

## ALM Webinar 6

# Researching ALM – which methodological approach fits your research question?

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# Webinar overview

1. Introduction
2. Quantitative versus qualitative methods
3. Mixed methods – combining quantitative and qualitative methods
4. Discussion: «Investigating the effect of Maths Eyes in different learning environments» (project title)

# General aspects of a research process

<b>(1) Identifying and specifying the research question</b>	
(practical) relevance, hypotheses	open questions, researchers' point of view
<b>(2) Linking the research question to the relevant theoretical background</b>	
current state of research	preconceptions
<b>(3) Empirical basis (defining research design, determine sample)</b>	
causal, experimental sampling strategy	exploratory, descriptive describing cases
<b>(4) Methodological approach</b>	
methods of data collection, data processing and analysis and the justification for their use	testing new instruments in a pilot study
<b>(5) Results</b>	
presentation, summary, analysis referring to the hypotheses	presentation, summary, analysis referring to the initial question
<b>(6) Conclusions</b>	
quality criteria, relevance of the results	generalisation (in relation to what?), theoretical and practical consequences

(Mayring 2012)

## Quantitative research is ...

... generally using mathematical methods,  
which can include:

- the generation of models, theories and hypotheses,
- the development of instruments and methods for measurement
- experimental control and handling of variables
- collection of empirical data
- modelling and analysis of data

(Given 2008)

and ...

- > quantitative research is particularly embedded into qualitative scientific argumentation.

# Objectives of quantitative research

- > Building sample based mathematical models by relating variables,
- > generalising such sample based models to the population represented by the very sample and ...
- > estimating the risk of the faultiness of this generalisation.

# Two different approaches

1. Searching for structures «hidden» in data
  - There is no quantitative hypothesis guiding the process, no dependant variable(s) to be explained through independent ones.
  - Data structures uncovered by statistics are in need of interpretation; that is: in need of qualitative analysis/argumentation.
  - This process fosters the construction of qualitative hypotheses and subsequently of quantitative ones.
  
2. Testing hypotheses ...
  - including dependant variable(s) to be explained through independent ones.
  - Hypotheses are fundamentally based on qualitative, scientific argumentation.

# Searching for structures «hidden» in data

Searching for structures «hidden» in data, e.g.

1. Bundling variables to factors and scales representing «latent variables», scientific constructs (like: self efficacy, mathematical competence, intelligence, ...)
  - factor analysis
  - principal component analysis
  
2. Bundling cases to clusters finding «typologies for cases» (like types of learners)
  - cluster analysis
  
3. [...]

# Testing hypotheses

Explaining dependant variable(s) through independent ones.

- > Nonparametric tests comparing subsamples (deviations or relations)
  - Crosstabs,  $X^2$ -Test, Phi-Test ...
  - Kruskal-Wallis-Test, Friedman-Test ...
  
- > Parametric Tests, like
  - regression analysis and generalized linear models
  - multilevel models
  - structural equations



# Characteristics of qualitative research

- > Aims at in-depth and interpreted understanding of the (social) world of research participants by learning about their circumstances, experiences, perspectives and histories
- > Generally works with small samples which are purposively selected on the basis of specific criteria
- > Collects data usually in close contact with the research participants
- > Works with detailed, rich and extensive data
- > Relies on analysis which is open to emergent concepts and ideas
- > Produces outputs which «re-present» the social world of the participants

(Snape and Spencer 2003, cited in Moriarty 2011)

# Overview of qualitative methods

- > They are used in a variety of disciplines: sociology, linguistics, anthropology or educational science
- > Often rely on verbal data (→ interview transcripts)
- > Diversity without real unity – qualitative methods are like tropical fruit (Reichertz 2007)
- > Can be differentiated according to their objectives:

## **Coding and categorising**

aim at reducing the original material

e.g. qualitative content analysis or grounded theory

(Flick 2005, p. 310ff)

## **Sequential analysis**

aim at reconstructing the case structure by uncovering , exposing and contextualising the statements

e.g. objective hermeneutics, conversational or discourse analysis

# Qualitative content analysis

- > Describes a systematic, data-reducing approach of analysis where categories stand at the centre
- > Developed by Mayring (e.g. Mayring 2000)
- > Categories are clearly defined and developed on...
  - an inductive basis, being very close to the material
  - a deductive basis, being derived from preliminary available information
- > Can be used for a variety of purposes:
  - structuring content
  - evaluating and assessing
  - establishing typologies(Kuckartz 2012)

# Grounded theory

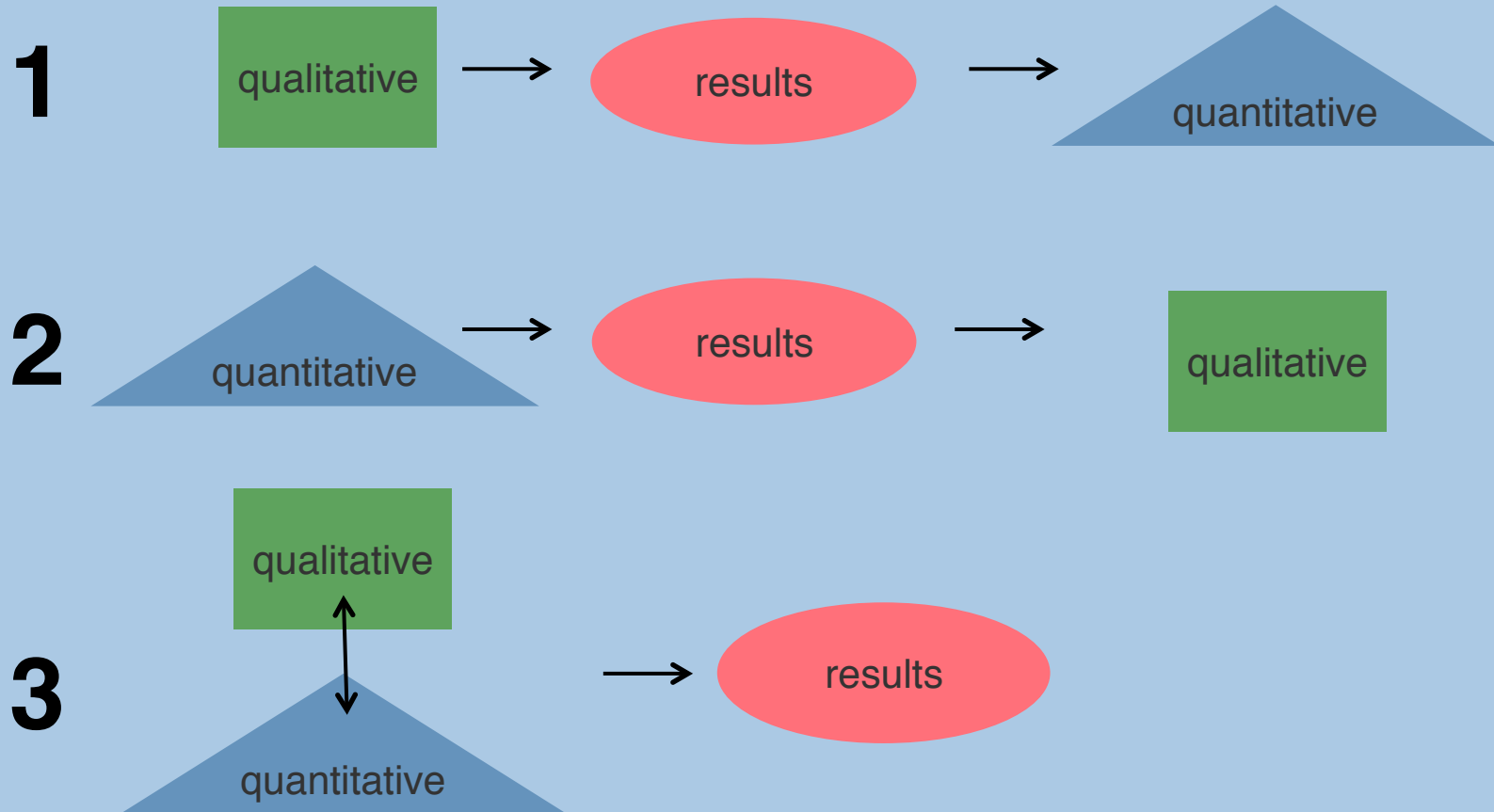
- > Aims at discovering theory through data analysis
- > Was developed by Glaser and Strauss, who later developed it into two different directions
- > Consist of the following essential concepts:
  - concurrent data generation/collection and analysis
  - writing memos (stop and memo)
  - theoretical sampling
  - constant comparative analysis
  - identifying a core category
  - advanced coding and theoretical integration

(Birks and Mills 2011)

# Mixed methods – combining quantitative and qualitative approaches

- > ... is possible at various levels, for example at
  - the technical level
  - the level of data
  - the level of people
  - the level of research design or
  - the level of the logic of research  
(Mayring 2012)
  
- > Combined research designs:
  1. generalisation
  2. elaboration
  3. triangulation  
(Mayring 2012)

# Models of combined research design



# An investigation into the effectiveness of Maths Eyes in different learning environments

## Background:

- > Maths Eyes is an initiative developed by Dr Terry Maguire
- > An approach to making real life mathematics more visible
- > Maths Eyes is seen as a resource to enhance mathematical literacy and numeracy among communities
- > Learners develop increased positive attitudes towards mathematics



# An investigation into the effectiveness of Maths Eyes in different learning environments

- > The initiative has been positively received, however evidence to support this is anecdotal only. This project will serve to provide more concrete evidence.
- > ***The overarching aim of this project is to investigate the effect of participation in Maths Eyes projects, on the attitudes and confidence of those involved; to promote the Maths Eyes initiative for use in primary, secondary and adult education, and in the wider community and to develop a theoretical framework, based on Maths Eyes, to improve mathematical literacy and numeracy.***





# An investigation into the effectiveness of Maths Eyes in different learning environments

## Research Questions:

- > Does Maths Eyes contribute to an increase in learners' mathematical confidence?
- > Does Maths Eyes influence a positive change in the attitudes of those who engage in the programme?



# An investigation into the effectiveness of Maths Eyes in different learning environments

## Research Plan:

- > The perception of attitudes and the definition of what is meant by being “mathematically confident” will be investigated through research of the literature
- > **Appropriate methods to identify and analyse the attitudes and confidence of participants will be determined**
- > **It is hoped that pre and post analysis of the attitudes and confidence levels of the participants will be conducted.**
- > A theoretical framework will be developed centred on the principles of Maths Eyes



# Guidelines für your research

- > Reflect your choice of methodology, considering:
  - its fit with the research question
  - its specific advantages / disadvantages
  - the resources available («less is more»)
  - the knowledge available
  
- > Look for discussion opportunities
  - workshops or summer schools
  - research groups
  - mailing lists
  - online fora
  - ....

# Literature

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