Competency Acquisition in Applied Knowledge Engineering
An Approach based on Learning from Errors

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Agenda

- Definition of the Subject Domain
- Relevant Competencies
- Scope of Competency Acquisition in KE
- Learners and their Prerequisites
- Didactic Setting
- Opportunities of Errors
  - “Learning from Errors” in Theory and Practice
- Survey and Results
- Lessons Learned
Knowledge in Organizations

Can be found in ...

- determined structures – organization charts
- described procedures – process models
- Implemented processes – programs and rules
- the heads of employees.

It is typically ...

- heavily fragmented and continuously changing,
- distributed along departments, groups, and persons,
- requires human interpretation to be accessed.

**Knowledge Engineering** is the processing of organizational knowledge in a way, that it becomes
- described uniquely and unambiguously,
- both contentally and formally.

Items to be Modeled

1. **Business processes**
   a) **Predefined procedures**
      e. g. order processing in eCommerce
   b) **Knowledge-intensive case processing**
      e. g. development of individual quotations

2. **Decisions**
   e. g. about the proper discount for a customer

3. **Vocabularies, glossaries and thesauri**
   e. g. for a specific knowledge domain

4. **Structures and relations**
   e. g. in enterprises or between business objects
Subject Domain: Applied Knowledge Engineering

- Digitized Processes
- IT Support for Knowledge Work
- Automated Decisions
- Big Data Analysis
- AI & Linked Data

A set of bridging technologies
Relevant Competencies

(1) Analyze and define real world problems and structures

(2) Communicate with stakeholders

(3) Choose adequate levels of abstraction

(4) Formalize real world concepts, individuals and their relations

(5) Choose the proper notation or specification

(6) Apply notations and specifications syntactically correct

(7) Choose proper tools and use them adequately

(8) Reflect the own work critically
Scope of Competency Acquisition in Knowledge Engineering
Learners and their Prerequisites

- Students at medium and higher levels
  - Business Administration Master
  - Business Information System Bachelor
- During their study they have already acquired
  - Basic knowledge about modeling methods and notations
  - Basic skills on tools and applications
  - Basic competencies of abstraction and reflection

But the most important thing is: deep expertise in a dedicated knowledge domain

 e. g. from work, from internships or from leisure activities
Overall Didactic Setting: One Cycle for each Topic

- Input
  - Impuls lectures
  - Video lectures
  - Reading material

- Transfer
  - Reflection questions
  - Tool-based training
  - Transfer assignments

- Coaching
  - Personal consultation
  - Remote feedback
  - Group reflection

- Project
  - Domain definition
  - Knowledge description
  - Knowledge engineering

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Opportunities for Errors

Knowledge Engineering in an individual domain generates a multitude of error opportunities:

- choosing an inadequate level of abstraction,
- incomplete analysis and description of structures, procedures and relations,
- neglecting the restrictions or support options of tools,
- incorrect usage of notation syntax,
- weak or erroneous implementation of notation logic and semantics,
- implementing suboptimal patterns.

Knowledge Engineering in an individual domain is a creative work in a complex environment.

⇒ Error opportunities cannot be forseen in total.

Each error and its discussion may lead to

- a deeper understanding of the domain,
- more solid modeling skills based on deeper understanding of the notation.
The Theory of „Learning from Errors“


- Horizon of expectations is a kind of a frame of reference
- Important kind of problems: experience of something contrary to our expectations – may act on the frame like a bombshell
- Learners are forced to reconstruct their whole frame of reference

⇒ Horizon of expectations is raised to a higher level, „damaging“ observations are integrated in a new frame of explanation


Three facets of Professional Error Competence of Teachers:

a) Knowledge of possible error types
b) Available strategies of action/teacher reactions
c) A constructive view on errors and their use in classroom interaction
The Process of „Learning from Errors“?

**Logical Error:** There is a logical problem. First of all, the supplier list should be split into two lists depending on the volume of the year. A parallelization must then be carried out, since both lists are processed further. One (under €1 million) must be supplemented by the delivery risks and sorted according to this criterion in descending order. Then the top 3 can be selected. The other is sorted according to volume and the top 15 is selected. After combining these two paths, the lists can be aggregated. Basically one could also do this one after the other, without parallelization.

Your modeling implies that only one vendor is checked for its volume. This is not true. To work with loop activities would not be useful either, you will get a list and want to cut this list according to certain criteria.

**Style Error:** This is not clearly specified. Do you mean every year in October? Then write: each October.

**Syntax Error:** Within a pool sending and receiving messages doesn’t make sense, since the sequence flow carries all data and documents.
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Improved (final) Model

- **Correct Style**
  - deeper understanding of the domain
  - more solid modeling skills
  - deeper understanding of the notation

- **Correct Syntax**

- **Correct Logic**
Survey Outline

❖ Participants: all active students (N=21) of the course in winter term 2016/17
❖ Paper questionnaire, anonymized, carried out in February 2017
❖ Analyzed items:
  • Self estimation of knowledge and skills at the start and at the end of the course
  • Usage rates and helpfulness of different forms/media of learning
  • Possibly missed alternative forms/media of learning
  • Personal feeling of being confronted with „making errors“
  • Agreement with the following statements:
    ➢ The opportunity to make my own errors and learn from them has contributed significantly to my learning success.
    ➢ The opportunity to model in my own domain of expertise has contributed significantly to my learning success.
Self Estimation of Knowledge and Skills Acquisition

Business Processes
- Start: non-existent
- End: excellent

Business Decisions
- Start: non-existent
- End: excellent

Business Vocabularies
- Start: non-existent
- End: excellent
Usage Rate and Helpfulness of Forms/Media of Learning

Helpfulness

- On-site lectures: most helpful
- Video lectures: often used
- eMail feedback: never used
- Individual consultation: not helpful

Usage Rate

- On-site lectures: often used
- Video lectures: often used
- eMail feedback: never used
- Individual consultation: not used
Personal Feeling about „Learning from Errors“

- About 75% had a kind of positive personal feeling assessing the learning setting as unfamiliar (curious) or challenging.
- About 25% gave a negative assessment to the learning setting as unpleasant or too hard.
(1) The opportunity to make my own errors and learn from them has contributed significantly to my learning success.

(2) The opportunity to model in my own domain of expertise has contributed significantly to my learning success.

➢ About 2/3 agree with the statements, 1/3 disagree.
Lessons Learned

(1) Students in the Business Administration programs are not very familiar with the presented learning setting. They evaluated the course challenging, maybe too hard.

(2) All active students achieved at least good results, in an oral feedback round they all reported about growing motivation because of personal domain expertise and intensive coaching.

(3) The competency acquisition during that short period can be estimated as above-average, mostly due to substantial practice in individual modeling.

(4) The same applies to the effort of the lecturer to give that different feedback on a multitude of models and development steps.

Example result page:  http://univera.de/FHB/KITP16/Eichler/
Thank you for your attention!

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