Design-based research as a "smart" methodology for studying learning in the context of work

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Abstract. Although Design-based Research (DBR) was developed for investigating class-room training this paper discusses methodological issues when DBR is employed for investigating learning in the context of work, as it is an authentic learning environment, a real-world setting for fostering learning and creating usable knowledge and knowing. The purpose of this paper is to provide new perspectives on DBR regarding how to conduct DBR for studying learning from experience in the context of work. The research question is: What to consider to make DBR a smart methodology for exploring learning from experience in the context of work? The exploration of DBR is based on a literature review and experience with DBR in the context of work.

Keywords: Design-based research, Organisational learning, Team Learning, Individual learning, Learning in the work place, Qualitative methods, Proactive Review

1 Introduction

The move from an industrial-based economy to an information-based economy demands new organisational capabilities and human skills [1], which in turn depend on a systematic capacity to learn continuously [2]. At the macro level, there is growing evidence that organisations produce superior results when they have the capability to facilitate the necessary interactions to support and advance learning in the organisation [3] [4]. Enabling employees to learn in the context of work helps to improve business results, competitive advantages and revenue [5]by improving products, services and work practices rather than learning to improve competences [6]. It is thus important to find methodologies that focus on learning in the context of work, which is precisely what this paper attempts to accomplish.

The paper explores design-based research (DBR) as a methodology for studying learning from experience in the context of work, which is a new setting as DBR was developed to study learning in educational settings [7], [8], [9], [10], [11]; [12]. Most

DBR is conducted in classroom settings in high schools in the domain of the natural sciences [13].

The research question is: What to consider to make DBR a smart methodology for exploring learning from experience in the context of work?

'Learning from experience in the context of work' refers to situations where employees learn from their practices as opposed to learning in courses or from work-related texts. DBR is strongly related to the context in which it takes place [8],[13], and thus the term 'context' needs to be described.

The paper is structured as follows: First Design-Based research is presented as the conceptual foundation for the paper, followed up by a brief introduction to theories of learning from experience in the context of work. Then the paper presents the empirical setting and an example of DBR in the context of work being a global IT company and a seven year development of an educational design for learning from experience in the context of work. Based on the conceptual foundation and the empirical data DBR in the context of work is discussed. Finally the conclusions are presented.

2 Conceptual Foundation

Authors use different terms to describe DBR, including 'design research', 'development research', 'design experiments' and 'design studies'[7, 8]. However, I will only use the term 'design-based research' (DBR) as described by the Design-Based Research Collective [10], Dede[11] and Wang and Hannafin [12].

DBR is not a well-defined methodology; rather, it is a combination of processes leading to knowing about learning that include qualitative and quantitative data [14]. *Wang and Hannafin* [12]. *define DBR as follows: 'DBR is a systematic but flexible methodology aimed to improve educational practices through iterative analysis, design, development and implementation, based on collaboration among researchers and practitioners in real-world settings, and leading to contextually sensitive design principles and theories'*[12].

DBR includes the following roles[12]: first, the researcher; second, the practitioners, i.e. those who are active in the training session, namely the teacher and the learners; and third, other stakeholders, including administrators or managers in the organisation[15].

The starting point of DBR is the identification of critical elements, such as failures and problems, in order to improve learning. DBR thus allows an intervention to be tried out and refined several times. A new iteration of the intervention requires a description of the disturbances that would lead to changes in the intervention. According to[14] the researcher or teacher should be aware of obstacles within the teaching situation and gather information about those obstacles in order *to 'fix whatever problems appear to be the reasons for failure'* (Ibid., 34).

According to [14, the analysis of the intervention may include three ontological dimensions of learning: the personal, the group and the organisation. Collins has set up a number of variables for researching the complexity in learning situations in real

life, and he categorises them as dependent variables and independent variables [15]. Dependent variables are those that the teacher may influence directly, whereas independent variables are contextual [14]. Collins (2010) points out that the variables are not to be held constant; quite the contrary, the variables are to enable the researcher to characterise the situation [15], and argues that it is important to report the process and the results of DBR.

2.1 Guidelines for DBR

According to Collins [14], [15], DBR may follow a process where the practitioners may be involved more or less intensively, as outlined below:

1. Implementing an intervention, including critical elements and how these elements interact.
2. Modifying the intervention; each modification starts a new iteration of the intervention.
3. Analysing the intervention, including the perspectives of the cognitive development of the individual learner; the resources available for the learning processes; the interpersonal relationships between the learners and the teacher as well as between the learners; the social aspects of the group involved and the institutional aspects, such as stakeholders' engagement and support.
4. Measuring the dependent variables called 'climate variables', 'outcome variables' or 'systemic variables' which look into issues like engagement, cooperation and risk taking. The teacher influences the dependent variables.
   Measuring the independent variables called 'setting', 'nature of the learner', 'required resources and support', 'professional development', 'financial requirements' and 'implementation path'. The teacher cannot influence or decide the independent variables.
5. Reporting on the DBR should include the goals and elements of the intervention, the research setting, a description of the iterations and the findings/outcomes and lessons learned [14], [15].

2.2 Learning from experience in the context of work

According to Dewey, 'Learning is coming to know' [16]. Learning in the context of work is different from learning in the classroom, most visibly because the lack of a teacher, but also because the employees are often not conscious of participating in a learning process. Furthermore, neither the employees nor their managers know what is to be learned [17]. The employee is simultaneously an individual, a participant in a team and a member of the organisation. In other words, there are three ontological dimensions that are not strictly divided; rather, the ontological dimensions are a way to describe different approaches to learning in an organisation (Nonaka and Takeuchi 1995). The starting points for learning are perplexity, confusion, doubt [16], disturbance, contradictions or conflicts [17], and hence reflecting, questioning and

analysing are important activities for learning in the context of work. This is not a straightforward process, and it is based on conversation between those who learn [17]; [18]. Those who are subjects to learning in the context of work are all employees [17], [19], [18] and they may contribute to the design of learning situations, give feedback to the researcher and perhaps even take part in the analysis in order for the researcher to take advantage of their expertise. Consequently, a methodology for studying learning from experience in the context of work should allow interaction between the researcher and the people under study. It should also include analysis of conversation as a means of learning as well as ways of identifying collaborative practices and group interactions.

According to Engeström [17], employees make the effort to learn in order to participate in 'culturally valued collaborative practices in which something useful is produced' [17, p141]. When learning from experience takes place in a specific organisation, the organisation defines the framework for learning. This framework is the context of learning. The context may be defined by factors such as the physical surroundings, the historical background, sociological aspects and *Ba* (means 'place' in Japanese). I explain these factors in greater detail below.

The *physical surroundings* include the geography, the building and the tools. The physical surroundings are parts of the resources available for learning processes [19], [20], [21], [22]). As the context develops over time, the *history* of the context is necessary for understanding the context itself. The history provides insights about what has happened, which may lead to an understanding of the present situation [19]; [21], [22]. *Social aspects* of the context may include organisational structure and power, division of labour, critical organisational competences, rules, channels of communication, language and time for learning purposes ([19], [20], [21], [22]. *Ba* is a Japanese word that roughly means 'place'. According to von Krogh et al. [23, p 178] 'Ba unifies the physical spaces, virtual spaces and mental spaces' and is based in the specific time of here and now. Ba changes constantly as the individual changes and as virtual and physical spaces change. Ba may be connected to the perception of a caring atmosphere.

Learning from experience raises the following question: how do we obtain experience? Our actions and interactions with the world may lead to experience, provided that we reflect upon what we try to do and what happens as a consequence. Experience stems from experimenting with things and feeling what we enjoy and what we suffer from, and thus experience is based on activities and involves emotions [16]. Experience may be achieved by trying and trying again. Oftentimes experience is not achieved in one go, and therefore experience is constantly under construction as the context changes over time and individuals adapt accordingly while integrating previous experience into new ones [24]. Experience is based in the past, utilised in the present and kept for the future [16]. Experience from work is personal and political and sometimes dangerous to speak out loud. Therefore, the researcher must think carefully about how to enable employees to share their experiences while bearing in mind the difficulties associated with sharing doubts or 'not knowing' [23].

It seems that a methodology for studying learning from experience should be based in a real-world setting and should include iterations for following experimentation and reflection on the educational design. Furthermore, a methodology for studying learning in the context of work must include the context

which may be defined by the physical surroundings, the historical background, sociological aspects and Ba. The methodology should also have indicators for resources and development in skills, competences or dispositions for the future.

3 Empirical setting

A global IT company changed its strategy from organic growth to growth from merges and acquisitions. Over five years more than 60 companies were merged into the global IT company, and the need for learning from experience was immense. Consequently an educational design for learning from experience was developed, and this educational design was called Proactive Review. This paper will not dwell on Proactive Review in itself, but look into the development that lasted for seven years and included thirteen iterations as table 1 shows. The development of Proactive Review was not a research project, but a business need maintained by the managers of organisational learning, who made it a project of research when she left the global IT company. Hence the manager of organizational learning is also the researcher and the author of this paper.

Table 1. Iterations in the Development of Proactive Review

#	Iteration	Initiator	Year
1	From AAR to PR	Top management	2005
2	Training facilitators	Manager org. learning	2005
3	PR community	Manager org. learning	2006
4	Managers' responsibilities	Manager org. learning	2007
5	Management challenges	Top management	2008
6	PR application	Top manager	2008
7	Online PR	Facilitators	2009
8	Online facilitator training	Manager org. learning	2009
9	Online connection between managers and facilitators	Managers	2010
10	PR triggers When to run PRs?	External Audit	2010
11	PR recognition - stamp	Facilitators	2011
12	Inter-organizational PR	Manager org. learning	2011
13	PR light for sales	Sales manager	2012

The first iteration was initiated by the top management, and the first educational design was developed by a small group of internal experts who tested the educational design on colleagues in various countries [25]. The testing uncovered the need for trained facilitators, so the manager of organisational learning initiated the second iteration that solved this problem. The trained facilitators asked for a way to "stay together" and continuously learn from each other, which led to the third iteration in which the manager of organisational learning established a professional community of trained facilitators. More Proactive Reviews took off in various countries and lines of

business, and the facilitators reported that the middle managers had a tendency to forget about the outcomes of the Proactive Reviews. Consequently the manager of organizational learning initiated the fourth iteration that stated the obligations of the managers. After a few years, Proactive Reviews became a common way of learning from experience in the global IT company, and the top management became aware of the potential and asked for information about issues identified by the "grass-roots" in Proactive Reviews. Consequently a fifth iteration of the educational design was initiated, and the result was a process for addressing management challenges directly from the Proactive Review to the top management excluding interference from middle managers. This process included the development of an application to capture the management challenges from all countries and lines of business in Europe, Middle East and Africa. This application was the sixth iteration of the educational design. The many merges and acquisitions caused a change in the global IT company from being a multinational company with local entities in the countries to become a global company with lines of business that crossed geographical borders. This change initiated the seventh iteration of the educational design so that Proactive Reviews could be conducted online in opposition to be face-to-face meetings. Consequently the trained facilitators needed additional training, and the eighth iteration of Proactive Review was an online training course for facilitators. As everybody worked with peers from other geographical locations, managers needed to get in touch with facilitators online. This need initiated the ninth iteration of Proactive Review, a kind of internal "facebook" where all facilitators were presented, and managers could ask for a facilitator in any country. The number of Proactive Reviews increased over the years so the internal audit started to look into the cost of this learning process and required formal prescriptions on when Proactive review should be conducted. Consequently the tenth iteration of Proactive Review was initiated. The facilitators met on a regular basis in web conferences, and it came up that it was sometimes hard to be allowed to facilitate because managers found other tasks more important. This issue let to the eleventh iteration in which led to the invention of a "recognition stamp" – a reward offered to high perming facilitators who put the stamp on their e-business cards. This way their managers were reminded about their facilitating skills in e-mails. The manager of organisational learning realized the need for running Proactive Reviews with external parties such as partners and customers which implied considerations of maintenance of confidential information. This led to the twelfth iteration of Proactive Reviews. The thirteenth iteration if proactive Reviews was initiated by a sales manager who wanted a "light" version of Proactive Review to be implemented at various points in the sales process. Shortly after the thirteenth iteration the manager of organisational learning left the company and no more iteration was initiated.

4 Discussing DBR in the context of work

The starting points for learning are perplexity, confusion, doubt [16], disturbance, contradictions or conflicts [17]. The starting point may also be critical elements in the intervention discovered by the researcher or the practitioners, or new

requirements emerging due to the organisational development [17]. The iterations in Proactive Review shoed these different starting points for iterations - the starting points were initiated by those who experience the problem—which was the practitioners or as well as the researcher [11].

DBR lacks a strong theoretical foundation, which may mean the results reported are simply common sense instead of a refinement of the theories [26], [8]. The theories behind an intervention are important for identifying critical elements[15], and Anderson and Shattuck (2012) recommend conducting a literature review before the creation of a new intervention.

DBR bridges theory and practice with the aim of contributing to more efficient learning and improved practices [10], [8]. The iterations in Proactive review enabled the employees and managers to become aware of and influence realities that surround their practices which, according to Engeström et al.19]and Fuglsang and Olsen [27], should be the aim for learning in the context of work.

Collins [15] stresses the importance of reporting the results from the intervention. The report is supposed to present all important findings from the intervention and, if possible, provide an improved intervention for learning. Collins [15] does not suggest when or how to report the findings or the improved intervention for learning. The iterations of Proactive Review required reported results, so iterations included a communication plan to ensure that relevant colleagues were informed about the changes.

Dede [11] suggests that the design of the research is differentiated from its conditions for success and that these conditions should not be changed between iterations of the DBR, and conditions for success may be used as indicators for finishing the iteration.

4.1 The context of work in opposition to a classroom

DBR was first developed and used for studying learning in classroom training [8], [9], [10], [11], [14], [15], which is a real-world setting that embraces messiness and complexity in real-world settings and provide some validity to DBR [8]. The iterations of Proactive Review in the global IT company indicate that this requirement for a real-world setting is suitable for studying learning in the context of work.

The messy setting enables research in authentic learning situations, but at the same time, the messy setting can make it difficult to control the interventions and to control what happens during the learning situation. While researchers try to look into various challenges in the learning situation, they easily end up with overwhelming amounts of data with no guarantee of effectiveness [11],[15].

When DBR is employed for learning in the context of work, the teacher is lacking; instead, there may be a facilitator to conduct the learning situation [26], [18],

and a level of analysis could be the group level as well as the organisational level that includes stakeholders from in- and outside the organisation where the learning is studied[15]. Important stakeholders could be top management, middle managers, experts, colleagues in other departments, unions, NGOs, the local community etc.

The boundaries between what the teacher may influence (the dependent variables) and what the teacher does not influence (the independent variables) does not fit into DBR employed for learning from experience in the context of work as there is no teacher. Furthermore, the extent to which the researcher may or may not influence the variables depends on the specific organisation in which she does the research. Therefore, DBR at work should not distinguish between dependent and independent variables.

4.2 Variables

DBR is also criticised for having too many variables [11], [26]. The variables include engagement, cooperation, risk taking and the effort to understand others' points of view, and it seems a contradiction to *measure* these behaviours, as suggested by [14]. Engeström [26] questions the variable-oriented approach of DBR, as it implicitly takes perfection, completeness and finality for granted instead of questioning the underlying causality [26 p 601]. In the iterations of Proactive Review the variables were used as inspiration for the researcher and practitioners when they collaboratively developed an intervention.

DBR provides variables for the context, including the physical surroundings and sociological aspects, but lacks the historical background [14],[15]. DBR includes analysis of the collaboration between peers, but lacks analyses on conversation as the means of learning. DBR provides variables for change in the dispositions of the individual learner and the development of their skills and learning strategies [15]. DBR examines the social interaction between learners [15] and includes analysis on the institutional and resource level. Consequently DBR mirrors the requirements for including three ontological dimensions in the methodology, i.e. individual learning, team learning and learning throughout the organisation.

4.3 The role of the researcher

Engeström [26] criticises DBR for allowing the researcher to define the intervention and to implement the intervention without questioning the intervention itself [26]. He claims that DBR has a linear approach to the development of an intervention, where the researchers create the intervention, the teachers implement it and the students are only recipients; as a result, the ideas of the students and teachers are ignored (Ibid., 600). The iteration of Proactive Reviews showed this was not the case, as the practitioners were heavily involved in the development and they different stakeholders initiated new interventions.

In DBR, there is not a strong distinction between the researcher and those to be studied [15]. New experience and insights are created collaboratively between the researcher and the practitioners. The active involvement of the practitioners in the global IT company enabled the researcher to take advantage of their expertise [28]. Furthermore, the researcher and practitioners collaborated on the selection and creation of the interventions that resulted in new iterations of the educational design. The engagement of the researcher—placed within the context being studied—leads to the best understanding of what is going on [29]. This involvement does not necessarily cause problems as long as the researcher is aware of her position and role [30]. In order to minimise bias, the researcher must be aware of her pre-assumptions and try to make them explicit.

Initiating and maintaining learning in the context of work implies ethical considerations [7]. The researcher must consider when to intervene and when to stand by idly and watch the practitioners; s/he must also consider the impact of whatever choices she makes [28], but ethical considerations in regards to DBR are not thoroughly described by Anderson and Shattuck [8], Ann Brown [9], Design-Based Research Collective [10], Wang and Hannafin [12], Collins et al, [14], or Collins [15].

Experience at work is not 'innocent'; consequently, the researcher must consider how to make it safe for employees to share their experiences while bearing in mind the difficulties associated with sharing doubts or 'not knowing'. In the development of Proactive Review the researcher asked for informed consent, ensured confidentiality, and decided to what extent the colleagues should participate in the analysis.

5 Conclusions

This paper has explored "What to consider to make DBR a smart methodology for exploring learning from experience in the context of work?"

The paper drew on Dewey [16] in regards to learning from experience; on Engeström [17], [19] in regards to learning in the context of work and on Design-Based Collective [10], Wang and Hannafin [12] and Collins [14],[15] to describe the original format and guidelines of DBR. Critical views on DBR were provided by Engeström [26] and Dede [11] as well as thirteen iterations of the development of Proactive Reviews in a global IT company.

The study found that DBR mirrors the requirement of studying a real-world setting including the three ontological dimensions for learning being the individual, the team and the organisation, which supports the recommendation of utilizing DBR for studying learning in the context of work.

DBR may be a smart methodology for exploring learning in the context of work, because it allows interaction between the researcher and the people under study; and

includes iterations on the educational design that may uncover development in knowledge and knowing or dispositions for the future.

DBR may be a smart methodology for exploring learning in the context of work, when the original number of variables in DBR is minimized to include resources, the physical surroundings, social aspects and Ba, added with the historical background. Furthermore DBR may be added analysis of conversation as the means of learning, when DBR is utilized for studying learning in the context of work

The original format of DBR lacks proper ethical considerations, and as learning from experience at work is not 'innocent', standards for ethical considerations should be added to the methodology when applied for the context of work.

DBR may be a smart methodology for studying learning in the context of work, because it is based on iterations of interventions in educational designs that may uncover development in knowledge and knowing or dispositions for the future.

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