

# Mathematics communication within the frame of supplemental instruction SOLO & ATD progression

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***Abstract.** Supplemental Instruction (SI) is considered a method for cooperative/collaborative learning being used at universities in many countries including Sweden, and lately also in upper secondary schools. Several studies have been made to evaluate SI in universities throughout the world, but hardly any studies have been made at lower levels. This project aims at developing an analysis strategy that is a combination of ATD and the SOLO-taxonomy. The aim is also to use the strategy when analysing students' discussions in mathematics at SI-sessions in Swedish upper secondary school.*

## **Introduction**

This project focuses on mathematics communication and one special family of educational methods, i.e. cooperative learning (Johnson & Johnson, 1999) and collaborative learning, which both are based on a philosophy saying that students learn better if learning together. One method for mathematics education, that has a lot in common with cooperative/collaborative learning, is Supplemental Instruction or SI. "The supplemental instruction sessions are guided by a senior student." (Malm et al., 2011a, p. 2)

Supplemental instruction is used by many universities in the world (Malm et al., 2011), and SI has recently been introduced in upper secondary schools in Sweden. The many studies that have been done throughout the world to evaluate the outcomes of SI in universities point at SI being effective when supporting "weak" students in mathematics (Malm et al., 2011b). Hardly any studies have been made at lower levels.

Anthropological theory of the didactic (ATD) is a theoretical framework for analysing and for developing mathematics education, which offers a handful of tools (Winsløw, 2010). The SOLO-taxonomy stands for "structure of the observed learning outcome" and was developed by John Biggs and Kevin Collis (1982).

Combining different theoretical frameworks is nothing new in education research. Susanne Prediger, Angelica Bikner-Ahsbals and Ferdinando Arzarello (2008, p. 176) argue for what they call *networking* and state that there is a need

for connecting theories in a more systematic way. By combining ATD with SOLO in the present project one may be able to catch the advantages of both. SOLO with its concrete questions to be asked and ATD with its praxeologies and the “institutional didactic process” (Bosch & Gasçon, 2006).

### **Aim**

The aim of the project is to analyse discussions in mathematics in upper secondary school. The focus is what happens in the classroom, and the intention is not to “look behind” what is observed. As “students” we consider both SI-leaders as well as SI-participants. The project does not particularly focus on so called weak students. The project focuses on the following two questions:

*To what extent is a combination of SOLO and ATD a suitable strategy when analysing mathematics discussions at SI-sessions in Swedish upper secondary school? What at the SI-meetings in upper secondary school influences learning progression of students’ mathematics discussions?* Learning progression will be defined as progression relative to (1) the SOLO-taxonomy and (2) the ATD-praxeology.

### **Research design**

The methodology is qualitative with a combination of theoretical development of a strategy and empirical tests of this strategy. The design is flexible as the method is developed step-by-step as the project continues (Robson, 2011, p. 132).

The empirical study uses data from two upper secondary Swedish schools. At these schools SI is a compulsory complement to the ordinary teaching at certain programs. Group vary in size from 5 to about 16 students. At both schools SI is scheduled as one meeting per week. Different kinds of data are gathered. This is done with emphasis on observations and video recording of SI-meetings. Questionnaires are answered by students and SI-leaders (senior students), short interviews are conducted with SI-leaders and SI-mentors (teachers guiding the SI-leaders). “Semi structured interviews” are used.

### **Discussion**

So far it is found that the SOLO-taxonomy and the ATD-praxeology partly elucidate different dimensions of the students’ learning. The ATD-praxeology clarifies whether or not the students explain the use of a special technique. It is used to understand a teaching situation. SOLO classifies to what extent students analyse what they do. Probably these are two useful ways of studying “level of knowledge”. These ideas have to be further developed.

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