On Conceptual Design of Educational Mathematics Assistants

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17:30–17:50

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There is an abundant variety of mathematics assistants (MMs), successfully used in education. The MMs reflect the respective representations of mathematics objects in the various domains: geometry, algebra, numerical analysis and simulation, graph theory etc. And the MMs reflect various aspects and views of education.

Since, in principle, there is only *one* mathematics (with unified foundations commonly accepted today), and since all the variety of MMs should reflect that foundations, this talk asks the questions: (1) What are the common grounds for existing MMs ? (2) What are the principles the development of MMs might converge to ?

(1) Common grounds: Here a *'step'* is suggested as the minimal unit on common grounds; a *step* operates on an object (i.e. on an algebraic object like a term, an equation, a function, or on a geometric object, or on a graph like a dag, etc) within a logic and a context. The *step* is related to at least one theorem and results in a transformed object and in an updated context.

The talk will discuss how a *step* relates to rigorous foundations in logics, as well as to MMs in algebra and geometry (omitting graph theory et.al).

(2) Some principles for convergence: Since MMs represent formal mathematics, MMs might explicitly implement principles of computer mathematics. Since MMs 'are (models of) mathematics', MMs might implement math knowledge in a human readable format (e.g. Coq, Isabelle, Mizar). Since formal logic is the basis of MMs but hard to learn, MMs might filter off details for naive users. Since learners want to proceed on their own pace, MMs might uncover logical details on demand providing continuous support from the introduction of variables up to mathematics on an academic level.

The ideas presented in this talk are immediately directed towards software development at the state of the art. Teachers might be interested, too, in order to know what to request from educational software.