The Beauty of Messiness: A Flexible Tool for Design Principle Projects

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Abstract

Abstracting and formalizing knowledge collected throughout a design science research (DSR) project is important to inform the design of future artifacts. Design principles are one of the prevailing forms to capture design-relevant knowledge and guide both research and practice to build new artifacts. Although today's DSR projects are often agile and creative, they require a minimum structure to ensure rigor. In this paper, we set out to master the tradeoff between creative messiness and fully standardized design endeavors by presenting a situational tool in the form of a card deck. We report on the building of a design tool and its demonstration via two illustrative examples. Overall, we complement the valuable body of DSR frameworks and introduce a flexible and configurable tool capable of taking into account specific project situations.

Keywords: Design science research, Card deck, Situational tool, Design principle.

1. Introduction

Abstracted and generalized pieces of design knowledge present valuable input for future design science research (DSR) projects. Among the well-accepted forms of storing these pieces of knowledge are design principles (Gregor et al., 2020). Design principles help researchers in formalizing knowledge obtained during—often large and interwoven—projects and make insights accessible to other designers. They synthesize design-relevant knowledge that is collected, for instance, in projects across several years as well as beyond disciplinary and institutional boundaries. Formalizing knowledge allows other actors to draw on previously gained experiences and, ultimately, not make the same mistakes (Chandra Kruse & Nickerson, 2018). Given the great potential of design principles, they have been developed for numerous purposes and important societal challenges (e.g., Nguyen et al., 2021; Schoormann et al., 2021; Seidel et al., 2018).

To execute DSR projects, researchers can build upon the rich body of general frameworks and methods (e.g., Hevner et al., 2004; Peffers et al., 2007) as well as contextualized guidance for design principles (e.g., Gregor et al., 2020). Nonetheless, we recognized that today's DSR projects, which often deal with digital innovation, confront researchers with new challenges. For instance, projects are becoming more agile (e.g., Mullarkey & Hevner, 2019) and innovation teams cross functional and disciplinary borders (e.g., Dorst, 2018). As a consequence, designing projects that aim to derive design knowledge is getting more complex. This observation is also supported by workshops that we conducted: researchers engaged in DSR projects on digital innovation argued that they are overwhelmed in terms of how to consider important components to produce rigorous and relevant knowledge, how to adapt existing tools to fit a specific situation, as well as how to communicate their unique (and messy) design paths. Also, our analysis of design principle papers indicates a great heterogeneity in how principles are produced and a need for making the production more traceable.

Against this backdrop, we set out to complement the emerging stream of research dealing with more process-oriented guidance on design principles (e.g., Möller et al., 2021) by providing a novel artifact in the form of a flexible and configurable tool. We seek to balance the tradeoff between a tight corset describing how to proceed and a completely free space specifying no concrete steps. Therefore, the research question is: *How to support DSR teams in designing projects for design principle development?*

To answer this question, we build upon the idea of 'card decks' (Carneiro et al., 2012). Card decks are well-known as a tool to aid design processes. They have been proposed for various purposes sharing similarities with our paper's goal (Roy & Warren, 2019; Yeoman & Carvalho, 2019). Both research and practice emphasized that using cards facilitates creative combinations of elements, fosters a shared understanding, visualizes project paths, as well as represents useful information to guide teams throughout design activities and resources (Carneiro et al., 2012; Hwang et al., 2020). Following this, our work is intended to complement established DSR paradigms by introducing a flexible tool that can be catered to individual situations.

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2. Related work on design principles

Since the design principle's popularity, there is a rich body of literature guiding different aspects of what to consider during a principle's life cycle. To build upon this body, we first cluster this guidance.

Grounding. An essential ingredient for design knowledge is an appropriate grounding (vom Brocke et al., 2020). Grounding refers to "[…] an establishment of an argumentative relationship between this piece of knowledge and some other part of knowledge [whereby] the other piece of knowledge is considered as a warrant (a good reason) for the part of knowledge in the focus" (Goldkuhl, 2004, p. 65). Broadly speaking: 'good' knowledge has good justifications. Sources of grounding can vary and should be aligned with the epistemological nature of the knowledge to be produced. While there is to the best of our knowledge less guidance on design principles in particular, Goldkuhl (2004), for example, proposed three grounding processes for design theories, namely *internal grounding* (i.e., grounding design knowledge in its background knowledge), *theoretical grounding* (i.e., using external warrants in the form of other theoretical knowledge that has a relation to the design knowledge at hand), and *empirical grounding* (i.e., applying and observing the design knowledge to provide a direct reference to empirical findings).

Formulation. Design principles are linguistic codifications of design knowledge. As the codification process requires condensing the knowledge into a retrievable shell, the careful crafting of these sentences is important. Prior research proposed templates to guide the formulation of design principles (Cronholm & Göbel, 2018). Our analysis of design principle papers indicates that the template as proposed by Chandra Kruse et al. (2015) is among the most frequently used (cited) ones. It reads as follows: "Provide the system with [material property—in terms of form and function] in order for users to [activity of user/group of users—in terms of action], given that [boundary conditions—user group's characteristics or implementation settings]".

Evaluation. Despite the fact that evaluation is one of the two main activities in DSR (i.e., building and evaluating, Hevner et al., 2004), we found only one evaluation framework explicitly tailored toward design principles. Iivari et al. (2020) presented a framework to evaluate 'minimum reusability' of design principles with five main criteria: easy to understand and implement (accessibility), represent important design elements (importance), communicate something new (novelty and insightfulness), be feasible and implementable (actability and guidance), and positively influence the design of an artifact (effectiveness).

Utilization and reuse. As accumulating design knowledge is a key issue in DSR (vom Brocke et al., 2020), knowledge needs to be reusable. Referring to design principles, Chandra Kruse et al. (2022) identified categories concerning 'what designers do' (e.g., guesstimating missing information, projecting into the solution space) and 'how designers apply the principles' (e.g., contextualization, extension, and refinement).

Overall, reflecting on the foundations above and related streams of research on design principles in particular, we observe that there is already a landscape of literature helping to design different aspects of those projects. However, to the best of our knowledge, we could not find more stepwise guidance providing a set of relevant activities that consider the peculiarities of developing, evaluating, and using design principles. Furthermore, even though available DSR approaches allow for iterations, a flexible method that is adaptable to specific situations and individual needs is especially promising for today's projects, such as in the context of digital innovation.

3. Research design

To develop a situational tool for design principles, we ourselves conducted a DSR study. Design is an established approach in the IS discipline (Gregor & Hevner, 2013) extending the boundaries of human and organizational capabilities by creating innovative artifacts. These artifacts are designed to solve a practical problem and provide utility (Simon, 1996). We employed a research process that is informed by the design science research methodology (DSRM) (Peffers et al., 2007) allowing us to integrate conceptual and empirical input as well as multiple iterations of the design artifact. Next, we describe the adoption of the DSRM by outlining three main groups of activities.

3.1. Problem identification and motivation

We started to specify the actual problem from two main sources: first, we synthesized prior methodical literature on guiding different aspects across the design principle life cycle (see Section 2). Second, we collected empirical data through a workshop with six design principle developers; three had successfully published principles and the three were in the development process. To position their level of experience, the participants classified their knowledge concerning DSR and design principles in particular via a 5-point Likert scale from 1-low to 5-high: familiar with DSR (4.33 avg.), familiar with DSR methodologies (4.17 avg.), familiar with the development of design principles (3.5 avg.). Based on the workshop several challenges could be extracted: (a) publishing design

research transparently and understandably to their peers and reviewers; (b) planning design projects, such as considering the main components and activities at the beginning of a project to be able to derive rigor design knowledge afterward; (c) handling numerous grounding sources, such as from theory or practical expert requirements; (d) having an appropriate structure of possible activities to guide throughout the design project and allow for collaboration with other actors.

Moreover, as an additional activity, we reflected on our own experience in developing and publishing design principles (reflection-on-action, Schön, 1983).

3.2. Design and development

We developed our artifact across three main phases. As a first phase, to ensure creating a method grounded in practical needs, we shed light on real-world design projects that have been performed. We invited designers who have published design principles either in the AIS Top Basket journals or leading conference proceedings across the last three years. In total, ten designers agreed to provide additional details of their papers through an interview. The interviewees cover different professional levels, experiences, and countries (see Table 1). All have conducted projects in the realm of digitalization, such as research on digital twins, analytics, digital transformation, or digital creativity.

Table 1. Overview of experts interviewed.

Experience in years	
<3	1 interviewee
3-5	5 interviewees
>5	4 interviewees

Followed paradigm	
ADR	3 interviewees
DSR	7 interviewees

All interviews were held virtually and recorded for transcription. The transcriptions were analyzed with an initial coding schema, which was informed by the related work on design principles (see Section 2). It covered activities, resources, and challenges that occurred during the design principle development. After the first analysis iterations, it was refined to capture a more complete picture of the development. One author coded all interviews, and two additional authors verified the coding. After about three-quarters of the transcriptions, no completely new insights could be extracted, pointing to a theoretical saturation.

In the second phase, we enriched the empirical data with insights extracted from papers presenting design principles. We strive to collect a representative sample. Therefore, high-quality papers from IS journals (i.e., an updated sample from Gregor et al. 2020 to include papers until 2021) and conference proceedings (ICIS, ECIS, DESRIST using AISeL and Scopus with search items "design principle" and "design theory" within title or abstracts) were selected. We screened each paper's full text and excluded those papers that do not explicitly report on design principles and research in progress. A sample of 157 papers was assembled, which was used to derive development activities for design principles and also for evaluating our proposed method.

Lastly, in the third phase, we consolidated the insights obtained from both the interview analysis and literature review by clustering the activities, techniques, inputs, outputs, and challenges in recurrent virtual meetings within the author team. In the spirit of agile work settings, which are often followed in innovative and creative projects, we decided to create a card deck. Card decks are well-accepted in research and practice for which reason they have been proposed for several purposes similar to this paper's aim, for instance, Scrum poker cards for agile work (Agile Stationery, 2022) and the IDEO method deck (IDEO, 2022).

3.3. Demonstration and communication

For demonstration purposes, we retrospectively applied the entire card deck to published papers acting as illustrative scenarios (Peffers et al., 2012). To do this, we examined two papers, mapped our cards with the activities reported in those papers, and demonstrate the method's ability to capture the project path.

4. Artifact description: Baustein tool

Next, we present '*Baustein*' (building blocks) (see Figure 1). We call it Baustein because of the analogy to other well-known games allowing us to create new products by recombining and adapting a predefined set of elements (here, method cards). As aforementioned, Baustein is inspired by card deck tools leveraging creativity, collaboration across disciplines and communities, as well as orientation in terms of procedures. Baustein's card deck distinguishes between the following two components:

- **Individual cards** represent a single activity to be performed. Each card is structured alongside areas for 'what' (guidance on choosing a suitable card for a development task at hand), 'how' (example techniques to achieve a certain outcome), 'inputs' (prerequisites and/or mandatory inputs to execute a card), and 'outputs' (results to be produced).
- **Modules** to represent more abstract clusters of what to perform, comprising several cards. Our method consists of 14 individual cards, organized along with four inductively created modules (see following sub-sections).

To use Baustein[1], designers can either start with a pre-defined strategy (e.g., Schoormann et al., 2022) or start with configuring their own approach. This reflects the fact that some designers are more likely to be guided with concrete compositions and activities to perform and others prefer to have full flexibility. Regardless of which entry is chosen, the design teams can assemble their strategies by means of the provided card deck. For additional support, we developed 'manual cards'. These describe the card deck's purpose, basic rules, possible combinations of cards, possible relations of cards (e.g., required input elements), and information on how to get started. With these manuals, designers get orientation navigating them through the cards and modules.

4.2. Module: Project organization

The first module comprises four cards to scope the problem space and strategize a DSR project.

In general, among the earliest activities of a DSR project are *problematization and need finding [**PROB**]*. Researchers formulate their intended purpose and the target user group(s) addressing a certain problem. Our literature analysis indicates heterogeneity in terms of how to problematize. As an example, some provided solution objects describing the tasks the artifact should be able to fulfill (Heinrich & Schwabe, 2014). To perform this activity, Baustein proposes a variety of techniques users can employ, including reviewing the literature, interviewing experts, or observing practice. Results can be formalized, for instance, in the form of solutions objects or research questions.

In contrast to starting with a specific problem, some designers begin with *envisioning and ideation [**IDEA**]*. Teams asked themselves what they want to do and why. This card supports the development of novel project ideas worthwhile to pursue. Therefore, creativity techniques can be applied or own observations can be discussed within a team of researchers. Outcomes can be new project ideas, indications for the relevance of an idea, and the motivation to implement an idea.

When facing a problem or having a promising idea, *planning and strategizing [**PLAN**]* should be done. Thereby, questions concerning the overall principle development strategy and the project setting (e.g., contextual factors) need to be considered. This card's goal is to assist users in operationalizing design knowledge endeavors. Researchers can rely on different techniques, including stakeholder maps to visualize actors relevant to a certain project or reflections on the level of engagement in a consortium. Typical outcomes are general strategies for producing design knowledge (e.g., inductive approaches vs. deductive approaches) and formulated overall project goals.

Before actually starting with the project, our interview analysis revealed activities for checking if the team is capable to perform this, a *feasibility check [**CHECK**]*. This card nudges users to reflect on their competencies and skills as well as access to resources relevant to achieving a goal (e.g., data from partners).

4.3. Module: Grounding and evaluation

The second module consists of three cards concerned with grounding and evaluating the design principles to indicate their applicability and usefulness.

The card for *grounding and conceptualization [**GROUND**]* subsumes techniques to learn from the past, such as reviewing literature and conceptualizing available knowledge by means of a taxonomy. It is intended to consider relevant knowledge which is already out there to build new artifacts and knowledge. Among the common outcomes are meta requirements (Walls et al., 1992) and conceptualized designs.

When having (initial) formulated design knowledge, empirical and theoretical evidence for its usefulness should be provided, for instance, through *ex-ante evaluation and justification [**ANTE**]*. Hence, this card deals with finding supportive indications already during a project to justify why the design principles work. Users might want to instantiate the knowledge through a situational artifact, such as a software system.

Typically, after several rounds of building and evaluation, final episodes for *ex-post evaluation and justification [**POST**]* are conducted. To do so, a range of evaluation techniques are proposed in the literature (Möller et al., 2021), such as instantiating the design principles into an artifact, getting feedback from experts, or providing logical arguments. Furthermore, Iivari et al. (2020) derived a five-criteria framework guiding the evaluation of design principles.

4.4. Module: Production and communication

This module provides three cards for building the actual artifacts and deriving design knowledge.

*Artifact building [**ARTE**]* addresses the creation of a situational artifact (March & Smith, 1995). Those artifacts can be produced with the help of different techniques and methods, including prototyping sessions and the act of implementation to make needs more graspable. Artifacts can be used to instantiate design already deduced design knowledge or serve as a foundation for extracting such knowledge.

[1] Baustein, including manuals, is available upon request.

The *knowledge formulation [**FORM**]* card deals with the question of how to synthesize the knowledge pieces collected during a project. Being informed by numerous potential inputs, such as meta requirements, design principles, and conceptual designs (e.g., architecture of a system), designers need to formalize the entire knowledge in an accessible way. Therefore, designers can draw on templates describing important principle components. For instance, as proposed by Cronholm & Göbel (2018) and Gregor et al. (2020).

After the knowledge has been formalized, a *target-user specific communication [**COM**]* should be considered. This card reminds designers to respect the actual target user group of a certain outcome and to present the outcomes appropriately. For example, while practitioners might be more interested in design features and visual mock-ups, academics might be more interested in general and abstract formulations (i.e., textual) to adapt them to other situations.

Figure 1. Overview of Baustein's card deck.

4.5. Module: Meta activities

Lastly, this module contains cards that can be used at single points but also (constantly) across a project.

*Refinement and revision [**REFIN**]* enable designers to review design principles and artifacts and formalize lessons learned about their applicability. By asking whether there are needs and indications for revising one of the products, including problem formulations, design principles, or system features, they are promoted to think about possible adjustments. Generally, revisions are made in the form of splitting, merging, abstracting, and contextualizing design knowledge. For example, in case a design principle is too abstract and does not provide impulses on how it can be implemented, one might want considering to contextualizing it.

An activity that is often mentioned during the interviews is captured as *abstraction level check [**ABS**]*. Through a distinct focus on checking abstraction levels of a single principle or an entire set of principles, the question about being too generic vs. being too specific can be reflected. Abstraction levels might be visualized via a hierarchy indicating sub-design principles and higher-order design principles (e.g., Wache et al., 2022).

In the spirit of hierarchies, designers also conduct a *dependency analysis [**DEP**]* in which relations between design principles are explored. This can be important as other types of prescriptive knowledge already stressed, for example, the relevance of sequences and specific orders (e.g., technological rules, Bunge, 1974).

As one of the most fundamental activities, design teams need to perform *reflection [**REFL**]*. By reflecting on what has been done (i.e., the process and the product of designing) knowledge engraved in artifacts can be extracted (Gregor & Jones, 2007; Möller et al., 2020). Our interviews particularly indicate that designers constantly asked themselves questions about whether the (interim) formalized knowledge captures all the relevant pieces as well as concerning the actual value added to the body of DSR knowledge. To do so, one might rely on conceptualizations to compare the insights from a project with the current state of knowledge.

5. Demonstration

To demonstrate the use of the Baustein card deck (*proof-of-concept*, Nunamaker et al., 2015), we apply Baustein retroactively to already published DSR papers dealing with projects in the context of digitalization. Thereby, we aim at visualizing unique project paths performed to achieve a certain goal, and with this, point to the need for flexible method adaption. For the presentation, we outline the aim of the study and then link the reported activities to the card deck's IDs.

Figure 2. Baustein application for Seidel et al. (2018).

5.1. Illustrative Example 1: Design principles for sensemaking support systems

Our first illustrative example is the paper authored by Seidel et al. (2018) providing design principles for sensemaking support systems in environmental sustainability (see Figure 2). The authors conducted a DSR study following Peffers et al.'s (2007) procedure model because it "allowed for multiple iterations of both the design principles and the development of an artefact (i.e., an information technology with certain material properties) to demonstrate and evaluate those design principles" [*PLAN*]. After formulating the problem across several iterations [*PROB*], an initial set of conceptual design principles was identified based on salient affordances required to support the sensemaking process [*GROUND*]. Therefore, scientific literature on sensemaking and affordances was used as a kernel theory. To formulate the design principles consistently [*FORM*], the paper draws on the template as proposed by Chandra Kruse et al. (2015) and defined the following principle style: "Provide the system with [material properties such as specific features] to afford users [activity of user/group of users], given that [boundary conditions]."

In the first round of development, demonstration, and evaluation, a prototypical web-based platform was implemented informed by the conceptual design principles [*ARTE*] and evaluated through users subscribed to the system and focus group discussions [*ANTE*]. The evaluation disclosed needs and potential for refinements [*REFIN*] leading to an adopted formulation of the design principle set [*FORM*].

The second round of development and evaluation started with specifying adjustments for the actual implementation [*REFIN*]; in the words of the authors: "the system was revised based on the findings from the first round of development". Following the revisions, the web-based platform was adjusted [*ARTE*]. The new version of the platform was again evaluated with active users (i.e., subscribers) and focus group discussions [*ANTE*]. As a result, additional needs for design principle revisions could be derived [*REFIN*], including the extension and adjustment of the set of principles (e.g., "implemented new design principles 3c").

In the third round of the project, revisions in terms of the system were synthesized [*REFIN*] and again translated into the platform [*ARTE*]. This final version of the system was evaluated through additional focus groups [*POST*] to examine criteria, such as usefulness (e.g., "more useful than the previous version"), user satisfaction, and understandability.

As the evaluation indicated promising results on the principle's usefulness, the entire process from the conceptual, theoretical-ingrained start across the empirical stages was reflected [*REFL*] and relevant insights, such as visual screenshots and the final set of the formalized design principles, were communicated by means of the paper [*COM*].

5.2. Illustrative Example 2: Design principles for learning analytics information systems in higher education

In a second use case, we apply Baustein to the paper from Nguyen et al. (2021) (see Figure 3). In the paper, a set of design principles to guide the development of learning analytics information systems is presented. The author's journey started with specifying an overall research approach [*PLAN*]. They followed Peffers et al.'s (2007) DSRM because it is "well suited for DSR, which's objective is to inform design principles." In accordance with the DSRM, a problem was formulated by reviewing available literature and synthesizing practical experience [*PROB*]. Moreover, the gap was already stressed by other scholars for which reason the authors argued for responding to available calls. The initial set of design principles was conceptualized from literature and kernel theories [*GROUND*] and formulated in an action and materiality-oriented manner [*FORM*]. Then, an artifact was implemented [*ARTE*], "[a] fully functioning prototype as a design instantiation [that] illustrates the established design principles."

With the prototypical implementation, two rounds of demonstration and evaluation were conducted. In the first round, the authors "demonstrate the prototype to users and gather their feedback" concerning utility, efficacy, and areas for improvement [*ANTE*]. These insights resulted in several refinements and extensions of the initial design principle set [*REFIN*]. In line with this, they "revised the design principles to address the issues experienced in the demonstration phase" [*FORM*]. Also, the system prototype was revised and updated to comply with the improved design principles [*ARTE*]. In the second evaluation round, by following a case study-based approach, several sources were surveyed and analyzed, including usage data of the system, a survey with students, and interviews with lectures [*ANTE*]. Again, refinements could be extracted [*REFIN*] leading to the adjustment of one design principle in particular [*FORM*].

Finally, the author team reflected on the entire project which went through theoretical and empirical phases as well as discussed the added value of the principles derived, such as concerning educational information systems [*REFL*]. All insights, including the final set of design principles, example screenshots of the implementation, a detailed overview of evaluation results, as well as contributions and implications were communicated [*COM*].

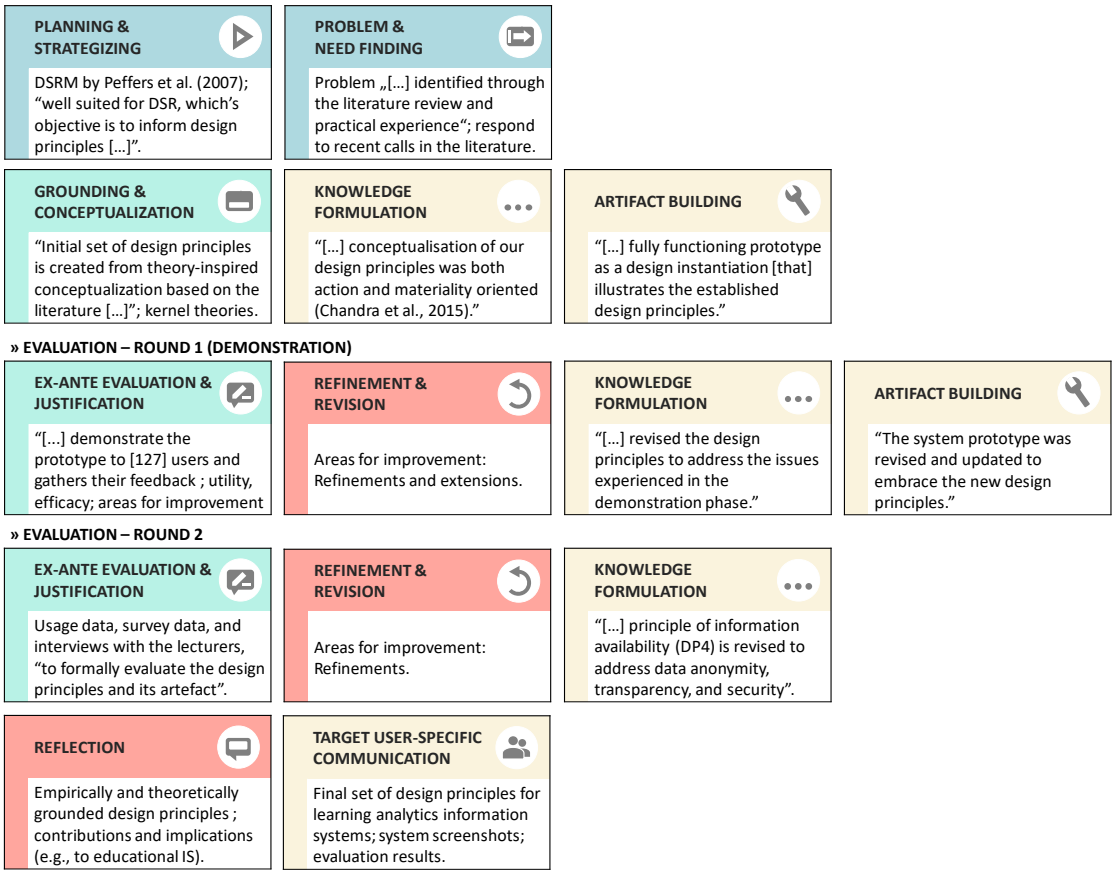

Figure 3. Baustein application to Nguyen et al. (2021).

6. Discussion

Today's projects dealing with digital innovation confront DSR researchers with new challenges, such as agility (e.g., design sprints) and complexity (e.g., large and interdisciplinary teams). These challenges require adaptability and reconfiguration of design practices. In this paper, based on triangulating prior literature, papers presenting design principles, and empirical data, we present *Baustein*. Baustein is a card deck consisting of 14 cards to visualize useful information, including activities, techniques, outcomes, and resources, as well as four major modules clustering cards.

6.1. Implications

Overall, our paper makes a fourfold contribution.

Flexibility. Given that Baustein is a card deck it allows for customization to fit individual project environments coined by various factors, such as team distribution and research consortia. To respect this, Baustein is situational, which can be more sequential, iterative, or even agile. Thereby, we seek to meet the tensions between restricted and standardized procedure models (e.g., challenges of squeezing a DSR project into a predefined framework) and completely free methods specifying almost no specific steps to follow.

Transparency. Card decks are well-known to leverage creativity but also transparency of design paths; also of rather messy and iterative processes. These benefits seem especially important in nowadays DSR projects containing numerous actors across disciplinary and institutional boundaries. Transparency enables additional participation because it is 'open' to other stakeholders and actors. Since Baustein is informed by real-world principle development paths, the mapping of predefined cards and activities is supported. In addition, visualizing project paths allows exploring patterns (e.g., Vaishnavi & Kuechler, 2015) for the development of design knowledge.

Navigation. The Baustein method helps scholars and practitioners in navigating through and justifying different steps to be (possibly) performed to derive design knowledge. This will reduce ad-hoc decision-making in terms of how to design such a project. Thereby, Baustein highlights steps that tend to be neglected. As an example, the 'grounding and

conceptualization' card reminds designers to build upon already published literature to foster knowledge reuse. This is important as we see that some papers produce new design principles that are often well-built but not embedded in the available body of research.

Supplement. Although Baustein can be applied as a standalone approach, it is not intended to be a replacement for existing and well-accepted design paradigms (e.g., Hevner et al., 2004) but rather a complement based on real-world insights. Comparable to the business model domain in which card decks are used to complement and add additional information to an underpinning structure (e.g., using specific cards to fill out the structure as proposed by the 'business model canvas'), designers might use Baustein in combination with other tools and methods. For illustration, one might start with an overall procedure-based structure of a DSR project as suggested by Peffers et al. (2007), and then get impulses for specific design knowledge-driven activities by our method, such as how to refine (card '*REFIN*') and formulate design knowledge (card '*FORM*'). In case researchers are highly engaged in an organizational context, one can begin with an active search for problems as suggested in ADR (Sein et al., 2011) and draw on our cards for additional support, including how to perform reflection (card '*REFL*'). As other illustrations, researchers can make use of Baustein to assemble and document DSR journeys (e.g., vom Brocke et al., 2021) or put Baustein cards to visual grids (e.g., Möller et al., 2021).

6.2. Limitations and outlook

Whereas Baustein is intended to meet the tradeoff between strictly following a procedure and complete freedom, some designers might prefer one of these poles. For instance, novel researchers might prefer having detailed guidance and more experienced researchers might prefer more freedom. Thus, different types of presenting information on the cards can be validated (e.g. Hwang et al., 2020). Baustein still requires effort to select and configure the different cards to a consistent approach. Although manual cards guide the usage, the next steps include creating additional insights concerning the preferences of different user groups. Referring to the grounding, even though we draw on a rich body of empirical and conceptual data, additional sources can lead to new findings and refinements. As another limitation, while this paper provides initial evidence of the proof-of-concept, we plan to move towards proof-of-use and proof-of-value by incorporating more naturalistic evaluation settings (Nunamaker et al., 2015). In this paper, we decided to underpin our project with insights from card decks. Card decks are widely accepted as tools for supporting purposes, including representation of research paths, shared understanding (e.g., Roy & Warren, 2019), and innovation (e.g., Ebel et al., 2022). Nonetheless, other underpinning approaches could be used that share similarities with our aim, such as from research patterns (e.g., Vaishnavi & Kuechler, 2015). In doing this, common configurations of the cards could be explored in the next steps as well as aligned with general DSR strategies (e.g., Schoormann et al., 2022). Lastly, the initial idea of our larger project was to create guidance for the development of design principles. However, through several design iterations and getting insights into how other DSR outcomes were typically designed in real-world situations, such as the implementation of prototypes, we are confident that Baustein is capable of supporting other DSR project aims as well.

7. Conclusion

With this work, we hope to (a) support principle developers in navigating through essential steps and making (more) informed decisions in terms of development strategies as well as (b) open and leverage further discussions on how to guide the actual building and evaluating process. Our paper provides a flexible and configurable method taking into account today's agile work practices. Thereby, it has promising potential to ultimately foster (digital) innovation and conquer our society's important challenges.

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