Measuring the Effects of Problem-Based Learning

*Progress in the development of a scale to rate the acquisition of professional knowledge through PBL*
Presentation outline

- Research project on „PBL“ at the TU Dortmund
  - Project outline
  - Research objectives

- After last year’s discussion at ECER…

- Measurement of knowledge acquisition through PBL
Research project „PBL“ at the TU Dortmund

- **Project Title:** Efficacy of problem-based learning and professional development of university teachers in three countries: Germany, Sweden and the Netherlands

- Funded by the **German Ministry of Education and Sciences**

- **Timeframe:**
  - Spring 2009-Spring 2010: Conceptualization of study, research design and theoretical framework (*Werkstattphase*)
  - Spring 2010-2012: Data collection and recommendations on the implementation of PBL at German universities
Research objectives

- **Description** of problem-based learning scenarios and practices across different European countries

- Exploration of teachers’ attitudes toward teaching in PBL and of the effects on the outcomes of problem based vs. ‘conventional’ teaching

- Exploration of the outcomes of PBL as a teaching method in higher education in a cross-national design
Effects of PBL – empirical evidence

- Positive effects on 'soft' dimensions, such as self-assessed competencies and teacher ratings of students‘ performances (Jones et al., 2002)
- No effect or negative effect on the acquisition of knowledge, in self report and measured in 'conventional' (summative, declarative) testings (Mamede et al., 2006)
- But: better performance in practical tests and problem solving (Colliander, 2002)
### Teaching vs. Testing: Match and Problems

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<tr>
<th>Teaching</th>
<th>Testing</th>
<th>Match</th>
<th>Problems</th>
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<tbody>
<tr>
<td>'Conventional' teaching: Lectures and courses</td>
<td>'Conventional' testing: paper-and-pencil test</td>
<td>✓</td>
<td>reproduction of declarative knowledge</td>
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<tr>
<td>Problem based teaching: course work, self-studies</td>
<td>'Conventional' testing: paper-and-pencil tests</td>
<td></td>
<td>poor alignment between teaching and testing</td>
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<tr>
<td>Problem based teaching: course work, self-studies</td>
<td>Problem-based testing: case studies, formative evaluation, portfolios</td>
<td>✓</td>
<td>fairness, standardization, comparability</td>
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- **'Conventional' teaching** focuses on lectures and courses, aimed at reproducing declarative knowledge. Testing in this context is often a paper-and-pencil test, which can lead to a poor alignment between teaching and testing.

- **Problem based teaching** involves course work and self-studies, which aims to develop problem-solving skills. Testing in this context can be case studies, formative evaluation, or portfolios. Despite these methods, there can still be issues with fairness, standardization, and comparability.

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*Source: ECER 2009, Theory and Evidence in European Educational Research, Vienna, Austria*
Key questions after last year’s discussion….

- Is there a difference in the structure of knowledge acquired through PBL?
- How do we conceptualize and measure this knowledge acquisition?
1. Clarification of terminology (ECER 2008)
2. Defining the problem (ECER 2008)

3. Analysing the problem, collection of ideas

4. Structuring / systematic inventory of ideas

5. Formulation of learning goals

6. Individual or collective research and studies

7. Synopsis and solution
Conceptualization of ‘knowledge’

- Assumption: The acquisition of knowledge through PBL is qualitatively different to ‘conventional’ knowledge acquisition

- Conceptualization of ‘knowledge’: surface vs. deep approach (i. e. Marton, 1982, Marton & Säljö, 1976a, 1997)

- Connection to problem solving and professional knowledge (Laurillard, 1997)
Measurement of knowledge acquisition – solution I

- **True/false or multiple choice items** with connection to professional aspects
  - i.e. Maastricht Progress Test
  - “Women are at higher risks for depression” => true/false?

- Quantitative and differential measures: **amount of knowledge** acquired

- Problems:
  - measurement of rather declarative/reproductive knowledge
  - poor alignment to aims and means of PBL
Measurement of knowledge acquisition – solution II

- Measurement through problem-based tasks: **text reading experiments** (Dahlgren, 1975; Marton 1975b)
  - text-based questions aiming at understanding of principles rather than facts
  - “Why does a bun cost one pence?”

- Qualitative measures: **different levels of understanding** (Dahlgren, 1997)

- Problem:
  - „texts as metaphors for classes“ (Marton & Säljo, 1997)
Problems

- What does this conceptualization of knowledge imply for the assessment?
- (How) Can we combine the advantage of the two approaches to measure the acquisition of knowledge through PBL?
Thank you very much!

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## Knowledge-based Items, examples from Psychology

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<tr>
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<tr>
<td>„A task that is finished is better kept in mind than a task that is not finished yet.“</td>
<td><em>(Learning and Memory)</em></td>
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<tr>
<td>„When in positive mood people can be much easier be convinced of something than when in bad mood.“</td>
<td><em>(Motivation and Emotion)</em></td>
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<tr>
<td>„The drug <em>Mondafinil</em> is often used by people who want to shorten their sleeping periods.“</td>
<td><em>(Neurochemistry and Pharmacology)</em></td>
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<td>„Elderly people have greater difficulties in planning a social event than in conducting a complex planning task.“</td>
<td><em>(Developmental Psychology)</em></td>
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<td>„Women are more creative when writing SMS than men.“</td>
<td><em>(Language)</em></td>
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