Combining design-based research and action research to test management solutions

Daniel Andriessen
INHOLLAND University of professional education

This paper presents an approach to organizational research that aims to produce research results that are both relevant and rigorous. The research approach combines the designing of a management tool with the testing of the tool using an action research methodology. The lack of relevance in organizational research is a much debated issue in literature. A design approach has been proposed to help bridge the gap between research and practice. However, in organizational research, there is little empirical evidence how design-based research works in practice and it is unclear how this type of research is best structured. The purpose of the paper is to illustrate what a comprehensive methodology for design-based research can look like and how an action research methodology can be used to test the design in practice.

The lack of relevance in organizational research has been has been debated in special issues of the Academy of Management Journal (Rynes, Bartunek, & Daft, 2001) and the British Journal of Management (Starkey & Madan, 2001) and has been addressed in presidential addresses to the Academy of Management (Bartunek, 2003; Hambrick, 1994). Design-based research has been proposed as a methodology that can help bridge the gap between research and practice (Romme, 2003; Van Aken, 2004).

Advocates of design-based research claim that this research can contribute to the development of organizational theory development and the enhancement of professional practice (Romme, 2003; Van Aken, 2005). However, design-based research is not yet widely applied in management studies and very few authors provide detailed guidelines on how to do it. The purpose of the paper is to illustrate what a comprehensive methodology for design-based research can look like and how an action research methodology can be used to test the design in practice.

Authors use various terms to describe design-based research, including *design science* (Van Aken, 2004; Van Aken, 2005), *design research* (Collins, Joseph, & Bielaczyc, 2004; Romme, 2003), *design experiments* (McCanliss, Kalchman, & Bryant, 2002), and *design studies* (Shavelson, Phillips, Town, & Feuer, 2003). I follow The Design-Based Research Collective (2003) and prefer the term *design-based research* to avoid confusion with studies of designers.

My argument is structured as follows. First, I discuss the nature of design-based research (DBR) as a research approach. Some claim DBR is a methodology, others state it s a paradigm. I position it as a type of research question. Second, I describe my paradigm for organizational research that is based on the ontology of embodied realism and constructivism and the epistemology of pragmatism. Third, this results in the description of a methodology for design-based research that involves action research.

The nature of design-based research

Design-based research has been portrayed as a research methodology (Collins et al., 2004), a research dialect (Kelly, 2003), a mode of research (Romme, 2003), and a research paradigm (Van Aken, 2004; The Design-Based Research Collective, 2003). These authors have in common the scientific ideal of creating prescriptive knowledge in order to improve professional practice. This prescriptive knowledge should contribute to practice in the form of general solutions for real world problems; solutions Van Aken (2005) refers to as *solution concepts*. The prescriptive knowledge should also contribute to theory by highlighting the *generative mechanisms* that make the solution concept work. A generative mechanism is the answer to the question, "Why does this intervention produce this outcome?" (Van Aken, 2005). These authors also have in common that they adopt the metaphor of "design" to emphasize three elements of the research: (a) the researcher acts like a "designer" who uses existing knowledge about the way organizations work to create a "blueprint" of a solution, (b) these solution concepts are like designs that *consciously* and *explicitly* have been "designed" before they are used and that are "redesigned" several times to improve them, (c) these designs are tested to check their validity.

Is design-based research a paradigm or a research methodology? According to Denzin and Lincoln (Denzin & Lincoln, 2000) a paradigm includes: (a) ethics, (b) ontology, (c) epistemology, and (d) methodology. Advocates of design-based research share an epistemology rooted in pragmatism (Romme, 2003; Wicks & Freeman, 1998). However, they may differ in their ontological point of view. I believe in the ontology of embodied realism (Lakoff & Johnson, 1999) but alternative positions may include critical realism, historical realism, and relativism (Lincoln & Guba, 2000). In addition, Van Aken and Romme (2005) argue that researchers can draw from several different research methods to test the validity of the design, ranging from more positivistic quasi-experiments (Cook, 1983) to action research type interventions (Susman & Evered, 1978). This implies that design-based research may make use of a variety of methodologies.

This leads me to conclude that design-based research is neither a paradigm nor a methodology. Instead, I suggest design-based research can best be positioned as research aimed at answering a particular type of research problem: the *design problem*. Based on a review of literature, Oost (1999) identifies five possible research problems in scientific research. Each of these five types of problem can be constructed in two ways. A research problem can be constructed as an open, explorative question or it can be constructed as a closed question aimed at testing of a hypothesis. Table 1 provides an illustration of each of the 10 combinations of research problems.

Design-based research is research aimed at providing answers to design problems. A design problem can be phrased as an explorative question (How can we improve situation Z?) or a question aimed at hypothesis testing (If we do X, will it improve situation Z?) According to Oost a design problem is not a separate type of research problem but a combination of an evaluation problem and an explanation problem. Methodologically speaking a design is a prediction that can be written as: $d: X \rightarrow Y$ (For domain d it is true that X will lead to Y) which is in fact an untested explanation: Y is caused by X. This prediction is an answer to an evaluation problem: what is a good solution for this problem?, or, what is the best means to this end? In design-research, the researcher needs to answer an explanation problem (Can X cause Y?) and an evaluation problem (Is Y a good solution for Z?)

2

Type of research problem	Example of explorative problem	Example of hypothesis testing
Description problem	What are the characteristics of X?	Does X have these characteristics?
Comparison problem	What are the differences between X and Y?	Are X and Y different?
Definition problem	To what class of phenomena does this belong?	Is this phenomenon part of this class?
Evaluation problem	How successful is this intervention?	Is this intervention a success?
Explanation problem	Why Y?	Is it true that X explains Y?

Note. Based on (Oost, 1999).

Table 1. overview of scientific research questions

From this it follows that in design-based research there are three possible design questions: (a) d: $X \rightarrow$? (What are the effects of intervention X in situation d?); (b) d: ? $\rightarrow$ Y (How can we achieve Y in situation d?); (c) d: $X \rightarrow Y$? (Is it true that intervention X leads to Y in situation d?) The first question calls for an explorative research approach to discover the impact of a particular intervention. The second and third questions are part of a research approach aimed at developing and testing solution concepts. In this case the question d: ? $\rightarrow$ Y is answered by developing a tentative solution concept in the design phase and the question d: $X \rightarrow$ Y ? is answered in the testing phase. Design-based research is a particular type of research that (a) is aimed at answering design questions, (b) that can be based on a variety of conceptions of reality, (c) that is based on a pragmatic epistemology, (d) and that can make use of different research methodologies.

In organizational studies, the literature on design-based research has typically focused on the nature, the benefits and limitations of this type of research. Less has been written about the practical application of the approach.

My paradigm

In this section, I describe the elements of the paradigm I use when doing organizational research. I follow Arbnor and Bjerke (1997), who state that a social scientist needs to explication the paradigm used in order to justify his or her research methodology. I explain the ontology, epistemology and ethics applied in my research.

Ontology

I believe there is a real world that exists independently of me and of which I can only have imperfect and incomplete knowledge. This world cannot be interpreted directly, but only subjectively through a process of sensemaking (Weick, 1995). Sensemaking is about making distinctions with words and their rules for use (Maturana & Varela, 1998) and using conceptual metaphors. Conceptual metaphors are crucial in sensemaking as they help to conceptualize our experiences with mental imagery from other domains, especially the domains of the sensor and motor functions of our body (Lakoff & Johnson, 1999). Often we use several different, and sometimes contradictory, metaphors to conceptualize a particular concept. For example, the phenomenon of light is both conceptualized using the metaphor of "particles" and "waves". The process of conceptualization can be seen as a process of mapping elements from a source domain (particle) onto a target domain (light).

The role of metaphor in our understanding of the real world is much wider than simply expressing literal similarity. Not only similarities and features are transferred from the source to the target domain but the target domain often gets its structure from the source domain. The application of conceptual metaphor often happens out-of-awareness (Lakoff & Johnson, 1999) and is part of the unconscious mental operations concerned with conceptual systems, meaning, inference, and language. Conceptual metaphors are what makes most abstract thought possible. However, all conceptualizations we use are bounded by our body because our fundamental forms of inference arise from our sensorimotor and other body-based forms of inference. Hence the term *embodied realism* for this ontology (Lakoff & Johnson, 1999).

The social world of human action and interaction, including the world of organizations, is different from the physical world of nature. The social world is the array of nonphysical phenomena produced by interacting human beings constantly involved in a process of sensemaking. Therefore, the social world does not behave according to general laws, and the interpretation of its behavior is a problem of *equivocality* (Weick, 1995). Furthermore, the social world, as such, does not "exist"; human beings continuously recreate it through language (Mumby & Clair, 1997). The social world can take almost any shape, depending on how one chooses to look at it (Gergen, 1999). Consequently, the social world can be conceptualized by a large number of sets of distinctions and metaphors.

Epistemology

This ontological standpoint of embodied realism and social construction has consequences for epistemology. Because we only can know reality through conceptualization, the correspondence theory of truth does not hold (Lakoff & Johnson, 1999). We cannot judge whether a particular conceptualization of the world is true by looking at that world and checking whether there is correspondence. What we *can* do is act upon our conceptualization of the world and check whether this produces expected or desired outcomes, using a pragmatic criterion of truth (Wicks & Freeman, 1998; Worren, Moore, & Elliot, 2002). This is in line with Perkins' (1986) idea of *knowledge as design*. He describes knowledge as a tool to get something done. We can check the validity of this tool by checking whether the knowledge creates the results we expect. We can do this by using the knowledge to design a solution to a problem and test the solution in practice to see if it works.
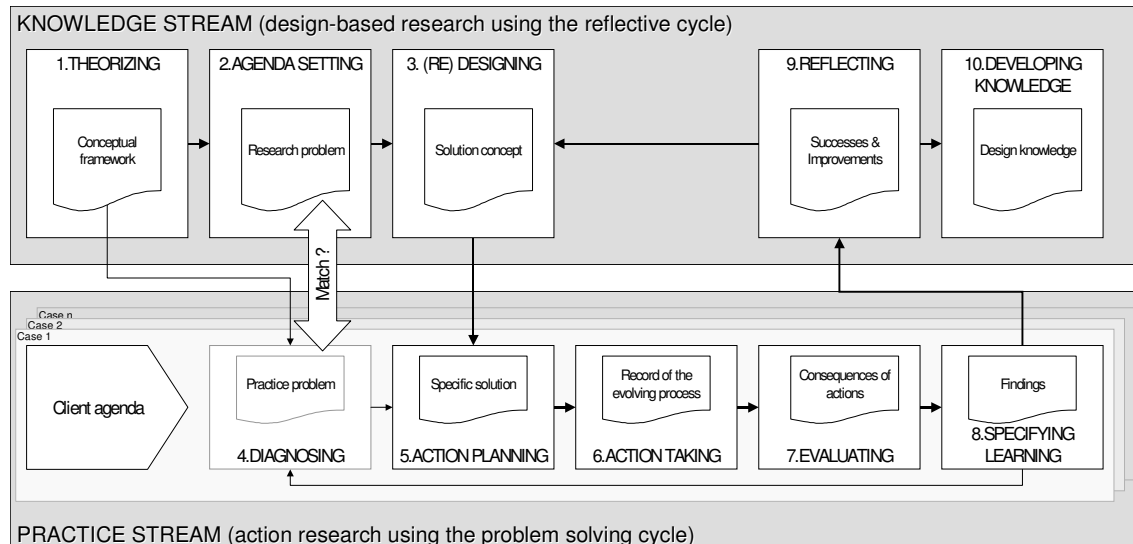
Ethics

I agree with Wicks and Freeman (1998) that ethics play a crucial role in organization studies. I believe that scholars in organization studies should use inquiry as a vehicle to help people lead better lives. Developing prescriptive knowledge requires ethical considerations. As Wicks and Freeman state "Any attempt to provide direction to corporations (e.g. firms should do x and not y) are at some level moral endeavors" (p. 124).

A methodology for design-bases research

On the basis of the ontological, epistemological, and ethical points of view as described above I suggest a methodology for design-based research as shown in Figure 1. The dual purpose of design-based research of contributing to theory and practice materializes in two distinctive but interwoven streams of inquiry. The objective of the *knowledge stream* is to develop generalizable knowledge that can

help create desired situations (Romme, 2003), preferably in a way that contributes to theory (Collins et al., 2004; Eden & Huxham, 1996). The objective of the *practice stream* is to contribute to the practical concerns of people in problematic situations, by solving particular problems in specific circumstances.

Figure 1. research methodology of a design-based research study using action research

In this methodology, action research is used to test a solution concept. When I talk about action research I refer to the action research approach as described by Susman and Everet (1978). There are many different types of action research (Kemmis & McTaggart, 2000). Susman and Everet adopt a specific interpretation of action research that fits the purpose of testing solution concepts. They state that action research has six characteristics: a) Action research is future oriented, aimed at creating a more desirable future. b) Action research is collaborative, creating interdependence between the researcher and the client system. c) Action research implies system development, generating mechanisms for problem solving in the client system. d) Action research generates theory grounded in action by applying theory in diagnosing situations and developing interventions, and by evaluating interventions to test the underlying theory. e) Action research is agnostic, acknowledging that every situation is unique and may require reformulation of previously developed interventions. f) Action research is situational. Susman and Everet propose a cyclical process of action research as shown in the practice stream of figure 1.

Other types of action research have additional characteristics that are not applicable to the approach used here (Kemmis & McTaggart, 2000). For example, *participatory research* stresses the shared ownership of research projects, the community-based analysis of social problems, and an orientation toward community action. *Critical action research* has a strong commitment to participation, empowerment, and the fight against injustice. *Action learning* aims at bringing people together to learn from each other, while *action science* tries to help professionals analyze the gap between their espoused theory and their theory in use. In *soft system approaches*, the researcher works with participants to generate system models of the situation and uses models to question the situation and suggest revised courses of action. The action

5

research approach used in this study did not have the participatory and emancipatory characteristics of these other types of action research.

The steps in the methodology are as follows (see figure 1):

1. Theorizing. I employ theory to develop a conceptual framework about the topic of interest.

2. Agenda Setting. I draw on this framework to define a research problem, which I phrase as a design problem: how can we …?

3. Designing. I develop an initial solution concept applying the design cycle. The design cycle consists of four steps : (a) specifying the intended application domain that consists of the class of problems the solution concept needs to address and the class of contexts to which it should be applicable, (b) listing the requirements for the solution concept (functional requirements, operational requirements, limitations, and limiting conditions), (c) designing a draft solution concept, and (d) evaluating the draft against the application domain and requirements.

The next step is to test this solution concept in the practice stream and to apply progressive refinement to the design (Collins et al., 2004) using a multiple developing case-study approach (Van Aken, 2004). To check whether the quality of implementation of the solution concept depends on the knowledge of the designer of the concept it is useful to have people test the solution concept who were not involved in its design. Van Aken (2004) refers to this procedure as β-testing.

The testing phase of the study started with step four.

4. Diagnosing. A crucial phase in the practice stream is diagnosing the practice problem. The problem of a case in the practice stream is different from the research problem in the knowledge stream. The practice problem is a problematization of the situation in a particular case for which the solution concept is a possible solution. The practice problem calls for a specific solution that can solve a particular problem, while the research problem asks for a solution concept that is applicable in a range of situations. At this stage, it is important to check whether the practice problem matches the application domain for which the solution concept is designed.

5. Action planning. In each case the action-planning phase involves identifying specific requirements and developing a specific design in a reflective conversation with the situation (Schön, 1983). The aim is to develop a tailor-made solution.

6. Action taking. In the action-taking phase, the specific design is implemented. During the implementation process, I gather research data using interviews, participatory observation, and document analysis.

7. Evaluating. I evaluate the process and outcome of the project with the client. Often it is useful to evaluate again after a considerate period of time, in order to assess the long-term impact of the solution concept.

8. Specifying learning. At the end of each case, I evaluate the project to specify the lessons learned.

The practice stream ends with step eight. In some cases one needs to go back to step four or five to change the diagnosis or alter the specific design. After step eight, I continue with the knowledge stream, reflecting on the implications of the case for the solution concept (step 9).

9. Reflecting. The next step is to reflect on the results of a particular case using within–cases analysis (Eisenhardt, 1989) in terms of the success of the solution concept and the possibilities to improve it through redesign. Most cases lead to alterations of or additions to the solution concept. I then test the redesign in a next case, except for the alterations that result from the last case.

10. Developing knowledge. The final step is to do a cross-case analysis (Eisenhardt, 1989) to analyze the indications and contra-indications of the solution concept. In addition I use a cross-case analysis to identify underlying generative mechanisms, in an attempt to contribute to theory development (Eden & Huxham, 1996).

Ideally, steps 3 to 10 are repeated several times with adding new cases until the point of theoretical saturation is reached (Eisenhardt, 1989).

Conclusion

A methodology combining design-based research with action research testing, can be a useful way to create business knowledge that is both relevant and rigorous. To address the issue of rigor versus relevance in research strategies it is helpful to distinguish between the knowledge stream, in which the solution concept is designed and reflected upon and that is aimed at developing generalizable design knowledge, and the practice stream, in which the solution concept is tested and that is aimed at solving real problems in organizations.

Design-based research combined with action research testing can produce knowledge that is relevant for both practice and theory. It can develop general solution concepts that professionals may use to develop specific solutions in specific situations. These solution concepts have been tested in real life situations and are "reality proof". Testing of solution concepts can produce knowledge about the circumstances under which the concept works does not work, especially when one or more test cases fail to produce expected results, like in this study. Knowing when a solution concept does not work is especially important because it reminds us that the social world does not behave according to general laws and prevents us from developing generic "Ten ways to better management" solutions. The theoretical contribution of design-based research may lie in the identification of important variables and relationships that are missing in theoretical models and the further specification of the validity domain of causal relations. Thus, design-based research can serve as a complementary mode of research to positivistic approaches and help to increase the relevance of organizational research.

References

Arbnor, I. & Bjerke, B. (1997). *Methodology for creating business knowledge*. London: Sage Publications.

Bartunek, J. M. (2003). A dream for the Academy. *Academy of Management Review, 28,* 198-203.

Collins, A., Joseph, D., & Bielaczyc, K. (2004). Design research: Theoretical and methodological issues. *The Journal of the Learning Sciences, 13,* 15-42.

Cook, T. D. (1983). Quasi-experimentation: Its ontology. In G. Morgan (Ed.), *Beyond method: Strategies for social research* (pp. 74-94). London: Sage Publishers.

Denzin, N. K. & Lincoln, Y. S. (2000). *Handbook of qualitative research*. (2 ed.) London: Sage Publications.

Eden, C. & Huxham, C. (1996). Action research for management research. *British Journal of Management, 7,* 75-86.

Eisenhardt, K. M. (1989). Building theories from case study research. *Academy of Management Review, 14,* 532-550.

Gergen, K. J. (1999). *An invitation to social construction.* London: Sage Publications.

Hambrick, D. C. (1994). What if the Academy actually mattered? *Academy of Management Review, 19,* 11-16.

Kelly, A. E. (2003). Research as design. *Educational Researcher, 32,* 3-4.

Kemmis, S. & McTaggart, R. (2000). Participatory action research. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 567-605). London: Sage Publications.

Lakoff, G. & Johnson, M. (1999). *Philosophy in the flesh.* New York: Basic Books.

Lincoln, Y. S. & Guba, E. G. (2000). Paradigmatic controversies, contradictions, and emerging confluences. In N. K. Denzin & Y. S. Lincoln (Eds.), *Handbook of qualitative research* (2nd ed., pp. 163-188). London: Sage Publications.

Maturana, H. R. & Varela, F. J. (1998). *The tree of knowledge.* Boston: Shambhala Publications.

McCanliss, B., Kalchman, M., & Bryant, P. (2002). Design experiments and laboratory approaches to learning: Steps toward collabarative exchange. *Educational Researcher, 32,* 14-16.

Mumby, D. & Clair, R. (1997). Organizational discourse. In T. A. Van Dijk (Ed.), *Discourse as Structure and Process* (pp. 181-205). London: Sage Publications.

Oost, H. (1999). *De kwaliteit van probleemstellingen in dissertaties (The quality of research problems in dissertaties).* Doctoral dissertation, University of Utrecht, Utrecht: IVLOS Reeks.

Perkins, D. N. (1986). *Knowledge as design.* Hillsdale: Lawrence Erlbaum Associates.

Romme, A. G. (2003). Making a difference: organization as design. *Organization Science: A Journal of the Institute of Management Sciences, 14,* 558-573.

Rynes, S. L., Bartunek, J. M., & Daft, R. L. (2001). Across the great divide: Knowledge creation and transfer between practitioners and academics. *Academy of Management Journal, 44,* 340-355.

Schön, D. (1983). *The reflective practitioner.* London: Temple Smith.

Shavelson, R. J., Phillips, D. C., Town, L., & Feuer, M. J. (2003). On the science of education design studies. *Educational Researcher, 32,* 25-28.

Starkey, K. & Madan, P. (2001). Bridging the relevance gap: Aligning stakeholders in the future of management research. *British Journal of Management, 12,* S3.

Susman, G. I. & Evered, R. D. (1978). An assessment of the scientific merits of action research. *Administrative Science Quarterly, 23,* 582.

The Design-Based Research Collective (2003). Design-based research: An emerging paradigm for educational inquiry. *Educational Researcher, 32,* 5-8.

Van Aken, J. E. (2004). Management research based on the paradigm of the design sciences: The quest for field-tested and grounded technological rules. *Journal of Management Studies, 41,* 219-246.

Van Aken, J. E. (2005). Management research as a design science: Articulating the research products of Mode 2 knowledge production in management. *British Journal of Management, 16,* 19-36.

Van Aken, Joan Ernst and Romme, A. G. L. (2005). Reinventing the future: Design science research in the field of organization studies. Paper presented at EURAM 2005 in Munich, Germany.

Weick, K. E. (1995). *Sensemaking in organizations.* London: Sage Publications.

Wicks, A. C. & Freeman, R. E. (1998). Organization studies and the new pragmatism: Positivism, anti-positivism, and the search for ethics. *Organization Science, 9,* 123.

Worren, N., Moore, K., & Elliot, R. (2002). When theories become tools; Toward a framework for pragmatic validity. *Human Relations, 55,* 1227-1250.