Research Project (2013-2017): Interaction Quality and Linguistic Outcomes of Education

EASI Science-L (Early Steps Into Science and Literacy)

Science Education at Early Childhood Education and Care Centres: Design and Implementation of Teaching-Learning Situations, Quality of Linguistic Stimulation, and Language and Scientific Abilities of the Children

Background and Research Questions

The research project investigated the interaction quality and possible linguistic outcomes of education among preschool children in the context of science education offerings. The study focused on the quality of linguistic stimulation and on the process quality of science teaching-learning processes. With the help of new instruments for the analysis of video and transcript data, it was examined whether, or in which phases of scientific inquiry, links with language competencies occur. In addition, the researchers were interested in determining what relationships were observable between the process quality of an educational situation and the outcomes of science education. The study was jointly funded by the "Haus der kleinen Forscher" (Little Scientists' House) Foundation, the Baden-Württemberg Stiftung, and the Siemens Stiftung. It focused on the following questions:

1. ***How high is the quality of linguistic stimulation in a scientific inquiry situation with children?***
   - *Are there differences in the quality of linguistic stimulation between institutions with and without a science education focus ("Haus der kleinen Forscher" focus, other science focus, no science focus)?*
   - *Does the quality of linguistic stimulation depend on the early childhood professionals' participation in continuing professional development (CPD)?*
   - *Can different characteristics of the quality of linguistic stimulation be found during the individual phases of scientific inquiry (inquiry cycle method)?*

2. ***Can links be established between the linguistic stimulation during the inquiry process and the children's language competencies?***
   - *Do children (incl. children with German as a second language) from institutions with and without a science education focus show differences in their use of academic language?*
   - *Is there a link between the academic language used by the children and the quality of linguistic stimulation by the early childhood professionals or their participation in CPD?*

3. ***How can science-related process quality be described micro-analytically, and what is it linked to?***
   - *Can science process quality be reliably and validly measured using video data?*
   - *Is the science-related interaction quality linked to the quality of linguistic stimulation in the inquiry situation?*
   - *Are there differences in science-related process quality between institutions with and without a science education focus, and does this depend on the professionals' participation in CPD?*
   - *Are there links to the children's science competencies?*

Implementation

Fifty-eight early childhood education and care centres from the Karlsruhe and Heidelberg metropolitan areas, and one early childhood professional and one group of around four children from each centre, participated in the study. Ninety-five percent of the participating professionals were women; in all, 222 children participated (average age 5 ½ years; 46% girls). The early childhood professionals designed and implemented an inquiry situation with the children that was video-recorded and analysed with regard to the research questions.

Key Findings of the Study

1. **A high quality of linguistic stimulation is possible during inquiry activities.**
   - Taking all early childhood education and care centres together, the average quality of linguistic stimulation was in the medium range. There were differences, depending on the institution's focus: Early childhood professionals from an institution certified by the "Haus der kleinen Forscher" Foundation demonstrated, on average, the highest quality of linguistic and cognitive stimulation.
   - Professionals who had participated in continuing professional development (CPD) on a science topic demonstrated a higher quality of linguistic stimulation than professionals who

had not undergone science-related CPD. On the other hand, no effect of purely language-related CPD was present in the sample investigated.

- Professionals who had attended a combined science and language CPD workshop provided by the "Haus der kleinen Forscher" Foundation demonstrated a higher quality of linguistic stimulation than professionals who had not attended that workshop. [1]
- Proportionally, a great deal of linguistic stimulation took place in certain phases of the scientific inquiry cycle ("Observe & Describe"; "Document Results"; "Discuss Results"). These phases offer particular potential for linking language and science education. Overall, however, the especially language-promoting episodes during the inquiry phases still occurred quite rarely.

2. **The children's language competencies are linked to the linguistic stimulation during the inquiry activities.**
   - The children in all study groups demonstrated, on average, comparable academic language competencies (independent of whether the early childhood education centre had a science focus or which science focus it had, and whether German was the child's first or second language).
   - Characteristics of the child (e.g., intelligence, age, and gender) had the greatest influence on the children's language abilities.
   - Early childhood professionals' participation in CPD was related to the children's use of (academic) language: Children whose early childhood professional had attended a combined science and language CPD workshop demonstrated a higher level of academic language performance than children whose early childhood professional had not undergone such CPD.

3. **Science-related process quality is linked to the professionals' participation in CPD, the quality of linguistic stimulation, and the children's competencies.**
   - The science-related process quality implemented by the early childhood professional was positively related to the children's scientific competencies.

[1] CPD workshop *Sprudelgas und andere Stoffe - Mit Kita- und Grundschulkindern Chemie entdecken und dabei die **sprachliche** Entwicklung unterstützen* (Carbon Dioxide and Other Substances – Exploring Chemistry with Children Between the Ages of Three and Ten and Supporting Language Development in the Process), see brochure with the same title published by the "Haus der kleinen Forscher" Foundation (2013). Available (in German only) at: www.haus-der-kleinen-forscher.de

- Science-related process quality was positively related to the quality of linguistic stimulation. In the inquiry situation, professionals with a higher process quality also demonstrated a higher quality of linguistic stimulation.
- The science-related interaction quality in the inquiry situation was higher among professionals who had taken part in the “Haus der kleinen Forscher” CPD workshops than among professionals who had not undergone science-related CPD.

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

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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”.