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DeResA: a DEsign RESearch Approach

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DeResA: a Design Research Approach

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Inhoudsopgave

1 Introduction

In this text a model for design research is presented. It is developed to understand the various steps of performing research and to facilitate the instrumentation of the steps.

2 DeResA, the model

2.1 Inspirators

Gravemeijer (2001) sees (developmental) research as a process in which thought experiment and practise experiment alternate. A thought experiment leeds to an Hypothetical Execution Trajectory (HET) which contains goals, plans and hypothesis of the execution of the HET.
In the following practise experiment the HET is performed, which leads to some sort of results. After that, as part of the next thought experiment, a reflection on the results takes place. New insights are gained, which lead to the growth of know how, the conjectured local theory. Based upon this reflection the next thought experiment is performed, or the gained insights are laid down in the conjectured local theory, i.e. in the form of a proven concept.

Streefland (1994) sees (developmental) research from the point of view of the level theory of Van Hiele (1986) as a (collective) learning process of progressive theorizing which connects the conjectured local theory to general theory. In his view this kind of research is both theory driven (from existing theory) and theory aimed (at new theory).

Van den Akker (1999) distinguishes three phases in (constructivist developmental) research: the preliminary phase with a front-end analysis which leads to a prototype. The prototype is evaluated with formative evaluation. The next phase is the formative phase in which the pilot is improved by formative evaluation. The last phase is the retrospective phase in which the final version of the pilot is reformulated into a design by summative evaluation. He distinguishes three criteria for the design: quality, coherence and practicality. One might state that whether the research undertaken satisfies more or less the criterion ‘practicality’ determines whether the research undertaken is more practical or more fundamental by nature.

2.2 Synthesis

From these approaches we distill our approach. The STM-model (see Figure 3) includes four dynamic blocks: three research blocks (the studies) and a scientific discourse block, and seven static blocks which contain a question, design, a plan, results or theory.
The design research approach starts with a design problem. With this design problem in mind an analysis study is entered. An analysis is made of the existing theory, which leads to possible designs and their implementation. Based on this analysis, decisions are made regarding the design and implementation of the design. These decisions can be described in a plan. The analysis study also leads to the first hypotheses in the conjectured local theory. The analysis study corresponds to the front end analysis of Van den Akker (1999).
The plan is input for the development study, where the preparations are made for the implementation study. The outcome of the development study is the (hypothetical) concept design (HCD) which contains goals, plans, guidelines and hypotheses of the contextual and executional aspects of the HCD.

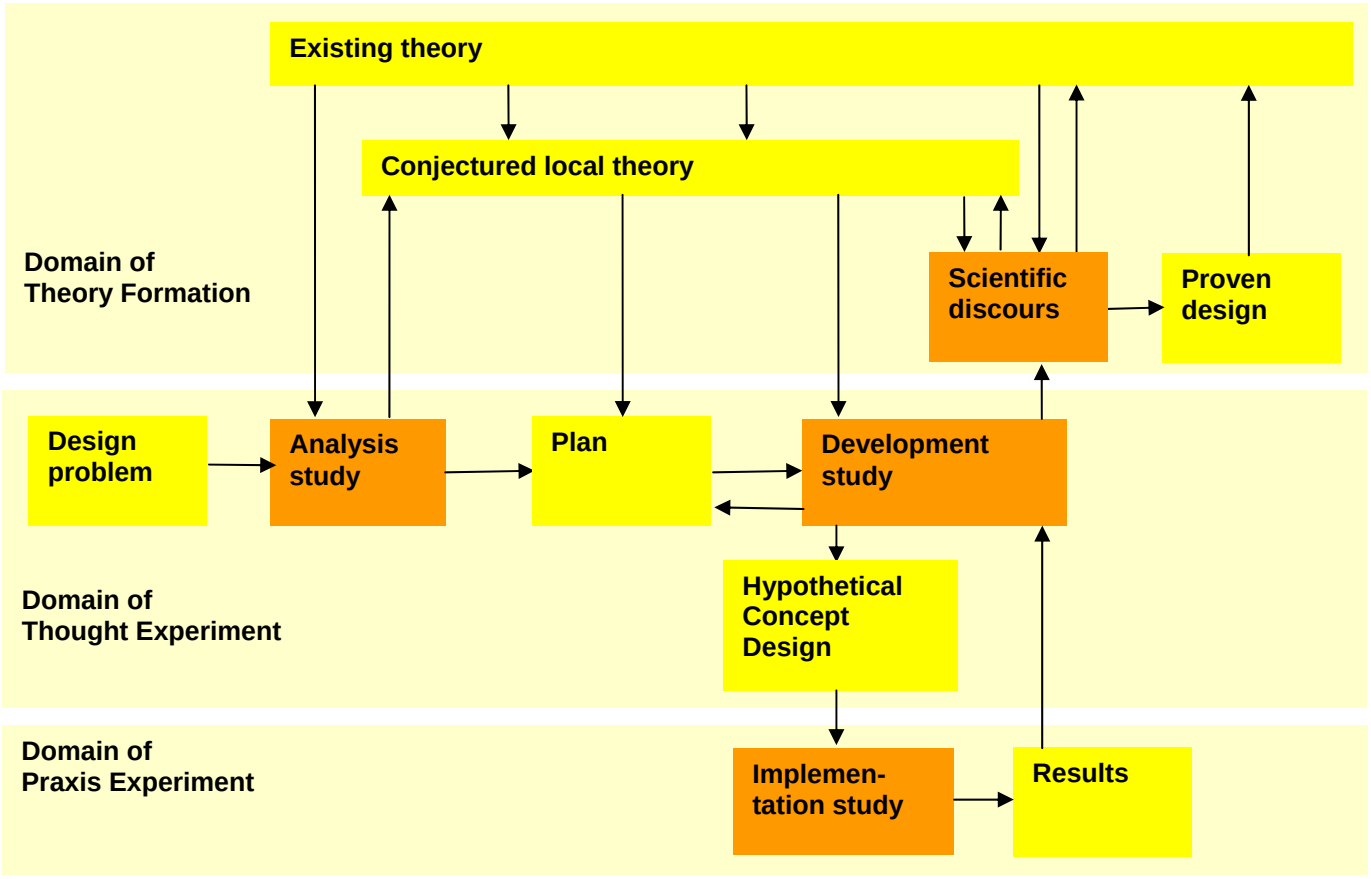

Figure 3: DeResA: A practical design research approach

The HCD is input for the implementation study in which the HCD is tested. This test leads to results, data of some form.
The results are input for the development study, where in the context of the HCD the results are interpreted. These interpretations are input for the scientific discourse, where the interpretations are discussed in the context of existing theory and the local theory under construction. Output is an adjusted local theory which deters the adjustment of the plan and the HCD with which another cycle of developmental study and implementation study is entered.

2.3 Two research cycles

DeResA contains two cycles that are of great importance for theory formation.
The cycle 'Development Study' -> 'HCD' -> 'Implementation Study' -> 'Results' -> 'Development Study' might be called the empirical cycle. It is the cycle in which a (hypothetical) concept design is tested in reality.
The cycle 'Development Study' -> 'Scientific Discourse' -> 'Conjectured Local Theory' -> 'Development Study' might be called the theory formation cycle. In this cycle new theory is generated.

2.4 Van Hiele

In this design research approach the Van Hiele Levels are eminent in two ways. In the first place in the three domains. The domain of the praxis experiment is Van Hiele Level 0, the level that is about 'things themselves'. The domain of the thought experiment is Van Hiele Level 1, the level of the relations with other 'things'. The domain of the theory formation is Van Hiele Level 2, the level of 'know how'. In the second place The Van Hiele Levels are present in the development of

the conjectured local theory, in the way Streefland (1994) describes them. These Van Hiele Levels are hidden in the model.

In order to be useful the transitions between the various phases of the STM have to be equipped with instruments. These instruments will be context dependent. A series of researches will be performed in order to develop these instruments.

3 DeResA in use

3.1 DeResA at the meso-level

DeResA was first applied in Slettenhaar, De Vries, Beun en Verwaard (2006). This showed that DeResA is a model that very convenient enables to describe and discuss the various steps in the design research performed.

3.2 Research approach under paradigm change

With the research cycles in mind, DeResA enables us to show the differences in research approaches due to paradigm changes.
The mechanics of Newton where developed by ‘measuring is knowing’. It leans heavily on the empirical cycle. The theory formation cycle is only entered to formulate new theory.
Einstein introduced the thought experiment as a scientific method. From then on, the theory formation cycle is the central cycle for theory formation. The empirical cycle is only entered to show that the predictions of a theoretical construction come true.
This shift coincided with the paradigm shift from theory as an ‘objective truth’ to the intersubjective construction of theory.

3.3 DeResA at the ‘square millimetre’

In a one-to-one participating observation as a research method in e.g. a didactical research, in which the researcher bases his next intervention on the outcome of the former one, the researches goes through both cycles many times. His first intervention is in the empirical cycle. The outcome of this forces him to enter the theory formation cycle in order to try to understand this outcome in the context of the conjectured local theory. This helps him to find the next suitable intervention.
In this kind of research both cycles have the same importance.

4 Discussion

In this text a design research approach, DeResA, is presented. It is applied in three different situations. The model shows to be able describe various aspects of doing research.
DeResA will be applied in researches in order to develop the instrumentation of the model.

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