

# Investigating the interplay of practical work and visual representations on students' misconceptions: the case of seasons

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**Abstract.** The paper aims at investigating to which extent the interplay between practical work activities and visual representations is effective in addressing students' misconceptions about seasonal changes. To this aim we designed a 8-hours teaching sequence in which students: (i) explore the radiation flow using a photovoltaic panel as a function of the incidence angle and distance from the source; and (ii) use specially designed visual representations about seasonal change. A sample of 88 prospective primary teachers was involved in this study. Analysis is in progress and results will be discussed at the conference

## 1 Introduction

Previous research studies have shown how much students' misconceptions about seasonal changes are resistant to traditional teaching [1]. Moreover, some authors have pointed out the difficulty in reading and interpreting images as factors that may influence the persistence of such misconceptions [2]. In a previous paper [3], we showed that specially designed images may be more effective than textbook images in helping students overcome such misconceptions. However, we have also shown that practical activities with a photovoltaic panel may enhance students' understanding of seasonal changes [4]. In this paper, we aim at investigating the effectiveness of a teaching sequence that blends both practical activities and specially designed images. The research question that guided the study was: *to what extent the interplay between practical work activities and visual representations is effective in addressing students' misconceptions about seasonal changes?*

## 2 Methods

### 2.1 Research Design

For the present study, we designed three instructional contexts: 1) practical work + textbook images; 2) practical work + specially designed images; 3) practical work + no images. During the practical work activity, the students, in small groups, were given a photovoltaic panel and an incandescent light bulb and measured the output voltage of the panel as a function of its inclination and distance from the source (Figure 1a). Details are reported in [4]. Two commonly used textbook images about seasonal changes were chosen for context 1). For context 2), we designed two diagrammatic images in which the Earth's orbit is circular and sunrays inclination on the ground is explicitly represented (Figure 1b). Details are reported in [3]. In context 3) the students after the practical work were given a short booklet without any image.

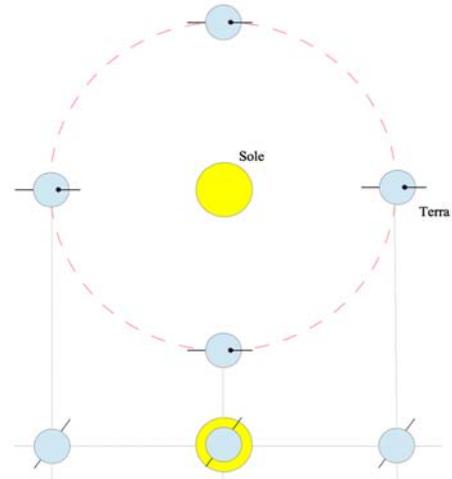


Fig. 1 The experimental setup used during the practical activities (a) and the specially designed image about seasonal changes (b)

## 2.2 Instrument and data analysis

To answer our research question, we adopted a pre-post design using an instrument that featured three tasks: written task, drawing task, multiple choice and true/false items. In the written task, students were asked to explain the change of seasons in words. In the drawing task, students were asked to explain the phenomenon using a drawing. Two multiple choice and 6 true/false items completed the instrument. To analyze students' drawings and explanations we used two rubrics developed in [3].

## 2.3 Sample

The intervention was proposed to a class of 88 prospective primary school teachers at the third year of the combined bachelor and master degree in Primary School Education of the Italian University of Verona in the framework of the 72 hour course "Foundations and Didactics of Physics". Students were divided into the three instructional contexts described above: 30 in context 1), 30 in context 2), and 28 in context 3). Overall, the activities took about 8 hours for each group.

## 3 Results and conclusions

Analysis of pre- and post-test in progress. We will present the main results at the conference.

## References

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