FUTURE SKILLS: APPROACHES FOR TEACHING DATA LITERACY IN HIGHER EDUCATION

Study on behalf of the working group “Curriculum 4.0” of the “Hochschulforum Digitalisierung”

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Hochschulforum Digitalisierung is a joint initiative by Stifterverband, CHE Centre for Higher Education and the German Rectors’ Conference (HRK). It is financed by Germany’s Federal Ministry of Education and Research (BMBF).
Objective and focus

- **Objective:** Compile actionable knowledge for the implementation of curricula for data literacy

- **Focus:** European and international best practice examples of offers for cross-disciplinary education of data literacy

- **Scope:** Scope was on the education of data literacy in different application domains and not on data science education

**Key questions:**

1. What is meant by data literacy and what is the main focus?
2. How is data literacy integrated into disciplines and curricula and how do you create incentives for teachers?
3. What is a transdisciplinary set of basic competencies and what are special competences?
4. What are requirements on graduates for the society, job market and research?
5. What are factors of success and failure of the curricular implementation?
Overview

1. Desk Research
   • Research and classification of 89 courses (of studies)
   • Summary of 17 state-of-the-art literature sources

2. Interviews and Survey
   • Selection and detailed classification of 15 cases
   • Interviews with representatives of 6 cases (21 questions)
   • Survey with 69 participants (16 questions)

3. Workshop
   • Conduction of an international workshop with 19 experts

4. Documentation
   • Stan-of-the-art handout
   • 100-page final report
Key question 1: What is meant by data literacy and what is the main focus?

“Data Literacy is defined as the ability to collect, manage, evaluate and apply data in a critical manner” [Ridsdale et al.]

- Expert interviews as well as survey fully or partially agreed to that definition (100% and 94%, respectively)
- The missing aspects usually affect and emphasize individual competence areas of data literacy
- There is a significant overlapping with the terms “Information Literacy” as well as with adjacent terms such as “Data Information Literacy”, “Science Data Literacy”, or “Statistical Literacy”
Key question 2: How is data literacy integrated into disciplines and curricula and how do you create incentives for teachers

1. Acquisition of competences in the field of data literacy should start as early as possible (for example at post-secondary institutions)
2. Awareness of the importance has to be raised for students as well as organizations (universities, institutes)
3. Any offer must be adapted to different educational levels and to specifics of disciplines, such as the general context, terminology, workflows, and problems
4. It is recommended to establish an independent institution/unit, which involves experts from different disciplines for developing educational programs
5. A national research, education and training agenda is required as well as the development of national infrastructures
6. Different models of integration imaginable: Online offers, a central introductory course with advanced modules, or approaches fully integrated in existing courses (of studies)
7. Successful offers modular and make use of modern teaching formats (such as hands-on and project-based learning)
8. Motivation of teachers to participate in joint offers mostly based on personal interest and broadening their own skills
Key question 3: What is a multidisciplinary set of basic competencies and what are special competencies?

Basic and advanced competences depend on purpose of data literacy education

Within the workshop to different main purposes were discussed:

1. Teaching of mature educated citizens: requires a cross-disciplinary, generic, basic, broad set of competences

2. Teaching data literacy competence for a specific discipline: requires more specialized, in-depth competences with adaptations
Key question 3: What is a multidisciplinary set of basic competencies and what are special competencies?

- Opinions regarding the classification of competences differed widely among expert; they only agreed on “introduction to data” and “basic data analysis” for being basic competences.

- The survey showed that “introduction to data” is seen by 95% as being a basic competence, followed by “data representation (verbally)” with 90% and “critical thinking” with 85%.

- The least basic competences were “data conversion” at 10% and “data preservation” at 15%.

- All other areas of competences were rated by at least 35% of respondents as being basic.
Key question 4: What are requirements on graduates for the society, job market and research?

- According to the survey, “critical thinking”, “data ethics”, and “data sharing” plays an important role for society
- For the job market, “data conversion”, “data-driven-decision making” and “data tools” are most relevant
- In the research sector, “data citation” plays a major role alongside “data discovery and collection”
- Expert interviews showed that for the society, competencies related to data ethics, for the job market, skills focusing on technical competencies, and for research, a broader set of competencies is necessary
Key question 5: Challenges and measures from literature and interviews

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<tr>
<th>Structures &amp; Collaboration</th>
<th>Competences &amp; Integration</th>
<th>Teaching/Training</th>
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<td>Challenges</td>
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<td>• Collaborations with others (breaking silos)</td>
<td>• Create awareness as early as possible</td>
<td>• Attracting enough competent trainers and teachers</td>
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<td>• Availability of resources</td>
<td>• Identifying relevant competencies</td>
<td>• Diversity of participants</td>
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<td>• Initial funding</td>
<td>• Different educational levels</td>
<td>• Application-oriented teaching</td>
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<td>Measures</td>
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<td>• Build up collaborations with other faculties, institutions, and industry</td>
<td>• Start at school level</td>
<td>• Modern learning and teaching concepts (e.g., mixed teams)</td>
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<td>• Bundle competencies across disciplines</td>
<td>• Basic skills already for non-graduates</td>
<td>• Lean based on real-world data</td>
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<td>• Shared pool of assets</td>
<td>• Offer standalone and interdisciplinary courses</td>
<td>• Scholarships for cross-discipline work</td>
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<td>• Overarching centers</td>
<td>• Integration of competencies into existing disciplines</td>
<td>• Create opportunities for teachers</td>
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<td>• Create a national strategy and infrastructure</td>
<td>• Tailor offer to the needs of the target groups</td>
<td>• Train-the-trainer offers</td>
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### Key question 5: Action items from expert workshop

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<td>1. Create required space in curricula and access to best practices, data and infrastructure</td>
<td>1. Create data education labs to support self-study</td>
<td>1. Make data literacy a prerequisite for accredited programs</td>
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<td>2. Educate department heads and convince executives, then roll-out</td>
<td>2. Start earlier at school, e.g. by educating next-gen teachers</td>
<td>2. Standardize data literacy education</td>
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<td>3. Build up joint physical spaces, community of teaching practices, and cross-X collaborations and make use of open content</td>
<td>3. Create a standardized DL competence framework</td>
<td>3. Paired teaching (data scientist and domain experts, contextualized)</td>
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Data Literacy Education: Funding Program of the Stifterverband and the Heinz Nixdorf Foundation on the Context of the “Future Skills” Initiative

• **Goal:** Funding of concepts for acquiring data literacy competences for students of all disciplines at German universities and colleges
• **Award:** 3 times 250,000 €
• **Duration:** 3 years (starting October 2018)
• **Submissions:** 47 concepts
• **Procedure:** Expert discussion in public section meeting (September 28, 2018)
• **Three winners:**
  • Georg-August-Universität Göttingen
  • Leuphana Universität Lüneburg
  • Hochschule Mannheim
• **Five more finalists:**
  • Hochschule für Technik und Wirtschaft Berlin
  • Ruhr-Universität Bochum
  • Universität Hildesheim
  • Johannes Gutenberg-Universität Mainz
  • Universität Regensburg

• For more information visit: [https://www.stifterverband.org/data-literacy-education](https://www.stifterverband.org/data-literacy-education)
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