

**DUTCH LESSON STUDY – EXAMPLES OF TEACHER LEARNING**

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*Lesson Study increases teachers' understanding of student learning, by collaboratively planning, teaching, observing and revising one or more lessons. We cover lesson studies on (1) an intuitive introduction of the derivate, (2) the transition from basic trigonometry to trigonometric functions, and (3) improvements in combinatorial reasoning.*

Six mathematics secondary school teachers from different schools have collaborated in a Lesson Study Team (LST) since 2009. Each teacher was given a four-hour weekly reduction in teaching load to participate. In addition to the teachers, the LST consisted of four staff members of the University of Twente in the Netherlands: a mathematician, a mathematics teacher trainer, a PhD candidate and a researcher (the leader of the LST). All staff members had specific roles in the LST. The team focused on student understanding, which entails subtle processes that occur in learning in which procedures applied on certain concepts become thinkable concepts themselves that can again be applied in more involved situations (Tall, 2013).

The first study, about the introduction of the derivative, focused on the use of *icons* (Verhoef, Coenders, van Smaalen, Pieters, & Tall, 2014). The results show that the well-thought-of choice of an icon influences operational symbolism positively when the icon is simple. The representation of the slope of a graph by means of a line segment with a dot halfway (at the point where it intersects the graph) was the first step to the relational understanding of the concept of derivative.

The second study focused on the transition from basic trigonometry to trigonometric functions, using static as well as dynamic icons (Verhoef & Timmer, 2013). Two teachers used a water wheel as icon, eliciting the use of symmetry of coordinates and helping students to reason about trigonometric characteristics. The teachers were more able to understand student learning, step by step.

The third study focused on combinatorial reasoning (Coenen, Hof, & Verhoef, 2015). As much as possible, members of the LST observed one case-student (Dudley, 2012) and the dynamics of the group as a whole. The teachers discovered that coaching students to use their common sense and building up their confidence can be even more valuable for them than theoretical insight. Additionally, for the topic of combinatorics, acting out a problem proved to provide more insight than the use of pictures (Timmer & Verhoef, 2014).

**References**

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