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Title **Knowledge by Design in Education: Epistemological questions revisited**

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Abstract The editorial introduces the special issue *Knowledge by Design in Education: Key challenges and experiences from research practice*, posing key questions, offering an insight into ongoing discussions, and presenting an overview of the included articles.

Keywords design-based research, epistemology

Einige Autorinnen und Autoren dieses Special Issues sind Mitglieder des wissenschaftlichen Netzwerks Design-Based Research als methodologischer Rahmen in der Bildungsforschung (DBR-Netzwerk, gefördert durch die Deutsche Forschungsgemeinschaft (DFG) – 452077361).

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Knowledge by Design in Education: Epistemological questions revisited

Alexa Brase, Tobias Jenert

1.0 Introduction

What characterizes theories that result from design-based research (DBR)? How can the relationships between data, context, and design be modelled and systematized within design iterations? How do interactions between research and practice influence design and theory building? And what role do ethical considerations play in DBR processes?

The observation that DBR (and its synonyms and close relatives like educational design research) assembles a variety of approaches under one roof is not a new one, nor are the questions we pose: in 2004, Sandoval and Bell ask: “What kinds of knowledge can design-based research produce?”, and: “How does the effort to design complex interventions influence research?” (Sandoval & Bell, 2004, p. 200). With these and other questions, they introduce a special issue of the *Educational Psychologist*. It is one of several special issues, not to mention edited volumes and single articles, dedicated to epistemological and methodological questions on DBR. They address the role of design in educational research (Kelly, 2003), work on unresolved questions in order for DBR’s claims to be considered “credible and trustworthy by others” (Barab & Squire, 2004, p. 3), or challenge DBR with special attention to the cooperation between researchers and practitioners (Emmler, Euler & Ertl, 2020).

In addition, monographs have been published that, like textbooks, provide orientation on the entire DBR process and address questions at the intersection of design, empirical activity and theory. In 2012 (with a second, updated edition in 2019), McKenney and Reeves published their book, describing educational design research along their now well-known generic model. In 2018, Bakker’s introduction for early career researchers followed, combining theoretical explanations, experiences and opinions by many DBR researchers. This volume provides concrete examples from PhD projects. Compared to the early 2000s, we have a larger knowledge base, but the challenges due to DBR’s nature as a framework for uniting knowledge generation and practical goals remain.

2.0 Discussions

We consider this special issue as a contribution to continue and update the discourse, and to connect it to the ever more lively discussion in German-speaking countries. Many DBR studies have been published

since 2004. According to a Web of Science query (see fig. 1), publication numbers have been increasing almost continuously. This indicates that the terms design-based research and educational design research have become more widely known and disseminated. It also shows that the genre has found a place within educational research.

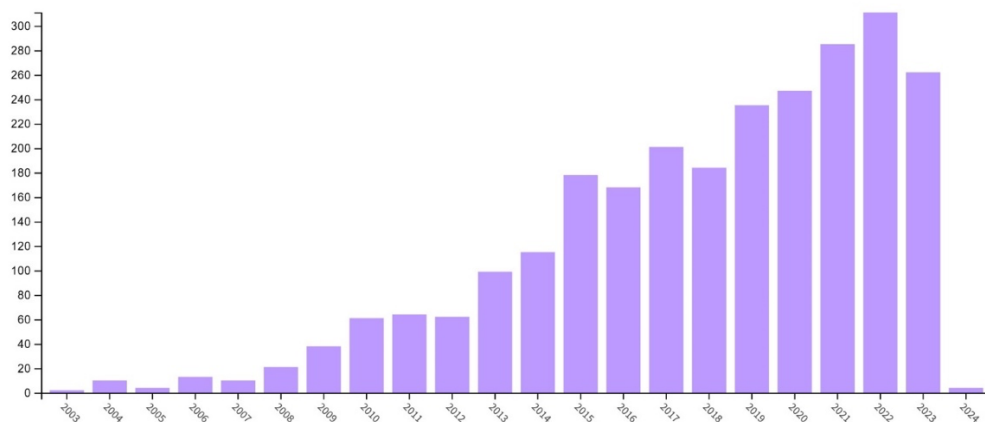


Figure 1: Number of publications per year with the topic “design-based research” or “educational design research” (Web of Science, 2024; query from January 23, 2024)

In many countries, authors are working with DBR, bringing with them local research traditions, experiences and discussions. This also applies to the German-speaking DBR landscape, which is strongly represented in this special issue, complemented by a contribution from esteemed colleagues from the United States, whom we invited to exchange ideas. This special issue emerges from a symposium in September 2022, organized by a DBR network based in Germany and Switzerland. The discussions led at the event and the network meeting following the day after showed that many issues are not solved and that the more intensively one deals with it from different perspectives, the further the ideas of DBR seem to diverge (Reinmann, 2022). The network members shared the impression that, although it is advantageous for the deeper discussion not to have to explain DBR in general, different DBR understandings and orientations became clear in the symposium. Ideas and views were expressed on what the differences are based on – variants depending on the subject matter and field of application, emphasis on different DBR characteristics, different perceptions of iterative processes – and how we as a network can deal with them: should we emphasize internal diversity and sharpen demarcations, or rather not overemphasize the differences? These are, after all, common in most research paradigms, and there is a clear consensus on the core characteristics of DBR. Is it possible to describe different variants on a spectrum? Should we focus on the core of DBR to have common ground for agreeing on standards? And what should these refer to: methods, the specific research logic, or the quality of the outcomes (design, theory, design principles) embedded in an argumentative grammar?

We also discussed what contribution DBR can provide to education and research. If DBR does not provide insights like the ‘what works’

concept suggested by evidence-based research (not uncontested, see Scharlau, 2019), what is its main value? Is it the promise of greater efficiency based on early failure and context-sensitive development that makes DBR convincing? Is it the sustainability evolving from intertwining research and design? Is it the potential Eureka moment, the systematically provoked insight, appearing in the design process? There can obviously be different reasons to use DBR; a dominant narrative has not (yet) emerged. This could be related to the fact that many DBR characteristics, like the iterative process or the research-practice collaboration, can also be found in other approaches and only become special when combined and related to each other. DBR changes how certain characteristics are weighted (Bikner-Ahsbabs, 2022). It is precisely these special features, the mutual relation of the characteristics to one another, the interweaving of design and research, and the knowledge that can be created in the process that this special issue is about.

3.0 The contributions in this special issue

We gather different kinds of articles, from overviews to (multiple) case studies and deep theoretical explorations. The articles by Prediger, Bikner-Ahsbabs, Rees Lewis et al. and Euler are based on or follow on from symposium presentations. The others are contributions beyond that, following a call. All articles address unresolved and newly debated questions on DBR's epistemology, associated challenges and relevant experiences from research practice.

One of the overarching topics is theory development. In "Conjecturing is not all: Theorizing in design research by refining and connecting categorial, descriptive, and explanatory theory elements" *Susanne Prediger* draws attention to the details of theory generation in design research. She argues that the elaboration of categorial, descriptive, and explanatory theory is a prerequisite for concise prescriptive theory. Using an example from teachers' professional development, she demonstrates the complex interplays between the theory elements and the theorizing processes necessary for testing conjectures. This shows how deep theorizing, by unpacking and connecting theoretical elements, can go beyond local problem solving and contribute to research.

Barbara Feulner, Jan Hiller and Pola Serwene are also concerned with theory work in their article "Different paths of theory genesis in the DBR research process - a subject didactic view on theory application, verification and development". Based on theoretical considerations and three case studies from DBR projects in geography didactics, they develop a model of theory genesis in DBR projects, visualizing how theories are applied, examined and developed. They demonstrate that theory work in DBR is a dynamic and multi-layered process, and support a rule-guided, justified and transparent development of theories.

Other articles are devoted to challenging entanglements between research and teaching. *Angelika Bikner-Ahsbabs* addresses the question

of responsibility in her article “Design research on an online summer school in mathematics education: An insight into philosophical commitments”. She uses a case study from higher education to show how the three philosophical commitments going along with educational design research – the axiological, ontological and epistemological commitment – are interrelated in a DBR project. She proposes that they should be united in a three-dimensional framework concept, integrating the ethical responsibilities of researchers for the design and the local theory.

Dieter Euler focuses on the cooperation between science and practice. His article “How to align objectives of practitioners and scientists in DBR projects?” elaborates, based on experience and examples, what practitioners contribute in different phases of the DBR process, why an alignment of objectives is relevant, what the challenges of cooperation are and which principles can guide the cooperation between practitioners and scientists in DBR. The author outlines a clarification process, distinguishing between a technical and an attitudinal dimension.

Daniel Rees Lewis, Matthew Easterday and Chris Riesbeck develop recommendations on “Research Slices: Core Processes for Effective Iteration in EDeR”. They propose principles of slicing to support effective iteration, characterizing effective research slices as minimal, deployed, valuable, and informative. Building on design-based ecological validity, slicing can be used to reduce wasted time and work in design research projects. With four case studies, the authors illustrate obstacles and pitfalls in slicing as well as strategies to deal with them. They address the challenge of following all principles at the same time and place slicing in the context of other relevant strategies.

In her article “Is this systematic enough? Systematicity and openness in the implementation phase of DBR” *Silvia Introna* focuses on the tension between requirements from research and teaching in implementing an intervention. Her case study from the field of German as a foreign language illustrates challenges for researchers, especially concerning project documentation. She discusses these challenges against the background of a recent discussion on DBR standards, draws attention to the need for guidelines to support researchers and suggests taking inspiration from concepts discussed in implementation research.

Alexa Brase addresses another challenge posed by the entanglement of research and educational practice. Her article “Knowledge Generation between Design, Data and Theory: Argumentation in design-based research” follows on from the discussion on argumentative grammars and design narratives, asking which outcomes emerge in DBR and how authors justify them. In a literature review, the author gives an overview of various types of outcomes and key arguments for their justification, showing how active selection of an argumentation strategy is crucial for sharing insights from DBR.

With these various considerations on “knowledge by design”, we wish to contribute to the discussion on DBR epistemology, invite further

perspectives (EDeR always invites discussion articles) and hope that researchers will find inspiration in it.

Acknowledgements

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Alexa Brase is a researcher and lecturer at the Hamburg Center for University Teaching and Learning (HUL), University of Hamburg. She completed her PhD at the University of Potsdam in 2019. Since her involvement in a design-based research project on an online learning environment for student research groups, DBR has become one of her primary approaches in higher education research and one of her main topics in teaching. Her current research and teaching interests also encompass the Scholarship of Teaching and Learning, as well as *Wissenschaftsdidaktik*.

Tobias Jenert is a professor for Management Education with a focus on Higher Education at the University of Paderborn. Before becoming a full professor in 2018, he worked as a postdoc researcher and assistant professor at the University of St. Gallen. His research focuses on the relationship between vocational and Higher Education, investigating access paths and the success of students with diverse backgrounds. His work is often intervention-oriented with a keen interest in methodological and epistemological questions.

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