

## Focusing Professional Development for Science Teachers on Student Learning

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### Objectives and significance of the study

This study investigates the effects of professional development for science teachers on student learning. It is usually expected that professional development programs positively impact student learning, however this dimension is not commonly incorporated in the programs evaluation. It is simply assumed that students will be indirectly impacted through their participating teachers in the work with their students. Two main research questions are addressed: 1) Are professional development programs effective in enhancing student learning in science? 2) What are the characteristics of the most and least effective programs?

### Underlying theoretical framework

A theoretical framework for the impact of professional development on student learning has been developed, grounded on Guskey's (1986) model of the teacher change process, and Loucks-Horsley et al. (1998) model for designing professional development programs for teachers of science. This framework centers the whole process of professional development on student learning, and emphasizes the necessity of research evaluating the effectiveness of professional development as a function of its impact on student learning.

An international perspective has been adopted, reviewing literature on professional development for science teachers across the world. As Scott, Stone and Dinham (2001) point out "teachers everywhere enter the profession to serve children" (p.13). What is more, they all struggle to improve their practice and teaching through professional development.

### Research design and procedure

To answer the proposed research questions a meta-analysis of 37 professional development programs reporting their impact on student learning was performed. Program characteristics have been defined according to the categories defined by Loucks-Horsley et al (1998), the National Science Education Standards (NRC, 1996), as well as new categories developed by us analyzing other variables such as the length of the program. Moreover, a Fixed Effects Model was used to differentiate between

the impacts of the different characteristics of professional development programs for science teachers.

### Findings

A significant impact of professional development for science teachers on student learning has been found in the form of an overall correlation effect size of  $r = 0.22$  ( $p < 0.001$ ). In particular, programs emphasizing work on curriculum development or implementation, scientific inquiry, pedagogical content knowledge, and lasting over 6 month and with a total duration of at least 100 hours have been identified as having a larger impact on student learning.

To enhance the findings vignettes have been developed based on the attained effect sizes describing possible professional development programs. These vignettes are driven by the quantitative results from the meta-analysis. These results are the backbone or framework from which the description usually present in a vignette emerges. Recommendations for present and future professional development programs are made based on what works best in order to maximize their impact on student learning.

### References

- Guskey, T. R. (1986) Staff development and the process of teacher change. *Educational Researcher*, 15(5), 5-12.
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- Scott, C., Stone, B. & Dinham, S. (2001) "I love teaching but ..." International Patterns of Teacher Discontent. *Education Policy Analysis Archives*, 9(28), pp. 1-7.