Hamburg, 26.07.2016

AN EMPIRICAL STUDY ON PLANNING AND IMPLEMENTATION OF STATISTICAL DATA COLLECTIONS OF PUPILS OF THE 9TH AND 10TH GRADE

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The afore-mentioned study an empirical investigation of existing difficulties and errors (incl. their causes, strategies and consequences) which occur during the solution process of planning and implementing a statistical collection of data.

Nowadays, the German stochastics lessons in secondary level I & II are discussed with the central idea of "data and coincidence". Dealing with statistical data is fundamental for stochastics lessons. In most of the cases, the statistical data is used from the respective school books. The planning and implementation of statistical surveys are two substantial phases in the whole process of a statistical investigation. Furthermore, considering the national educational standards these are mandatory educational contents of the secondary level I & II (KMK 2003, S. 16). Nevertheless, they are little discussed in the German stochastics lessons. According to Pisa in 2012, there still is a "relative weaknesses in the section of uncertainty and data" today and further "this is where a starting point for a further improvement of mathematical competence in Germany becomes appears." (Prenzel/ Salzer & Klieme 2013, S. 82). So, how can considerations for planning statistical data collections find their way into school lessons? In addition, it is of didactic interest what kind of pupil difficulties and errors (incl. their causes, strategies and consequences) with planning and implementing of a statistical surveys are found. With this in mind, this empirical study will detect the difficulties and errors of German pupils of the 9th and 10th grade with the help of the Grounded Theory. This Poster poses the basic research questions of the difficulties and errors of planning and implementing of statistical data collections, and outlines the design, methodology and evaluation method of the study.

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Aim of this study

Research questions

The state of research shows, that practically any results about *causes, strategies* and *consequences* of pupils difficulties and errors in the area of planning and implementing of statistical data. Because such essential knowledge is generally not just provided, but requires didactic analysis and observations of processes of pupils which are investigated in the present study following questions:

Which difficulties and errors occur when pupils of the 9th and 10th grade of different schools when solving tasks to plan and implement statistical data collections?

This are main research questions:

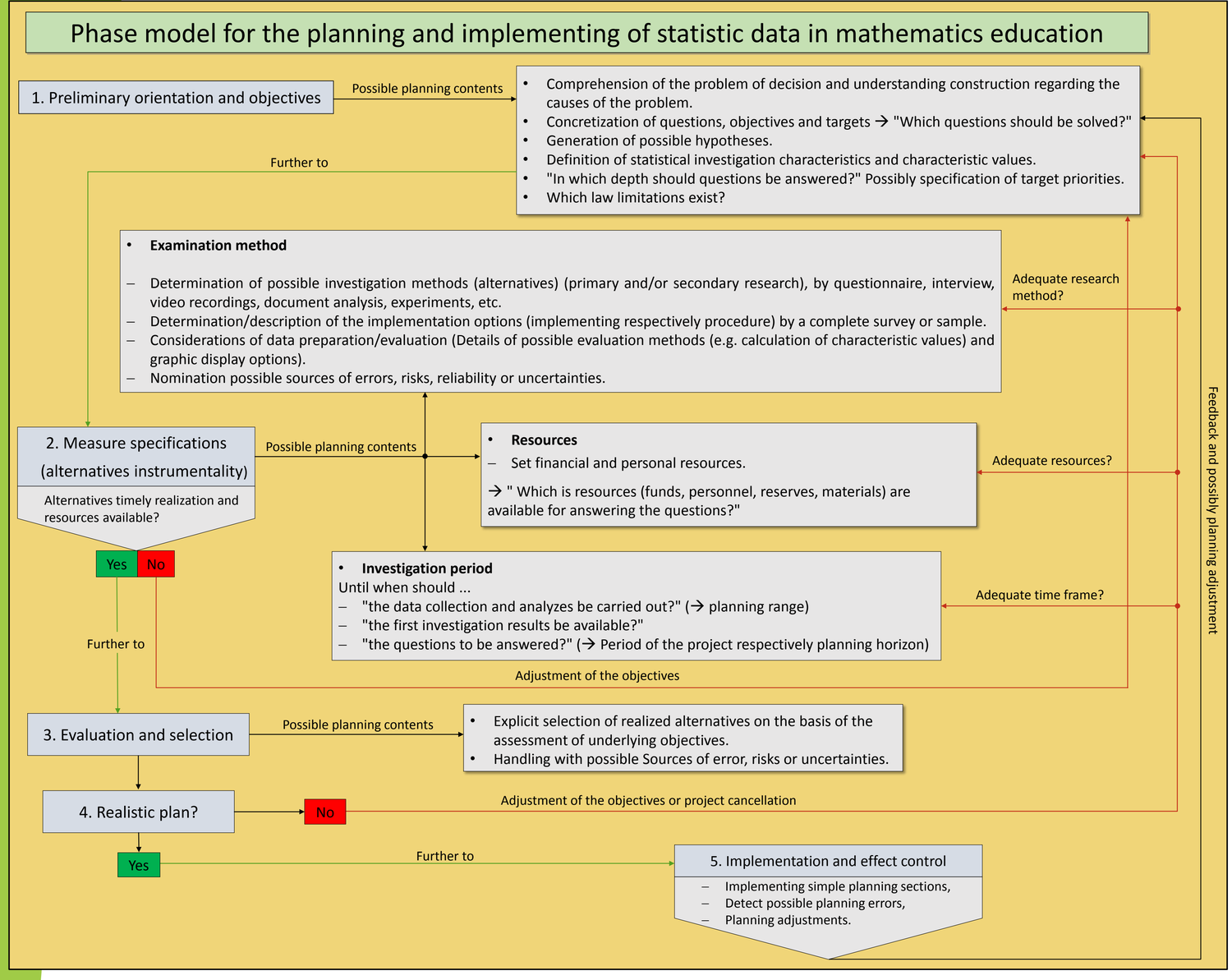
- *What causes underlie the difficulties and errors of pupils?*
- *Which strategies/ interactions do students perform during the solving process?*
- *What are the consequences of the undertaken strategies/ interactions?*

Theoretical background

Phase model for the planning and implementation of statistical data in mathematics education

In the literature there are a variety of different planning and decision models, which have, depending on the problem, divergent perspectives in the course of planning and require correspondingly different planning techniques and forms of modelling. (Klein & Scholl 2012, p. 13, chap. 2.4.1).

Planning tasks and associated with these subjective decisions and theoretical models have been contents in the public transport system and business economy for many years. In our opinion, the planning processes carried out here are therefore excellent for the development of a statistical planning and decision model for school everyday life, because they reflect the complexity and the multivariate work and development processes in all its facets. The subsequent cybernetic planning model shows a possible plan of procedures, which was developed from theoretical considerations in the context of the ongoing dissertation study.



Difficulty definition:

"One point in the editing process, in which it`s reconstructed, that a person performs nothing or something not obvious (in the sense of not sure, dubiously) and doesn't want to or can't rely on nothing of the task situation […]" (Lange 2013, p. 32).

Error definition:

1. Errors are committed inadequate or dissonant decisions that are made in the editing process during the prior orientation and objectives, the measure specification (alternative mediation) and the subsequent assessment and selection of people. Such dissonant decisions are, for example, an improper or lack of specification of individual objectives and/ or this goal achievement ends needed measures (investigation methods, resources, investigation period) and their subsequent selection and evaluation - independent of whether the decisions adopted in this have been properly carried out.
2. During the statistical data collection (implementation and effect monitoring), errors are forgotten, accidentally incorrect or deliberately unimplemented single, necessary measures (strategies). Such errors are, for example, disregard statements of objectives or questions, the erroneous application of (mathematical) methods or rules.

Tasks for planning and collection of statistics data in mathematics instruction as part of a new culture of tasks

In the framework of the study designed a set of four in the context of the thing different task types. A task has been settled in the natural science (Biology) (jump distances of frogs), two tasks in the context of the economy (media equipment, use of media) and a task in the field of traffic counting. Each task was divided into three subtasks, while on a brief but precise and comprehensible task formulation are designed (Stäubel & Wodzinski 2008, p. 194).

Name: _____
School form and class:_____

Date:_____

Exploration of the jump distance of different frogs

Frogs are interesting creatures. They differ by many features, e. g. in their size or their colors. A particularly impressive feature of frogs is their jumping ability. Because frogs can jump differently far, researchers have been investigation the jump distances of different frogs for a long time.

Research assignment:

a) **Plan** an experiment, with which you can examine the jump distances of different sized plastic frogs. **Document** your approach as accurately as possible. That is to say plans and documented So that in hindsight other people can comprehend your experiment and perform it.

b) **Convert your** considerations with a small trial.

Note:

As an aid, you may use the different sized plastic frogs.

c) **Explain** whether your considerations from part a) were sufficient, or if your planning needs an adjustment.

Name: _____
School and class:_____

WP ENGINEERS

Date:_____

Traffic counting

The city of Hildesheim is responsible for ensuring that traffic works well. To ensure this, a traffic count is performed every five years to review the development of traffic and to make necessary changes. Such a survey was recently performed in 2010, 2016 topical data are needed for the year. Here Engineers often play an important part, such as WP in Hanover, which plan traffic counts, execute and evaluate. This volume of traffic is examined in different places (e. g. in the town centre or in front of schools and universities). The results are used to develop future-oriented concepts of mobility of the city of Hildesheim, e. g. the traffic reduction in front schools, a sustainable environmental protection, or multiple use of parking positions.

Your task:

a) **Plan** a traffic count in an appropriate location in your vicinity. **Document** your approach as accurately as possible. So that in hindsight other people can understand your experiment and perform it. Use the enclosed place map for your considerations. Show important details of your planning on the map.

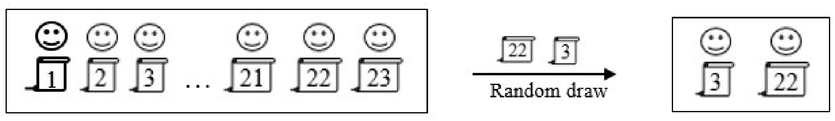
b) **Convert your** reflections through a small sampling.

c) **Explain** whether your considerations from part a) were sufficient, or if your planning needs an adjustment.

Study design

Description and selection of subjects – qualitative case selection

A total of 16 different pairs of pupils are examined aged between 15 and 16 years. The pupils come attend different secondary schools and high schools (9th and 10th school year) from Hanover and Hildesheim. The following figure exemplifies the determination of a pupil couple.



In a class, with e.g. 23 pupils, the pupils were provided with numbers . The numbers 3 and 22 were pulled at random drawing. The two pupils represent a pair of pupils.

Description of data collection in the framework of the study

1) The task set is available in a "natural environment" (within the school and school time) but outside of class. To retrospectively analyze non-verbal strategies, the processing of tasks by the pairs of pupils is recorded video graphically.

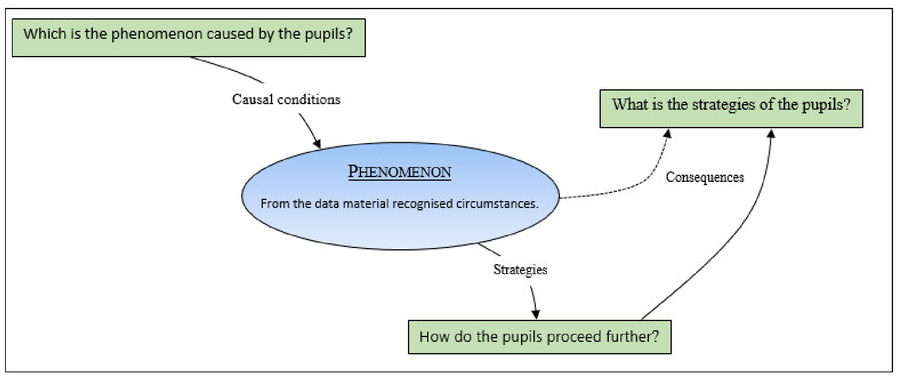
2) The video recording is shown to the participants directly after the task processing. The two participants get the opportunity to explain their thoughts and behavior (in not self-explanatory points), with the method *"stimulated recall"* (Henderson & Tallman 2005).

3) A second form of interview is carried out in addition to the method simulated recall. This second (half-open) interview consists of two parts.

- In the **first part of the second interview**, the pairs of students are interviewed based on the basis of their manufactured transcript (for example, why have you listed no alternative trial place?)
- In the **second part of the second interview**, selected questions (interview key questions) will be directed to the pupil pairs.

Methodological considerations for the evaluation procedure

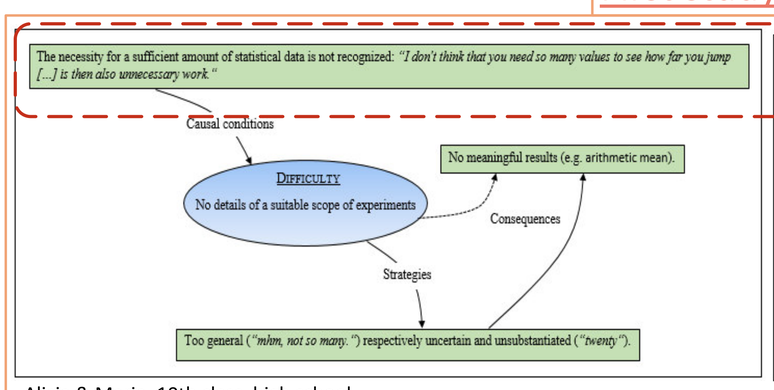
To generate hypotheses, qualitative data analysis takes place on the basics of **Grounded Theory** (Glaser & Strauss 1967/2008). The analysis process is based on a multi-level evaluation process, which is the *"method of constant comparing"* empirical data sets underlying (ebd., p. 111). The following figure illustrates the procedure of the analysis process in terms of Grounded Theory.



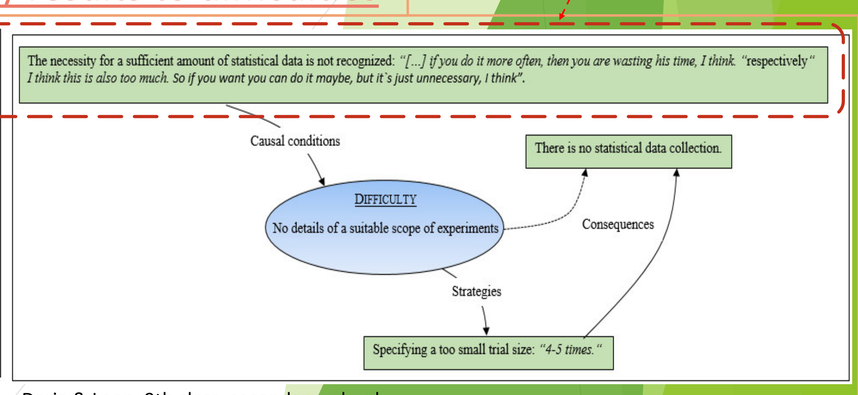
Visual clarification the *"coding paradigm"* after Strauss. In the Centre, the isolated phenomenon is expressed by three possible concepts in connection (causal conditions, strategies, consequences) (In dependence on Strübig (2014, p. 25)).

Collective category

First study results to difficulties



Alicia & Marie, 10th class, high school



Daria & Leon, 9th class, secondary school

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