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Title Is this systematic enough? Systematicity and openness in the implementation phase of DBR

Author **Silvia Introna**
University of Bielefeld
Germany

Abstract Within Design Based Research (DBR), designing and implementing an intervention in order to improve an educational practice become part of the research process. This represents a unique feature of DBR. Though the innovative nature of DBR raises questions that have not yet been answered. This paper focuses on the extent to which systematicity, as principle of scientific research, and openness, as essential prerequisite of teaching practice, can be both fulfilled within the implementation phase of DBR studies. By presenting an investigation in the field of German as a foreign language I will offer an example of the challenges that researchers face regarding the tension between systematicity and openness. Besides the discussion about DBR standards, the aim of this paper is to delineate concrete requirements for the further development of this research approach. Guidelines helping researchers to use DBR appropriately represent an important step which could clarify still controversial aspects of DBR and also lead to an increase in its use. In this paper, I suggest that concepts discussed within the implementation research, like for instance Fidelity of Implementation, can help to develop such guidelines.

Is this systematic enough? Systematicity and openness in the implementation phase of DBR

Silvia Introna

1.0 Introduction

Both research and practice are at the heart of Design Based Research (DBR): Empirical investigation for the purpose of generating theoretical knowledge (*research*) is performed through the development and implementation of an intervention aimed at improving a current educational practice (*design*) (Euler, 2014, p. 16). Although the innovative combination of research and practice is a unique feature of DBR, some consequences arise from the interaction between these fundamentally different areas. In this regard, Reinmann (2022a) talks about tension (*Spannung*) between standards characterizing research and practice respectively. Since both constitute DBR, Reinmann (2022a, pp. 17-18) considers such tension as a constituting aspect of the DBR approach. Although Reinmann´s position is quite understandable, making a differentiation between scientific research standards and standards for the development and implementation of the intervention can be seen as critical. Doing so one assumes that designing and implementing the intervention do not belong to the scientific research process within DBR (Euler, 2022, p. 3). Instead, both research and design are constituting parts of DBR, meaning that within this approach designing and implementing an intervention become steps of the scientific research process (Euler, 2022, p. 3). Herzberg (2022, p. 3) offers another interpretation of Reinmann´s position by considering her differentiation between standards linked to the need of both investigating and designing within DBR which does not change the fact that research and design are no opposites, "but intertwined discourse practices". Reinmann (2022b, p. 4) herself recognizes the possible misunderstandings caused by the dichotomy of DBR standards and in order to avoid them proposes a new threefold understanding of DBR. Regardless of the discussion about DBR standards, this paper focuses on a much more practical issue resulting from the combination of research and practice within DBR. This is the strain between systematicity as a feature of scientific research and openness as a principle of teaching practice. In the context of DBR, an open attitude during the implementation of the intervention enables a flexible adaptation of the intervention concept to the authentic teaching and learning situations in which it is put into practice. This may result in discrepancies from the intended application of the intervention concept which can only be partially documented and thus becomes accessible to the scientific community only to some extent. The implementation phase

within DBR can therefore be blamed for lacking systematicity. This paper demonstrates and critically examines the need for both systematicity and openness within DBR, by presenting a study on the acquisition of academic reading competence in L2 German (Introna, 2021). The goal of the paper is to provide an insight into the challenges and open questions that the coexistence of systematicity and openness within DBR has raised in the context of my PhD project. On a broader level I hope to initiate a discussion about the extent to which systematicity and openness can be both fulfilled within the framework of DBR. The brief overview of my research project given in section 2 aims at contextualizing the discussion about implementation within DBR. Section 3 focuses on implementation from different perspectives and discusses how systematicity can be enhanced within the implementation phase of DBR. Finally, section 4 presents some concluding remarks.

2.0 Investigating the acquisition of academic reading competence in L2 German using DBR

The study I will present in this section aimed to investigate the acquisition of foreign language advanced reading skills in the context of a strategy-based reading program in L2 German for international students in the humanities and social sciences at a German University. Being an outcome of the developed intervention at the core of the research interest, this study can be seen as an example of *research through design* aiming in fact at "understanding the responses the intervention engenders" (McKenney & Reeves, 2019, pp. 24-25). Therefore, the main research question of the study was: What contributes to the acquisition of foreign language academic reading competence in the context of a strategy-based program promoting academic reading in L2 German of international students in the humanities and social sciences at a German University? Besides this theoretical goal I also pursued a practical one, developing an intervention to fill a gap in the context of university education. In Germany, international students enrolled in German-language degree programs are supposed to master advanced reading skills in L2 German not only without the possibility to be supported in their development but also without an understanding of what academic reading means at all (see Introna, 2021, pp. 44-52). The purpose of the PhD project was to design a solution for this problem. Due to the focus of this paper, only the research steps needed to understand the implementation process within the study will be discussed in depth, while the rest of the research process will be summarized extensively.

The study started with analyzing the educational problem: the lack of adequate reading programs for international students enrolled in German-language degree courses. The issue was first examined from a theoretical perspective by reviewing literature about literacy in higher education. The literature review showed that behind the lack of supportive reading programs for international students at German universities important knowledge and research gaps in the field of academic

reading exist. Therefore, the next step was to define the theoretical framework of the investigation by modelling the main construct of the study: foreign language academic reading competence (see Introna, 2021, pp. 52-120)[1]. Foreign language academic reading competence was conceived as a multidimensional construct consisting of four levels. At the cognitive level (1), it encompasses all knowledge assets necessary for reading foreign language academic texts, like world knowledge, L2 and cultural knowledge, text, reading, and subject knowledge as well as strategy knowledge. The metacognitive level (2) refers to the self-regulation of reading, i.e. the purposeful planning, control, and evaluation of one's reading process based on metacognitive strategies. The motivational component (3) includes the emotional and motivational factors of reading, such as self-efficacy or attitude. Cognitive, metacognitive, and motivational levels of foreign language academic reading competence build on those of academic reading competence in the L1 and enable foreign language academic reading. This comprises, at the procedural level (4), four main reading activities: critical reading, learning from texts, reading multiple texts, and writing during reading, which were found to be specific reading practices of the university context[2]. Personal requirements (*personale Voraussetzungen*), social circumstances (*soziale Bedingungen*), textual requirements (*textseitige Anforderungen*) (see Hurrelmann, 2009) and the socio-cultural background of the L2 reader were identified as influencing factors of foreign language academic reading competence, with the latter emerging as a specific factor of reading in a foreign language.

Third and last step of the first research phase was an exploration of the reading situation in the specific context, for which I designed the intervention, that is the humanities and social sciences at Bielefeld University. For this purpose, I conducted a written survey using an online questionnaire. The survey focused on the importance of reading German academic texts in the humanities and social sciences as well as the difficulties and needs of students with regard to reading academic texts in German (see Introna, 2021, pp. 120-159).

Based on the theoretical foundation laid in the first research phase, an intervention concept was developed and implemented. The concept mainly emphasized the procedural and metacognitive components of foreign language academic reading competence as these reading practices and features characterize the university context the most. The specific characteristics of these practices when carried on in a foreign language were obviously covered as well. Unfortunately, the findings which emerged from the survey could not be used to narrow down the content of the intervention due to the small number of international

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[1] In this context, reading was examined from the perspective of cognitive psychology (see Chen et al., 2016, among others), educational (see Hurrelmann, 2009, among others) and literacy research (see Street & Lefstein, 2007, among others).

[2] According to the *ideological model of literacy* (Street, 1984), literacy can be seen as a context-specific social practice. In order to define literacy in a specific context, like for instance universities, one needs to analyze that particular setting (see Street & Lefstein 2007, pp. 193-200).

students taking part in the survey[3]. In order to design the intervention concept, a literature review on (L2) reading promotion in the university context was needed. From this review core elements of reading promotion emerged which were acknowledged as elements of the intervention to be developed, such as, for example, different phases of strategy teaching and cooperative practice.

The first intervention draft was a strategy-oriented reading program in form of a block seminar consisting of four six-hour sessions. The different components of academic reading competence to be trained were presented from the beginning as interrelated practices and therefore were promoted in parallel over several sessions. For this purpose, the training of each reading practice was broken down into several steps. For example, deep text comprehension as part of critical reading consisted of analyzing text structure, comprehending content and argumentative structure of texts, recognizing the textual frame of reference, and interpreting the text on the basis of one's own prior knowledge. In order to give a more detailed idea of the individual sessions of the reading program, I will show some sections of lesson plans in chapter 3.1.

The intervention was held for the first time in the summer semester of 2018 as part of PunktUm´s[4] support program for international students at Bielefeld University[5]. Seven students attended the block seminar on a regular basis. Subsequently, a qualitative evaluation of the intervention took place. At this point, the opinions of the participants were collected with the help of two different evaluation questionnaires and a final group discussion. At the end of each session, seminar participants were given a session evaluation questionnaire (see Introna, 2021, Annex C), in which they were asked open-ended questions about what they liked and disliked about the session, to what extent the session had helped them with the reading of German academic texts and what had been less helpful. At the end of the entire block seminar, the participants were given another evaluation form in which certain aspects of the intervention were to be evaluated, such as the seminar content and materials and the phases of strategy teaching (see Introna, 2021, Annex E). The questionnaire also included open-ended questions in order to make the evaluation as communicative as possible in accordance with the principle of communicative interaction within qualitative evaluation (see von Kardorff & Schönberger, 2020, pp. 142-145). The group discussion took place two weeks after the end of the block seminar and was attended by six of the seven

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[3] In order to provide a complete picture of the local context of the study, not only international students participated in the survey. The sample consisted of 21 international students (*Bildungsausländer*innen*) and 220 non-international students.

[4] PunktUm is the German Learning Center at Bielefeld University supporting international students by means of individual writing consultations as well as courses and workshops on academic literacy practices in German as a foreign language.

[5] Contrary to the DBR principle of cooperation between researchers and practitioners I decided to fulfil both roles. This decision was supported by the special situation of the university context described by Reinmann (2016, p. 2), in which researchers are at the same time usually practitioners, namely teachers. With my study I wanted to test the feasibility of DBR within a small research framework like a PhD project conducted by a single person, as usual in the field of German as a foreign language.

seminar participants. While the evaluation questionnaires were mainly used to evaluate the intervention, the group discussion also aimed at collecting data which could answer the main research question of the study. The group discussion allowed in fact the collection of data, which played a central role in generating knowledge about the acquisition of academic reading competence in L2 German. All data obtained was analyzed using constructivist grounded theory (see Charmaz, 2014) and with the help of the ATLAS.ti software. In this initial evaluation, the intervention's suitability and feasibility were the primary areas of examination. Thus, the evaluation focused on successful aspects of the intervention as well as on elements worthy of improvement. The data analysis was completed when several categories had been identified in the data that could be used as an empirically sound basis for revising the block seminar.

A main change in the revision of the intervention was reducing the content of the block seminar. Because of the participants´ critical opinions about the speed-reading exercises as well as the strategies to deal with language difficulties while reading in a L2, these activities were deleted from the seminar concept. However, considering the fact that the intervention deals with academic reading in L2 German, language as a topic of the block seminar could not be omitted. For this reason, the L2 reference in the block seminar had to be rethought. Because no L2-specific reading promotion concepts can yet be found for the university context, I did not have the possibility of drawing on existing ideas or concepts for the specific promotion of foreign language advanced reading skills. Instead of teaching strategies for coping with linguistic difficulties in academic reading, which had apparently not been of much use in the first implementation, coping strategies were to be worked out in exchange with the seminar participants and then practiced and reflected upon. Another change in the revision worthy of being mentioned concerned the time frame of the block seminar: Instead of four six-hour sessions, six four-hour sessions were scheduled for the second implementation.

The revised intervention was subsequently implemented in the winter semester of 2018/19. Only four students attended the block seminar on a regular basis. The second evaluation was also designed qualitatively; in addition to the evaluation forms, interviews were used due to the low number and heterogeneity of the participants. However, the interview guide was developed on the basis of the group discussion guide. The four interviews took place one to two weeks after the end of the block seminar. The data analysis was followed by a further revision of the intervention. In section 3.1 I will discuss in detail how I implemented the reading program.

The third research phase of the study included a final summative evaluation of the block seminar as well as a retrospective data analysis aiming at answering the main research question. The purpose of the final evaluation was to investigate the extent to which the academic reading competence in the L2 German of the participant students had actually been promoted within the framework of the developed strategy-oriented reading program. With this purpose, the data from the

two formative evaluations were again analyzed qualitatively using constructivist grounded theory (see Charmaz, 2014). The data set for answering the main research question of the study included four interviews, the group discussion and the answers in the evaluation forms. Also at this point, constructivist grounded theory (see Charmaz, 2014) was used for the data analysis. This was completed when the main factors of the acquisition of foreign language academic reading competence within the developed strategy-oriented reading program were identified.

3.0   Implementation between systematicity and openness

In the following pages I will show how the tension between openness and systematicity became evident in the implementation phase of my study and will discuss the issue on the basis of DBR literature. After that, implementation will be considered beyond DBR focusing the perspective of implementation research. Finally, suggestions will be given on how systematicity can be enhanced within DBR making use of ideas conceived in the context of implementation research.

3.1   Implementing the L2-reading intervention of the study

As already explained in chapter 2, the developed intervention was a strategy-oriented reading program aimed at promoting the procedural and metacognitive components of the foreign language academic reading competence construct. In order to systematically document the intervention concept and make it accessible to the scientific community, I drafted a lesson plan for every session. Here, I gave information about the duration of the different lesson phases, their focus, the chosen social forms, the used media or materials as well as a brief description of what teacher and students were supposed to do in each phase. A segment of the lesson plan of the first session in the summer semester of 2018 is shown in Table 1.

Time	Phase	Teacher-students interaction	Social form	Media/Materials
10:50-11:30	First topic: becoming aware	Participants are given a short German scientific text and are asked to read it as they usually read texts in their studies (±25 min.)	individual work	scientific text 1
		Participants are asked to discuss their reading habits in pairs. In case of reading difficulties participants can also discuss what they do to overcome them (±10 min.)	partner work	

Time	Phase	Teacher-students interaction	Social form	Media/Materials
		Participants are asked to discuss their reading habits in plenary (±5 min.)	plenary	

Table 1: Segment of the lesson plan of the first intervention session in SS 2018 (Introna, 2021, Annex L_SS)

In agreement with my supervisor, I decided to attach the lesson plans as annexes to the PhD thesis (see Introna, 2021, Annex L_SS and L_WS) and publish them together with the dissertation because an extensive description of every single intervention session within the dissertation text would have represented a long digression. McKenney and Reeves (2019, p. 256) also recognize this as a problematic issue: "For example, it can be difficult to figure out how and where to describe the intervention, and very few formats allow for detailed description of how interventions are designed".

However, the issue at the heart of the present paper does not concern the documentation of the intervention designing process but of the intervention implementation. While implementing the intervention concept, the arisen authentic teaching-learning situations directly impacted on how the seminar concept was put into practice. I will explain this using authentic examples. While leading the reading program, I used the lesson plans to guide myself through the sessions. There, I took notes about some aspects of each session, for instance, how the students reacted to the planned activities and materials, which phase of each session was more or less successful – from my perspective – or which problems emerged. Some of these notes concern divergences from the intended implementation of the intervention concept. In the first session of the summer semester 2018 I wrote about the phase *First topic: becoming aware* – showed in Table 1 – the following comment: "Students read diligently but 25 minutes are not enough ([Student] read only two pages in 20 minutes). I have to shorten the text! or let the students read only the first pages" as well as: "11:18 am → The partner work does not make any sense, I can move on with the joint discussion". These notes show that the time planned for this phase was wrong because the students needed more time to read the text. Therefore, the decision was made to skip the partner interaction in order to have time for a joint discussion.

In the second session I realized that the students were a little confused during the phase shown in Table 2.

Time	Phase	Teacher-students interaction	Social form	Media/Materials
14:20-14:55	Third topic: in-depth comprehension	I give an overview of the levels of text comprehension that we already addressed (text structure, content and argumentative structure)	plenary	scientific text 2 + worksheet 5

	of aca-demic texts: textual reference frame	and introduce the new level: the frame of refer-ence and problematize it (only partially and im-plicitly visible, infer-ences are needed). Us-ing the example of the scientific text 2 I show how to identify the frame of reference on the basis of worksheet 5 (10 min.)		
		Participants are asked to identify the frame of reference of the text they have brought with them, using worksheet 5. (If the questions can-not be answered or the frame of reference of the text is difficult to grasp, participants are asked to think of possi-ble solutions and maybe to use them, such as ex-panding their knowledge through re-search) (25 min.)	individ-ual work	stu-dents´ own dis-cipline-specific text + work-sheet 5

Table 2: Segment of the lesson plan of the second intervention session in SS 2018 (Introna, 2021, Annex L_SS)

About this phase I annotated: "Difficult → they are confused! The ex-amples are ok but not clear enough! Topic should be deepened. Next session! Maybe it´s better to work all together with only one text". The fact that the students did not fully grasp what the textual frame of ref-erence is, brought me to change my plans for the following session by adding an initial phase about this topic. There, I gave better examples of the frame of reference of academic texts and how one can identify them using the questions on the worksheet used.

Another divergence from the planned implementation of the interven-tion concept can be found in the fourth session in relation to the lesson phase shown in Table 3.

Time	Phase	Teacher-students in-teraction	Social form	Media/ Materi-als
14:15-14:55	Second topic: reading multiple texts	I give a brief input about reading multiple texts and show the grid on worksheet 4 as a ba-sis for text analysis and comparison (10 min.)	plenary	work-sheet 4

Time	Phase	Teacher-students interaction	Social form	Media/Materials
		Participants analyze their own text on the basis of the grid (20 min.)	individual work	students´ own discipline-specific text + worksheet 4
		The experience is discussed in plenary (10 min.)	plenary	

Table 3: Segment of the lesson plan of the fourth intervention session in SS 2018 (Introna, 2021, Annex L_SS)

About this phase I wrote: "Better with a text in common and in pairs. Very good idea, they are working together! + motivation + easy" meaning that I decided spontaneously to let the students work together with the grid on one text and that this decision turned out to be good. Even during the implementation of the revised intervention in winter semester 2018/19, some notes show that I made changes while implementing the lesson plans. For instance, in the fifth intervention session the last phase – shown in Table 4 – could not take place because of lack of time, which mainly depended on the prolonged interaction among students.

Time	Phase	Teacher-students interaction	Social form	Media/Materials
12:10-13:35	Third topic: learning from texts	I present a strategy for selecting the core information in a text and show the procedure: Converting headings into questions, finding answers in the text and writing them down (5 min.)	plenary	scientific text 6 + worksheet 3
		Participants are asked to try out the strategy using scientific text 6 (20 min.)	partner work	scientific text 6
		Results as well as the strategy are discussed in plenary (5-10 min.)	plenary	
		Participants are asked to practice the strategy using their own text (alternative: ask questions to text, look for answers) (30 min.)	individual work	students´ own discipline-specific text
		Joint reflection (15 min.)	plenary	

Table 4: Segment of the lesson plan of the fifth intervention session in WS 2018/19 (Introna, 2021, Annex L_WS)

The comment "Next time?" shows that this phase was added at the beginning of the following session. This, however, led to the fact that there was too little time available for another phase, about reading multiple texts, which could not be satisfactorily implemented, as some negative notes confirm.

While the ability to adapt lesson plans flexibly to the teaching-learning situation is itself an essential component of teaching, the question about how to deal with this flexibility in the context of DBR challenged me during the implementation phase of the study. Given the fact that it was impossible to fully describe the teaching practice and how this impacted the implementation of the seminar concept within the dissertation, I decided to address this issue as a problematic aspect of DBR in the section of the PhD thesis in which I critically evaluated the study. There, I only referred to the need of adapting the lesson plan to the authentic teaching-learning situation with regard to the prolonged interaction among participant students which had led to problems with the time plan of the last two sessions in the winter semester. I wrote:

> Likewise, the interaction between the students could not be controlled within the block seminar. In order to ensure a relaxed and collegial atmosphere, the interaction among seminar participants was never interrupted or severely restricted. In retrospect, this decision turned out to be good because of the supportive function of peer-interaction for the acquisition of foreign language academic reading competence that emerged from the retrospective data analysis. Nevertheless, the prolonged interaction between students had consequences on the time plan of the sessions. Thus, the flexible adaptation of the lesson plans to the teaching situation, which itself is a component of teaching, is problematic because a systematic description of the implementation is only roughly possible. (Introna, 2021, p. 327)[6]

Thus, the question arises of the extent to which my way of dealing with this issue fulfills the systematicity principle of scientific research. Considering the fact that scientific research is expected not to act "randomly, without a plan, or in a disorganized manner", interventions developed within DBR should be more systematic than educational practices which are not research-based (Reinmann, 2022a, p. 8). On the other hand, adapting the intervention to the authentic classroom situation requires a certain degree of openness. According to Reinmann (2022a, p. 12), openness should therefore be considered a "quality feature" of DBR studies: "One makes decisions about the intervention with reasoned assumptions in order to explore what is possible. This can lead away from original observations, goals, or questions; one drifts, so to speak – with full intent (Krogh & Koskinen, 2020, p. 5). Such

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[6] The excerpt from the dissertation presented here was translated in English by the author.

drifting is not a mistake while designing and implementing the intervention, but a quality feature"[7]. Against this background, Reinmann (2022a, pp. 17-18) argues for recognizing the tension between systematicity and openness as a constituting aspect of DBR, since both research and practice are at the core of this approach. In similar ways, van den Akker (2005, in McKenney et al., 2006, p. 84) talks about the need for adaptability within DBR which he recognizes as a key to achieve synergy between research and practice. According to van den Akker (2005, in McKenney et al., 2006, p. 84), researchers should demonstrate adaptability among other things "allowing the study to be influenced, in part, by the needs and wishes of the partners". Even if in this statement the term *partners* most likely refers to practitioners and stakeholders, it is reasonable to suggest that the needs and wishes of the intervention target group also require adaptability during the design implementation, as my study showed. According to McKenney et al. (2006, p. 85), adaptability within scientific research "requires sound understanding of research rigor so that prudent changes and choices […] are made". Even if not fully explicit, the tension between systematicity and openness can be clearly seen here. In DBR publications, however, the assumption that in a real-world research context "no two situations will be identical and that adaptation to local circumstances is always necessary" (Bakker 2019, p.52) appears to be a prerequisite for DBR. While accepting the "(potential) cost of losing control over data collection rigor" (McKenney et al., 2006, p. 84) linked to the real-world research setting, the adaptation of the developed design or in other words modifications made during the implementation should remain consistent with goals and principles of the intervention (McKenney & Reeves, 2019, p. 201). Only then the design can become "tolerant to variation", with tolerance referring to "how precisely core components must be enacted for the intervention to be true to its goals" (McKenney & Reeves, 2019, p. 207). In this regard Bakker (2019, pp. 82-83) uses the term implementation fidelity to describe the extend to which "the design was implemented as intended"[8]. When it comes to how to measure implementation tolerance or how to allow prudent changes or to enable drifting during the implementation phase the DBR literature still lacks answers. In this respect, the need of further developments emerges in current publications. Reinmann (2022a, p. 16) talks about the need of developing "meta-standards" aiming at ensuring the coherence of DBR projects. For Herzberg (2022, p. 3) these "meta-standards" should be linked to practical instruments which can enable and support a reflection about how the standards can be put into practice while using DBR. In a similar way Euler (2022, p. 7) believes that guidelines or directives are needed in order to help researchers using DBR properly.

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[7] This quote was translated in English by the author.

[8] Bakker (2019, p. 83) writes about different approaches to implementation. Implementation fidelity plays a role only in one of them, which considers the design implementation as an independent variable.

Considering my PhD project, DBR guidelines addressing the following questions would have been of great use: How should the implementation process be documented? Are there key elements or components of the implementation that need to be imperatively made accessible to the scientific community? Which possibilities exist for the documentation of the implementation phase of DBR studies either within or outside the final publication? Answers to these questions would prevent not only that researchers are left alone to decide which information are to include and how in scientific publications about DBR studies. Knowing more about documentation while implementing the design would also insure that important data will not get lost. As Euler (2014, p. 18) as well as Gravemeijer and Cobb (2013, p. 103) point out, DBR pursues a particular kind of outcome generalization, which, in terms of ecological validity, consists in the possibility of transferring theoretical findings and practical design principles from one study to another context. In this respect, Gravemeijer and Cobb (2013, p. 102) speak of virtual replicability as a quality criterion of DBR. While pure replicability in the sense of reliability cannot be guaranteed, the criterion of virtual replicability can be met if the research process is reported systematically and in detail, also disclosing the contextual factors of the study or the local conditions under which the theoretical findings were obtained (McKenney & Reeves, 2019, p. 20). At the same time, however, McKenney and Reeves (2019, p. 256) recognize that educational design researchers struggle with the "level of detail with which the context should be described" and warn that they cannot "tell the whole story all at once" (McKenney & Reeves, 2019, p. 262). Though, without knowing the details of the implementation process of a developed instruction, the very transfer of theoretical and practical findings to other contexts can become difficult. That is why an answer to the question about how systematic the documentation should be during the implementation phase of DBR studies can contribute to its further development. Even though I attached all lesson plans, worksheets and power point slides used in the summer and winter semester as annexes to the PhD thesis and I published them together with the dissertation making them available to the scientific community, I did not describe the implementation process of the reading program in detail. Therefore, readers are left alone in the examination of the intervention implementation without the possibility to clearly understand how the reading program was put into practice. All these considerations are what prompted the question in the title of this paper: Is my way of dealing with the documentation of the implementation phase systematic enough? In order to answer this question, the next section explores implementation beyond DBR aiming at finding a way to both fulfil openness and systematicity while implementing the developed design within DBR.

3.2 Implementation beyond DBR

According to Henriksen and Ejsing-Duun (2022, p. 235), implementation in DBR is vaguely defined which can be attributed to the lack of scientific maturity of DBR. Thus, they analyze implementation strategies in current DBR studies and identify different implementation typologies, all with the aim of ensuring an impact of the developed design even after the project has been concluded. *Sustained implementation* involves for instance maintaining the project´s benefits through the institutionalization of the design practices or "through ambassadors or passionate participants" (Henriksen & Ejsing-Duun, 2022, p. 238), who continue to implement the design methods and ideas in their own work. *Design diffusion* refers instead to a more passive implementation strategy which consists in making developed materials, like templates or guidelines, available for future use, like I did in my study. In this regard, however, Henriksen and Ejsing-Duun (2022, p. 239) note that the optimistic belief that interventions will seamlessly transfer from one setting to another represents a constraint within DBR. Long-lasting changes in education can also be realized promoting the *professional development* of stakeholders or involved practitioners (2022, p. 240). In their concluding remark about how little is known on how to expand DBR outcomes to new contexts Henriksen and Ejsing-Duun (2022, p. 243) acknowledge the gap at the heart of this essay. Regarding this matter, it is worth to look at implementation from other perspectives.

The implementation of instructional practices obviously occurs not exclusively within the context of DBR investigations. Implementation research focuses on the process of implementing an intervention in a specific setting to identify the conditions at institutional, organizational, and personal level that enable a successful implementation (Schrader et al., 2020, p. 15). Even within efficacy and effectiveness studies, which are concerned with the investigation of intervention outcomes respectively in experimental conditions and real-world settings, the question of how the intervention is enacted plays an important role (Schrader et al., 2020, p. 17). Questions like "what does program implementation look like?" and "has the program changed from the original intent? […] move us from merely knowing *if* a program works toward understanding *why*, *how*, and *under what conditions*?" (Century et al., 2010, 199). These same questions, why, how, and under which conditions a developed design works, lie at the heart of DBR. Stains and Vickrey (2017, p. 2) who stress the importance of a deep understanding of how an intervention is implemented in order to evaluate its outcome, discuss the measurement of fidelity of implementation (FOI) as a framework to explain the impact of interventions. As already mentioned in section 3.1 FOI indicates "the extent to which the critical components of an intended educational program, curriculum, or instructional practice are present when that program, curriculum, or practice is enacted" (Stains & Vickrey, 2017, pp. 2-3). Within implementation research FOI is considered to be a quality criterion for interventions (Schrader et al., 2020, p. 18). Moreover, measuring FOI

can "promote the successful propagation of an EBIP [evidence-based instructional practice]" (Stains & Vickrey, 2017, p. 3), i.e. it can contribute to the successful future program implementation. I suggest here that the concept of FOI is also worth to be considered in regard to the question on how the implementation phase within DBR can be made more systematic.

In the FOI literature the critical components of interventions are divided in structural and process components, which refer respectively to the organizational features of the intervention, like for instance the planned activities, and to how the implementation should occur, for example in regard to the instructor´s behavior (Stains & Vickrey, 2017, p. 3). Century et al. (2010, pp. 205-206) propose a further differentiation in which structural and instructional critical components are divided into two subcategories each. The structural-procedural critical components refer to the organizing elements of an intervention, for instance the duration and content of teaching units, the order of the activities as well as the materials needed. The structural-educative critical components, instead, concern the instructor´s knowledge, like content and pedagogical knowledge, which is needed in order to be able to put the intervention in action. Instructional critical components, which are divided into pedagogical and student engagement critical components, focus on the actions and behaviors needed when enacting the intervention. The first subcategory concentrates on the instructor and includes among other things his or her pedagogical strategies. The second subcategory targets the program recipients and comprises inter alia peer interaction.

In order to identify the critical components of an intervention, Stains and Vickrey (2017, p. 4) suggest three approaches based on a review of Mowbray et al. (2003): analyzing existing empirical studies about the intervention effectiveness; consulting experts, i.e. undertaking a literature review or asking the opinion of the intervention´s designers through interviews or surveys; and finally engaging in qualitative research, for instance interviewing program participants about the advantages and drawbacks of the intervention. On this point, it is easy to draw a parallel between these three approaches for the identification of the critical components of an intervention and the steps for design development and implementation within DBR. After the critical components have been identified, measuring FOI means to investigate whether the critical components are available during the intervention implementation. In order to do so, Century et al. (2010, p. 209) use various instruments, like teacher questionnaires and classroom observation protocols. As a result, they can determine which critical components of the intervention are enacted and calculate a composite score for each critical component category. Together, the four composite scores provide information about which implementation type took place in the study. Obviously, many other ways for the measurement

of FOI exist[9]. In any case measuring FOI assumes scores assigned to the implementation and analyzed statically.

Without further elaboration, the question to be discussed is to what extent high FOI ensures a successful implementation. Based on a review of implementation studies in educational context Schrader et al. (2020, pp. 27-29) found that high FOI is mostly favorable for the implementation, but can also have a negative impact on it. Hetfleisch et al. (2014) for instance determined in their study that only when the implementation was undertaken close to the original concept, the participants´ competencies seemed to be significantly promoted (Hetfleisch et al., 2014, p. 313). On the other hand, Humphrey et al. (2017, p. 203) observed that levels of fidelity were not significantly associated with any intervention outcome in their study.

Even if FOI represents an independent research focus within implementation research it is only one of many factors that can have an impact on the enactment of instructional practices (Schrader et al., 2020, pp. 18, 27-28). "Implementation of an educational program, curriculum, or instructional strategy also depends on components outside the intervention" (Stains & Vickrey, 2017, p. 4). Participants´ features, like students´ enthusiasm or resistance, instructor´s conception of teaching as well as the teaching context can all influence the implementation and consequently the outcome of a developed program. Therefore, Stains and Vickrey (2017, p. 4) underline the need to identify and measure these "moderating variables" and to take them into account when analyzing the intervention effects. However, finding appropriate measurement tools or creating new ones represents a big challenge which makes clear the need of further development. The discussion about FOI and moderating variables within the implementation of instructional practices can disclose valuable considerations in regard to the question of how the implementation phase of DBR studies can both fulfill openness and systematicity.

3.3 Enhancing systematicity in the implementation phase of DBR
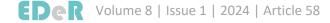
In my opinion, two main points argue against the integration of the measurement of FOI and moderating variables within DBR. Measuring FOI as well as other influencing factors of implementation imply further data collection and statistical data analysis that would make DBR even more complex than it already is. DBR investigations can be seen as "collection of sub-studies" (McKenney & Reeves 2020, p. 89) in which every research phase focuses on different questions. These, however, build on each other and serve to answer a main research question. While McKenney and Reeves (2020, p. 89) talk about conceptual challenges in building up the complex study structure, I found the design and implementation phase especially difficult, mainly because of the time consumption and high effort needed on my part. The

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[9] Century et al. (2010, p. 212) mention among others the possibility to calculate a single FOI value, like in Balfanz et al. (2006) or, to distinguish among gradations of fidelity, like in Rezmovic (1982).

second point against the measurement of FOI and moderating variables refers to the exploratory nature of DBR within education. Even if DBR has its roots in the *design experiments* of Brown (1992) and Collins (1992) it cannot be considered an experimental research approach within the educational context. As already mentioned, DBR in education presumes "the common sense understanding that no two situations will be identical" (Bakker 2019, p. 52). Consequently, the assumption that the influencing variables of an authentic teaching and learning context should be controlled can no longer be supported. That is why McKenney et al. (2006, p. 84) write about "the (potential) cost of losing control over data collection rigor". With this in mind, measuring FOI and moderating variables does not seem to be reasonable within the real-world research context characterizing DBR.

Rather than the question of whether measuring FOI as well as other influencing factors of implementation is viable within DBR, it is worth to discuss how these considerations can inspire the formulation of guidelines for a systematic documentation of the design implementation. As already mentioned in section 3.1, concrete documentation guidelines regarding the implementation process within DBR would have been of great use in the context of my study. One of the questions I asked myself was: "Are there key elements or components of the implementation that need to be imperatively made accessible to the scientific community?". In this regard, the discussion about the critical components of interventions within the FOI research can help to answer this question. If one considers the categorization proposed by Century et al. (2010, pp. 205-206) and analyzes how I documented the implementation within my study it is evident that the structural-procedural critical components of the developed reading program are documented in the lesson plans I drafted. There, I provided information regarding the duration of the different lesson phases, their focus, the planned social forms and the needed media or materials. Besides, the lesson plans also included brief descriptions of what teacher and students were supposed to do in each lesson phase, which partially fulfil the function of instructional critical components being these about the instructor´s and student´s actions and behaviors within the intervention. Moreover, the core elements of reading promotion emerged from the literature review aimed at designing the reading program, like for example the different phases of strategy teaching and cooperative practice, can be seen as key information within the instructional critical components. The structural-educative critical components, which instead concern the instructor´s prerequisite knowledge, were not documented in my study. During the course of the block seminar I took notes about some aspects of each session, for instance, about divergences from the intended implementation of the intervention concept. These notes can be seen as an attempt to record – but not to measure – the FOI, that is to which extent the planned design took place as intended. In this regard the documentation of the implementation clearly lacked systematicity. In retrospect, I think that taking field notes right after every session would be a viable way to document the implementation phase more systematically. In this re-

gard, a reflection report stating the critical components of the intervention as well as possible moderating variables could have helped to organize the notes.

Coming back to the question of whether my way of dealing with the documentation of the implementation phase is systematic enough it can be noted that what I intuitively[10] did made key information about the developed reading program available for the scientific community. With little advice on what to take in consideration while taking notes about differences between intended and enacted implementation I could have gathered more useful information for the further implementation of the block seminar in new contexts.

4.0   Conclusion

DBR is an innovative research approach that can enhance theoretical knowledge and improve educational practice at the same time. On one hand, my PhD project contributed to the improvement of educational practice though the development and implementation of a strategy-oriented reading program for international students at Bielefeld University. On the other hand, the present study made it possible to gain insights into various aspects of foreign language academic reading in the context of German higher education. Still, further discussion among the DBR community is needed in order to address controversial aspects of the approach. One of these issues concerns the need of both systematicity and openness while implementing the developed intervention. The aim of the present paper was to give an example of the tension between systematicity and openness in a DBR study and to open up a discussion about the question of how the intervention implementation should be documented in order to fulfil the systematicity principle of scientific research. As advocated by Euler (2022, p. 7), guidelines helping researchers using DBR appropriately could be of great use in this respect. Here, I suggest that existing considerations about implementation processes, like for instance those within implementation research, can help to develop such guidelines. Knowledge concerning FOI or, to be more specific, knowledge about the critical components of an intervention as well as of moderating variables while implementing could contribute to enhance systematicity within the implementation phases of DBR projects.

The fact that designing and implementing an intervention in order to improve an educational practice become part of the research process is a unique feature of DBR. In order to enable researchers to make the best use of it, these aspects need to be fully explained by the scientific community. In particular, the question of how to document the imple-

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[10] The term "intuitively" used here has less to do with intuition than with my experience in the educational context. The decision about how to document the reading program can be explained through my expertise with the development of seminars as well as other interventions for the university context.

mentation phase of a DBR study is paramount for the transfer of theoretical and practical findings from one educational context to another.

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Author Profile

Silvia Introna is a lecturer in the Department of German as a Foreign and Second Language at Bielefeld University. She is also a coordinator of a programme promoting students' literacy skills. Her research interests include advanced literacy skills acquisition, academic reading in German as a foreign language, qualitative research methodology and Design Based Research.

Author Details

Dr. Silvia Introna
University of Bielefeld
Universitätsstraße 25
33615 Bielefeld
Germany
+49 521 106-5313
silvia.introna@uni-bielefeld.de

Editor Details

Prof. Dr. Tobias Jenert
Chair of Higher education and Educational Development
University of Paderborn
Warburger Straße 100
Germany
+49 5251 60-2372
Tobias.Jenert@upb.de