What do I have to know and to do?

Development of a Theory-based, Normative Competence Description for the Profession of Computer Specialist

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Agenda

1. Motivation and Existing Problems
2. Research Questions
3. Research Process
4. Resulting Model
5. Summary and Conclusion
Vocational Education in Germany

• Vocational schools in Germany are part of the mandatory school system
  – Students attend vocational schools after general education
  – *Dual vocational education* as important part of vocational education

• *Dual vocational education* consists of
  – Practical training at the company and
  – Theoretical education at (part-time) schools

• The curriculum for the profession as computer specialist is oriented towards the “*concept of learning fields*”

• *Learning fields*:
  – Describe competencies students should achieve
  – Describe specific content students should know
  – Are based on real-life working processes
Motivation

• Curricular concept of learning fields has not been completely implemented into daily lesson

• Possible reasons are:
  - Problems with school organisation and scheduling
  - Curriculum lacks of real-life relevance
  - Improvable definition of the learning fields
  - A lack of appropriate teaching material

→ Development of a *Comprehensive, Normative Competence Description* could improve the situation
Further Advantages of a Competence Model

- Basis for further research upon vocational competence development
- Basis for a revision of school curricula and in-company training regulation
- Support for teachers in developing teaching material
- Contribution for further improvement of EQF and DQR
- Contribution to teacher education
- Support to connect teaching concepts from general and vocational education
Research Questions

Which fields of actions describe the profession of a computer specialist?

Which competencies and skills should be acquired during apprenticeship to gain the ability to work on these fields of action?
Working Process and Substudies

- Curricula
- DQR / EQF
- Company Trainers
- Job Offers
- Working Processes
- Competencies
- Tasks
- Requirements

Comprehensive Competence Model
First Step: Review of Curriculum and In-Company Training Regulation

Curriculum:
- Concept of learning fields
- Competence-orientated
- Orientated towards working processes

In-Company Training Regulation:
- Subject classification
- Only information about knowledge
### The EQF (European Qualification Framework for lifelong learning) / DQR

#### Segment of the DQR
- Examples of professional fields
- Without levels (here: 5) and their reasoning

#### Competence definition describes learning outcomes

#### Personal competency has been described in a very general way

#### Reference to in-company training regulation and outline curriculum

<table>
<thead>
<tr>
<th>List of professional fields</th>
<th>Professional Competency</th>
<th>Personal Competency</th>
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</thead>
<tbody>
<tr>
<td>TR and LF No.</td>
<td>Knowledge</td>
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<td>(instrumental and systematic assessment ability)</td>
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</table>

1. Shaping an operational organisation
   - No. 1, 3 & LF 1, 3, 5
   - CSp have knowledge of general conditions of national economies and structure of economic systems. They assess the role and structure of companies in economic systems. They understand market structures and the role of production factors for performance. They understand operational connections and participate in operational processes in an active way. They have knowledge about protection, occupational safety and environmental protection.

2. CSp have the ability to gather information (also in English), to analyse sources of information (e.g. technical descriptions, manuals etc.) concerning specific tasks of IT and occupational processes, to evaluate and select the information for their work. They use various techniques to organise their work.

3. CSp plan tasks in their teams. They shape cooperation actively in their organisation. They use various techniques for communication and creativity.

4. CSp have a sense of responsibility and they work efficiently. They develop strategies for independent working and learning. CSp know English technical terms and terms of expressions in their working area.

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TR: In-company training regulation (“Ausbildungsordnung”)  
LF: Learning field from outline curriculum  
CSp: Computer specialists for application development
# Interview Study among Certified Trainers

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**Occupational working processes**

| A new working place for an employee | d | d | a | d | b |
| User help desk | d | b | d | c | a |
| Installation, maintenance and support of servers | c | d | b | a | b |
| ... |   |   |   |   |   |
| Application development for collection department or accounting department | d | b | d | d | a |
| Planning, documenting and accounting an application development project | b | d | d | a | b |
| Implementation of project plans into functional SW | b | d | d | a | b |

**Main topic of the respective working process**

**Alternate topic of the working process**

- **a:** **Main learning objective:** apprentice/student has to deal actively with the problem to learn the topics of the learning field
- **b:** Apprentice/student uses mainly previous knowledge from the respective learning field to deal actively with the problem
- **c:** Apprentice/student uses previous knowledge as background for decision making processes
- **d:** Apprentice/student uses the knowledge from the learning field implicitly
### Working Processes assigned to DQR

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<td>Marketing IT Systems</td>
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<td>Calculating Economic Efficiency of IT Services</td>
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#### Occupational Working Process

- User help desk
- Software installation and configuration of Clients
- Software installation and configuration of Servers
- Maintenance of Telephone Systems
- Installation and Support of Customer IT Solutions, including all Hard- and Software
- Customer Advisory Service
- Application Development for Different Company Departments

**Main topic of the respective working process**
- **Main learning objective:** Computer specialists have to deal actively with the problem to learn the topics of the learning field
- Computer specialists use actively previous knowledge and skills from the field of action - consolidation of skills
- Computer specialists actively use previous skills and knowledge for decision making processes
- Computer specialists implicitly use previous knowledge from the field of action for different working processes

**Alternate topic of the working process**

- **a:** Main learning objective: computer specialist has to deal actively with the problem to learn the topics of the learning field
- **b:** Computer specialists use actively previous knowledge and skills from the field of action - consolidation of skills
- **c:** Computer specialists actively use previous skills and knowledge for decision making processes
- **d:** Computer specialists implicitly use previous knowledge from the field of action for different working processes
Review of Job offers

- 100 job offers from 4 online job agencies

- **Demanded requirements:**
  - Personal, operational & professional competencies
  - Formal requirements
  - Experience

- **Described tasks:**
  - Vocational operational fields
  - Description of working areas

- **Categorisation:**
  - Resulting Statements:
    - About 1300 requirements
    - About 980 tasks
  - Methods of content analysis
  - Categorisation based upon curriculum
  - Result: *Multilevel category system*

Extract from Category System

Assignment to DQR

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WIPSCE 2015, London
Implications for the Prospective Competence Model

- The DQR as accepted model is a suitable basis for development
- Problems with DQR:

  - Lack of explicit nomination of "technical IT service"
  - No "administration of database systems"
  - Additional action fields necessary
  - "Calculating economic efficiency of IT services"
  - "Organizing and implementing (complex) IT projects"
  - "Applying organisational structures"

Development of a new, sound model required
## Resulting Competence Model

### Personal Competence
- **AF 1:** Designing Business Processes in IT and CS
- **AF 2:** Delivering Service and Advice
- **AF 3:** Developing Software Components, Application Software and Databases
- **AF 4:** Administration and Maintenance of Database Systems
- **AF 5:** Configuring and Installing IT Systems
- **AF 6:** Networking IT Systems
- **AF 7:** Delivering Technical Services

### Professional Competence
- **Cross Sectional Process 8:** Organizing and Implementing Complex IT Projects
- **Cross Sectional Process 9:** Applying Organisational Structures
- **Cross Sectional Process 10:** Calculating and Evaluating Economic Efficiency of IT Services
Exemplary field of action: “Delivering service and advice”

**Knowledge:**

Computer specialists *know* the basic principles and rules of IT service. They *are aware* of basic pedagogical and didactic concepts for teaching IT. They *formulate* technical subjects *in* target group oriented and technically *appropriate* ways. They *have* comprehensive *knowledge* of communication and presentation techniques.

**Competencies:**

Computer specialists expertly *advise* customers and interested parties. They *analyse* need *based* by defined criteria. They *provide* recommendation and *select* service and components in a qualified way. They *prepare* didactically technical topics for different target groups and *teach* them easily comprehensible. They *create* qualified offers for these situations. They *document* their work as well as technical issues appropriately for different target groups.
**Personal Competence**

**Social Competence**
- Computer specialists communicate with customers.
- They analyse requirements of the customers, they explain, advise and discuss appropriately and professionally by using technical language.
- They work in teams.
- When giving seminars, they adapt their technical language to their target group.
- They use creativity and communication techniques.

**Self-competence**
- Computer specialists try to understand several business processes and discuss resulting conclusions.
- They work independently on their tasks. They use their knowledge target-oriented.
- They study further to keep themselves up-to-date.
- They use different media and methods to solve given problems.
- They deal carefully with data and information given by customers and partners. They comply with rules to protect personal data and trade secrets.
- They weigh up carefully their decisions and recommendations. They look after their customers in all conscience.
## Assignment: Working Processes - Model

### Cross sectional processes complete description

Validation by experts confirms the model

### All working processes can be assigned to one single action field

<table>
<thead>
<tr>
<th>Occupational Working Process</th>
<th>CSP 8</th>
<th>CSP 9</th>
<th>CSP 10</th>
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<tbody>
<tr>
<td>Design and Installation of IT Working Places</td>
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<tr>
<td>User help desk</td>
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<td>X</td>
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<tr>
<td>Installation and Configuration of Telephone and Broadband Connection</td>
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<tr>
<td>Installation and Support of Customer IT Solutions, Including all Hard- and Software</td>
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<tr>
<td>Modelling Business Processes by Using It Infrastructure</td>
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<tr>
<td>Planning, Documenting and Accounting an Application Development Project</td>
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Summary and Conclusion

• Theory-based normative competence description has been created
• Model has been based on empirical data
• Validation by several experts was successful
• Useful for further development of curriculum and in-company training regulation
• Can be also matched to e-CF

• Next possible steps:
  – Developing more teaching material based on these results
  – Developing of items for testing and evaluation
Thanks for your attention!

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