Diagnosing Lifelong Learners’ Conceptual Development

Language Technologies for LifeLong Learning (LTfLL) project

Adriana J. Berlanga
Overview

1. LTfLL project
2. Diagnosis of conceptual development
3. Current work
4. Questions
1. Languages Technologies for LifeLong Learning (LTfLL) project

Description

“The LTfLL project will create next-generation support and advice services to enhance individual and collaborative building of competences and knowledge creation in educational and organizational settings. The project makes extensive use of language technologies and cognitive models in the services”

- Open Universiteit Nederland - Netherlands (Coordinator)
- Universiteit Utrecht - Netherlands
- Eberhard Karls Universität, Tübingen - Germany
- Wirtschaftsuniversität Wien - Austria
- Université Pierre-Mendès - France
- Politehnica University of Bucharest - National Center for Information Technology - Romania
- Aurus Kennis-en Trainingssystemen BV - Netherlands
- The University of Manchester - United Kingdom
- Institute for parallel processing of the Bulgarian Academy of Sciences - Bulgaria
- BIT MEDIA e-Learning solution GMBH and CO KG - Austria
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“The LTfLL project will create next-generation support and advice services to enhance individual and collaborative building of competences and knowledge creation in educational and organizational settings. The project makes extensive use of language technologies and cognitive models in the services”

3 Themes

1. Services for establishing the current position of the learner. Semi-automatic analysis and comparison of learners portfolios to the domain knowledge and continuous measurement of conceptual development (Using LSA)
2. Support feedback services based on analysis of learners’ interactions and textual output (Using NLP and LSA)
3. Knowledge sharing infrastructure that allows comparison and sharing of private knowledge to give rise to new common knowledge and social learning (Using ontologies and social tagging)
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2. Diagnosis Conceptual Development
Theoretical Background

• **How to support medical students so they have the level of expertise required for a particular domain in a particular level**
  – Identify the current status of the learner’s conceptual development (*person’s knowledge of a domain by looking on how she organizes the concepts of such domain*)
  – → identify potentially weak knowledge areas and recommend remedial actions.

• **Distinction between expert, novices and intermediate levels**
  – Differ in their problem-solving skills, knowledge use, information processing, the time the use to provide diagnosis, and their well-organized knowledge structures
2. Diagnosis Conceptual Development
Theoretical Background


<table>
<thead>
<tr>
<th>Novices</th>
<th>Intermediates</th>
<th>Experts</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Use every-day conceptual</td>
<td>• Much detail arguments, and long protocols</td>
<td>• Larger numbers of ready-made illness scripts</td>
</tr>
<tr>
<td>knowledge, knowledge less</td>
<td>• Have great difficulty with the activation of</td>
<td>when dealing with a case</td>
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<tr>
<td>hierarchically structured</td>
<td>relevant knowledge when confronted with problems</td>
<td>• Present problems in terms of abstract</td>
</tr>
<tr>
<td>• Novices structure concepts</td>
<td>that are not in professional terminology (i.e. raw</td>
<td>principles</td>
</tr>
<tr>
<td>less well than experts.</td>
<td>material)</td>
<td>• Give extensive explanations in which the</td>
</tr>
<tr>
<td>• Present problems in terms of</td>
<td></td>
<td>links between different disciplines are</td>
</tr>
<tr>
<td>literal characteristics.</td>
<td></td>
<td>given and activate knowledge through many</td>
</tr>
<tr>
<td>• Limited, incomplete knowledge,</td>
<td></td>
<td>roads (observation data, specific tasks, other</td>
</tr>
<tr>
<td>short texts, expressed in everyday</td>
<td></td>
<td>hypothesis, ..)</td>
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<tr>
<td>language, both in the verbs and</td>
<td></td>
<td>• jargon, instead of detail arguments</td>
</tr>
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<td>nouns.</td>
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</table>
## 2. Diagnosis Conceptual Development

**Theoretical Background**


<table>
<thead>
<tr>
<th>Expertise Level</th>
<th>Knowledge Structure</th>
<th>Learning</th>
<th>Problem solving</th>
<th><strong>Reasoning process</strong></th>
<th>Demand on cognitive capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Novice</strong></td>
<td>Networks (incomplete and loosely linked)</td>
<td>Knowledge accretion, integration and validation</td>
<td>Long chains of detailed reasoning steps through networks</td>
<td>Step by step process</td>
<td>High</td>
</tr>
<tr>
<td><strong>Intermediate</strong></td>
<td>Networks (tightly linked and integrated)</td>
<td>Encapsulation</td>
<td>Reasoning through encapsulated network; abbreviated</td>
<td>Big steps (but still one at the time)</td>
<td>Medium</td>
</tr>
<tr>
<td><strong>Expert</strong></td>
<td>Illness scripts</td>
<td>Illness script for formation</td>
<td>Illness script activation and instantiation</td>
<td>Groups of steps activated as a whole</td>
<td>Low</td>
</tr>
<tr>
<td><strong>“Experienced expert”</strong></td>
<td>Memory traces of previous cases</td>
<td>Instantiated scripts</td>
<td>Automatic reminding</td>
<td></td>
<td>Low</td>
</tr>
</tbody>
</table>
2. Diagnosis Conceptual Development
Measuring Conceptual Development

• Structural approach (Goldsmith et al., 1991) to assess the person’s knowledge of a domain by looking on how she organizes the concepts of such domain

3 steps

1. Knowledge elicitation: Measures an individual’s understanding of the relationships among a set of concepts.
   • Categorization methods: card sorting, word association
   • Graphical: concept maps, semantic networks
   • Verbal reporting: thinking-aloud, essay, essay questions

2. Knowledge representation methods: cluster analysis, three constructions, dimensional representation, pathfinder nets, verbal test.

3. Evaluation of an individual’s knowledge representation relative to some standard (e.g., expert’s organization of the concepts in the domain)
   • Qualitative assessment of derived representations
   • Quantifying the similarities between a student representation and a derived structure of the content of the domain
   • Compare the cognitive structures of experts and novices.
2. Diagnosis Conceptual Development

Measuring Conceptual Development

- **Structural approach** (Goldsmith et al., 1991) to assess the person’s knowledge of a domain by looking on how she organizes the concepts of such domain

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   - Qualitative assessment of derived representations
   - Quantifying the similarities between a student representation and a derived structure of the content of the domain
   - **Compare the cognitive structures of experts and novices**
3. Current work

Knowledge Elicitation

Conceptual Map vs. Text output

Knowledge Evaluation

Expert and Text output

Comparison
3. Current work

Knowledge Elicitation

Conceptual Map vs. Text output

Knowledge Evaluation

Comparison

1. Exploring existing tools
   JMap; SMD; MITOCAR
   Infomap, PathFinder...

2. Looking for suitable corpus

3. Defining Method of evaluation

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Feedback, Questions, Comments…