Panel 5
Self-Study
A Practical Example and the Results

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Objective of „Computer Science in Mechanical Engineering“

- Content of the lecture: Introduction to Software Engineering
  - Java
  - Basics of object-oriented programming
  - Project management
  - Software development processes
  - Requirements analysis
  - Software design
  - Testing

- Objective of the affiliated laboratory:
  - Practical introduction to Programming
  - Consolidation of contents of lecture by application
Challenges

- Huge number of attendants
- Limited resources
- Varying previous knowledge
- Prejudices against programming
- Low motivation

“I am studying Mechanical Engineering, not Computer Science”
Top priority: Reduce prejudices, improve motivation

- Avoid unnecessary complexity
- Provide success in early stages
- Self-contained and applicatory tasks
- Establish a connection to topics from Mechanical Engineering

**Medium of Choice: Robotics**
- Platform: LEGO Mindstorms NXT
- Firmware: LeJOS
- Programming in teams of two
Constraints due to boundary conditions

- Usual Mindstorms courses:
  - Students build robots themselves
    - Each group needs own robot
    - Demand for more storage space
  - Students build individual robots
    - Robots cannot be shared
    - Individual problems
  - Models are often mobile
    - Demand for test areas
    - Debugging via Bluetooth
Use of a preconstructed fixed crane model

+ Close relation to applications within Mechanical Engineering
+ One setup
+ No time spent on construction
+ Model can be used subsequently by several groups
+ No additional testing areas
+ Data transfer via USB

- Students cannot construct their own robot
- Predetermined setup constricts students
The Laboratory - Structure

weeks

01 02 03 04 05 06 07 08 09 10 11 12

Lecture

Java Programming  Software Engineering  Additional Topics

Laboratory

Intro Java  Intro NXT  Supp. Gate 0  Supp. Gate 1  Support  Final Gate
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Theory-based recommendations

Learning activities

- **Learning process phase**

- **Key activities**: groups of activities with focus on certain aspects

- **Concrete activities**: can be ordered in sequences

Learning resources

- **Learning tools/services** can be recommended based on the chosen learning activities and on the skills of a learner

- **Artefacts**: any product of individuals or groups or of their behaviour or interactions (e.g. documents)

- **Actors**: human beings and (software-) agents

21 April 2010
Activities

Learning Phases

Learning process phase 1: Learner profile information is defined or revised

Learning process phase 2: Learner finds and selects learning resources

Learning process phase 3: Learner works on selected learning resources

Learning process phase 4: Learner reflects and reacts on strategies, achievements and usefulness

Key-Activities

- Goal setting
- Task strategies
- Time management
- Self-monitoring
- Self-evaluation
- Help-seeking (SRL)
- Self-reflection
- Exercising
- Interacting
- Receiving
- Exploration
- Experimentation
- Creation
- Imitating

Concrete Activities

- To identify strategies how to reach goals
- To set goals specific
- To order goals hierarchically
- To focus on the learning process
- To focus on performance outcome
- To formulate goals specifically and precisely
- To set and revise goals daily (temporal proximity)
- To set goals consciously
- To set goals with lack of conflict among goals
- To define dependencies between and within (sub-)goals
- To describe obstacles, which could hinder (sub-)goal achievement
- To describe cause of obstacles
- To self-control time
- To observe
- To memorize
- To imitate
- To absorb
- To copy
- To reproduce
- To acquire skills and behaviours from other people
- To transform/classify/organize modeling stimuli into easily remembered schemes
- To code symbolic
- To organize cognitive
- To practice/exercised train motorically
- To select relevant events out of total stimulus complex
- To transform conceived actions into real behaviour
- To guide own performance
- To control own performance
- To correct if necessary own performance
- To process external, vicarious and self reinforcement
- To be attentive
- To give oneself feedback regarding accuracy
Dependencies Web Knowledge Map (WKM)

**Teacher**
- Providing structures and "seed content"
- Motivation and introduction for the students
- Evaluate and steer the process

**Industry**
- Uses the WKM for professional development
- Provides practical (real world) exercises, examples, contact partner, excursions, practical trainings or master thesis.

**Students**
- Uses the WKM for self-controlled learning
- Add comments, questions, refinements
- Get industry-contacts

- **Web Knowledge Map (WKM)**
  - Relation Classes
  - Knowledge Classes
  - Knowledge Objects
  - Relation Objects

- **Navigation**
- **Administration**
- **Get student contacts**
- **Get industry contacts**
- **Get feedback**
- **Add new content**
- **Organise and motivate**
- **Content usage**
- **Content refinement, insert questions, add comments**
- **Get feedback**
Knowledge Map

History with CAM-widget

Chat-widget for collaborative learning
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Benchmark Data

Start Date: 10.08.2012, 15:05 h
End Date: 18.09.2012, 11:27 h
Logins: 5796
Website hits: 240239
Accessed articles: 144295
Hits per login: 41
Accessed articles per login: 25
Knowledgemap - Hits

Logins

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IV. Related Projects
ROLE – Responsive Open Learning Environments

- European collaborative 4-year project (16 research groups from 6 EU countries and China, 2009-2013)
- Centred around the concept of self-regulated learning to create responsible and thinking learners
- Tools from ROLE Widget Store helps teachers to create open personal learning environments for their students with support for
  - planning their learning process
  - searching independently for resources
  - learn and reflect on their learning process and progress
- IMA/ZLW&IfU: Knowledge Map testbed including the Web 2.0 Knowledge Map (Wiki with additional visualization capabilities, WKM), chat & history widget
  - Used in course for information science in mechanical engineering with +1500 students incl. tool evaluation

To read more:
- ROLE’n Web: http://www.role-project.eu/
ExAcT – Center of Excellence in Academic Teaching

ExAcT is part of state-countries program “RWTH 2020 Excellence in Teaching and Learning” and part of the project “RWTH 2020 – Improving teaching quality together“ of the Institute Cluster IMA/ZLW & IfU at the RWTH Aachen university.

- **ExAcT Qualification**
  - Advanced training and competence impartation for academics at all levels of a university career

- **ExAcT Research**
  - practice-orientated and student-centered teaching research on media- and subject-didactic issues in the context of different disciplines
  - Networking of all actors involved in teaching at the RWTH University
### Project ELLI Research Fields

<table>
<thead>
<tr>
<th>Empiricism &amp; surrounding parameters</th>
<th>Curricular development</th>
<th>Concepts for Teaching and Learning</th>
<th>Testing based on skills</th>
<th>Teaching experiments</th>
<th>Large classes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Best Practice Monitoring</td>
<td>Assessment</td>
<td>Shift from Teaching to Learning:</td>
<td>Skill oriented</td>
<td>Didactic skill</td>
<td>Appropriate</td>
</tr>
<tr>
<td>Collaboration of the CoP and the Advisory Board</td>
<td>Orientation Phase</td>
<td>Problem-based Learning</td>
<td>Integrated in the learning-process</td>
<td>enhancement of secondary- and impact-research</td>
<td>teaching and learning concepts</td>
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Questions?

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