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# An educational experimentation on surface phenomena with elementary school pupils

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**Abstract.** Educational approaches to surface phenomena at elementary school are almost non-existent. Very little is known about the level of understanding of some specific properties of liquids connected with surface tension at this schooling level. Here, we report the results of a comparison between two educational paths about surface phenomena. We show the results of a quantitative analysis of answers given to a questionnaire and also discuss the outcomes of a qualitative analysis.

## 1 Introduction

Educational approaches to surface phenomena at elementary school are almost non-existent. Very little is known about the level of understanding of some specific properties of liquids connected with surface tension at this schooling level [1,2].

Here, we report a comparison between two educational paths on surface phenomena at elementary school. Two open-ended questionnaires consisting of questions that refer to everyday life phenomena and two educational paths, both based on laboratory activities, were designed. We administered the questionnaires to a student sample made of 42 third-year elementary school students randomly divided into two groups (control and experimental groups). The experimental group attended an IBSE-based path in which pupils were encouraged to be active part in carrying out the proposed experiments. The control group attended a more traditional path in which the teacher carried out the experiments and presented the results to the pupils. We studied and compared the two educational paths through quantitative analysis of answers given to a questionnaire. We go in depth to the comparison by the outcomes of a qualitative analysis based on interviews, and other material produced by the pupils during the activities.

## 2 Results and conclusions

In the first analysis, we categorized the responses by founding the common conceptions. Subsequently, distinguishing them through the two categories, common knowledge and scientific knowledge.

The results obtained with the pre-instruction questionnaire showed a poor understanding of the phenomena related to surface tension in an equivalent way between the two groups. Moreover, a high percentage of unanswered answers was found.

At the end of the activities, the percentage of not given answers was very low. Moreover, an improvement in the quality of explanations and interpretations of the proposed phenomena was highlighted. No significant difference between the two groups was found.

However, the ongoing analysis highlighted a greater interest and a greater propensity for participation by pupils belonging to the experimental group. It was very satisfying to see how the pupils belonging to the experimental group built their knowledge autonomously, seeing them try the same experiment several times because they did not obtain the expected result or because they wanted to observe it again to grasp other facets. They provided a higher number of comments, questions and considerations throughout the experimental activities and during the lectures, reasonably demonstrating the greater aptitude of an inquiry-based approach to interest and involve pupils.

## References

- [1] Sari Havu-Nuutinen, Sirpa Kärkkäinen, Tuula Keinonen Primary, School pupils' perceptions of water in the context of STS study approach International, Journal of Environmental & Science Education 6(4), 2011 321-339.
- [2] Annika Åkerblom, Daniela Součková, Niklas Pramling, Preschool children's conceptions of water, molecule, and chemistry before and after participating in a playfully dramatized early childhood education activity, Cultural Studies of Science Education 14, 2019 879-895.

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