

Informatics as Part of General Education

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Computer Science ist the most important post industrial science (Niklaus Wirth)

- Industrial society based on natural science and material/energy technology, as consequence introduction of natural sciences (physics, chemistry, biology) into college
- Information Society enabled by information and communication technology, based on informatics, as a consequence need to introduce informatics into college

Informatics is too important to leave it to users alone

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What is informatics?

- Informatics, as seen by the public is the use of office applications and the Web
- Informatics as seen by the school is media education (Medien Erziehung)

Informatics as a scientific discipline: Denning's layer model (from "Great principles of computing")

- 1 **Computing mechanics:** How do computations work?
- 2 **Design principles:** How to organize ourselves to build computations that work?
- 3 **Core technology:** How do we design computations that support common elements across applications?
- 4 **Application domains:** How do we work with others to design computing that serves them?

Goals of education at colleges according to the MAR (Maturitäts-Anerkennungs-Reglement 1995) (Art. 5)

- Maturandinnen und Maturanden finden sich in ihrer natürlichen, technischen, gesellschaftlichen und kulturellen Umwelt zurecht...
- Die Schülerinnen und Schüler gelangen zu jener persönlichen Reife, die Voraussetzung für ein Hochschulstudium ist...
- ... gelangen zu jener persönlichen Reife [...] die sie auf anspruchsvolle Aufgaben in der Gesellschaft vorbereiten

to understand the modern world a knowledge of informatics is as necessary as a knowledge of natural sciences

to be prepared for university studies

- a skill in constructive problem solving and a capability to process large data sets, of modeling and abstraction is necessary and for this
- a knowledge of the laws and the costs and the limits of information processing is necessary

Preparation for accepting the challenges in the modern society

to become a responsible actor in modern society

- the constructive model-oriented problem solving approach of informatics is a valuable exercise and indispensable for many solving many problems

- Design of algorithms and data structures
- Knowing the basic elements of programming
- Expressing in formal languages
- Understanding the complexity of different computing tasks
- Coding of information
- Managing large data sets
- Modeling
- Methods for coping with complexity

The subject

- 1 must orient itself at the great basic principles of the discipline
- 2 must be taught at different levels of abstraction from the basic levels near the machine to the higher-level application-oriented concepts
- 3 must uncover the constructive aspects of abstract processes
- 4 must build a bridge to the constructive methods of engineering

As sciences

- 1 Informatics and Mathematics are closely associated to each other, especially by discrete mathematics and logic
- 2 Informatics and Mathematics are nevertheless autonomous
- 3 Informatics is concerned with men-made systems, Mathematics arose from the study of natural phenomena
- 4 Mathematics is by nature axiomatic-deductive, concerned by seizing infinity, whereas Informatics is constructive, concerned by mastering complex finiteness

There is a privileged partnership between Informatics and Mathematics. In college therefore

- Mathematics and Informatics are to be carefully coordinated
- Informatics needs mathematical contents which are not offered in the present curriculum of Mathematics
- these contents should be introduced in Informatics in the context of problems and models of Informatics

There are two (interrelated) aspects concerning the relation of Informatics to other disciplines

- Researchers today use adaptive virtual work places for processing data and the preparation of information, which greatly improves efficiency
- In many disciplines, processes are seen as computational in nature, which may lead to new insights

At least five application areas may be distinguished:

- Communication: The internet provides access to any sort of information and enables to publish own information
- Spreadsheet processing: to analyze and represent data, measurements, lists. Allows optimization, simulation and mathematical modeling in general
- Data bases: allow the management of large data sets
- Information extraction: In most cases not the measurements are of interest but the information extracted from them
- Programming: Allows to extend and adapt the functionality of virtual work places

The computational lens (Karp)

- In some sciences mathematical language allows for deep analysis of theories and to link them with experimentation and observation
- In many science processes are computational in nature. Then computational models allow formulation of extended theories and virtual analysis and experimentation

Subjects of education in informatics: basic ideas and concepts

Subjects in informatics must address basic ideas and concepts such as

- algorithms and limits of computation
- using formal languages to communicate with the computer
- basic constructs of programming
- representing information as data, data structures
- concepts of computer nets
- protection of data and secure communication
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Everyone who taps at a keyboard is working on an incarnation of a Turing machine (Time Magazine, 1999)

Informatics must become compulsory branch for everybody at the college