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A laboratory path for 9-11 year-old children

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ABSTRACT. Several studies have shown that both students of all ages and adults hold many misconceptions about fundamental astronomy concepts. One of the most common misconceived concepts concerns seasons. The main difficulty appears to be the understanding of the mechanism that drives this phenomenon. Since a few years, the Planetarium of Torino offers a 1-hour laboratory to primary school students where it is demonstrated how seasons work. The laboratory consists of a short explanation of the concept and of a practical demonstration of the phenomenon leading to the seasons. Afterwards students are asked to fill in a questionnaire. We aimed to evaluate how successful the laboratory was in terms of short- and long-term understanding of the concept. We focused on questionnaires filled in by 9-11 year-old students who attended the laboratory the last two years. The analysis highlighted a decent comprehension of the phenomenon not only in short-term timescale, but also in the long-term perspective. It pointed out the need to create a learning progression consisting of pre-activity sessions based on sky observations and post-activity sessions performed by the teachers aimed at fixing and fostering the concepts tackled during the entire path. Despite the preliminary stage of this program, our research suggests some crucial interventions to improve the learning process demonstrating the importance of continuing this project in the future.

Most common mistake:

Seasons are the effect of variable Sun – Earth distance

Why?

1) Often people try to derive unknown answers from the known concepts

for example: when you are more distant from a hot source you feel less heat

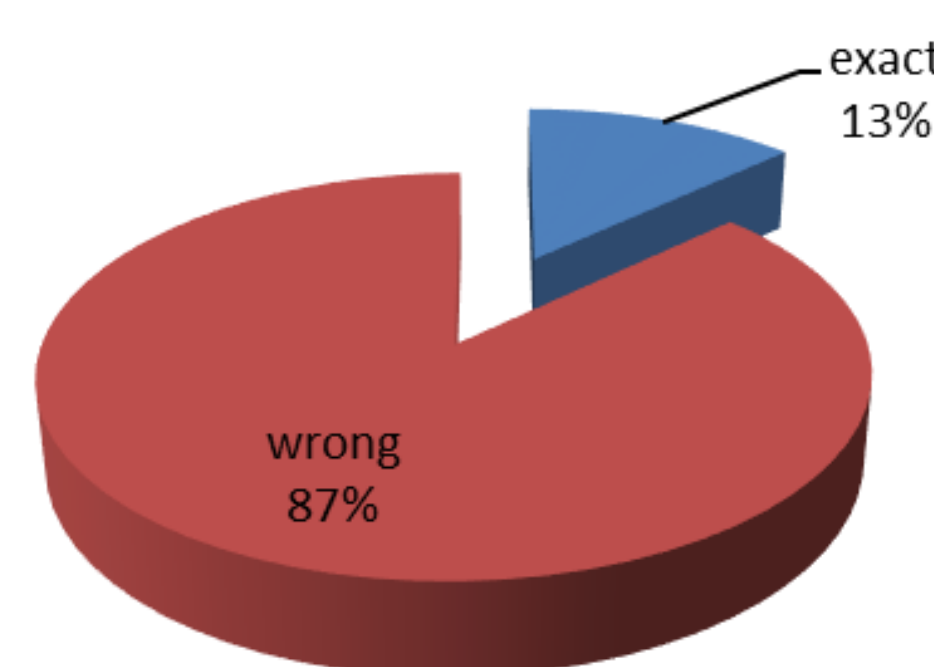
2) Often books show a very elongated Earth orbit

Positive results to a test on season mechanism:

- University students 36,3%
- Future Physics teachers 27,1%
- Future primary school teachers 25,0%
- Test class 27,8%

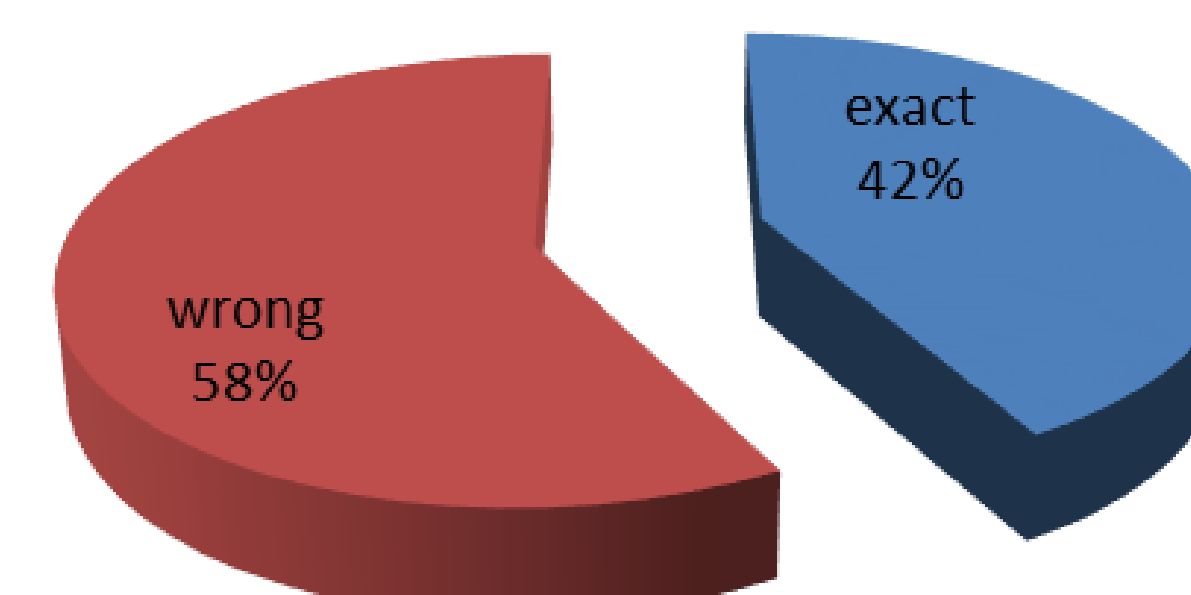
From "Teaching Future Teachers Basic Concepts – Seasonal Changes – at a Time of Reform in Science Education" di Ricardo Trumper)

V class of primary school children before laboratory



The effect of the Laboratory

V class of primary school children after laboratory



The Laboratory



FEATURES :

- Orbit with zero eccentricity
- Fixed inclined globe that moves on the plane with fixed distance from the Sun
- Energy flux measured by a solar panel in different positions on the globe

Preliminary conclusions:

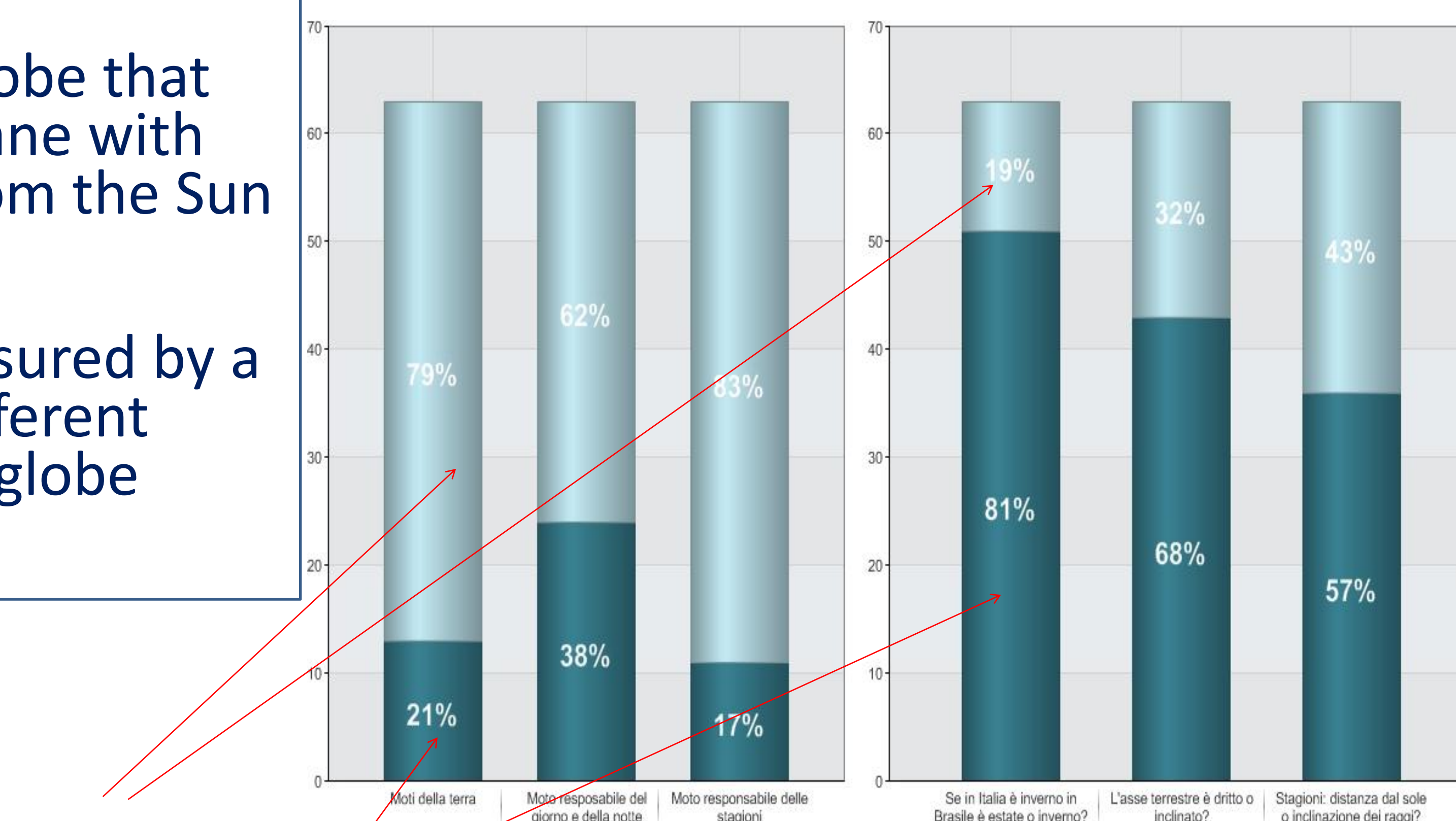
Important observations to do before the Laboratory :

- Different number of hours of light during the year
- Different length of shadows during the year
- Different temperature during the year

Preliminary conclusions:

Concepts to learn:

- Earth axis inclination
- Solar ray inclination on Earth surface
- Different solar energy flux absorbed



Notionistic knowledge

Conceptual knowledge

One year after the laboratory