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Notes:
The empirical part of mu PhD thesis will take place in september/october 2009.
Research questions are preliminary. I am grateful for any tips on earlier as well as on recent research treating GeoGebra but also for any comments or ideas about how to improve my coming research.

Integral calculus

Students' concept development in a learning environment based on the dynamic software GeoGebra

Many students in upper secondary school in Sweden have great difficulties with the concept of integrals. They do not understand the concept, neither can they apply their knowledge on new situations nor use integrals as a mathematic tools in other fields such as physics or engineering. One way to target this problem is to change the approach to the instruction of the integrals in upper secondary school and then to analyze how students deal with different aspects of integrals and how their understanding of integrals is impacted by the method according to which the concept has been introduced and presented in the classroom.

The *aim* of this research is to investigate how last year students in the upper secondary school in Sweden deal with the concept of integrals when they learn in an environment based on the dynamic software GeoGebra.

Research questions:
- How does students' understanding of integrals develop in a learning environment based on the dynamic software GeoGebra?
- Does a learning environment based on GeoGebra imply any significant differences in students' understanding of the concept of integrals compared to "working with paper and pencil"-based learning?
- Does GeoGebra as a learning tool imply any changes in students' attitudes toward integral calculus?

Method: Classroom observations in two classes in two different upper secondary school in Sweden. All students participating in this study will be provided by own laptop and the course will be based on GeoGebra. Working materials will be adjusted for use in GeoGebra based learning environment .