2. GoTEd-Week
Towards Coping with the Future:
21st century skills and assets

Methods of research – different scientific approaches on digitality in an educational context

Manuel Neubauer | Florian Frank

19.05.2022 | Würzburg
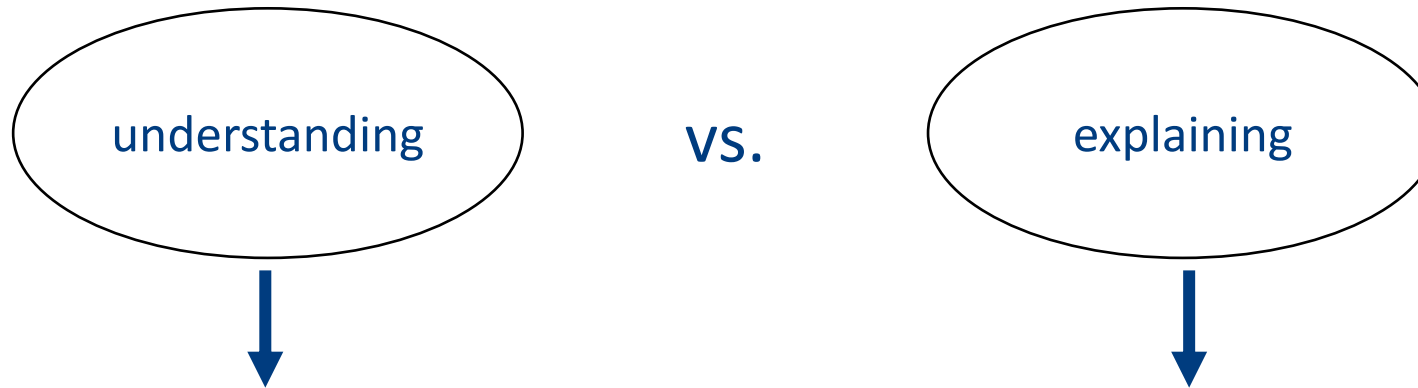
Hermeneutics as scientific approach
Structure:

1. Theory of hermeneutics

2. Hermeneutics as scientific approach in the science of education

3. Transfer to own research: „orders of digitality"

4. Conclusion - The importance of hermeneutics for 21st century skills.

Hermeneutics as scientific approach
Theory of hermeneutics

Wilhelm Dilthey:
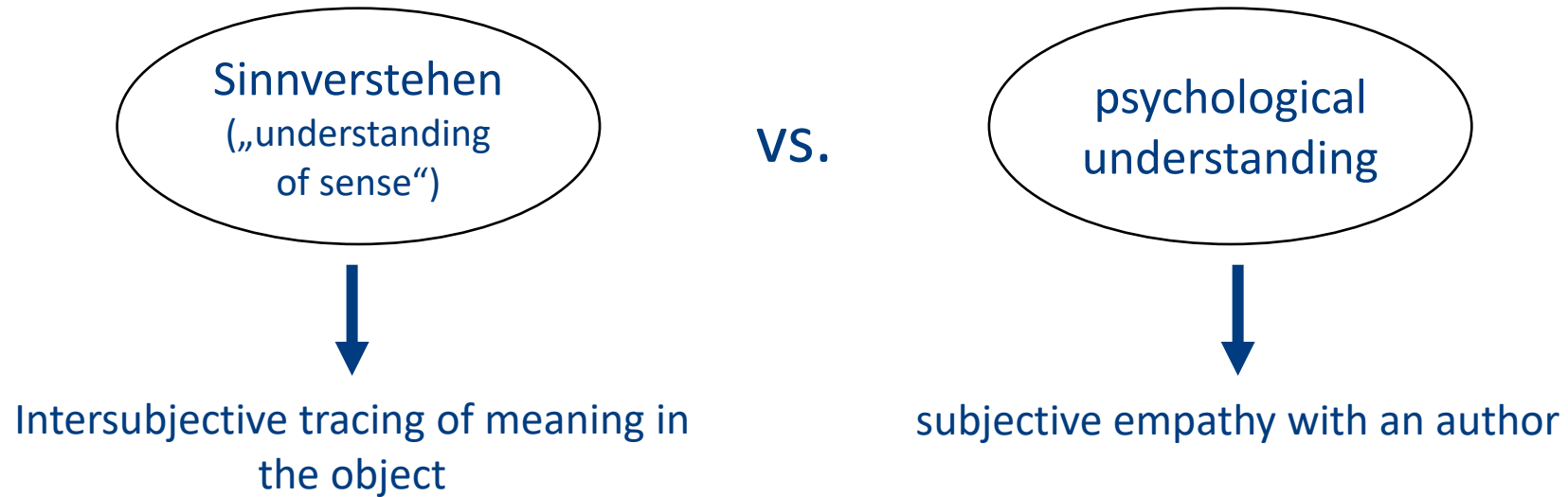
understanding   vs.   explaining

„Seelenleben"

- things that spring from the human mind and soul
- things into which people lay meaning

nature

- in physical sense

Hermeneutics as scientific approach
Theory of hermeneutics

CoTeach

Sinnverstehen
(„understanding
of sense")

vs.

psychological
understanding

Intersubjective tracing of meaning in
the object

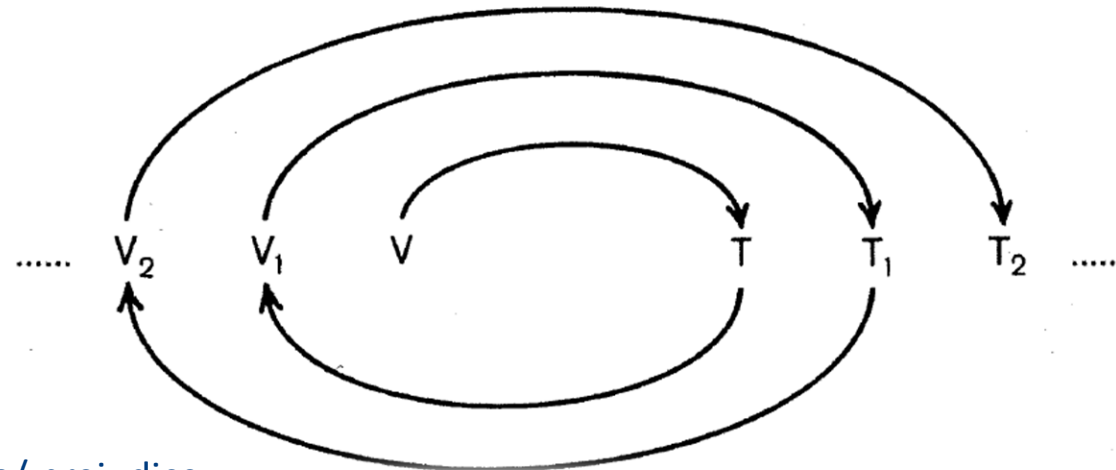subjective empathy with an author

„When we try to understand a text, we do not put ourselves in the author's mental state, but if one wants to speak of putting oneself in something, then we put ourselves in his opinion. This means nothing other than that we try to accept the factual right of what the other person says." (Gadamer 1959/1993, p. 58; translated by MN)

Hermeneutics as scientific approach
Theory of hermeneutics

hermeneutic circle:

fig. „Hermeneutischer Zirkel" Danner [5]2005, S. 62.

V   = pre-understanding/ prior knowledge/ prejudice
T   = understanding (of text)
V_1 = corrected/extended prior knowledge…
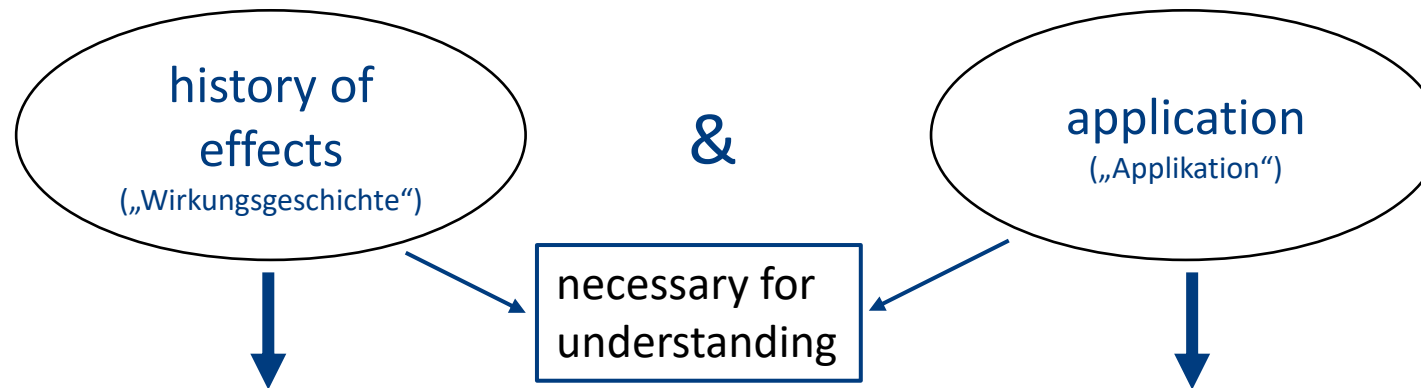T_1 = corrected/extended understanding (of text)
…

Hermeneutics as scientific approach
Theory of hermeneutics

hermeneutic situation:

history of effects
("Wirkungsgeschichte")

&

application
("Applikation")

necessary for understanding

- consciousness that is shaped by history
- becoming aware of this consciousness shaped by history
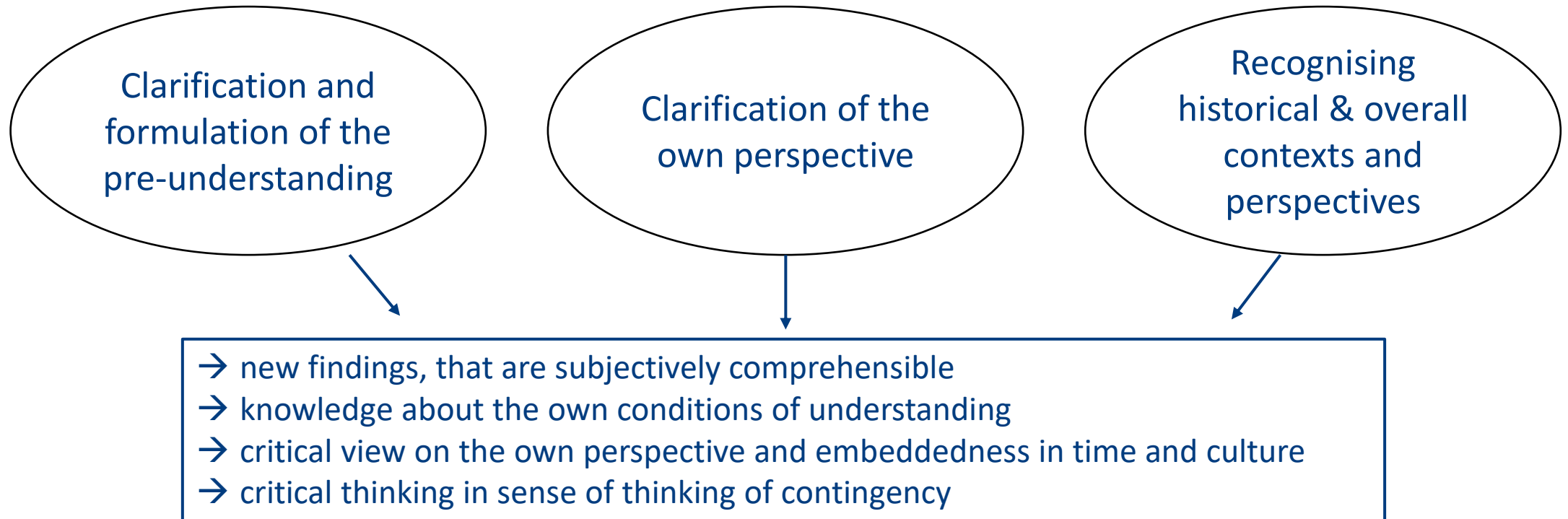
- meaning for the own situation
- mediation between past and present

Hermeneutics as scientific approach
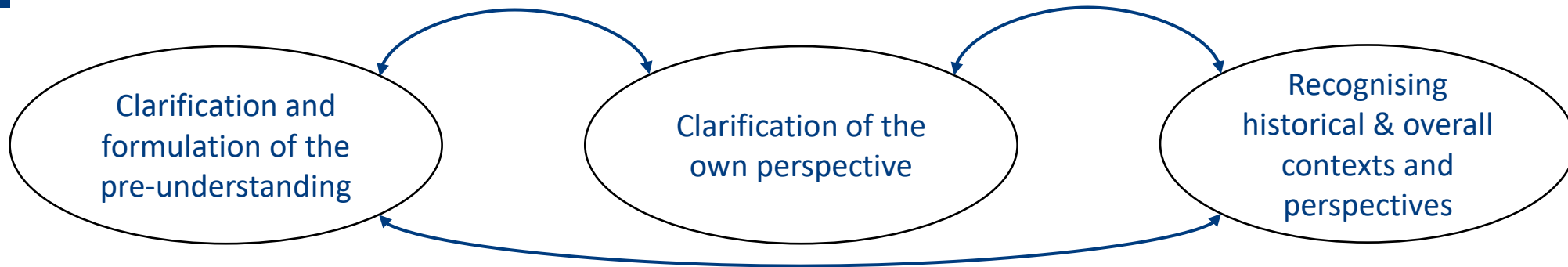## … in the science of education

Principles of hermeneutic as scientific approach in science of education:

Clarification and formulation of the pre-understanding

Clarification of the own perspective

Recognising historical & overall contexts and perspectives

→ new findings, that are subjectively comprehensible
→ knowledge about the own conditions of understanding
→ critical view on the own perspective and embeddedness in time and culture
→ critical thinking in sense of thinking of contingency

Hermeneutics as scientific approach

Transfer to my own research: „Orders of digitality"

- **Question of research:**
  How can „Bildungsprozesse (processes of „Bildung") be thought in terms of orders of digitality?

- **Pre-understanding of subject-world-relationship**
  subjects emerge from social practices through addressing and readdressing

- **Pre-understanding of „Bildung"**
- *Bildung as a process of transformation of world and self relations.*
- *„Bildungsprozesse" are triggered by crises.*
- *„Bildungsprozesse" do not happen passively*
- *Bildung is to be thought of as a critical ethos*

- **Context: usability (application to scenes of adress)**
- *Meaning of interfaces*
- *Goal of usability*

- **Historical context of usage**
- *Distinction between equipment („Zeug") and thing („Ding")*

Hermeneutics as scientific approach
Conclusion:

- A hermeneutic approach can help to become aware of preconceptions of digital technology and enables a critical and reflective perspective.

- A critical and reflective perspective is characterised by not only being able to use digital technology, but also to reflect on their significance for our lives.

- This perspective is important especially in the educational and school context.

Hermeneutics as scientific approach
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Hermeneutics as scientific approach

Thank you for your attention!

Methods of research

structure of the talk

1. Design-Based Research

2. How we used design-based research

3. Mixed Methods

4. How we want to use mixed methods

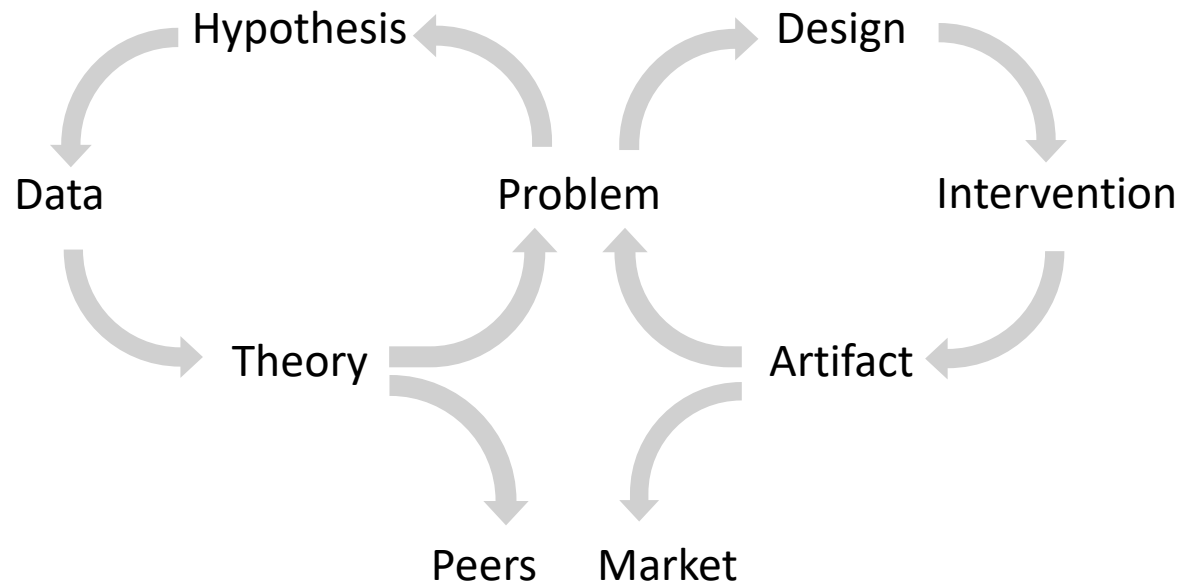5. Final overview over the presented approaches

Design-based research
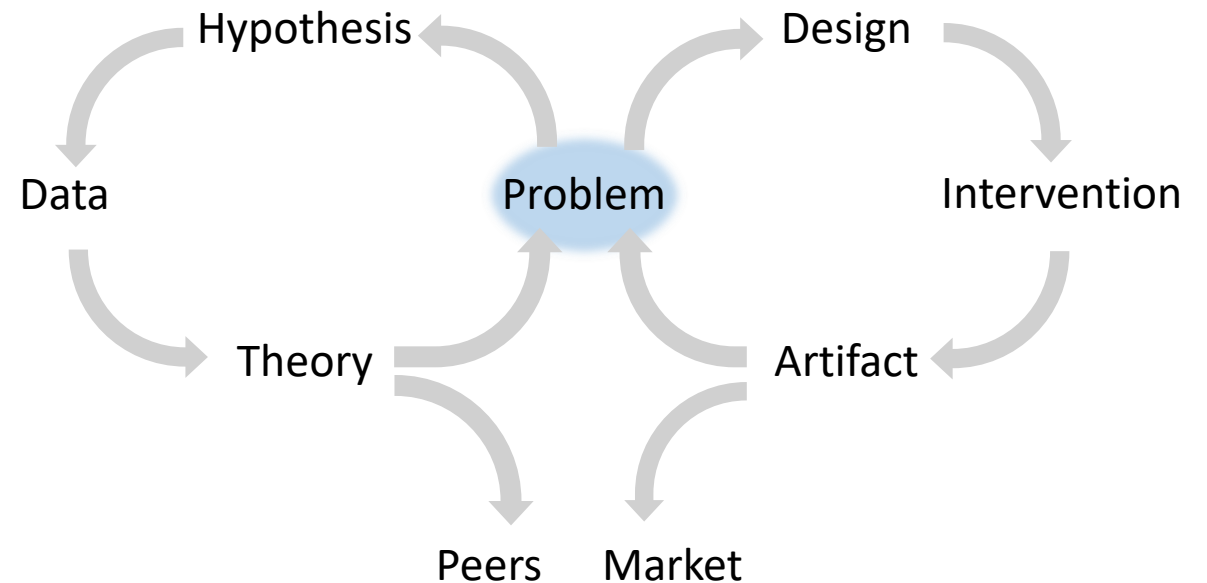
Central tenets of DBR (Anderson et al, 2012)

1. Situated in a real educational setting, adressing a real problem of practice encountered in that setting

2. Focus on design and evaluation of a significant intervention

3. Collaborative partnership between researchers and practitioners

4. Involving both quantitative and qualitative methods

5. Advancement of the theory of education as well as distribution of a practical intervention as goals

6. Iterative procedure
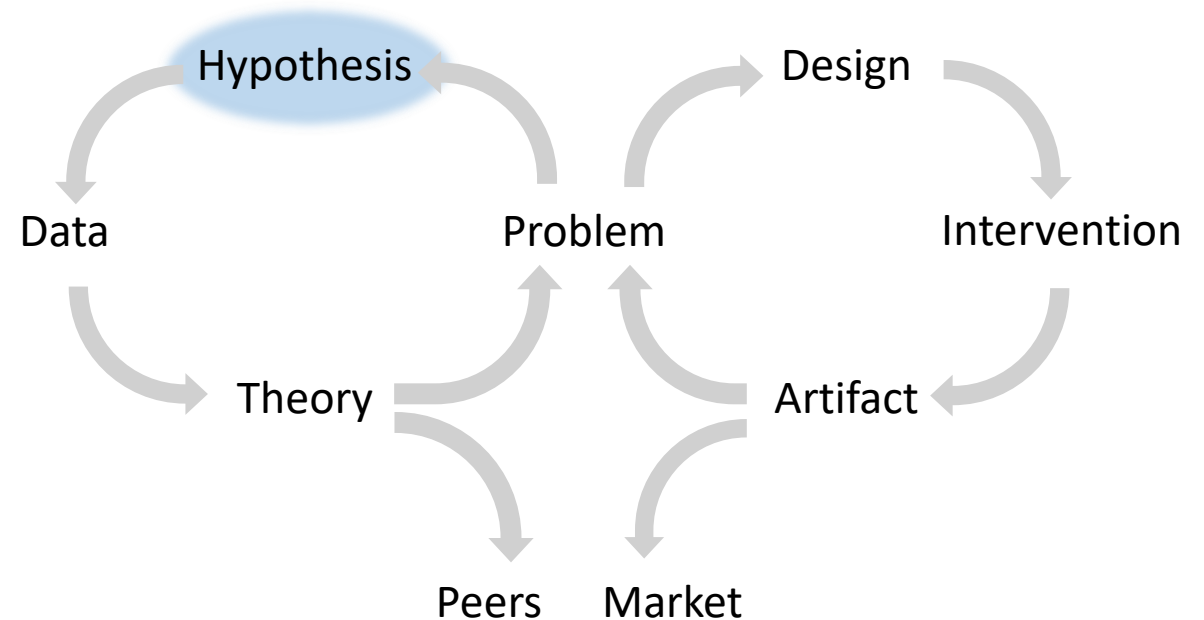
Phases of a DBR project (Ejersbo et al, 2008)

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         Hypothesis                    Design

Data                  Problem                  Intervention

         Theory                        Artifact

              Peers    Market
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Methods of research
How we used Design-based research

Phase 1: Identifying a problem

➢ Lower secondary school students have difficulties understanding electricity, multiple studies showed them exhibiting common misconceptions like the assumption that electric current can be consumed (Burde, 2018; Müller et al, 2015; Fromme, 2018)

➢ Derived problem: teaching electricity is overwhelming students, because they cannot perceive the inner workings of a simple circuit

- For successful learning to occur, students have to keep in mind both the experimental outcomes and the mental models of electricity to understand it
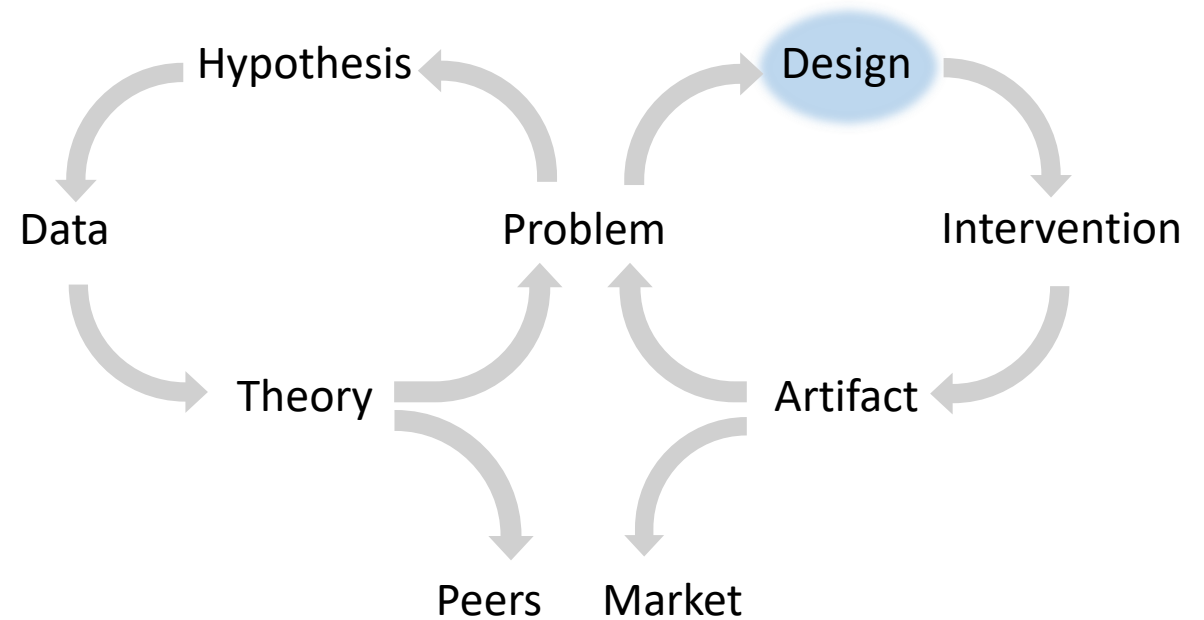
Hypothesis

Design

Data

Problem

Intervention

Theory

Artifact

Peers

Market

Methods of research
How we used Design-based research

Phase 2: Working towards a hypothesis

➢ CTL (Plass et al, 2010): cognitive capacity is finite, overburdening a student's cognitive abllity inhibts the learning process

➢ CTML (Mayer (Ed.), 2014): a learning process's cognitive load can be reduced by eliminating the temporal and spatial distance between the ressources used for the learning process

➢ *Augmented Reality*: projecting virtual objects into a physical world

➢ This allows for the combination of the experiment and the model, allowing for the freed up cognitive ressources to go towards learning

Hypothesis

Design

Data

Problem

Intervention

Theory

Artifact

Peers

Market

Methods of research
How we used Design-based research
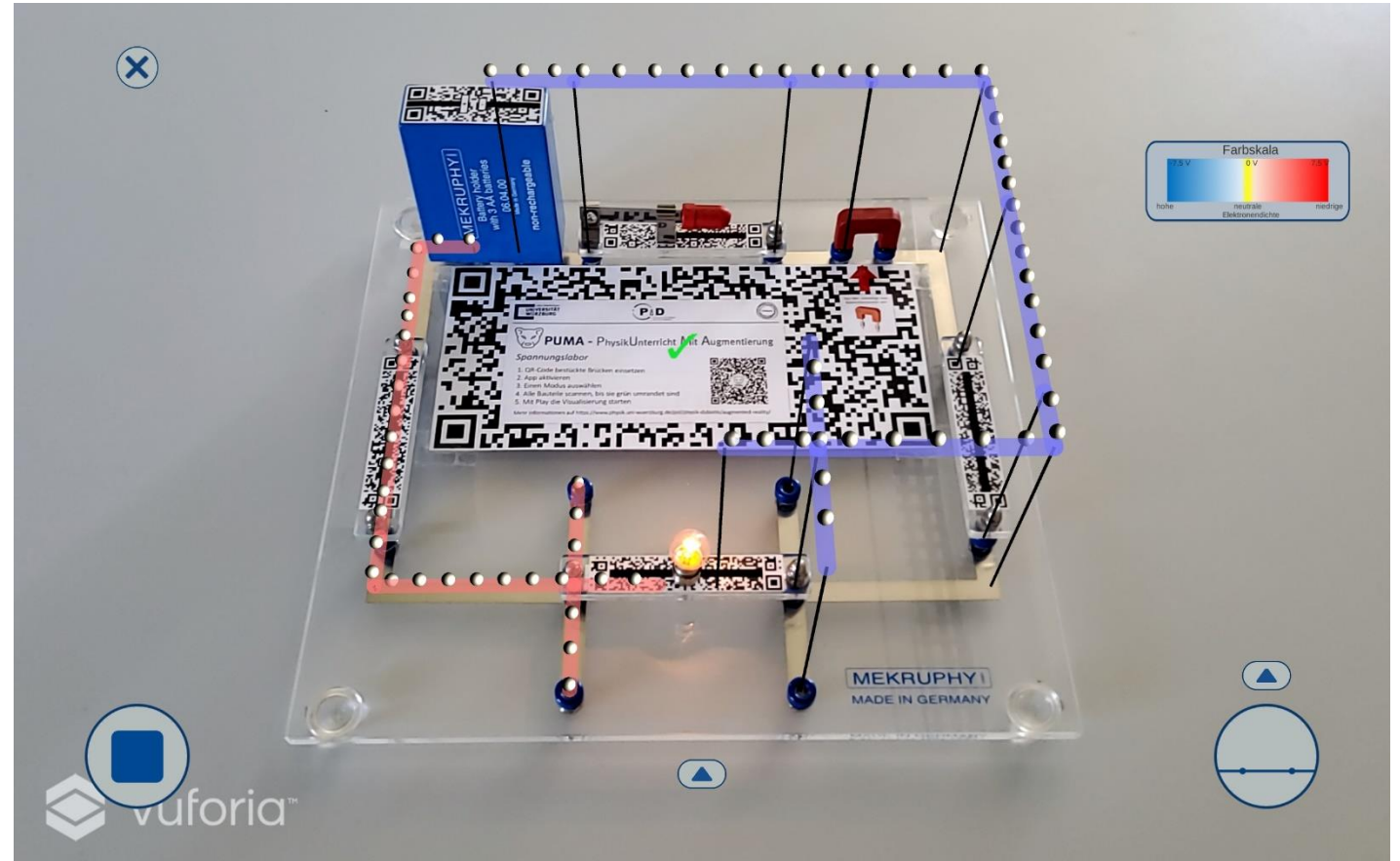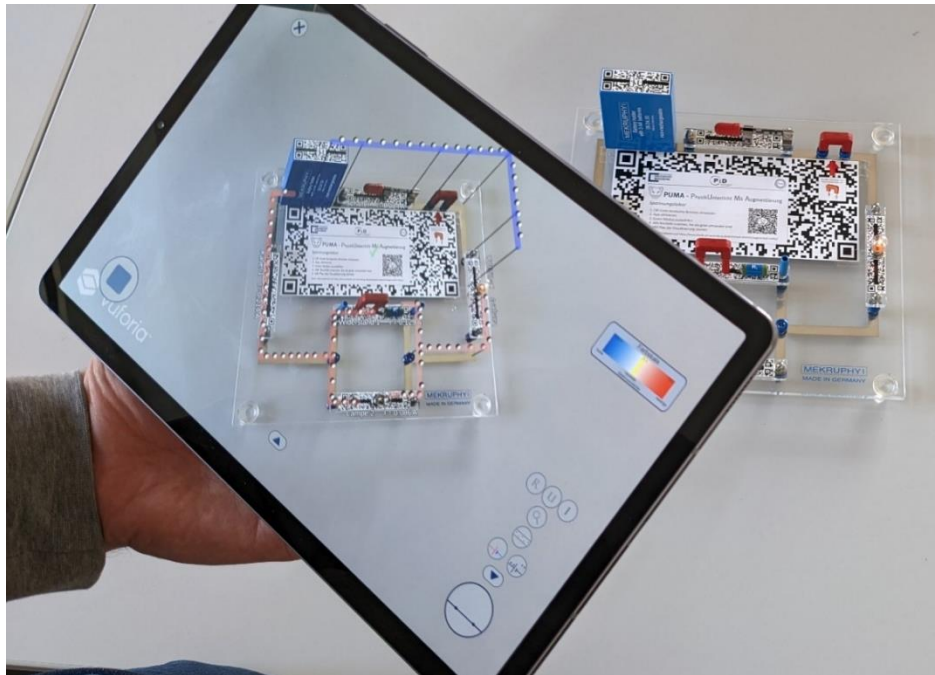
Phase 3: Designing an intervention

➢ Core development team of two: one full time researcher, one half time researcher/half time teacher

➢ As soon as possible: development-accompanying qualitative research (Frank et al, 2022)

→ Structured interviews (Mey et al, 2011) with teachers (14 interviews over a span of five months)

→ Focus on the viablility of our intervention in a classroom setting

→ The results of these interviews are used in developing the application further

Hypothesis

Data

Problem

Theory

Design

Intervention

Artifact

Peers   Market

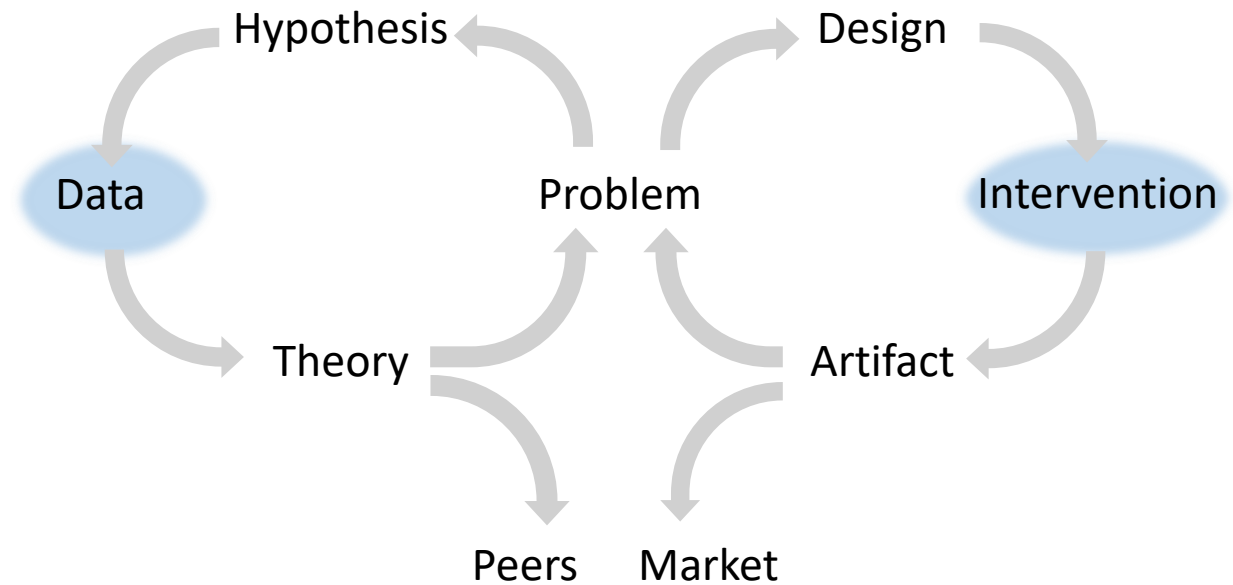➤ For a closer look at the app, see Stolzenberger et al, 2022

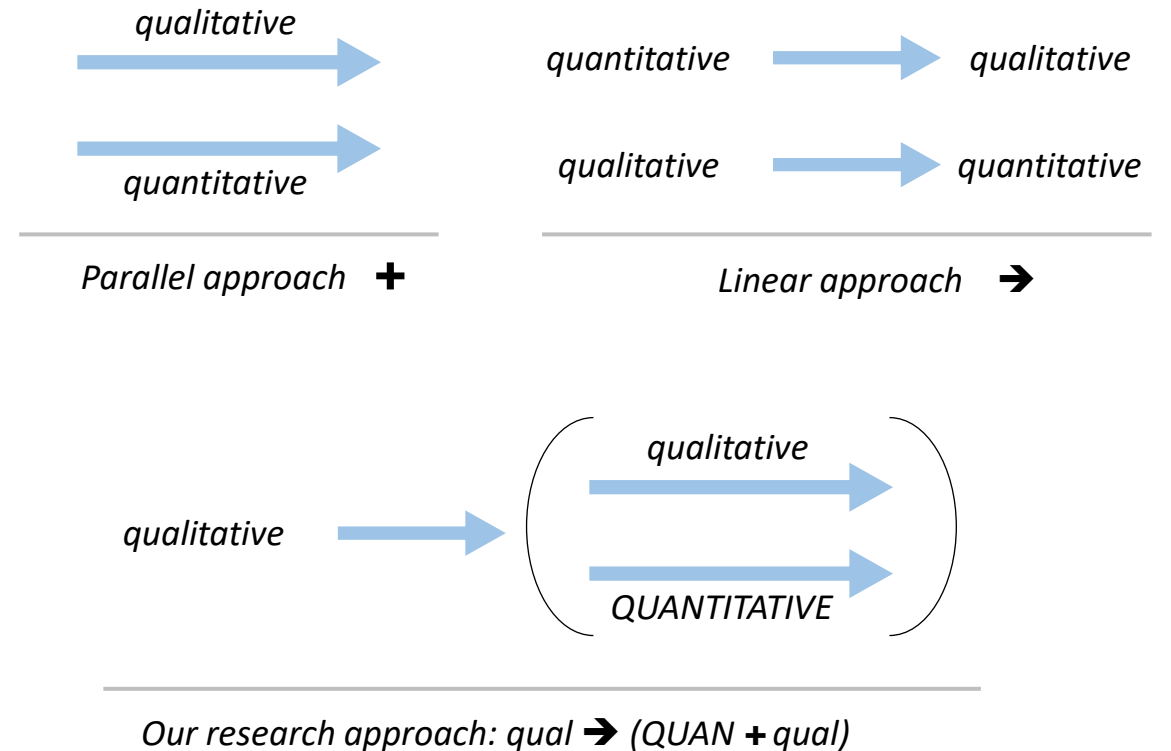# Methods of research
How we used Design-based research

Phase 4: Deployment and data aquisition

➢ Current phase of the project

➢ So far: two qualitative trials

  → Deployment in a one-lesson classroom intervention with observation, working in small groups

  → Deployment in a two-lesson classroom intervention without observation, but with close communication and follow-up interviews

➢ Next phase: quantitative student lab study

  → *mixed methods*

Florian Frank & Manuel Neubauer

Methods of research
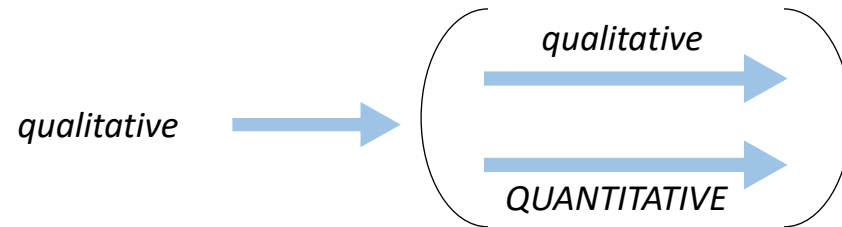## Mixed methods

Empirics-based research methods

➢ Qualitative and quantitative methods

➢ Mixed methods, as the name implies, links both

➢ Further characterisation can be made using temporal order and emphasis (Kimmons, 2022)

➢ Temporal order: parallel approach and linear approach

 → Notation: + or ➔

➢ Emphasis: emphasis on one of the methods or both

 → Notation: upper case for emphasized methodology, lower case for the lesser emphasized methodology

qualitative

quantitative

Parallel approach **+**

quantitative → *qualitative*

qualitative → *quantitative*

Linear approach ➔

qualitative → (*qualitative* / *QUANTITATIVE*)

Our research approach: qual ➔ *(QUAN* **+** *qual)*

Methods of research
How we want to use Mixed methods

Planned quantitative research

➢ Extracurricular student lab approach with Pre/Posttest-Design with one control and multiple treatment groups

➢ Lower secondary school students are split into three groups, working towards the same goal, but with different means (textbook, AR-application, simulation)

➢ Measurement of knowledge gain and perceived cognitive load via single-choice questionnaires

➢ Goal: validation of the applications and generation of additional theoretical knowledge about how learning with digital tools works

qualitative

qualitative
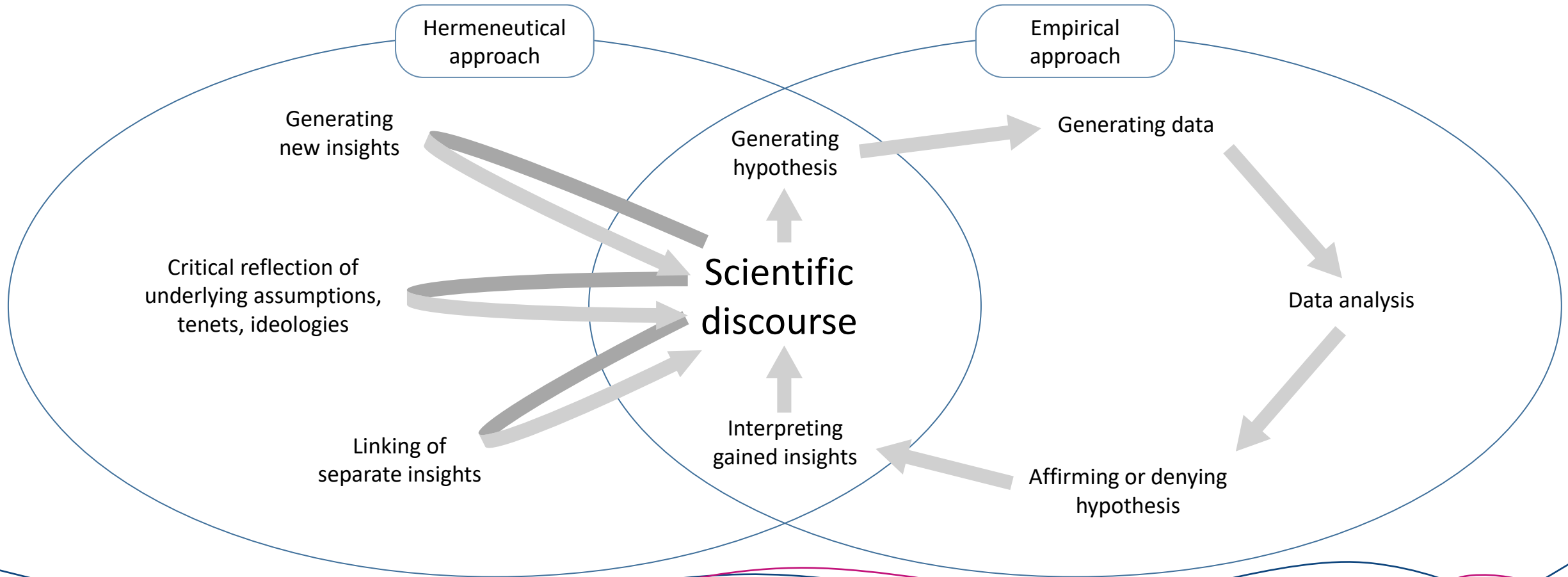
QUANTITATIVE

Our research approach: qual ➔ *(QUAN + qual)*

Planned qualitative research

➢ Qualitative interviews after the student lab with the accompanying teachers, that observed their students and can comment on possibly unusual behaviour they exhibited

Methods of research
Literature referrenced in this talk

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