STRUCTURED DERIVATIONS: A METHOD FOR TEACHING PROOFS IN HIGH SCHOOL MATHEMATICS

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Mathematics is based on proofs. A theorem without a proof is like magic, a theorem with a proof is self-evident (although it sometimes requires quite a lot of effort to see this). But proofs are considered difficult in today's high school (age group 16 -19) mathematics and are therefore usually avoided. When proofs are given, they are often informal and the underlying logic is not explicated.

Mathematical proofs are based on logic, but the use of logic in proofs is usually not taught in high schools today. Where logic is taught, it is seen as a separate object of study, rather than a tool to be used when solving mathematical problems.

Structured derivations, originally developed by J. von Wright and me in 1998 as an extension of E. W. Dijkstra's calculational proof method, provides an alternative approach to teaching mathematics in high school. It is based on a fixed logic based format for presenting proofs, derivations and calculations in a unified manner. The fixed format and the detailed justification of each proof step makes it is easier to explain proofs in class. Structured derivations also makes it easier for students to understand the mathematical argument in the proof,   helps them in constructing their own proofs and to detect errors in their proofs.

The talk will provide an overview of structured derivations, as well as describe the main results of our teaching experiments. Our research group has done quite a lot of experiments and empirical studies of structured derivations in high school mathematics, with very encouraging results. The method has been extended and refined during the last five years in a tight feedback loop with experiments where the method has been tested in practice. The method is accepted by the Finnish National Board of Education, and is presently taught in our continuous education courses for mathematics teachers in high school.

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