

Research Project (2013–2017): Science-Related Outcomes of Education

EASI Science (Early Steps Into Science)

Effects of Early Science Education Offerings on Science-Related Competencies of Early Childhood Professionals and Children

Background and Research Questions

The aim of the research project was to gain knowledge about the science-related outcomes of education in early childhood. The focus lay on the science-related competencies of the children, on the one hand, and of the education professionals at early childhood education and care centres, on the other. These competencies were investigated with regard to the dimensions of the goals of early science education.¹ A further aim of the project was to develop reliable and valid instruments for the measurement of science competence in early childhood professionals and children. The study was funded by the “Haus der kleinen Forscher” Foundation and the German Federal Ministry of Education and Research (BMBF).

The following questions were the focus of the study:

1. *How can the structure of the science-related competencies of early childhood professionals and children be described and measured?*
2. *Does education have an effect on the science-related competencies of early childhood professionals and children? Are there differences between institutions with and without a science education focus (“Haus der kleinen Forscher” focus, other science focus, no science focus) and do the educational outcomes depend on the professionals’ participation in continuing professional development (CPD)?*
3. *What is the connection between the quality and frequency of the implementation of science education offerings at the institution and the competencies of education professionals and children?*

¹Anders, Y., Hardy, I., Pauen, S., & Steffensky, M. (in print). Goals of Science Education Between the Ages of Three and Six and Their Assessment. In Stiftung “Haus der kleinen Forscher” Foundation (Ed.), Scientific Studies on the Work of the “Haus der kleinen Forscher” Foundation. Springer Science+Business Media: Dordrecht (NL).

Implementation

One hundred and ten early childhood education and care centres from the metropolitan areas of Berlin, Jena, Kiel, Münster, and Frankfurt participated in the study. Three hundred and twenty-seven early childhood professionals (average age 38 years; 88% women) and 283 children (average age 5 1/2 years; 48% girls) took part.

Key Findings of the Study

1. Science-related competence is multi-dimensional.

- Science competence comprises cognitive and motivational facets. Interest, motivation, knowledge, and beliefs play a role.
- In the study, instruments of a high scientific quality were successfully developed for the empirical measurement of science-related competencies of early childhood professionals and children at pre-primary level.

2. Science-related education offerings have an effect.

- Science-related continuing professional development (CPD) was positively related to the professional competencies of the early childhood professionals.
- Early childhood professionals who had participated in science-related CPD (“Haus der kleinen Forscher“ CPD or other science-related CPD) showed greater content knowledge and pedagogical content knowledge than education professionals who had not undergone CPD.
- Early childhood professionals who had undergone science-related CPD had a greater interest in science and a higher level of perceived self-efficacy in relation to their pedagogical work compared to education professionals who had not undergone CPD.
- Early childhood professionals who had undergone CPD were more inclined to hold learning theory beliefs that emphasize children’s own initiative; they more strongly rejected approaches that assign children a passive role than did the education professionals who had not undergone CPD.
- Early childhood professionals implemented science education opportunities more frequently and in higher (self-reported) process quality.
- Early childhood professionals from the “Haus der kleinen Forscher” Group had attended, on average, more CPD workshops on science topics than professionals from the Science Comparison Group.
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- Early childhood education and care centres certified by the “Haus der kleinen Forscher” foundation had anchored the domain of science education more firmly in their institution than had the comparison groups. This can be seen, for example, from the fact that the domain of science education was addressed more frequently at team meetings at these institutions.
- Children from institutions with an explicit science focus (determined by the institution management) showed greater enjoyment of learning and self-confidence in relation to science than children in institutions without a science focus.

3. The quality and regularity of the implementation science education offerings are decisive for the children’s learning gains.

- The science competencies and motivation of the education professionals’ were, in part, positively related to the process quality and the frequency of science education offerings. The more firmly science education was anchored in the institution, the greater the science-related motivation of the professionals. Hence, over and above the effects of professionals’ own CPD, their motivation benefits from the anchoring of science in their institution.
- The reported quality and frequency of science learning opportunities had a positive interaction effect on the children’s knowledge. Regular science learning opportunities with a minimum of process quality were the determining factor for the learning growth. Regular learning offerings with low process quality, or high-quality learning offerings than took place only rarely, did not on their own have any positive influence on children’s science knowledge.

The full final report on the research project will be published in 2018 in the series *Scientific Studies on the Work of the “Haus der kleinen Forscher” Foundation*.

Implementing Research Group

Prof. Dr Mirjam Steffensky (Project Manager and Spokesperson)

Department of Chemistry Education at the Leibniz Institute for Science and Mathematics Education (IPN)
Olshausenstr. 62
24098 Kiel, Germany
Telephone: +49 431 – 880 3158
E-mail: steffensky@ipn.uni-kiel.de

Prof. Dr Yvonne Anders

Freie Universität Berlin
Department of Early Childhood Education
Habelschwerdter Allee 45
14195 Berlin, Germany
Telephone: +49 30 – 838 579 66
E-mail: yvonne.anders@fu-berlin.de

Prof. Dr Ilonca Hardy

Goethe University Frankfurt
Institute for Pre-Primary and Primary School Pedagogy
Grüneburgplatz 1
60323 Frankfurt, Germany
Telephone: +49 69 – 798 36269
E-mail: hardy@em.uni-frankfurt.de

Prof. Dr Miriam Leuchter

Department of Children and Youth Education
University of Koblenz-Landau
(Up to spring 2016: University of Münster)
August-Croissant-Str. 5
76829 Landau, Germany
Telephone: +49 634 - 280 34153
E-mail: leuchter@uni-landau.de

“Haus der kleinen Forscher” Foundation

Rungestr. 18
10179 Berlin
Germany

www.haus-der-kleinen-forscher.de

Do you have any questions, remarks, or suggestions about the scientific monitoring of the Foundation’s work? If so, please contact: forschung@haus-der-kleinen-forscher.de

Further information and study findings can be found at:
<https://www.haus-der-kleinen-forscher.de/en/> under the heading “Research and Monitoring”.