LIFE LONG LEARNING FOR IMPROVED PRODUCT AND PROCESS MODELING SUPPORT

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THE CHANGE PROCESS

The CHANGE PROCESS

The learning process has not changed to any considerable degree during the latest centuries. A big shift came when the art of printing was introduced during the middle 1400 (Guthenberg).
The most important changes due to introduction of ICT in the learning process are

- Higher emphasis on *learning* (and learning to learn) than teaching
- The teacher becomes more of a *tutor* (coach, facilitator) than information disseminator
- Greater opportunities for distant learning in *virtual environments*
- Life *long learning* becomes an important issue (time and place independent learning).
- *Globalization* with cultural diversity and global market place development with greater possibilities to combine courses from different universities (*virtual universities*)
- Increased *modularization* of information containers with dynamic formation of higher level containers and inclusion of time marked data.
- Possibilities to adapt and/or develop *new pedagogical methods/learning styles* (learning material, learning modes, student competence and intelligence profile, improved collaboration, new teacher roles, and social contexts).

IT IN CONSTRUCTION LEARNING DOMAINS

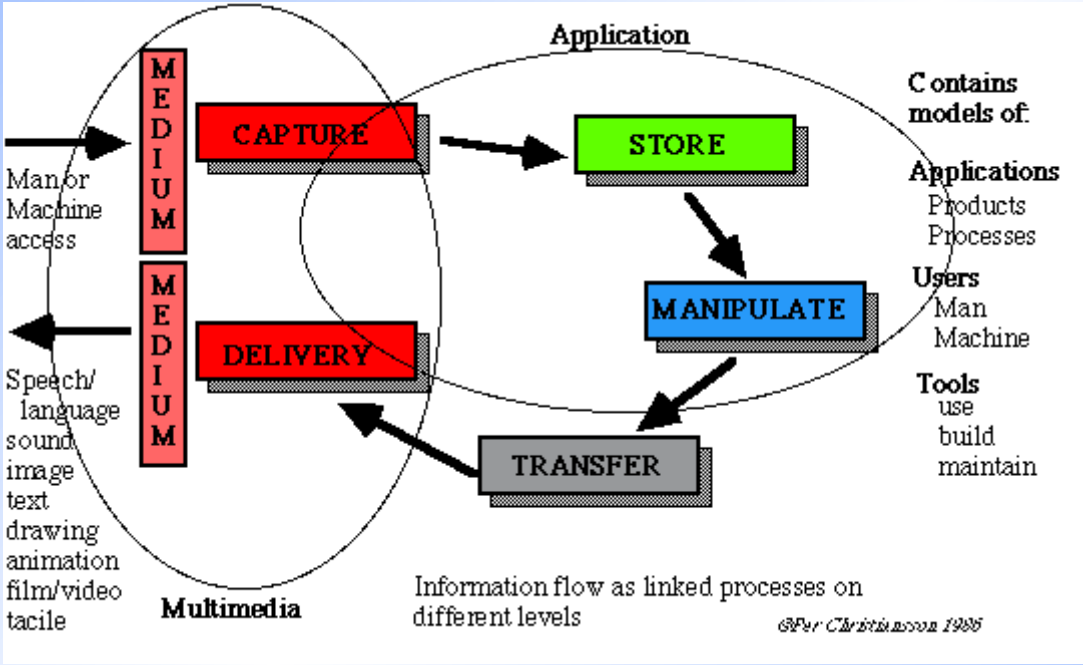
ICT and education

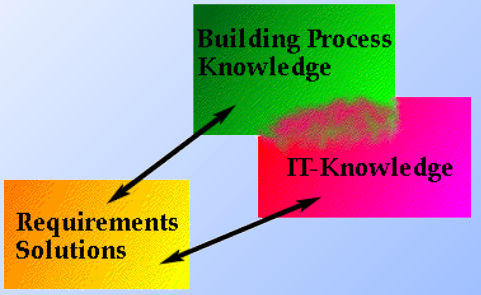
Computer tools were introduced in the education during the mid 1960s. Our IT education experiences are based on course and education systems development as well as teaching from around 1970

- 1972 course in "Computer Controlled Measurements and data manipulation and presentation" at Lund University, Sweden,
- 1983 courses in "Cad, and 3D- and database modeling using Medusa", (Christiansson and Herrera 1985). Workstations were expensive (25.000 US$),
- 1986 post graduate course in "Knowledge Based System",
- 1992 "New tools for knowledge transfer - development of hypermedia systems
- …….

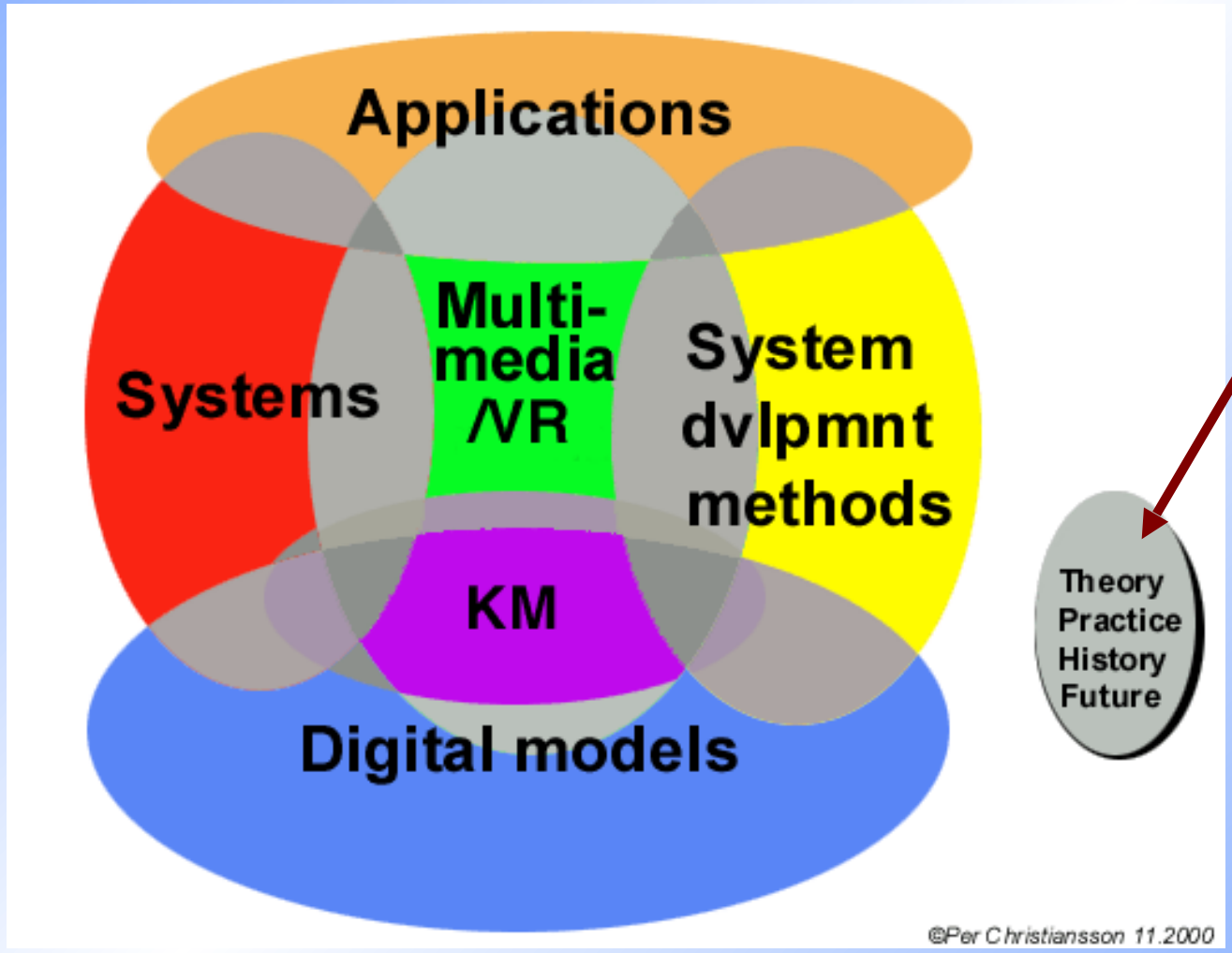
'BUILDING INFORMATICS'

Information and Communication Technology (ICT) is a cross disciplinary domain with strong relations to a number of established sciences such as computer science, cognitive psychology, mathematics, artificial intelligence, social sciences, and informatics. The Construction ICT is by nature also tightly connected to theoretical and practical building sciences.





IT in Construction Learning domains



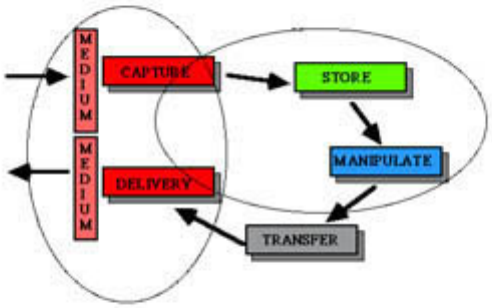
IT in Construction Learning domains (Building Informatics)

User Environment (UE) design
- User needs capture
- Requirements specs
- Contextual design
- Usability/evaluation

Knowledge Management (KM)
- Intranet/extranet specifications
- ICT and change strategy
- Knowledge and experiences discovery, capture, storage and transfer
- Information QA

Intelligent Buildings (IB)
- IB design
- Services and systems
- Networks
- Facility management
- Intelligent city

Computer Supported Collaborative Working (CSCW)
- Virtual workspaces
- Sync/async communication
- Distributed collaboration
- Storytelling



Building simulations
- Building systems simulations
- Building systems integration

Virtual Buildings (VB)
- CAD
- Product and process models and modelling
- Classification
- Conceptual modelling
- 3D geometric modelling

Human Computer Interaction/ Multimedia (HCI/MM)
- HCI design
- Multimodal interfaces
- MM formats
- Computer graphics
- Virtual Reality

Knowledge Representations (KR)
- Relational databases
- Object Oriented
- Logic
- HyperText
- XML
- Semantic Web

The IT in construction main learning domains at Aalborg University.

LEARNING PARADIGMS
PPBL

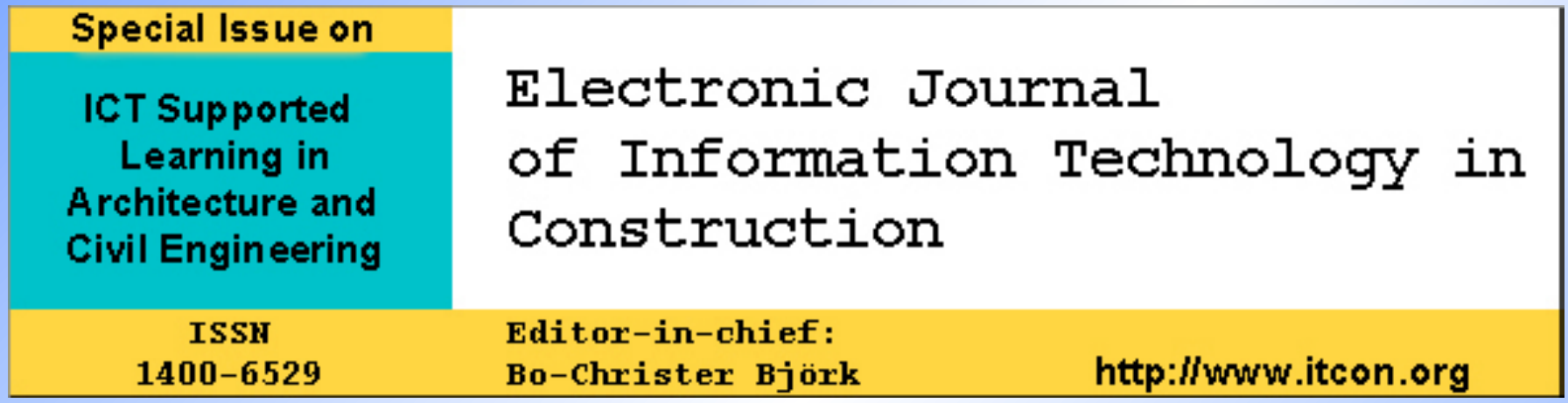
LEARNING STYLES

Our possibilities to provide tools that suite different *learning styles* should be taken into account as we develop ICT supported learning material/ access.

The *learning environment* should as far as possible *support different learning styles* involving concrete experiences, reflective observations, abstract conceptualization, and active experimentation (Kolb et.al. 2003) also taking into account that students have different preferences on the way information is accessed

- The *Visual/Verbal* Learning Style (learns best when information is presented visually and in a written language format. Like to study by yourself in a quiet room)
- The *Visual/Nonverbal* Learning Style (learns best when information is presented visually and in a picture or design format. Likes film, videos, maps, and charts in classroom settings and tends to like to work in a quiet room and may not like to work in study groups. May have an artistic side)
- The *Tactile/Kinesthetic* Learning Style (learns best when physically engaged in a "hands on" activity, classroom demonstration and field work outside the classroom)
- The *Auditory/Verbal* Learning Style (learns best when information is presented auditory in oral language format. Likes group discussions. Likes to interact with others in a listening/speaking exchange)

Learning paradigms



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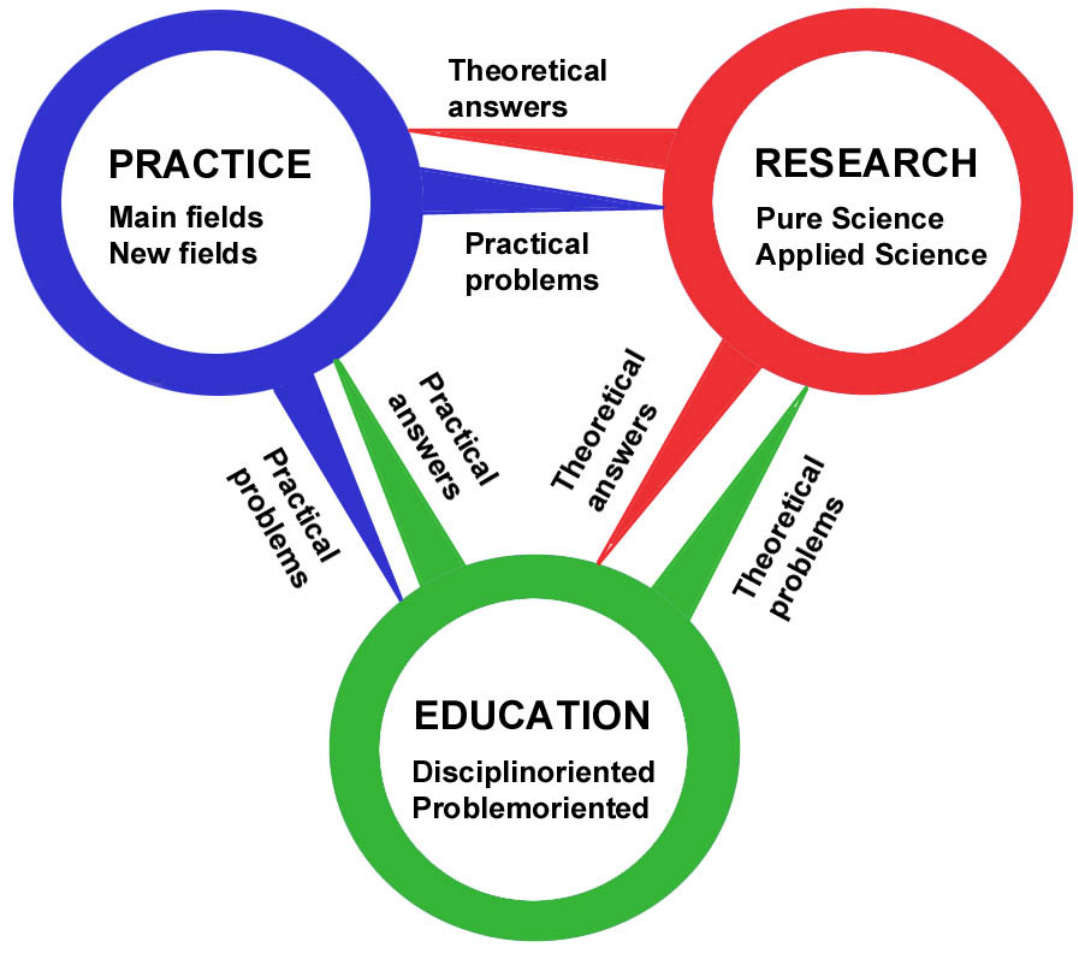
- Properties of learning spaces
- ICT tools to support learning
- (Meta) information handling
- Learning styles
- Learning material properties
- Pedagogical methods

Research - Practice - Education



The dynamic model of the relationships between practice, research, and education

PPBL

The PPBL, Project Organized Problem Based Learning, methodology was introduced 1974 at Aalborg University.

The first year the freshmen learn to *work in project-groups*. The next two years in the undergraduate programs the project work is mainly *design-oriented*. The last two years in the graduate programs the project work is mainly *problem-oriented*

The duration of each project is one semester. In the program 50% of the time is distributed to the *project work*, 25% to *courses related to the project* and 25% to *courses related to the curriculum.*

PHYSICAL AND VIRTUAL WORKSPACES

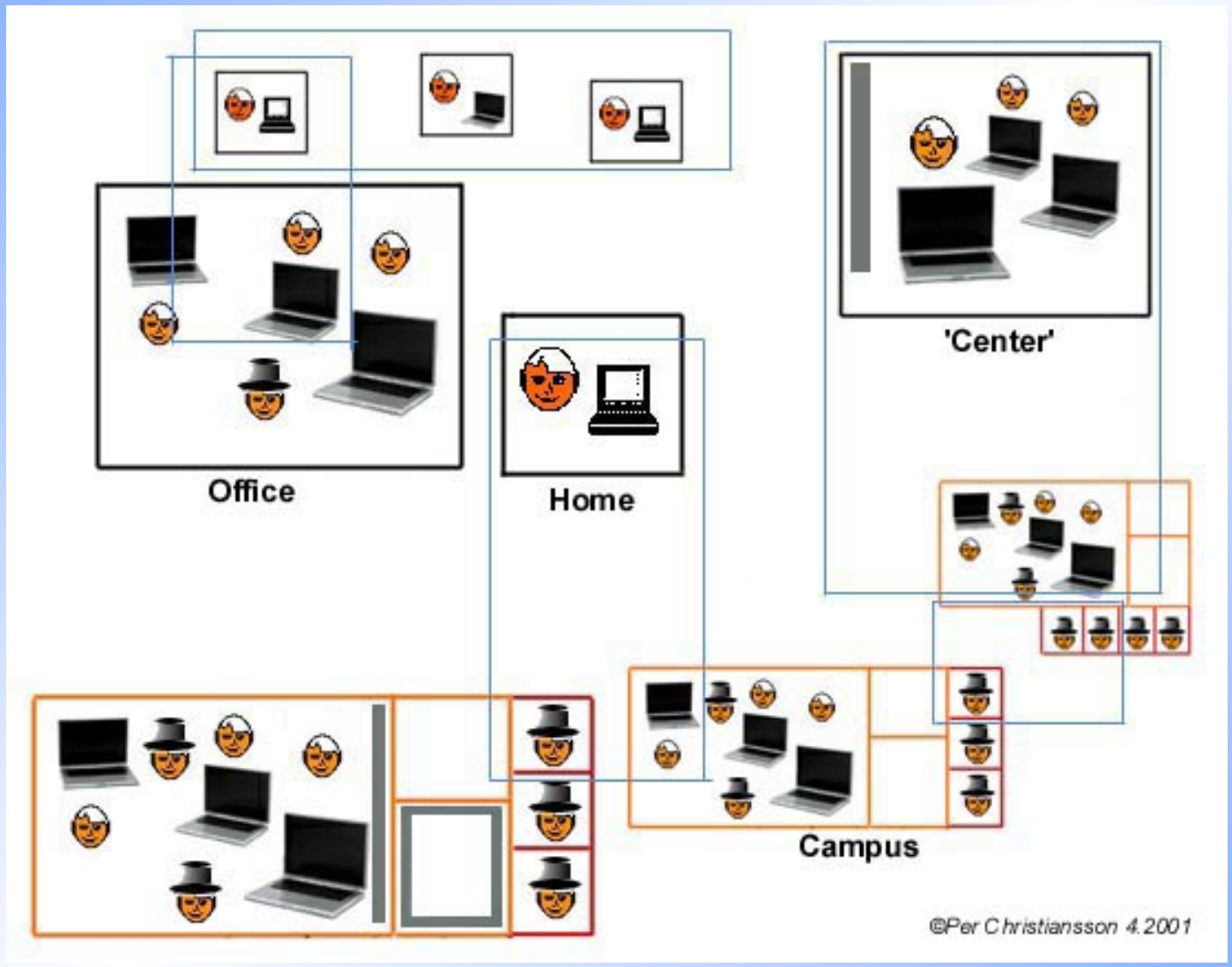
Distributed Learning

Distributed learning takes place in a virtual learning space that expands the conventional study chamber and classroom in time and room with regard to learning style and interaction modes as well as learning material and learning methods

Some issues in connection with properties for and relations between physical and virtual rooms

- Distributed environments are in most cases *complement* to campus spaces
- Rooms with *new properties* can be implemented (augmented, mixed reality and immersive environments, ICT tools transparency)
- Virtual rooms can *change state* (function and form) quickly (group room, personal, presentation, discussion,..) through opening and closing of communication channels, change of interface properties, access to adapted information resources, creation of social and emotional contexts.

Learning Rooms



Students learn and collaborate in physical and virtual rooms (blue lines)

TOOLS AND INFRASTRUCTURE

ICT Tools

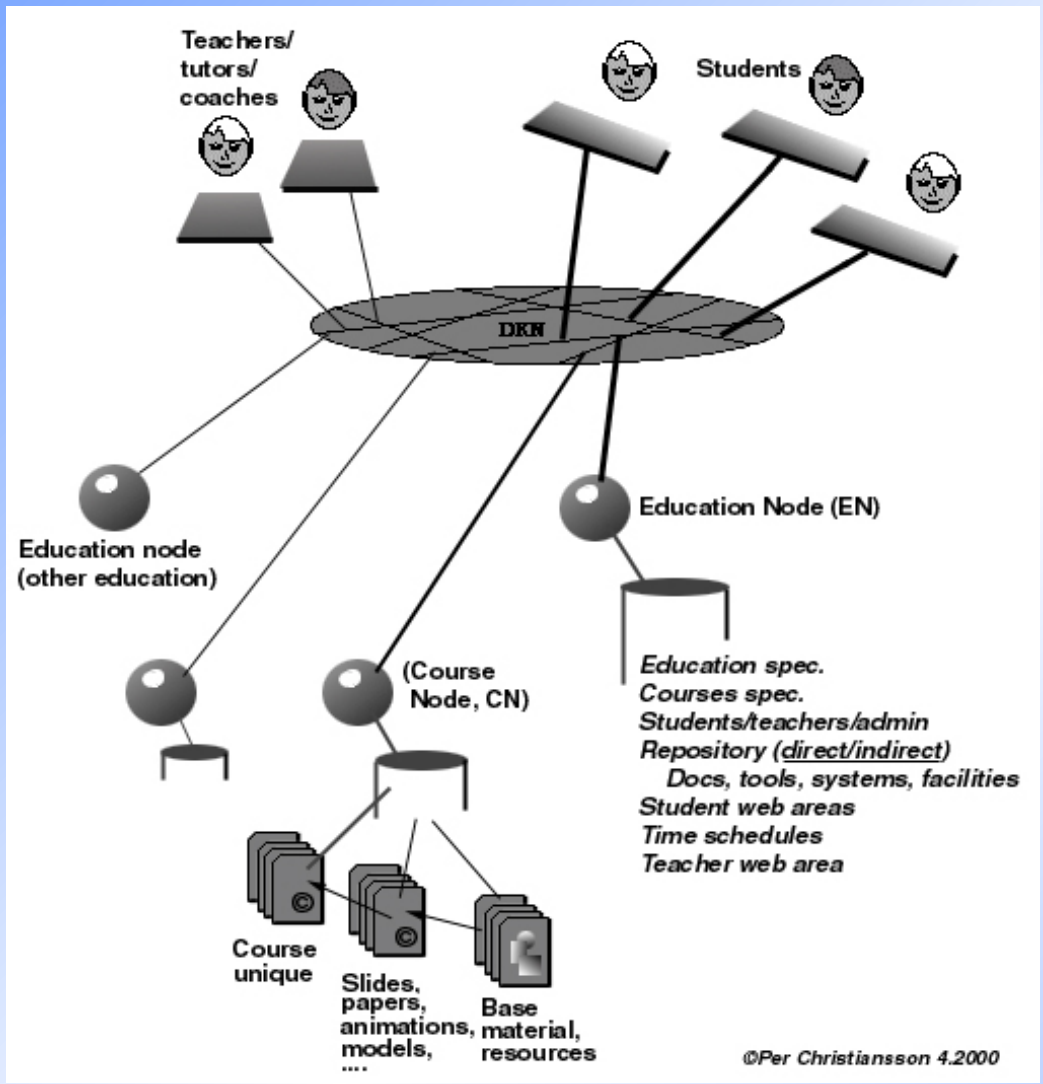
The ICT tools broadly falls within the following categories

- *Human Computer Interaction* (HCI) with multimodal access to dynamically composed information containers and applications

- *Communication and collaboration* support (human-human, human-artifact, artifact-artifact)

- Digital *information containers* with modularised content and separation between storage and access media

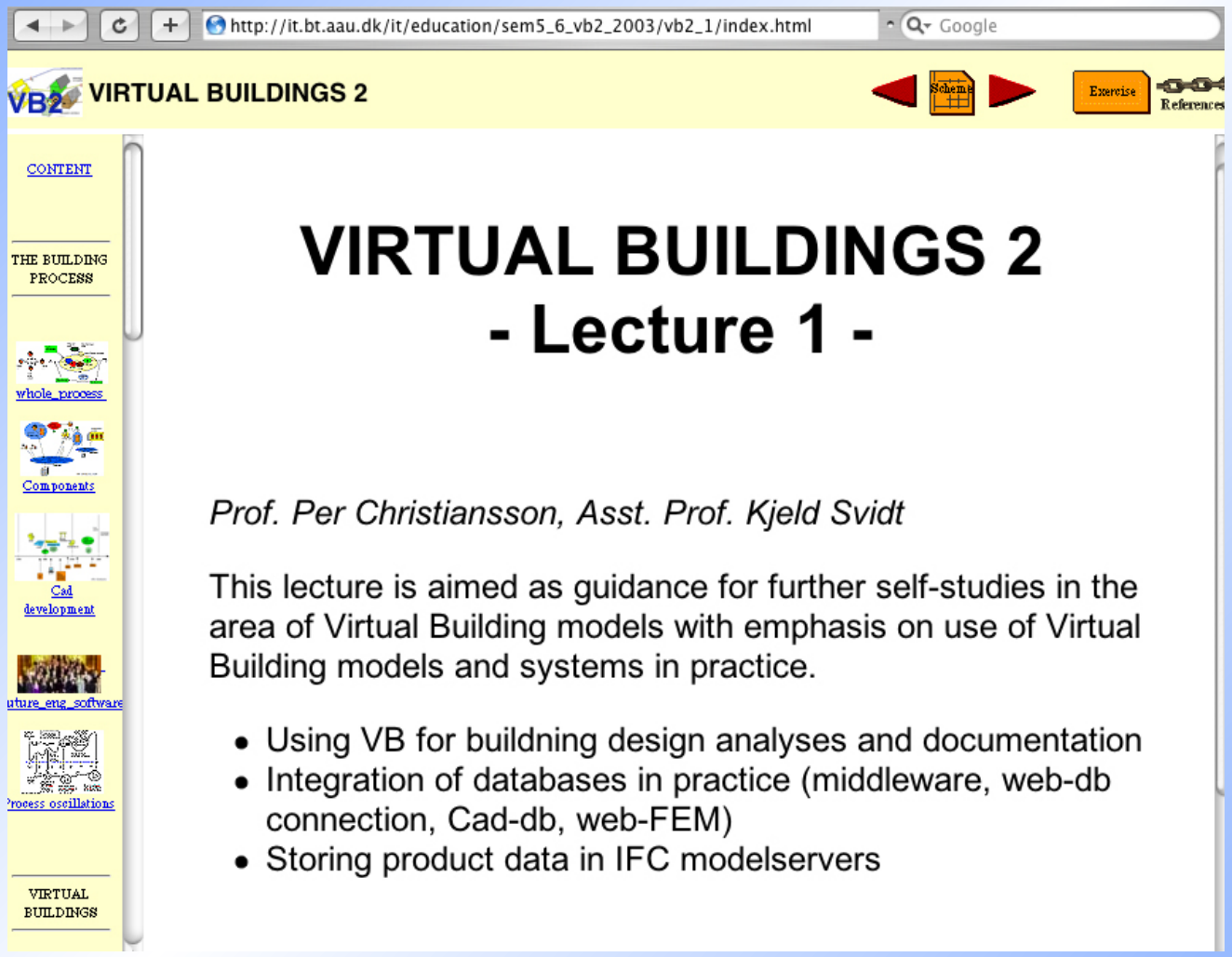
MII learning environment



Students main education access is through the Education Node, EN. If all traffic is channeled through EN it is easier to create administrative data as 'who-is-on' and 'when', and 'who has accessed what'. This is *though* in conflict with direct student access to teacher produced locally stored material.

LEARNING MATERIAL

Learning material



The course material is accessed from the education web, EN in figure 3, that also gives access to student project work and administrative courses information.

COURSE CONTENTS

MII 1st year

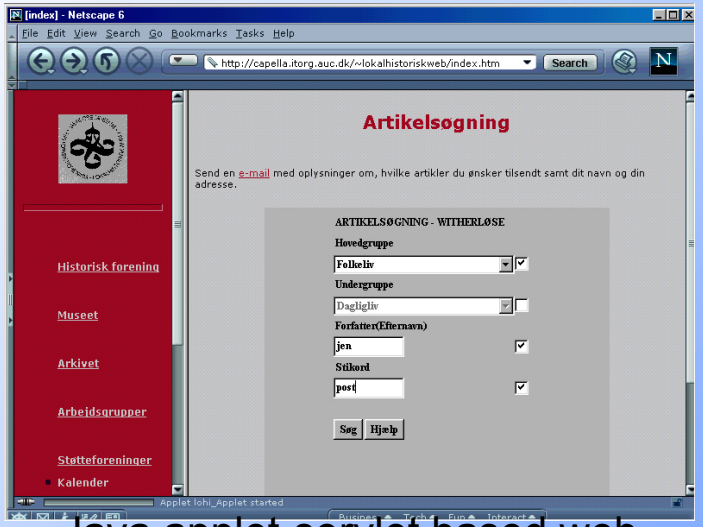
Master of Industrial IT

(Building Management not shown here)

The 1st year theme is 'Distributed Information systems'

The aim is to convey theoretical knowledge and deep understanding on distributed information systems

- Object oriented systems
- Human Computer Interaction
- Databases
- Client Server Technology



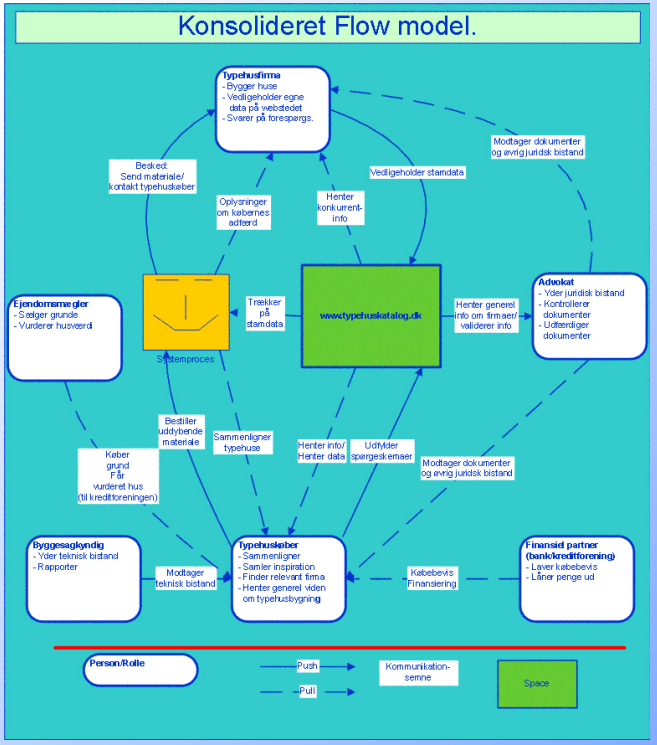
Java applet-servlet based web-database connection (student project)

MII 2nd year

The 2nd year theme is ‘Models and Communication

The aim is to convey *theoretical knowledge and deep understanding* of some important fundamental domains and ICT-tools that will influence the future development

- Computer supported collaboration
- Different types of knowledge representations
- Analyses and modeling of the building
- process and building products
- Knowledge management
- Usability Engineering and Contextual Design



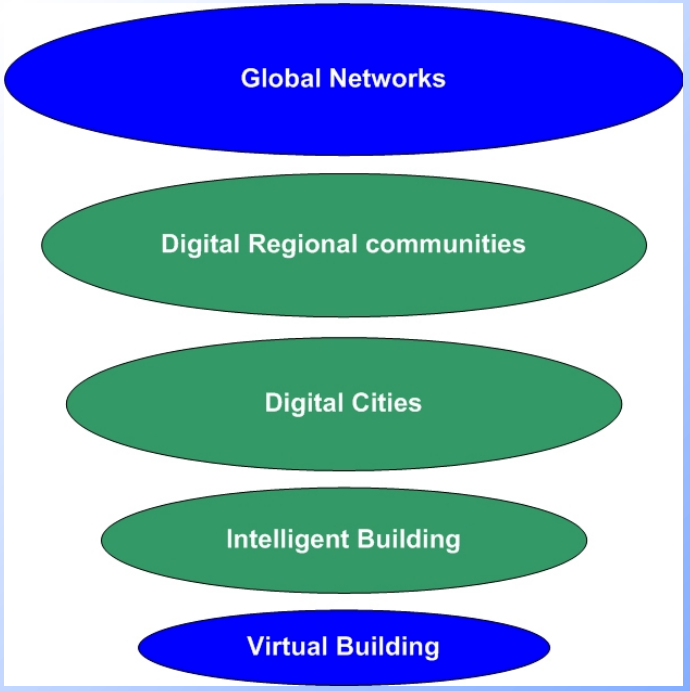
Contextual Design work flow model used for type house catalogue application

MII 3rd year

The 3rd year theme is 'Integrated IT in the Building Process'

The aim is to convey analyses, experiences and examples on advanced present and future use of IT in the different parts of the building process.

- Virtual Buildings
- Work with and analyses building product model exchange using IFC and model checker tools
- Intelligent buildings and services in the digital cities
- Building Simulations



Digital cities intelligent and responsive building investigation domains

CONCLUSIONS

Conclusions

We are only in the beginning of development of cross-disciplinary university courses in open environments with highly communicative IT tools in contrast to traditional classroom teaching.

- excellent possibilities to advance the learning methodologies suitable for life long learning and to render existing courses more effective

- need to raise the IT competence of the teachers to meet the needs for and carrying through of the changes in education in connection with specification of distributed learning system and tools.

- learning material knowledge representations and properties must be (at least implicitly) explained to the learners (and teachers/tutors) ('involve end-users early')

- closer natural collaboration between universities in course development, and experience exchange.

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