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Towards an Empirically Founded Data Literacy Competency Model

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Data as (Re-)Emerging Topic of Computer Science and other Sciences

Computer Science

- data has been a fundamental area of computer science from its beginnings
- often, mainly the role of data in databases and data structures were considered
- big data, data management and data science gave the topic “data” new impetus
- in recent years, both science and practice put increasing emphasis on data

Other Sciences

- increasing amounts of data are captured in other disciplines, particularly in social and natural sciences
- gathering, storing, analyzing and interpreting data is a central aspect of many sciences
- data-rich and data-driven research is considered a fourth research paradigm
- CS methods for handling data become relevant for every researcher and generally everyone today

Current Research on Data Literacy and Related Fields

Data Management

- focuses on the static aspects of storing and handling data
- model of key concepts of DM:

Practices	Core Technologies	Design Principles	Mechanics
• acquisition • cleansing • modeling • implementation • optimization • analysis • visualization • evaluation • sharing • archiving • erasure	file stores, databases, data stream systems, data analyses, data mining, semantic web, document stores	• data independence • integrity • consistency • isolation • durability • availability • partition tolerance • concurrency • redundancy	• structurization • representation • replication • synchronization • partitioning • transportation • transaction

Grillenberger & Romeike, Koli Calling 2017

Data Science

- emphasizes the dynamic aspects of handling and processing data
- is an uprising topic of (general and higher) CS education
- gives insight into the use of data
- fosters an understanding of the potential that data analysis involves

Data Literacy

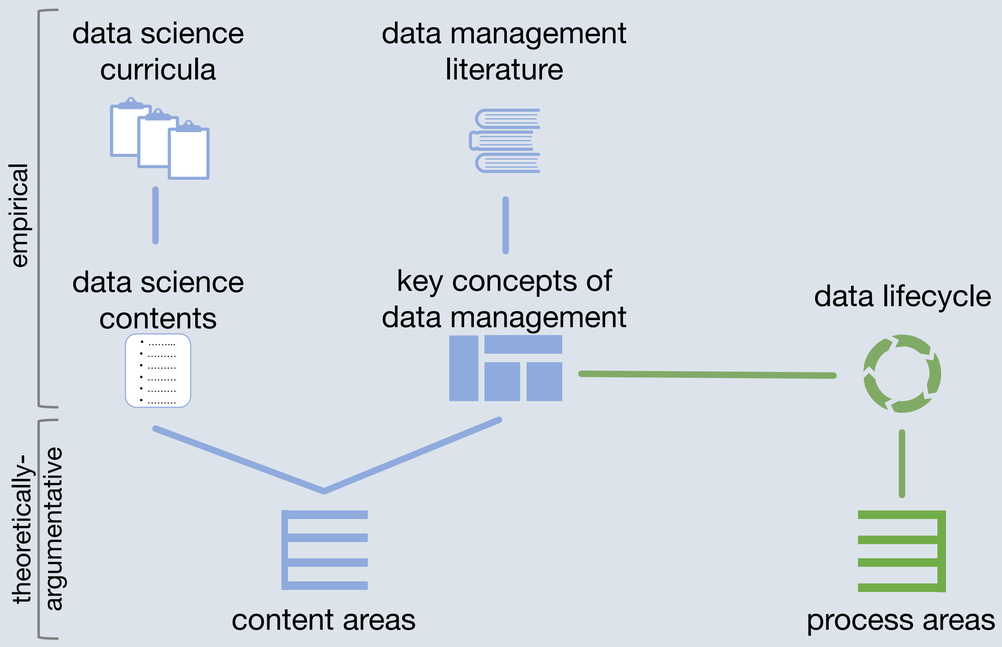
- particularly involves aspects of CS and mathematics
- is related to several concepts of databases, data management and data science
- needs to be distinguished from information literacy
- is necessary for everyone and in every discipline when handling and processing data

Data Literacy Competencies

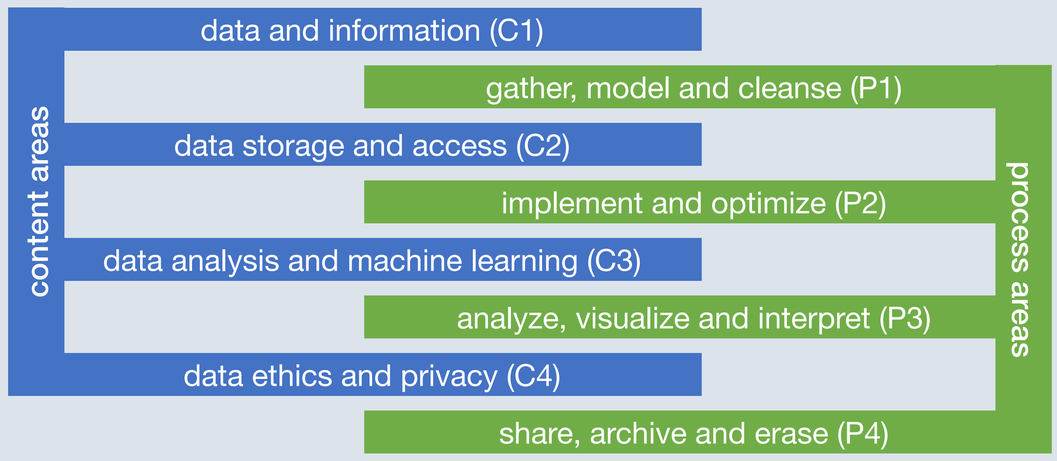
- Ridsdale et al. (2015) built a competency model by analyzing best-practice approaches
- these approaches cover an interdisciplinary perspective
- as data literacy includes various CS concepts, investigating this field from a CS perspective gives additional insights and foundation

Developing a Competency Model: Approach

- a data literacy competency model can be developed by theoretically deriving competency areas from existing work
- empirical data on the contents of data science and the key concepts of data management can serve as a basis
- dividing the model into process and content areas is suitable for considering both perspectives on this topic



Results & Exemplary Competencies



C1/P1: verify if captured data appropriately represents the original information
C2/P1: structure gathered data in a way suitable for storing them
C2/P2: compress data to increase storage efficiency
C3/P3: visualize the results of data analyses
C3/P2: implement specific data analysis methods using appropriate tools
C4/P4: discuss data storage for further uses from an ethical perspective
C4/P3: evaluate potential ethical issues raised by data analyses

➔ The process and content areas can be combined in different ways and hence cover various competencies

Future Work

- evaluate the competency model and its competencies
- divide the model into several levels representing different target groups and respective competency goals from “generally everyone” over “every scientist” to “data professionals”
- implement interventions that strive for fostering data literacy and evaluate them

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