The Teaching and Assessment of Inquiry Competences

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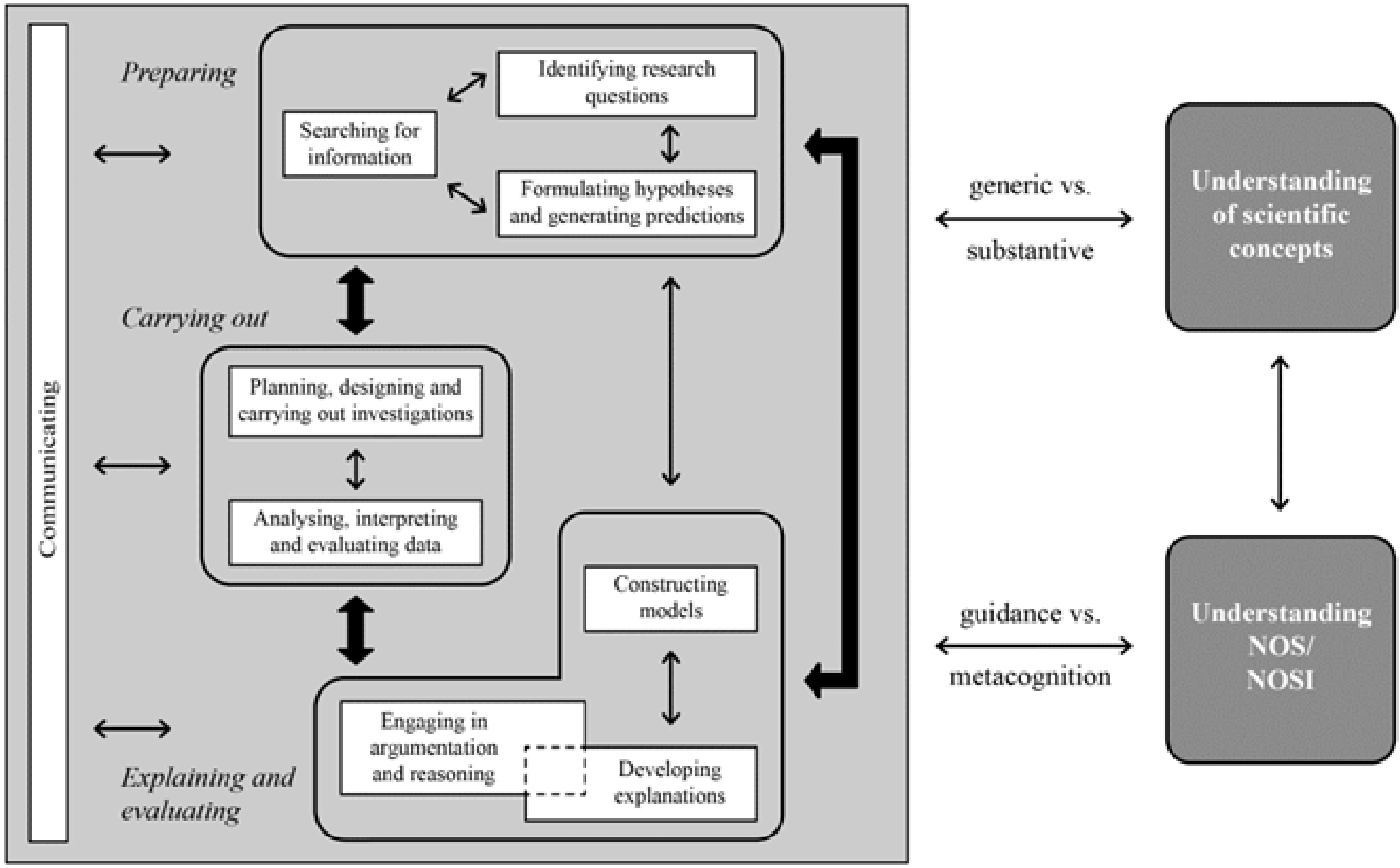
Aims of the chapter

- Describe inquiry-based approaches in
  - science -> scientific inquiry
  - Technology -> engineering design
  - mathematics -> mathematical problem solving
  - 21st century skills -> innovation

- For each domain, the description is structured along 3 questions:
  - (1) How is the concept defined and which competences are students supposed to develop?
  - (2) What changes in teaching are needed to support students in developing these competences?
  - (3) What changes in assessment are needed to assess these competences?

Scientific inquiry



[Rönnebeck, Bernholt, & Ropohl, 2016]

Mathematical problem solving

- IBE as concept in mathematics education relatively new
- Often related to EU projects
  - ‘refer[ing] to a teaching culture and to classroom practices in which students inquire and pose questions, explore and evaluate’ [Maaß & Doormann, 2013]

- Mathematical problem solving (and posing)
  - At the heart of mathematics education
  - Requires modelling
  - IBE as a possible mechanism
  - Distinction between problems where the outcomes are validated within mathematics (investigations) and those where the validation comes from outside the field of mathematics (mathematical modelling) [Niss, 2015]

Innovation

- Relatively new concept, not much investigated yet
- Innovation competence can be operationalised as students' ability (alone or in collaboration with others) to
  - ➢ generate solutions to issues, while drawing on their disciplinary knowledge and their analysis of the field of practice where the issue arises
  - ➢ analyse and reflect on the value-creating potential and realisability of their ideas;
  - ➢ work towards implementing their ideas
  - ➢ communicate about their ideas to various stakeholders

[Nielsen & Holmegaard, 2015]

Teaching and assessing inquiry

- Transforming domain-specific characteristics of inquiry into **educational settings** (e. g. authenticity, thinking processes …)
- Role of the teacher changes from **disciplinary expert/conveyor of knowledge** to **facilitator/guide** of learning, e. g.
  - Observe, listen instead of immediately ‘helping’
  - Provide scaffolding
  - Ask ‘good’ questions
- Role of the students changes from **mere passive recipients** of instruction to **active participants** in their learning processes
- Requires new forms of assessment
  - Allowing for assessing complex, process-oriented competences
  - Acknowledging active role of students
- Potential of formative assessment

➢ Need for support and TPD

Inquiry across domains – similarities and differences

	Scientific inquiry	Mathematical problem solving	Innovation
Learning driven by	Scientific questions and phenomena	Problems (inside/ outside mathematics)	Authentic problems from field of practice
Focus on	Working and thinking processes of scientists	Math. development towards deduction and proof -> often lack of interest in the actual problem resolution	using disciplinary knowledge and skills in order to improve on an authentic field of practice
Competences	Both, domain-specific and transversal		
Teaching and learning	Teachers as facilitators of learning Students as active participants		
Assessment	New formats (complexity, process orientation) Potential of formative assessment		

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QUESTIONS?

Literature

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