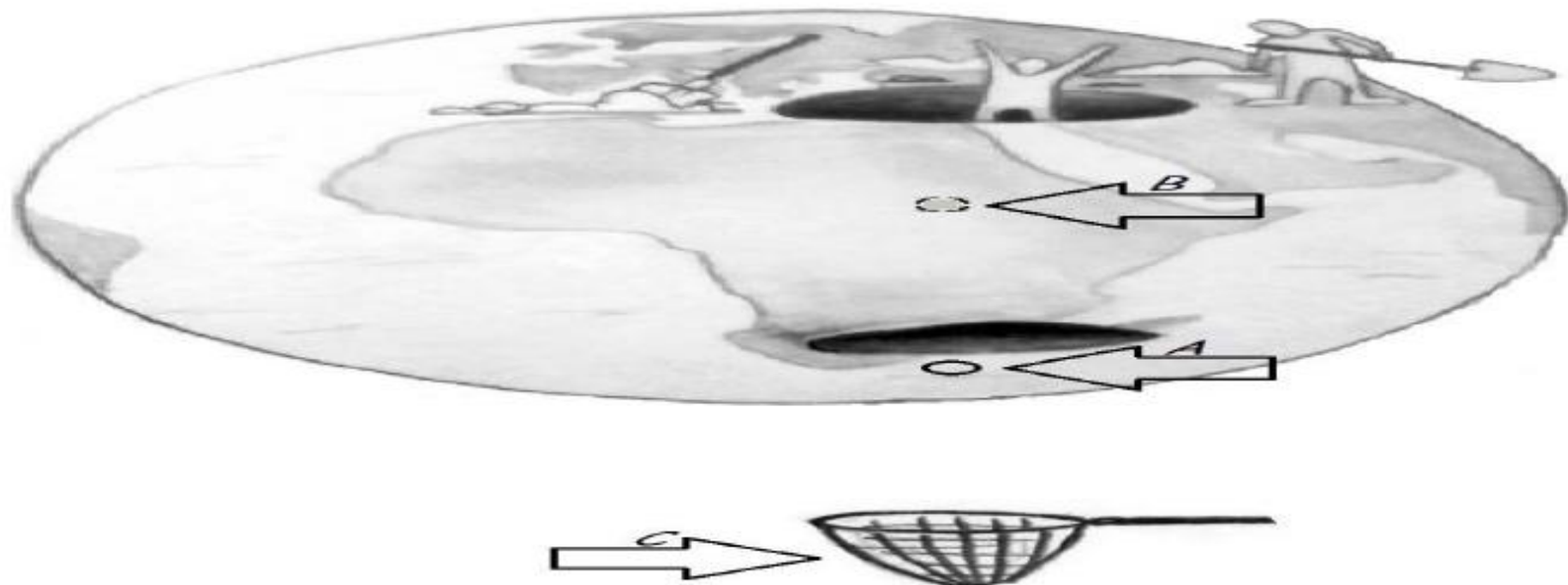
Two people have dug a huge tunnel straight down from the one side of the earth to the other (as shown in the figure) and one of them jumps in. Where will this person stop?

A) On the other side of the tunnel

B) In the middle of the tunnel

C) In the net

# Objects falling in holes dug into the Earth




Two people have dug a huge tunnel straight down from the one side of the earth to the other (as shown in the figure) and one of them jumps in. Where will this person stop?

A) On the other side of the tunnel

21%  
5 out of the 30

B) In the middle of the tunnel

 12%  
1 out of the 19

C) In the net

70%  
66 out of the 117



*“I think that the person will fall into the net. It is like the holes we dig on the beach. When I do so, I can see water going from the one side of the hole to the other.”*

*(4<sup>th</sup> grade student)*

*“I chose A. I think that the person will stop on the other side of the tunnel. I have observed that when you drop a thing in a hole it falls downwards. Same here, the person will go down to the other surface of the Earth.”*

*(11<sup>th</sup> grade student)*

Misconception of an absolute view of down inconsistent with the scientific view of an Earth-referenced understanding (down related to the force of gravity being exerted from the Earth to an object and pointing towards its centre).

# Implications for teaching

- Students' self-generated analogies can serve as a diagnostic form of assessment revealing their prior to instruction knowledge which gives rise to misconceptions.
- Such assessments could provide teachers with valuable information about students' understanding which can serve as a starting place for the introduction of new scientific concepts.

Teachers also need to better understand how students use that prior, often experientially grounded everyday knowledge, when thinking about new phenomena and situations.

The use of analogies students self-generate can provide the teacher with an understanding of the ways in which students apply such real-world knowledge.

In this respect, a better understanding of the self-generation of analogies and their application could be a valuable tool in assisting teachers to address students' misconceptions.

# *Key references*

- Goswami, U. (1992). *Analogical Reasoning in Children*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Gunstone, R. F., & White, R. T. (1981). Understanding of gravity. *Science Education*, 65(3), 291-299
- Huxley, T. H. (1894). *Science and Education* (Collected essays, Vol. III). New York: Appleton.
- Kim, M., & Choi, K. S. (2003). Access to structural similarity in the analogical problem solving of children. *School Psychology International*, 24(2), 218-231.