Media Upheaval and Standards of Informatics

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Stefan Freischlad and Sigrid Schubert

Didactics of Informatics and E-learning

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Contents

Motivation

- research project promoted by the German Research Foundation (DFG):
  "Informatics in secondary schools and e-learning to master the digital media upheaval"
- from July 2005 to June 2009
- research question: contribution of informatics to media competences
- relation between media education and informatics [GI, 1999]:
  - media as motivation for concepts of informatics through real-life situations
  - informatics concept as prerequisite for discussion about new media

Focal Points

A **Internet structures**
previous knowledge: computer network at home, the Internet
→ concepts of computer networks (e.g. model of layers, Internet addressing)

B **communication in the Internet**
previous knowledge: e-mail
→ aspects of Internet applications (e.g. WWW)

C **information security in the Internet**
previous knowledge: home banking
→ security services (e.g. access control), social aspects

Digital Media Upheaval

characteristics of informatics systems	user experience	competences
automated data processing	- new applications (e.g. e-commerce)	- comprehension of possibilities and limitations of informatics systems
interactivity	- user as recipient and active participant - new possibilities for design of media - human-computer interaction becomes more important	- comprehension of informatics systems - abilities to design
networking	- security risks of the infrastructure - responsibility of the user for correct configuration	- comprehension of the infrastructure - comprehension of security requirements - knowledge about legal framework

Structure of the Research Project

1. requirements
   - specify and analyse real-life experiences of learners
2. development of learning concepts and materials
   - Didactic System "Internetworking"
   - implementation of the concept in a course of informatics
3. evaluation
   - acceptance: learner survey
   - interview teachers about the Didactic System "Internetworking"
   - validation of exercise classes through test items like PISA items
4. recommendation for the development of the Didactic System "Internetworking"

Educational Standards

- operationalised through test items like items of the Program for International Student Assessment (PISA)
- independent from common core curriculum
- based on a competence model
- items composed of stimulus (real-life situation) and question
- contribution within this project:
  - development of test items and thus describing competences
  - connection of Didactic System and competence model

Competence Classes

- mathematics competence model transferred to informatics
- competence classes:
  - **application**
    $\longrightarrow$ competences related to application of informatics systems
  - **construction**
    $\longrightarrow$ competences implying knowledge about the inner structure of informatics systems
  - **decision**
    $\longrightarrow$ competences based on knowledge about possiblities and limitations of informatics systems

Exemplary Test Item

Stimulus is an e-mail with characteristics of a Phishing-mail.

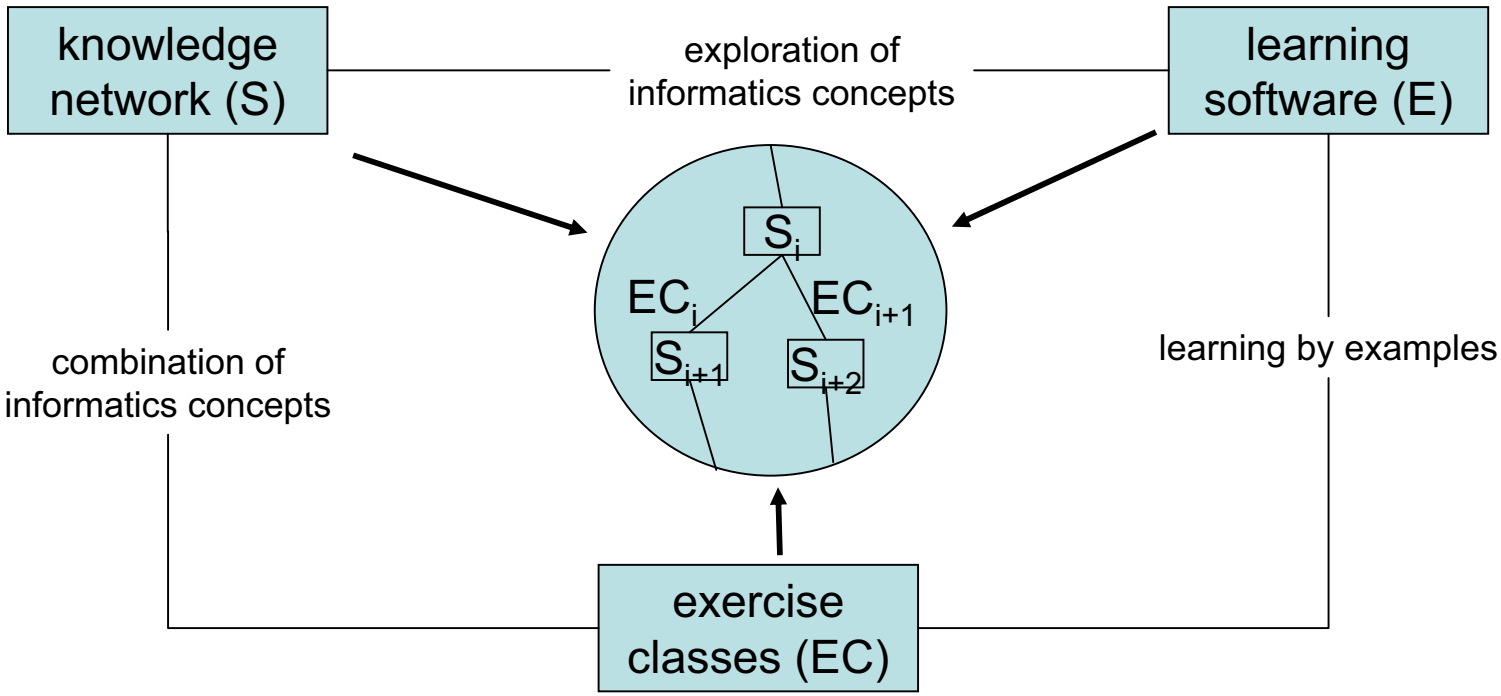
Is the displayed sender address trustworthy?

- ☐ Yes, an e-mail can just be sent if the sender has correctly authenticated himself.
- ☐ No, it is possible to fake the sender's address.

→ competence class construction

- knowledge about communication between two hosts in the Internet
- no guaranteed authentication with Simple Mail Transfer Protocol (SMTP)

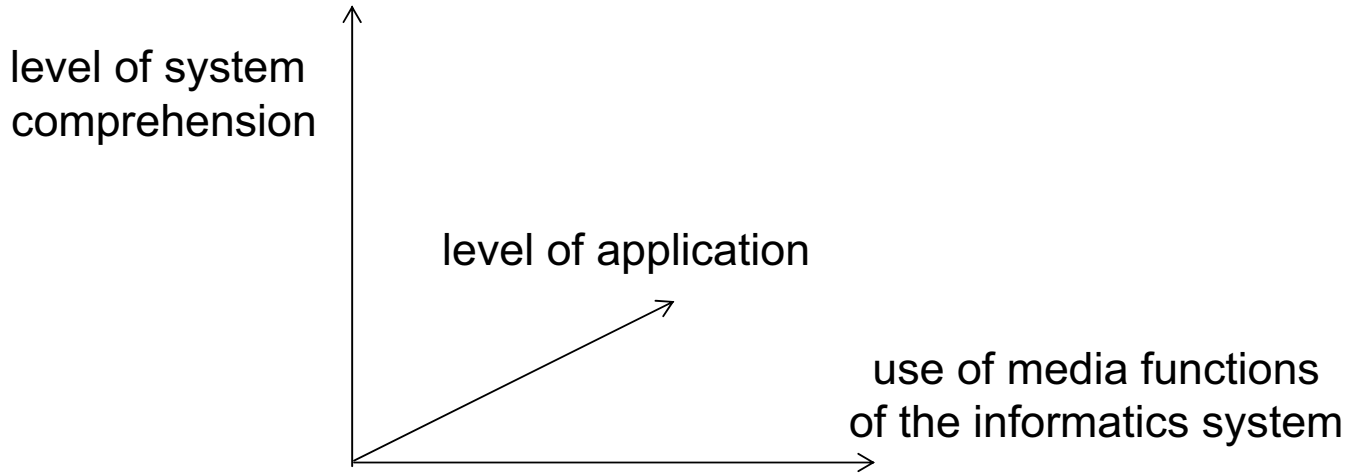
Didactic System – Structure



[Brinda/Schubert, 2002]

Competence Dimensions

approach to a model of competences in informatics [Magenheim, 2005]

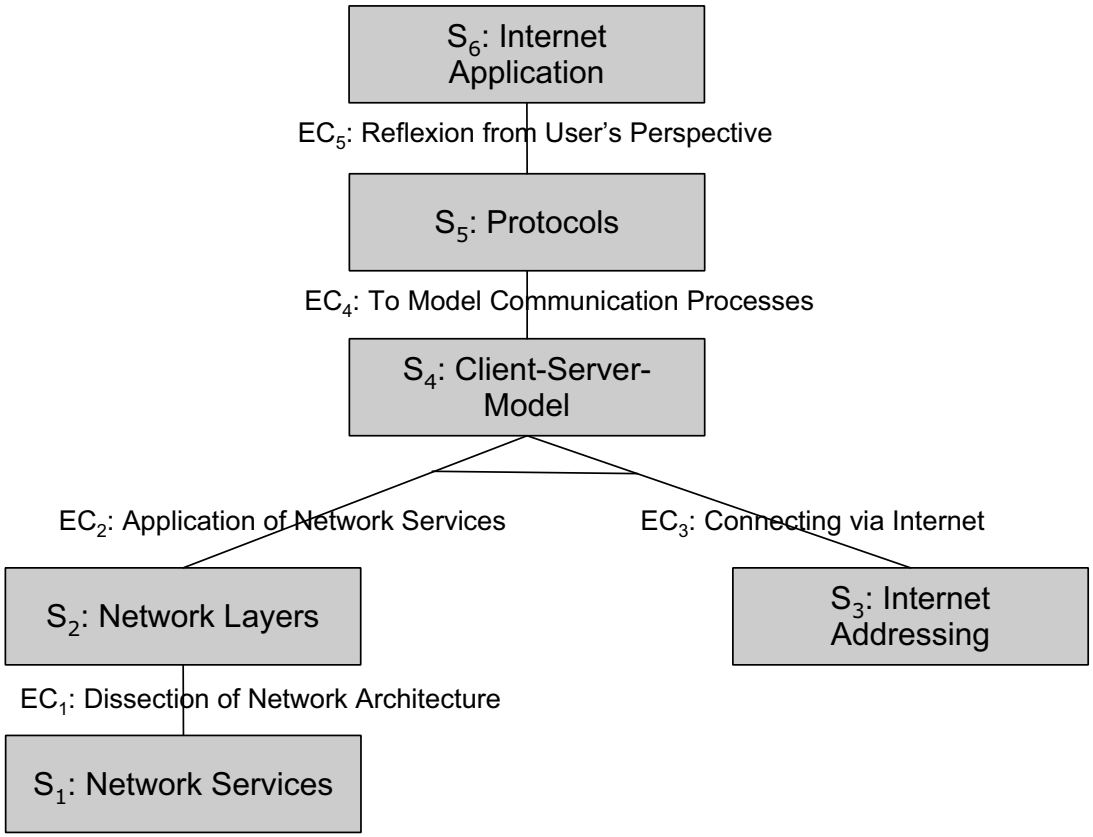


- level of system comprehension → knowledge networks
- level of application → exercise classes
- use of media functions of the informatics system → learning software

Knowledge Network

"Communication in Computer Networks"

Internet applications: e-mail and WWW



Didactic System and Standards

- contribution to educational standards of informatics by test items
- Is it possible to connect Didactic System and competence model?
- Is an assignment of exercise classes to edges of the knowledge network possible?
  - classification of exercises by learning objectives
  - construction of a learning path

Phenomena

- phenomena of informatics:
  "We call the occurences of informatics [in everyday life and society] phenomena of informatics." [Humbert/Puhlmann, 2005, p. 2]
- stimulus and motivation for contents in informatics

examples:

- Phishing
  - security service authentication
  - e-mail source code
  - e-mail transmission path
- Cookies
  - privacy protection
  - dynamic Web pages

Phenomenon "Phishing"

You have got a suspicious e-mail from an online shop. How could you find out, whether the sender address is authentic?

1. view source code of the e-mail → analyse e-mail header
2. analyse transmission path by IP-addresses → IP address information
3. compare sender IP and sender address → lack of authenticity during transmission with Simple Mail Transfer Protocol (SMTP)

Informatics Lessons: E-mail

Communication in Computer Networks

implementation in informatics:

- school computer network: IP-addresses and client-server-model
- protocols: e-mail transfer with Simple Mail Transfer Protocol (SMTP) and Telnet
- e-mail software: analysis of an e-mail application and error correction by programming using a state diagram
- authentication and e-mail: comparison of e-mail-protocols and analysis of transmission path

Phenomenon "Cookies"

You are visiting the Web page of an online shop. A dialog is opened and you are asked to accept cookies. Would you accept or decline? Explain your decision!

- stateless Hypertext Transfer Protocol (HTTP) $\rightarrow$ do I need a shopping cart?
- privacy aspects $\rightarrow$ do I accept that every linked ressource marks my computer for visiting this domain?

Informatics Lessons: Cookies

Communication in Computer Networks

implementation in informatics:

- investigation of learners:
  - "What are the contents of a cookie?"
  - "What are the benefits of cookies?"
- cookies as decentralized database → privacy
- additional mechanism for stateless Hypertext Transfer Protocol (HTTP) → extended design possibilities
- dynamic Web pages: design with state diagram and implementation of an online quiz using cookies

Conclusions

Results

- theoretical foundation of knowledge network "Communication in Computer Networks"
- diploma thesis:
  - analysis of PISA items
  - design test items about Phishing, firewall, access control
- first phase of implementation in informatics:
  - research cooperation with secondary schools
  - practical training of student teachers in grade 11

Further Work

- development of learning software "Internetworking"
- analysis of the first phase of implementation in school
- development of knowledge networks about Internet structures
- analysis of real-life scenarios $\longrightarrow$ design of exercises

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