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A Longitudinal Lesson Study Approach to Enhance 5-year-old Children's Learning of Part-whole Relationships of Numbers

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In this paper we present findings from a Swedish intervention project about 5-year-old's learning of the ten first numbers and early arithmetic skills using a longitudinal lesson study approach. A team of researchers worked in close collaboration with nine preschool teachers, during a period of two semesters. The teachers and the researchers had a common object of research; to develop, test and refine situations and activities in practice that would promote young children's development of understanding the first ten numbers and their relations. The aim of this paper is to describe the longitudinal process of lesson study used and present findings discovered during the process about teaching and children's learning.

Five preschools with 5-year-old children from two suburbs of a larger Swedish city participated in the study. Before the intervention started, task based individual interviews (for about 15-20 minutes) with the 65 children were conducted. Similar interviews were conducted after the lesson study intervention. The research team had regular meetings with the preschool teachers during the period of the study. During the meetings: i) activities and games driven by a theoretical idea about learning these skills were planned, ii) the implementation of activities was discussed, using video recordings of the preschool teachers themselves enacting the games in the preschool groups, and iii) the team discussed how to refine the implementation of activities, with several attempts to work with the same activity. How often and how long the teachers worked with the activities between the meetings varied between preschools. The activities built on theoretical ideas and work of Neuman (1987, 2013), and Sensevy, Quilio and Mercier (2015). Neuman conjectures that an essential part of learning early arithmetic skills is the discernment of the part-part-whole relationship for the ten first numbers, and that one way to help learners discern this relation is to encourage them to use their fingers to structure numbers. These ideas are significantly different from those usually framing the early number learning in Sweden. The teachers successively got familiar with these ideas. The aim was that they should make the theory a lived-theory, and use ideas from the variation theory of learning (Marton, 2015) also when implementing activities to make the mathematical content taught salient for learners.

Preliminary findings on what the children learned and how knowledge about the ten first numbers and early arithmetic skills were developed are presented.

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Introduction to Similar Triangles

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The overarching goal of this Lesson Study is to develop students who can think critically, collaborate and articulate effectively. To achieve this, learning experiences were infused in the research lessons to provide opportunities for students to discover mathematical results on their own and develop conceptual understanding of the topic of Similarity.

The research lessons were conducted with three Secondary Two (8th Grade) Express classes using the Lesson Study approach. Each lesson was observed by a team of teachers collecting data on student learning and thinking, followed by post-lesson discussions where data collected was shared and analysed with recommendations incorporated into the subsequent lessons for other classes.

The design of the research lesson started with an open mathematical task whereby students in small groups of six manipulate triangular cut-outs to discover the properties of similar triangles. In their small groups, students were given opportunities to explain, comment and justify their ideas as well as representation of their mathematical ideas in tabular, pictorial and numerical forms. Finally, some groups were selected to share their findings with the class.

To orchestrate mathematically productive discussions, the teacher utilised the Five Productive Practices of Mathematical teachers (Smith and Stein, 2011); anticipating students' strategies, monitoring each group's work, selecting strategies worth discussing, sequencing of presentations and connecting strategies and ideas to help students understand the mathematics concepts.

The team tried to pre-empt the likely difficulties students may face and prepared a list of questions to use to facilitate the learning process. These difficulties and questions were recorded in a monitoring chart. While students were working on the learning activity, the teacher was actively observing the interactions among the students. When required, the teacher facilitated the learning process by asking appropriate questions, such as metacognitive prompts (or reasoning questions), to bring about deeper learning.

Findings:

It was observed that students enjoyed doing hands-on work. The collaborative nature of the activity allowed students to discuss and build on each other's ideas as they explored and discovered the key concepts. Some students were weak at using mathematical evidence to substantiate their claims. Their organisation skills and documentation of data could be improved. The students were weak in mathematical communication as they were unable to use mathematical terms appropriately in their discussions and writing.

Implications:

Teachers could incorporate more opportunities for exploratory and discussion-based activities where students need to collect and organise data, and articulate their thoughts and ideas. Effective facilitation and questioning by the teacher enhances these learning experiences and brings about deeper learning by the

students.

Keyword(s): Learning Experiences, Lesson Study, Similarity, Research Lesson, Five Productive Practices of Mathematical teachers, Monitoring Chart, Metacognitive prompts

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Study of Students Learning Activities in English Learning Media Subject

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The study was conducted to know the students learning activities in English learning media subject. The process of learning Activities (plan, do (learning process) and reflection (after teaching)) used Lesson Study Activities. The number of sample are 40 students of semester IV. This research applied descriptive analysis. The researcher found that the students learning activities in English learning subject are (1) Visual activities, such as identifying, respond with friends' working and observation; (2) Oral Activities such as, discussion, explain, respond, introduction, ask and answer and simulation; (3) Listening Activities such as discussion ask and answer, and listening; (4) Writing Activities such as writing in the table and making paper; (5) Drawing Activities, such as creating media of learning; (6) Motor creativity, such creating media and simulation of media; and (7) mental activities, such as respond, analysis, making conclusion and explain; (8) Emotional activities, such as happy, spirit, nerves and bored.