Towards New Teaching in Mathematics

How to teach mathematics according to the Fibonacci-philosophy?

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First we have to realize, there is not a single way of successful mathematics teaching. But we know for sure if learning is to be successful students must get the chance to go individual ways in their learning process.
There are certain basic guiding principles that ought to be characteristic for our teaching:

- Less focus on passing factual knowledge to students, more focus on independent problem solving.
- Less focus on mere computing and manipulating formulas, more focus on understanding.
- Not only focus on acquiring particular math skills and results, but also focus on the necessary learning processes and strategies.

The implementation of these guiding principles leads to an *experimental access* to mathematics. If there is actually a formula or a rule then it is at the end of the learning process, not at the beginning.

We introduce mathematics in the context of carefully chosen problems. In the process of trying to solve such problems the students develop mathematics. We follow the American mathematician Paul Halmos (1916 – 2006) who demands: “Don’t preach facts, stimulate acts.” That means: The teacher is not an entertainer, the student is not only a consumer. We do not present ready to consume mathematics. Teachers must help students to understand the concepts of mathematics, not just the mechanics of how to solve a certain problem.

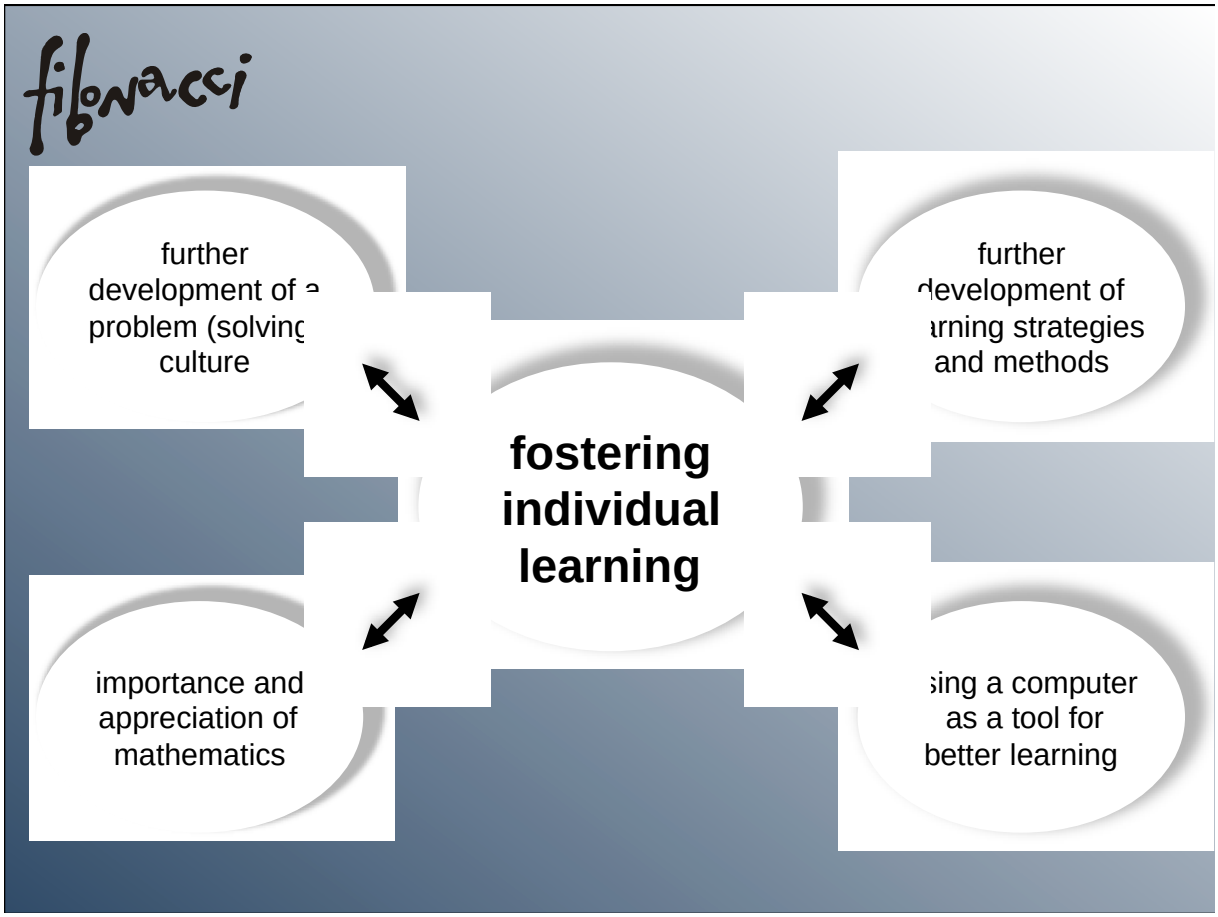
“Stimulating acts” means to encourage students to develop their own informal methods for doing mathematics. We ask them

- to explore,
- to observe,
- to discover,
- to assume,
- to explain,
- to prove.

This sequence of activities exactly describes what we understand by *Experimental Mathematics*. The first five items are typical for science teaching as well. The distinctive feature of mathematics is the last item: In mathematics we have to prove our discoveries and conjectures and after that the results are valid for ever.

Strictly speaking our goal of mathematics education for the 21st century was already written down in the 19th century by Wilhelm von Humboldt (1767 – 1835): “The student is mature, if he or she has learnt so much that he or she is able to learn independently.”

Even about 200 years old this message is still very topical. Big ideas never loose their relevance. To support this aim we have to continue the further development of a problem-based culture and of learning strategies and methods. We have to encourage teachers to use the computer as a tool for better learning and we have to stress the importance of mathematics for our daily life and for our future.



It has already been stated that successful instruction has an individual face that is primarily that of the individual instructors. Ideas and materials provide inspiration, but implementation always has a personal touch. To improve classrom instruction we first have to change the way we deal with content, i.e. we need innovations in the classroom. Access to the "Fibonacci philosophy" is best achieved through conscious consideration of one's own teaching. Here certain central themes can serve as a means of orientation. These themes take five different aspects of teaching into consideration:

1. Teaching style
2. Work with problems/tasks
3. Technical contents
4. Type of achievement testing
5. The role of mathematics teachers.

Reflection based on these central themes also makes sense for education degree students and probationary teachers. Although first-time instructors usually have only very limited teaching experience (if any), these central themes clearly point to crucial areas for subsequent instructional activity (for a detailed explanation cf. SINUS international, Towards New Teaching in Mathematics, Part I).

A first step is taken by reconsidering one's own instruction on the basis of the central themes indicated. Thus the foundation is laid for a change in teaching. What remains then is for implementation to take place in accordance with the slogan cited from Paul Halmos: "Don't preach facts, stimulate acts."

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Literature:

Baptist, Peter, Carsten Miller and Dagmar Raab (eds.):
SINUS international, Towards New Teaching in Mathematics, Part I, II, III, Bayreuth 2011