Design Science in the Field: Practice Design Research

Göran Goldkuhl[1,2(✉)] and Jonas Sjöström[1]

[1] Department of Informatics and Media, Uppsala University, Uppsala, Sweden
`jonas.sjostrom@im.uu.se`
[2] Department of Management and Engineering, Linköping University,
Linköping, Sweden
`goran.goldkuhl@liu.se`

Abstract. There exist different types or genres of design science research (DSR) in information systems, like laboratory-oriented and practice-oriented DSR. This paper investigates arguments for a practice-oriented approach to DSR. It uses the research approach of practice research as a starting point to elaborate on a practice-oriented DSR approach we label Practice Design Research (PDR). In doing so, we address two unresolved issues in IS DSR: Theorizing and evaluation. PDR consists of two inter-related sub-activities: theorizing and situational design inquiry. The conduct of situational design inquiry is described as iterative cycles of (1) pre-evaluate, (2) plan & design, (3) test & intervene and (4) post-evaluate. We justify the foundations of these iterative sub-activities/cycles through a theoretically informed argument based on pragmatist philosophy and practice theory.

Keywords: Design science · Practice research · Epistemology
Practice theory · Evaluation · Theorizing · Pragmatism

1 Introduction

Design science research (DSR) has emerged as a viable research approach in information systems (IS). The interest for this type of research among IS scholars seems to be still growing. We see many applications of DSR, and there are many meta-scientific contributions concerning DSR methodology and epistemology. Despite several years of progress in DSR, there are unresolved issues, controversies and even confusion among IS scholars concerning how to conduct DSR. Gregor and Hevner [11, p. 338] state: "We contend that ongoing confusion and misunderstandings of DSR's central ideas and goals are hindering DSR from having a more striking influence on the IS field. A key problem that underlies this confusion is less than full understanding of how DSR relates to human knowledge". Iivari [15, p. 107] takes a similar position, stating that "the scientific discourse on DSR is still in a state of conceptual confusion", suggesting that one cause of confusion exists due to different types or DSR genres. He has identified two types of DSR genres that are also characterized but not labeled. We have given them the following labels: (1) A *laboratory approach*, in which the DSR scholar addresses a general problem (conceived of as a "class of problems") through

the design of "conceptual artifacts" and possibly materialized instantiations. The laboratory approach does not require specific and real problems in real-life practice contexts. (2) A *practice approach*, in which the DSR scholar solves real-life issues by building and implementing artifacts into practice. Collaboration with practitioners, in this genre of DSR, is essential.

Iivari [15] claims that the laboratory genre seems to be the prevailing approach in the IS DSR community following such bias in the seminal work of Hevner et al. [14]. This can explain the criticism and argumentation of Sein et al. [35] when introducing their intervention-oriented approach to DSR labeled Action Design Research (ADR). They claim that "traditional design science does not fully recognize the role of organizational context in shaping the design as well as shaping the deployed artifact." [ibid, p. 38]. How to take into account specific practice contexts in DSR efforts is thus one critical concern for DSR.

The two identified DSR genres have a close resemblance to a similar discourse within the discipline human-computer interaction (HCI). Zimmerman and Forlizzi [47] label this type of research as "research through design" and they distinguish between the two strategies of (1) *research through design in the lab* and (2) *research through design in the field*. Confer also characterizations in [17].

Interestingly – despite the emerging recognition within the IS community that DSR may benefit from elaborating on the relationships between research and practice – there has not been any substantial efforts to exapt ideas from the field of practice research into the DSR field. Practice research (PR) has emerged as a viable research approach in different social sciences. There exists an active branch within the discipline of social work [28, 32, 40]. Similar approaches, with the same or similar labels, appear in e.g. nursing [38], organizational strategy [45], urban planning [44], education [26] and human-computer interaction [19]. Practice research in IS [7, 8, 23] may arguably encompass action research, design research and evaluation research as special variants. Practice research resonates well with mode 2 knowledge production [6] and engaged scholarship [41].

With this backdrop, we turn to two controversies and not yet fully resolved issues in DSR: *Theorizing* and *evaluation*. First, the role of *theorizing* in DSR. Early dominant publications, e.g. [14, 29], downplayed the role of theory as an outcome from DSR. There have been many objections to this a-theoretical stance; e.g. [10, 12, 18, 20, 42]. It is not only a matter of the nature of a theory outcome (as design theory or design principles), but also how theorizing takes place as an integral part of the DSR process. In some established DSR process models, e.g. [29], theorizing has no distinct place. Second, the role of *evaluation* in DSR. In Hevner et al. [14] DSR is understood, in its essence, as an iterative cycle of build and evaluate activities. However, these authors did not detail how evaluation should inform the design process in different stages. As a response to this, DS researchers proposed several evaluation frameworks, suggesting roles and process points for evaluation, e.g. [37, 43]. In addition, there are alternative approaches, like ADR [35], where evaluation is fully integrated into other activities of building and intervention and thus not seen as separate and distinct activities.

We could add to these two DSR issues the intersection of the two. How is evaluation related to theorizing? Should it be seen as a part of theorizing or should be closely related to the design process of a new artifact?

In this paper, we embrace a practice view of DSR. The main purpose is to elaborate a practice-based DSR approach. When doing this we seek to clarify the meaning of different aspects of DSR, especially theorizing and evaluation by exploring DSR as a mode of practice research. We exapt ideas from practice research as a general topic as a means to conceptualize DSR and its constituents of evaluation and theorizing. The purpose of the paper is thus to describe and explain DSR based on an explicit practice perspective.

2   Research Approach

We use two unresolved DSR issues – evaluation and theorizing – together with the knowledge need for an elaborated practice-based DSR as impetuses for this paper. They form together a problematic situation in this inquiry. The way that we frame DSR, either as a laboratory exercise or a practice improvement effort in the field, has fundamental consequences for DSR conceptualization and performance. Our purpose is to give a contribution to *DSR as research in the field* (i.e., into practices). We define DSR as a practice loop, i.e., moving from problematic situations in a practice through design and back to an artifact-renewed and improved practice (Fig. 1).
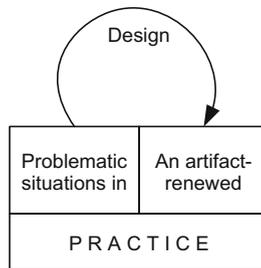
Fig. 1. Design research as a practice loop

It is fundamental to start the process with the practice and its problematic situation and to end the process with a renewed and improved practice. This means that we propose to use design (research) as a way to conduct an inquiry process in its original pragmatic sense [4], i.e. as movement from a problematic situation to a resolved and settled situation.

The way we have conducted this is in itself through an inquiry. The different problems, concerns and issues described above constitute the problematic situation that needs to be resolved through our inquiry of this paper. The resolved situation, as our knowledge contribution, is a practice-oriented conceptualization of design research. We sketch an approach to design research that we have labelled practice design research (PDR). We will in the next Sect. 3 go through some important literature sources that have argued for practice DSR concerns. We do not start our work of developing PDR from scratch. As mentioned, we obtain our main inspiration from the research approach

of practice research. We will account for some fundamentals of this research approach in Sect. 4.1. In the remainder of Sect. 4 we will articulate practice design research as a possible DSR approach with the main idea to direct design research as a practice improvement endeavor. In this section we will not only present conceptualizations and models of PRD. We will give theoretical grounding through literature references. The theoretical sources are mainly obtained from pragmatist philosophy and theory since our approach is positioned within this paradigmatic stance [9, 13, 49, 50]. The paper is ended with conclusions in Sect. 5.

3   Practice Orientation in Current Design Science

Several DSR approaches consider practical problems the starting point, e.g. [14, 29]. However, critics state that these approaches pay too little attention to the organizational context of IT artifact design [1, 24, 30, 31, 35]. Hevner [13] defines DSR as consisting of three cycles (relevance, design, and rigor). The separation of relevance cycle from design cycle might, however, be inappropriate for making design sufficiently practice-based. Sein et al. [35, p. 37] criticize established DSR approaches to "value technological rigor at the cost of organizational relevance, and fail to recognize that the artifact emerges from interaction with the organizational context even when its initial design is guided by the researchers' intent." Sein et al. [35] apply an ensemble view of IT artifacts, from [27], describing IT artifacts as carriers of "social structures" and embedded in social practices. Thus, ADR demands a close interaction with practice. Sein et al. [35] object to a separation between building, intervention, and evaluation. Instead, they speak of interweaving these types of activities. Evaluation should be seen as an ongoing and concurrent activity to building and not as they interpret current DSR to "relegate evaluation to a subsequent and separate phase" [ibid, p. 37]. DSR emphasizes organizational intervention as an integral activity of DSR; "current DR methods … consider organizational intervention to be secondary" [ibid, p. 39]. Hevner [13] considers intervention as a matter of technology transfer managed through action research. The fundamental idea of ADR is the opposite; to integrate and fuse DSR and action research into one coherent research approach.

McKay et al. [24, p. 135] demand DSR to be "geared more toward intervening in contexts to make improvements and ensuring that change works well." They argue against a narrow "construction-oriented view" of DSR and claim the importance of a broader human-centered perspective including topics like "how IT … artifacts appear to users, what they mean to users, how they communicate to users, the nature of the user experience with the artifact, the value ascribed to designed artifacts within contexts of use by users." [ibid, p. 137].

Baskerville and Myers [1] put forth an ethnographic approach to design science called Design Ethnography, comprising a traditional ethnographic study of practices as a basis for design and also the use of ethnographic techniques integrated into design. The authors claim "the design task itself can be used as a vehicle to better understand the everyday lives of the people" [ibid, p. 25].

Rohde et al. [30, 31] investigate epistemological foundations of DSR from a social practice perspective. Their stance is to conceive "design as an intervention into social

practices" [30]. Such a design practice is seen "as a reflective practice confronted with wicked situations." They claim the importance that evaluation should be conducted in real-world settings. The introduction of new IT artifacts in social practices is always made through an appropriation process. Rohde et al. [30] claim social practices to "evolve together with the appropriation of the IT artifact. In this process, unanticipated opportunities for the design of the artifact may emerge organically within work practices." The consequence of this is that "emergence in the appropriation process cannot be observed before the intervention has occurred" [ibid]. There needs thus to be an intervention before a proper evaluation can be conducted. The appropriation view is far from seeing IT artifact implementation as a matter of technology transfer as claimed by Hevner [13].

Simplistic sequences of DSR activities (like build → evaluate → intervene) should thus be avoided. Epistemologically, a sound action logic is much more complex and nuanced.

Arguments for a more practice-based foundation of DSR can be found in the referenced contributions above. General arguments are presented for adopting a practice approach to DSR [1, 24, 30, 31]. Sein et al. [35] have operationalized a DSR approach in the field: the Action Design Research method. Their arguments against sequencing evaluation after building and before intervention are convincing. However, a DSR scholar is not much helped through their descriptions of interweaving building, evaluation, and intervention. Even if these activities are closely related it is not helpful to claim them as integrated and fused in the way it is done in Sein et al. [35]. It should be possible to analytically differentiate such activities and specify how they can be possibly sequenced in different ways. We will present such attempts in the following section when introducing Practice Design Research.

Even if there are several similarities between ADR and our approach (PDR), there seem to be differences between our starting points. Our interpretation is that Sein et al. [35] have started with DSR and then adapted it and fused it together with action research. Our starting point is practice research. We have then proceeded with this research approach and specified how design research could be one variant (sub-class) of it.

4 Practice Design Research

4.1 Practice Research Foundation

Practice research means research into some practice(s) with the purpose to improve such and similar practices. Fundamentally, we base our practice view on Dewey's idea of inquiry as a theory of knowledge [4]. Through an inquiry into social practice, experiences are gained through activities aiming at improving practice.

The presented PDR approach here takes the practice research approach as presented in [7, 8] as a starting point. Practice research has described as an interplay between the two sub-practices of situational inquiry and theorizing [7]. Practice research is related to three target practices (research community, general practice, local operational practice).

Situational inquiry (SI) means an investigation into one local practice or sometimes into several such local practices. The situational inquiry is driven by conceiving problematic situations in the local (operational) practice. The aim is to understand the practice in order to improve it. A situational inquiry (1) can be just a diagnosis or (2) it can include design proposals or (3) even implementation of change measures and new artifacts [7]. The result from SI in relation to local practice(s) is labelled a local practice contribution. This means that a local practice contribution can be (1) an evaluation or (2) a design/change proposal or (3) implemented change measures. SI will often be conducted collaboratively between researchers and practitioners.

SI will interplay with theorizing during a practice research. Theorizing comprises both furnishing of "theoretical tools" to SI and taking care of empirical data from SI. Theorizing means knowledge production. It produces useful knowledge aimed for "general practice", that is practice communities that are not limited to the local practice studied. This is called general practice contribution. Theorizing as a sub-practice of PR exists also with the purpose of adding to the scientific body of knowledge within the research community.

4.2   The Interplay of Situational Design Inquiry and Theorizing

We have applied the perspective and the anatomy of practice research to elaborate a practice-oriented DSR approach. We label our approach Practice Design Research (PDR). While the ADR originators refer to action research as the fundamental inspiration and a reference model when adapting DSR, we base our DSR adaptation on practice research. What we accomplish in this development is thus the formulation of a form of practice research oriented towards design as the focal kind of inquiry and practice improvement. An analysis of similarities and differences between action research and practice research is presented in [8].

Drawing from the ideas of situational inquiry in PR [7] we use the term "situational design inquiry" in PDR to emphasize the design orientation of our approach. The structuring of theorizing and situational design inquiry has been done in new ways within PDR (Fig. 2) compared with general PR.

Following PR, it is essential to conceive of theorizing as a distinct and separate sub-activity within a DSR study. PR thus addresses the confusion concerning DSR outcomes as local artifacts vs. general knowledge. In [14] the result of DSR is emphasized to be an artifact – a construct, method, model or instantiation. Hevner et al. [14] mention that artifacts may be technology-based (e.g., software), people-based (e.g., incentives that affect people's actions) and organization-based (e.g., process design). Several scholars are demanding DSR outcome to also be of abstract and theoretical character, e.g. [20, 36, 42, 46]. Gregor and Hevner [11] differentiate between contributions on different abstraction levels, from instantiations (level 1), nascent design theory (level 2; constructs, methods, models, design principles, and technological rules), to design theory (level 3; 'mid-range and grand theories'). Our interpretation of this discourse is that IS scholars recognize that theorizing is an insufficiently conceptualized part of DSR. The division in PDR into theorizing and design inquiry emphasizes that theorizing is an explicit part of such an approach aiming for general and abstract knowledge, in addition to contributions made to the local

practice. Theorizing in PDR should result in (1) general practice contributions and (2) additions to the scientific body of knowledge following the principles of PR (Fig. 2). Such results can be abstracted descriptions of artifact features and their contributions to practical use values (as a kind of design principles).
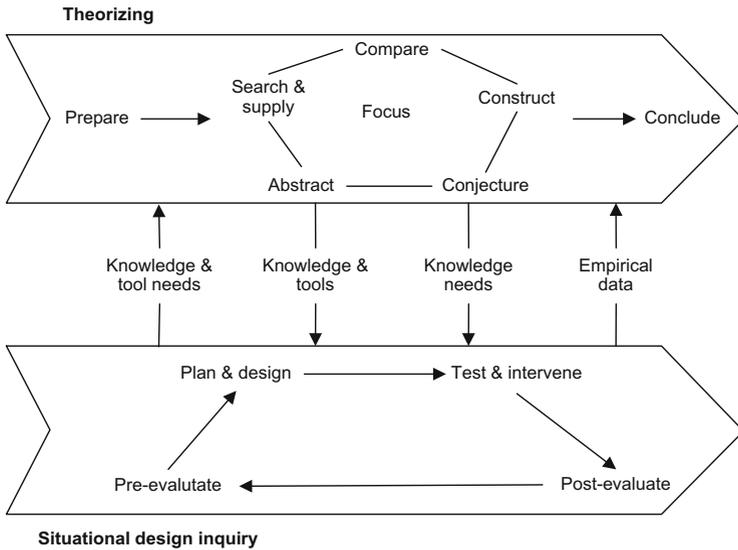
Fig. 2. Theorizing and situational design inquiry in practice design research.

While we separate situational design inquiry from theorizing for the sake of conceptual clarity, we acknowledge the entanglement of the two. Figure 2 illustrates the anticipated value creation in PDR: Through the inquiry process needs for knowledge and cognitive tools are identified. These trigger the theorizing activity, i.e., search for or articulation of knowledge to apply in the situational design inquiry. Through theorizing, different knowledge needs are generated like hypotheses and questions sometimes operationalized in data collection instruments. Situational inquiry feeds empirical data into theorizing as a source for analysis, abstraction, and formulation of theoretical propositions. The remainder of Fig. 2 is discussed in depth in Sects. 4.3–4.5.

4.3   Situational Design Inquiry

PDR recognizes four stages as fundamental in the design inquiry process: (1) Pre-evaluate, (2) plan and design, (3) test and intervene, and (4) post-evaluate. Figure 2 illustrates the four stages on a high level. The stage-division is inspired by the inquiry process as described by Dewey [2, 4] and the principal stage division of the act by Mead [48]. We synthesize Mead's division of four phases (impulse, perception, manipulation, and consummation) with the three-stage model presented in [9], consisting of pre-assessment, intervention (including simultaneous monitoring), and

post-assessment. In comparison with [9 and 48], we inserted a second phase of planning between pre-assessment and intervention. PDR thus follows Dewey's concept of inquiry by acknowledging the crucial moments of suggestions and reasoning before taking action. Each stage in the PDR view on situational design inquiry, in turn, consists of activities as elaborated in Fig. 3.

The PDR inquiry process corresponds well with the phases in canonical action research (CAR) as described by Susman and Evered [39]. Pre-evaluate corresponds directly to "diagnosing" in the CAR model [39]. Plan & design corresponds to "action planning," and test & intervene corresponds to "action taking." Post-evaluate includes "evaluation" and parts of "specifying learning." This latter activity is however also included in theorizing; cf. [8].

The **pre-evaluate** phase (of this new SI model) starts with the experience of problematic situations; something "difficult" or "disturbing" following Dewey [2]. The next stage is the generation of data about the problematic situation ("observe"). Data should be recorded and analyzed ("describe & abstract"). PDR advocates an explicit evaluation ("assess") of the situation (according to generated data and conducted descriptions). This initial phase of establishing a problematic situation and its evaluation is part of with an emerging focus and demarcation. Evaluators of the current situation should not only investigate with critical knowledge intent, i.e., a search for "what does not work.", but also with interest for "what works (well)," i.e., different strengths in the situation. Such an analysis is often called an appreciative inquiry [22].

The activities of pre-evaluate should be seen as iterative and continual. The principal epistemic order described above and in Fig. 3 is not only a model of "frozen stages", but also pertains to the overall inquiry structure and the other three inquiry stages.

Plan & design means the generation of proposals and a direct assessment of these. It is necessary to reflect on and articulate values ("desire") as a basis for proposing. Otherwise, there is a risk for an amendment of minor problems, and neglecting serious issues. Value analysis can thus also slightly shift the focus from the pre-evaluate stage in this design stage.

The propose phase covers the generation of new designs of different degrees of realization; spanning from hunches and ideas to visualizations in models and further to instantiated prototypes and full-blown products.

Assessment in plan & design is a desktop evaluation of proposals before any practical test searching for implied consequences of the projected suggestions. The assessment includes a comparison between status quo (problem statements from pre-evaluate) and the proposed solution and anticipated (through reasoning) identified consequences.

Test & intervene means that new actions are taken in relation to the inquired practice. Actions, following the tenets of design science, may include the use of new artifacts. A current practice might be resilient to changes and new ways of working. To get new procedures to work, it is often necessary to appropriate these new procedures to fit the situation [30, 31]. Modifications and adaptations sometimes need to be done. This appropriation is conducted based on experiences, and an "assessment-in-action" following the theories of Schön [33] stated as "reflection-in-action". Typically, this stage of test & intervene iterate until a new (modified) way of working is functioning satisfactorily. What is implemented can thus deviate from the planned intervention.
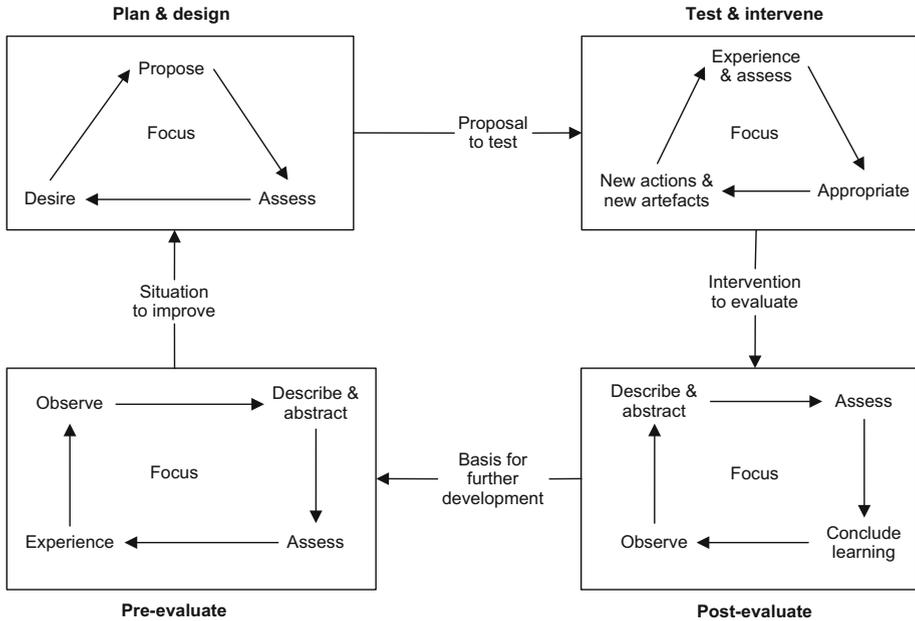
Fig. 3. The situational design inquiry process unfolded.

This new action is, in an inquiry context, seen as a test. And as such, it should be appropriately evaluated, not only through an assessment-in-action. There should be an explicit **post-evaluation**. Such an evaluation includes data collection ("observe"), description, abstraction and explicit assessment. This finalizing post-evaluation should also comprise an overall statement of the learning from the inquiry process; i.e., the transformation of the problematic situation into a satisfactory one. Dewey [4] describes the closure of an inquiry as a resolution of the problematic situation into a settled one.

4.4   Theorizing Activities in PDR

We divide PDR theorizing into three stages (Fig. 2), slightly revised from [7]: Prepare, continual theorizing, and conclude.

The **prepare** stage includes an initial formulation of research interest and research questions, as well as an initial establishment of the knowledge base for the study (i.e., literature review). Further, there is a need to make initial arrangements for the empirical work in situational design inquiry, including the furnishing of cognitive tools – selection and situated adaptation of ideas from the knowledge base – for SI. It is important to emphasize these initial formulations of research interest and establishment of knowledge bases are provisional and open to later refinement. The prepare stage is to give the design study an initial focus and direction.

The **continual theorizing** stage in PDR means a continual interest in conceptualizing and explaining the emerging theoretical focus at hand. A focus emerges through on-going reflection and learning, which may lead to a revised understanding of the

problem and its solution, and sometimes to a shift in research interests and theoretical focus. Continual theorizing consists of several generic activities: (i) Abstraction (data analysis and conceptual development), (ii) search and supply of relevant extant knowledge that may be relevant in the PDR process, (iii) compare, i.e., a continual analysis and comparison of (1) different empirical elements, (2) various theoretical elements and (3) consistency between data and theory, (iv) construct/design of cognitive tools for descriptive, explanatory, normative and prescriptive purposes, and (v) conjecture, i.e. articulation of hypotheses and issues to study in the empirical SI. These activities are considered 'generic' in the sense that they exist in some form in all theorizing situations, whether explicitly reflected upon or not. We conceive of theorizing as a continual shift between these activities, aligned with SI events. It is hard to state a precise epistemic order between the activities; therefore there are no arrows in Fig. 2 to indicate any particular order.

The **conclude** stage corresponds to the formalization of learning in ADR and refers to the post-inquiry work to make final reflections and formalize the results of the theorizing process intended for targeted audiences (research community and general practice).

4.5   Evaluation in PDR

At the heart of pragmatism lies an interest to engage with the development of ideas that support human understanding and govern human action. We differentiate between theoretical ideas and situated ideas proposed by designers and researchers in the situational design inquiry. We conceive of an 'idea' in a broad sense. It encompasses any representation of knowledge (instantiations, methods, models, concepts, design principles, design theory, etc.).

Evaluation plays crucial roles in both sub-practices of practice design research. In the design inquiry process, evaluation is vital for understanding the current practice, emergent design ideas and the usefulness of new artifacts put into test and use in practice. Evaluation appears in all four stages of the inquiry process, which is found in Fig. 3 (through the word 'assess'). However, these evaluation activities in the inquiry stages differ in character. Table 1 summarizes the differences.

Activities in situational design inquiry provide empirical data to the theorizing process potentially signaling the applicability and usefulness of the ideas used in an inquiry. Ideas may be either (i) theoretically informed proposals from researchers, (ii) creatively crafted ideas by practitioners and researchers, or a combination of (i) and (ii). For example, a design proposal from the researchers, based on theory X, is rejected by the local practice due to incoherence with the existing technological base. The implication for the situational inquiry is that the proposal is rejected in its current form. The implication for theorizing is that the researcher has new data regarding the applicability of the theory in the particular context of inquiry. When the researcher presents a revised version of theory X to their academic peers, a set of values (e.g., rigor and relevance) different from the values in the local practice (e.g., technological fitness) will be used to determine the goodness of the generic idea.

Table 1. Different types of evaluation in the stages of situational inquiry.

Stage	Temporality	Evaluation object	Character of evaluation
Pre-evaluate	Evaluation-before-design	Current practice	Observation-based explicit evaluation
Plan & design	Evaluation-in-design	Proposals	Evaluation of anticipated consequences
Test & intervene	Evaluation-in-action	Experiences of new action and artifact	Reflection-in-action
Post-evaluate	Evaluation-after-action	Experiences of new action and artifact	Observation-based explicit evaluation

Evaluation of ideas in theorizing thus seeks to (i) draw from the experiences in practice of a situated idea to (ii) phrase a generic idea, and (iii) evaluate the generic idea based on values in the academic community.

Evaluation in PDR theorizing can thus mean learning from experiences of implementing ideas in situational inquiry. Following James' [16] view that ideas also need to be anchored in older truths, ideas may also be assessed through theoretical studies. Evaluation is not a separate and explicit activity in theorizing (Fig. 2) due to its continual presence in the abstraction process. Evaluation occurs both in studying the empirics and in studying theoretical sources. It occurs throughout the abstraction process. The view of evaluation as an integrated part of theorizing calls for attention to how data is collected and documented for research purposes. PDR calls for data collection that allows for a reconstruction of design rationale as well as a transparent empirical justification of generic idea propositions.

To account for evaluation in theorizing, we need to further elaborate on PDR knowledge outcomes. In the PDR context, our primary interest is ideas that support inquiry, either by (i) promoting an enhanced understanding of existing practice (e.g., a business modeling technique) or by (ii) providing prescriptive advice for design (e.g., design principles). That is; PDR does not only focus prescriptive knowledge: Ideas that support description and explanation of practice are considered equally important.

Everything that can be conceived of as a proposal in theorizing can be assessed in different ways. Every proposal can be pre-assessed before any use; to determine if it applies to the situation. Such pre-assessment usually occurs through theoretical scrutiny, but it can also be conducted by the support of naturalistic evaluation through collaboration with practitioners, or through artificial evaluation techniques from the laboratory genre of DSR. It can be post-assessed after use (either in theorizing or situational design inquiry) concerning its usefulness regarding intended purposes or emergent reasons. This conceptualization of evaluation in theorizing follows the inherent nature of evaluation (both pre-assess and post-assess) in actions [9, 48]. It also follows from the importance of reasoning and judgments of ideas as necessary parts of the inquiry process as described by Dewey [2, 4].

What can be seen as proposals to be assessed in theorizing? The answer is everything that is put forth in these processes conceived of having an epistemological

value. The articulated research focus directs what is done in PDR and this needs to be assessed. Extant theoretical knowledge is brought into the PDR process to be used for different purposes. What kind of extant knowledge that is selected needs to be assessed. In theorizing, cognitive tools are generated and adapted to be used for further theorizing or situational design inquiry. These tools need to be evaluated. One important task in theorizing is the generation of hypotheses or other conjectures. Such hypotheses need to be assessed to inquire if they are interesting, valuable and applicable in the research process. Empirical data are supplied from situational inquiry to be used for analysis and abstraction in the theorizing process. Such data cannot be taken for granted. They should be assessed to scrutinize their validity, sufficiency, coverage, and usefulness. Theorizing should produce theoretical constructs (such as design principles and design theory) as outcomes directed to the research community and general practice (Fig. 2). The evaluation of such theoretical constructs needs to be conducted following academic standards as well as values from other target groups.

5   Conclusions

We acknowledge that existing DSR approaches recognize the role of practice in design-oriented research in various ways. There is, however, a significant difference between current DSR approaches and our proposed approach to practice design research. Other approaches, on the one hand, do not use practice as a vantage point for conceptualization, resulting in a set of scattered – albeit meaningful and useful – ideas on how to relate to practice in design-oriented research. Practice design research, on the other hand, is an exploration of how to understand design-oriented research, grounded in the ontological and epistemological roots of pragmatism and practice research. Practice design research is a consequent elaboration of practice-oriented DSR as described as one genre of DSR as a contrast to laboratory-oriented DSR; these genres described by [15, 47].

ADR is the only other elaborated approach we have found that builds on an articulated underlying philosophy. ADR relates to interpretivism and interventionism as a measure to position itself against DSR as accounted for by Hevner et al. [14]. ADR, however, puts the idea of an ensemble artifact at the fore and builds their method around it. Second, in contrast to other design-oriented approaches, our approach offers an analytically viable view on theorizing and its relation to design inquiry. Inquiry as a starting point is a contrast to different DSR approaches regarding the idea of knowledge contributions. PDR, coherent with Dewey's inquiry as a theory of knowledge, serves to develop and evaluate ideas in a broad sense, whether they aim at describing, explaining or even predicting phenomena. The idea of contributions beyond prescriptive knowledge and instantiations is a clear distinction from the prevalent DSR discourse. The roots of PDR in pragmatism and Dewey's notion of inquiry give a solid foundation for the creative and possibility-exploring aspect of DSR. Inquiry and knowledge is the basis for change and improvement of the world; Dewey [3] writes "reason has a creative function … which helps to make the world other than it would have been without it".

There is a risk that the approach presented is conceived of as 'yet another model,' thus causes even more confusion about evaluation and theorizing in DSR. Our response to such argumentation is that the approach – while still in its infancy – offers an enhanced conceptual understanding of the role and nature of evaluation in DSR, as well as increased clarity regarding theorizing and its interrelations with situational design inquiry. PDR has a clear difference to ADR since neither theorizing nor evaluation has conceptually clear and distinct positions in ADR. We acknowledge that evaluation should be conducted in close alternation with the build and intervene activities in entangled ways, but we find it essential to analytically clarify the different roles and positions of evaluation in both situational design inquiry and theorizing.

We emphasize that PDR addresses the practice genre of DSR, and in doing so we explore the consequences of addressing design-oriented research drawing from practice theory and pragmatism. There is a contemporary stream of practice theory, e.g. [5, 19, 25], and a related discourse on socio-materiality, e.g. [21, 34], that elaborate more in detail about various aspects of practice. For instance, as the entanglement of technology and the social world, power and politics in organizations, and the emergent characteristics of socio-material practice. The very idea of Dewey's moral inquiry is to be able to identify and improve the social world taking into account such complex aspects. The cohesive ontological and epistemological foundations of PDR support commensurability with contemporary streams of practice theory and socio-materiality.

The purpose and scope of this paper was to describe and present the basic features of the Practice Design Research approach including its philosophical foundation in pragmatism. We have used different parts of PDR in design oriented research projects, so this approach should not be seen as just a methodological idea. There exist an empirical base, although not presented in this paper. Future research will analyze and present findings from such empirical research.

References

1. Baskerville, R., Myers, M.: Design ethnography in information systems. Inf. Syst. J. **25**, 23–46 (2004)
2. Dewey, J.: How We Think. D.C. Heath & Co., Boston (1910)
3. Dewey, J.: The development of American pragmatism. In: Dewey, J. (ed.) Philosophy and Civilization. Minton, Balch & Co., New York (1931)
4. Dewey, J.: Logic: The Theory of Inquiry. Henry Holt, New York (1938)
5. Feldman, M., Orlikowski, W.: Theorizing practice and practicing theory. Organ. Sci. **22**, 1240–1253 (2011)
6. Gibbons, M., Limoges, C., Nowotny, H., Schwartzman, S., Scott, P., Trow, P.: The New Production of Knowledge. The Dynamics of Science and Research in Contemporary Societies. Sage, London (1994)
7. Goldkuhl, G.: The research practice of practice research: theorizing and situational inquiry. Syst. Signs Actions **5**(1), 7–29 (2011)
8. Goldkuhl, G.: From action research to practice research. Australas. J. Inf. Syst. **17**(2), 57–78 (2012)
9. Goldkuhl, G.: Pragmatism vs. interpretivism in qualitative information systems research. Eur. J. Inf. Syst. **21**(2), 135–146 (2012)

10. Goldkuhl, G., Lind, M.: A multi-grounded design research process. In: Winter, R., Zhao, J. L., Aier, S. (eds.) DESRIST 2010. LNCS, vol. 6105, pp. 45–60. Springer, Heidelberg (2010). https://doi.org/10.1007/978-3-642-13335-0_4

11. Gregor, S., Hevner, A.: Positioning and presenting design science research for maximum impact. MIS Q. **37**(2), 337–355 (2013)

12. Gregor, S., Jones, D.: The anatomy of a design theory. J. AIS **8**(5), 312–335 (2007)

13. Hevner, A.R.: A three cycle view of design science research. Scand. J. Inf. Syst. **19**(2), 87–92 (2007)

14. Hevner, A.R., March, S.T., Park, J., Ram, S.: Design science in information systems research. MIS Q. **28**(1), 75–105 (2004)

15. Iivari, J.: Distinguishing and contrasting two strategies for design science research. Eur. J. Inf. Syst. **24**, 107–115 (2015)

16. James, W.: Pragmatism. A New Name for Some Old Ways of Thinking. Longmans, Green & Co., New York (1907)

17. Koskinen, I., Zimmerman, J., Binder, T., Redström, J., Wensween, S.: Design Research Through Practice. From the Lab, Field, and Showroom. Morgan Kaufmann, Amsterdam (2011)

18. Kuechler, B., Vaishnavi, V.: A framework for theory development in design science research: multiple perspectives. J. AIS **13**(6), 395–423 (2012)

19. Kuutti, K., Bannon, L.: The turn to practice in HCI: towards a research agenda. In: Proceedings CHI-2014, Toronto (2014)

20. Lee, J.S., Pries-Heje, J., Baskerville, R.: Theorizing in design science research. In: Jain, H., Sinha, A.P., Vitharana, P. (eds.) DESRIST 2011. LNCS, vol. 6629, pp. 1–16. Springer, Heidelberg (2011). https://doi.org/10.1007/978-3-642-20633-7_1

21. Leonardi, P.: When flexible routines meet flexible technologies: affordance, constraint, and the imbrication of human and material agencies. MIS Q. **35**(1), 147–167 (2011)

22. Ludema, J., Cooperrider, D., Barrett, F.: Appreciative inquiry: the power of the unconditional positive question. In: Reason, P., Bradbury, H. (eds.) Handbook of Action Research. Sage, London (2001)

23. Mathiassen, L.: Collaborative practice research. Inf. Technol. People **15**(4), 321–345 (2002)

24. McKay, J., Marshall, P., Hirschheim, R.: The design construct in information systems design science. J. Inf. Technol. **27**, 125–139 (2012)

25. Nicolini, D.: Practice Theory, Work, & Organization. Oxford University Press, Oxford (2012)

26. Nilsen, P., Nordström, G., Ellström, P.-E.: Integrating research-based and practice-based knowledge through workplace reflection. J. Workplace Learn. **24**(6), 403–415 (2012)

27. Orlikowski, W.J., Iacono, C.S.: Desperately seeking the "IT" in IT research – a call to theorizing the IT artifact. Inf. Syst. Res. **12**(2), 121–134 (2001)

28. Pain, H.: Practice research: what it is and its place in the social work profession. Eur. J. Soc. Work **14**(4), 545–562 (2010)

29. Peffers, K., Tuunanen, T., Rothenberger, M.A., Chatterjee, S.: A design science research methodology for information systems research. J. Manag. Inf. Syst. **24**(3), 45–77 (2007)

30. Rohde, M., Stevens, G., Brödner, P., Wulf, V.: Towards a paradigmatic shift in IS: designing for social practice. In: Proceedings DESRIST-2009, Malvern (2009)

31. Rohde, M., Brödner, P., Stevens, G., Betz, M., Wulf, V.: Grounded design – a praxeological IS research perspective. J. Inf. Technol. **32**, 163–179 (2016)

32. Salisbury Forum Group. The Salisbury Statement. Social Work & Society, vol. 9 (2011)

33. Schön, D.: The Reflective Practitioner - How Professionals Think in Action. Basic Books, New York (1983)

34. Scott, S., Orlikowski, W.: Entanglements in practice: performing anonymity through social media. MIS Q. **38**(3), 873–893 (2014)
35. Sein, M., Henfridsson, O., Purao, S., Rossi, M., Lindgren, R.: Action design research. MIS Q. **35**(1), 37–56 (2011)
36. Sjöström, J., Ågerfalk, P.J.: An analytic framework for design-oriented research concepts. In: Proceedings of AMCIS-2009, San Francisco (2009)
37. Sonnenberg, C., vom Brocke, J.: Evaluation patterns for design science research artefacts. In: Helfert, M., Donnellan, B. (eds.) EDSS 2011. CCIS, vol. 286, pp. 71–83. Springer, Heidelberg (2012). https://doi.org/10.1007/978-3-642-33681-2_7
38. Stevenson, C.: Practical inquiry/theory in nursing. J. Adv. Nurs. **50**(2), 196–203 (2005)
39. Susman, G.I., Evered, R.D.: An assessment of the scientific merits of action research. Adm. Sci. Q. **23**(4), 582–603 (1978)
40. Uggerhøj, L.: What is practice research in social work - definitions, barriers and possibilities. Soc. Work Soc. **9**(1), 45–59 (2011)
41. Van de Ven, A.: Engaged Scholarship: A Guide for Organizational and Social Research. Oxford University Press, Oxford (2007)
42. Venable, J.: The role of theory and theorising in design science research. In: Proceedings of DESRIST 2006, Claremont (2006)
43. Venable, J., Pries-Heje, J., Baskerville, R.: FEDS: a framework for evaluation in design science research. Eur. J. Inf. Syst. **25**, 77–89 (2016)
44. Watson, V.: Do we learn from planning practice?: the contribution of the practice movement to planning theory. J. Plann. Educ. Res. **22**, 178–187 (2002)
45. Whittington, R.: Completing the practice turn in strategy research. Organ. Stud. **27**(5), 613–634 (2006)
46. Winter, R.: Towards a framework for evidence-based and inductive design in information systems research. In: Helfert, M., Donnellan, B., Kenneally, J. (eds.) EDSS 2013. CCIS, vol. 447, pp. 1–20. Springer, Cham (2014). https://doi.org/10.1007/978-3-319-13936-4_1
47. Zimmerman, J., Forlizzi, J.: Research through design in HCI. In: Olson, J., Kellogg, W. (eds.) Ways of Knowing in HCI. Springer, New York (2014). https://doi.org/10.1007/978-1-4939-0378-8_8
48. Mead, G.H.: Philosophy of the Act. University of Chicago Press, Chicago (1938)
49. Lee, A., Nickerson, J.: Theory as a case of design: lessons for design from the philosophy of science. In: Proceedings of the 43rd Hawaii International Conference on System Sciences (2010)
50. Goldkuhl, G.: Design research in search for a paradigm: pragmatism is the answer. In: Helfert, M., Donnellan, B. (eds.) EDSS 2011. CCIS, vol. 286, pp. 84–95. Springer, Heidelberg (2012). https://doi.org/10.1007/978-3-642-33681-2_8