Laboratory Didactics
- Case Study and Problem Solving

Engineering Pedagogy
Case Studies - History

- Historical roots in the casuistry of the legal and medical teaching
- Casuistry (Latin casus, "case") generally refers to the consideration of individual cases in a particular subject area.

Case study as a method of knowledge-finding by individual case study

Case study as a teaching method through case-based problem solving

Harvard Business School Lecture Schedule 1908:
„In the courses on Commercial Law, the case-system will be used“
Source: Kaiser 1976, p.51

- Transfer of the case method in the business area under W.B. Donham (2. Dean)

- Order at the Harvard Bureau of Business Research to collect case materials for all subjects
What is a Case Study?

1. A complex teaching method

2. Problem solving process is in the foreground

3. Problem situation mostly from practice

4. Learners must have the problem situation independently analyze and develop solutions to problems in group work

5. The different solutions should a critical Evaluation are subjected to.
The Problem Solving Model

1. Problem Identification
   - “Why is there a problem?”

2. Plan Evaluation
   - “Did it work? What do we do next?”

3. Plan Implementation
   - “What will be done to resolve the problem?”

4. Problem Analysis
   - “By how much should the student grow?”

5. Goal Setting

Referral

- “Is there a discrepancy between current and expected performance?”
1. Confrontation with the case
   - The case will be presented to the learner.
   - Information on the case will be collected.
   - Problems and decision needs to be clarified.

2. Evaluate information
   - Processing of the questions in groups
   - Material is provided or must be searched independently.
   - Results of the group work are presented in plenary.

3. Exploration and resolution options for action
   - Courses of action are to develop and discuss.

4. Defense of the proposals for action
   - The different courses of action are to present and justify.
   - The action decision is to make.

5. Collation with reality
   - The prepared solution of the case is to compare with the solution in the reality.
## Variants of the work with case studies

<table>
<thead>
<tr>
<th>Method</th>
<th>Problem recognition</th>
<th>Acquisition of information</th>
<th>Problem solving</th>
<th>Criticism of solution</th>
</tr>
</thead>
<tbody>
<tr>
<td>Case-Study-Method</td>
<td><strong>Focal point:</strong> hidden problems need to be analyzed</td>
<td>Information is given</td>
<td>Possible solutions to the problem are to identify and decisions to made</td>
<td>Comparison of the solution with the decision in the real world</td>
</tr>
<tr>
<td>Case-Problem-Method</td>
<td>problems are clearly stated</td>
<td>Information is given</td>
<td><strong>Focal point:</strong> Possible solutions to the problem are to identify and decisions to made</td>
<td>Comparison of the solution with the decision in the real world</td>
</tr>
<tr>
<td>Case-Incident-Method</td>
<td>the case is incomplete represented</td>
<td><strong>Focal point:</strong> Information is to acquire independently</td>
<td>Possible solutions are to identify. The case is solved.</td>
<td></td>
</tr>
<tr>
<td>Stated-Problem-Method</td>
<td>problems are given</td>
<td>Information is given</td>
<td>The final solutions are given. It will look for alternative solutions.</td>
<td><strong>Focal point:</strong> Critique of the given solutions</td>
</tr>
</tbody>
</table>

Brainstorming

Principle of the Method:
Brainstorming benefits from:
- retrieval of unconsciously or unappreciated knowledge
- positive thinking and elimination of criticism
- the heterogeneously group

Creative problem solving by combining seemingly unrelated elements
Preparation, process and evaluation of the brainstorming

**Preparation**
- Choose a heterogeneous group of people
- Invite 5 to 10 participants
- Location: unusual trouble-free environment
- Time: 15 - 45 minutes
- Information about: problem, rules

**Brainstorming-meeting**
- Rules: not a criticism, allows many wild ideas, continuation of idea approaches
- Procedure: co-ordinator explained topic, ensure observance of the rules
- Visualize ideas on a flip chart

**Evaluation**
- Complement of ideas in consultation
- Classification and evaluation of ideas
- Announcement of the proposed solutions
Problem-solving by motivated modification of information

Diagram:
- Information
  - Motivation
    - Modification of information
      - Approximation
        - Thinking
        - Induction
        - Deduction
        - Simplification
        - Sequencing
        - Try and Error
      - Alienation
        - Analogy
        - Association
        - Creative confrontation
        - Inversion
        - Provocation
        - Transformation
Basic rules for knowledge discovery after Renè Descartes (1596-1650) (Discourse de la Mèthode)

* Dissect each problem into as many parts as possible …

* Arrange your thoughts. Start with the simplest and then work step by step

* Compile a comprehensive list of all the facts. Get an overview, that you're sure to have miss out nothing
The basic problem is to decompose
for each parameter, the characteristics are to compile

<table>
<thead>
<tr>
<th>PARAMETER</th>
<th>AUSPRÄGUNGEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>$A_1$ $A_2$ $A_3$ $A_4$ $A_n$</td>
</tr>
<tr>
<td>B</td>
<td>$B_1$</td>
</tr>
<tr>
<td>C</td>
<td>$C_1$</td>
</tr>
<tr>
<td>D</td>
<td></td>
</tr>
<tr>
<td>...</td>
<td></td>
</tr>
</tbody>
</table>

for each parameter, the seemingly optimal value is to select

the optimal values of all parameters are to combine

Current problem

Basic problem

Problem elements = Parameter (What?)

known or possible solutions = characteristics

Optimisation

Combination
## Morphological Analysis - Example

<table>
<thead>
<tr>
<th>Organisation Type</th>
<th>Leadership Culture</th>
<th>Buyer Structure</th>
<th>Dominate Product/Service</th>
<th>Co-operation Strategies</th>
<th>Employee Profile</th>
<th>Main Employee Incentive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Official state agency</td>
<td>Bureaucratic hierarchy</td>
<td>Ministry dominated</td>
<td>Process + method support</td>
<td>Outside help when needed</td>
<td>Life-long service</td>
<td>Money</td>
</tr>
<tr>
<td>Government owned enterprise</td>
<td>Strong scientific leadership</td>
<td>Military and material dominated</td>
<td>Soft studies</td>
<td>Joint ventures</td>
<td>Career researcher</td>
<td>Managerial career</td>
</tr>
<tr>
<td>Academy</td>
<td>Marketing division leadership</td>
<td>Defence Industry</td>
<td>Hard studies</td>
<td>Consultant purchasing</td>
<td>Development engineer</td>
<td>Pleasure in one's work</td>
</tr>
<tr>
<td>Trade institute</td>
<td>Umbrella management</td>
<td>Civilian agencies</td>
<td>Basic research</td>
<td>Mediator only</td>
<td>&quot;Consultant&quot;</td>
<td>Educational motivation</td>
</tr>
<tr>
<td>Consultant firm</td>
<td>Gatekeeping</td>
<td>Private markets (national)</td>
<td>Testing, construction</td>
<td>Entrepreneur</td>
<td>Titles, specialist career</td>
<td></td>
</tr>
<tr>
<td>&quot;Learning organisation&quot;</td>
<td>Skunk-works (ad hocri)</td>
<td>International markets</td>
<td>Second opinion</td>
<td>Elite troops</td>
<td>Organisation gives status</td>
<td></td>
</tr>
</tbody>
</table>
## Synectics Excursion

<table>
<thead>
<tr>
<th>Stage</th>
<th>Explanation</th>
</tr>
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<tbody>
<tr>
<td>1. Problem as given</td>
<td>Transmission of the problem by an expert</td>
</tr>
<tr>
<td>2. Analysis of the problem</td>
<td>Discussion about the problem</td>
</tr>
<tr>
<td>3. spontaneous reaction</td>
<td>spontaneous ideas for solutions are to give</td>
</tr>
<tr>
<td>4. Problem as understood</td>
<td>the better understood problem is to reformulate</td>
</tr>
<tr>
<td>5. First direct analogy</td>
<td>for a technical problem are to find analogies in nature and vice versa</td>
</tr>
<tr>
<td>6. Personel analogy</td>
<td>personal feelings concerning an analogy are to describe</td>
</tr>
<tr>
<td>7. Symbolical analogy</td>
<td>from the feelings, conflicting words are to form (adjective + conflicting noun)</td>
</tr>
<tr>
<td>8. Second direct analogy</td>
<td>from the word pairs are direct analogies to form</td>
</tr>
<tr>
<td>9. Examination</td>
<td>detailed description of a chosen analogy</td>
</tr>
<tr>
<td>10. Force fit</td>
<td>Drawing conclusions from the description of the analogy</td>
</tr>
<tr>
<td>11. Solution as understood</td>
<td>Formulation of the proposed solution</td>
</tr>
</tbody>
</table>
Thank you for your attention