

- F01-PP** **LT2** **Complex object of learning - How to improve learning democracy at school by the use of Variation Theory and Learning Study**
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- Keywords:**
variation theory, learning study, democracy, learning, instruction
- The aim of this study is to test in what way variation theory (VT) can serve as a guiding principle when learning an abstract concept like democracy. The model Learning study is used, which is a kind of lesson study in combination with the theoretical framework of a learning theory (LT). The iterative process means designing the forthcoming lessons based on the results and analysis of the data from the previous lessons. The data consists of pre/post-tests and video-observed lessons. The study contains four research sessions with four different groups of pupils in three different schools in grade 6 at the compulsory school. In total two teachers and 78 students participated during the four research sessions, one lesson per group. The first lesson (A) included 21 students, the second (B) 17 students, the third (C) 21 students, and in the final session (D) there were in total 19 pupils. The research sessions were 80 minutes each, and the planning was guided by the variation theory. The results show that the teachers' different ways of presenting aspects on the object of learning – democracy - different aspects where possible to discern. The different patterns of variation used are described in relation to differences in the students' learning outcome. In all lessons democracy was contrasted against dictatorship. In order to facilitate learning different aspects of the object of learning were designed in a pattern of variation to see if and in that case what kind of differences this meant for the students. The results show that in group A the test scores increased by 63%, in group B the increase was 32%, group C 29% and in the last group (D) the test scores increased by 91%.
- F02-PP** **LT2** **Pedagogical content knowledge in Biology generated by the use of Learning Study**
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- Keywords:**
Learning study; biology; genetics; pedagogical content knowledge; guided learning
- The point of departure in this paper is a learning study performed in an upper secondary school, focusing on the biological topic of genetics. The research design in the intervention started with a screening of students' ways of explaining important concepts in genetics and their relations. On the basis of that screening, the specific object of learning was formulated: "to understand the relationships between genes and traits". This was followed by an iterative sequence of three videotaped research lessons within three different student groups (N=27; A9, B10 and C8), which all included joint planning and evaluation by two teachers and two researchers. The results of the previous research lesson was the base for further improvements in the following research lesson with a new group of students, however the same teacher taught all three research lessons aiming to minimize the effect of teachers' personality as an important factor for the changed results. With a pre-and post-test design, accompanied with a delayed post-test six weeks after teaching, it was concluded that it was only during the third research lesson that the students' answers improved in a statistically significant way (paired T-test; $p=0,048$), which almost prevailed also six weeks after the research lesson ($p=0,087$). The aim of this paper is to suggest contributions to the field of pedagogical content knowledge that can be made through an analysis of the iteratively developed teaching strategy, specifically the strategies used in the successful third research lesson. The argument we put forward is that explicit pointers towards whole/part relations are essential, for example by guided learning towards discernment of different biological organisation levels; levels that are expressed with specific technical terms. School science makes use of numerous technical terms in order to explain, for example the relationships between genes and traits. However, technical terms are embedded in thematic