The Design Framework: An Organizing Artifact for Enhancing the Fidelity of Educational Research, Implementation, and Assessment

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Abstract: *Design* provides a unifying metaphor for describing research across fields of education. We propose a *design framework* as a visual and cognitive representation to unify the discourse of educational researchers, instructional designers, teachers, and policy makers by providing a common vocabulary of practice. An artifact-based design perspective illustrates how education research can be conducted to investigate intended design outcomes, to critically study the mismatch between stated and unstated intentions and outcomes, and to evaluate studies that trace learning outcomes from designed learning interventions. We then explicate three applications of the design framework to different fields of educational inquiry.

Focus of the Symposium

We argue that design provides a unifying metaphor for describing research across fields of education. As education continues to grow as a field of inquiry, the different research traditions used by educational researchers continue to fragment the discourse. This presents a considerable problem for researchers who attempt to communicate across discourses as well as for researchers who seek to communicate research findings to a broader public. We propose a *design framework* as a visual and cognitive representation to unify the discourse of educational researchers, instructional designers, teachers, and policy makers by providing a common vocabulary of practice.

Significance

Contemporary education researchers explore a remarkable diversity of questions under the guise of educational research. However, while education departments have become an academic growth industry, educational researchers continue to struggle for the professional identity of their field. Some writers attempt to draw out the defining characteristics of the field in terms of research that is truly educational (Ball & Forzani, 2007) or scientific (Slavin, 2002; Feuer, Towne, & Shavelson, 2002). Others have situated the "problem" of educational research in the institutional and political culture of education schools (c.f. Levine, 2005; Clifford & Guthrie, 1988, Powell, 1980). Ellen Lagemann (2002), for example, locates the origins of the fractured identity of educational research in the early history of the field. Achieving respect for a new field of study in the world of academia led early educational researchers to "emulate their brethren in the 'hard' sciences (or at least the more developed social sciences)" (p. xii). Many educational researchers latched onto prevailing standards of academic quality in fields such as sociology, psychology, economics, linguistics, critical theory, or the humanities in order to legitimize their own work. The search for respect was compounded, according to Lagemann, by the lower status of people attracted to the field of educational research, which in turn reinforced the field's quest for legitimacy both in schools of higher learning and with the public. The quest for legitimacy often resulted in an uneasy double standard in which mainstream academic researchers continued to question the necessity of separate departments dedicated to (substandard) educational research, while advocates of disciplinary fidelity within education zealously enforced perceived standards of methodological rigor. This internal conflict within the field often resulted in the wholesale dismissal of educational research from legal disputes, policy making or local school governance issues in favor of experts in disciplines outside of education, and further marginalized educational researchers from participating in public discourse. The quest for legitimacy via disciplinary affiliation has diverted educational researchers from "pondering what distinctive characteristics might compromise rigor and relevance in this particular domain of scholarship" (Lagemann, 2002, p. xii).

The number of scholars thoughtfully revisiting the identity question indicates the felt need for educational researchers to understand their work as members of a field. This symposium offers a new approach intended to revive discussion about what constitutes the distinctive characteristics of education and how these characteristics might shape educational research. We consider the idea of re-organizing the educational research discourse around the concept of design. We begin by exploring the definition that education is design for learning, and tracing how

this definition fits examples of education from different fields of study. Our discussion moves beyond the contemporary discussion of the legitimacy and value of design research as an educational research method. To that end, we develop a model to demonstrate how design can be seen as a powerful analytic model for understanding education.

We begin by presenting the idea of an artifact, that is, a policy, program, curriculum, assessment, or other device implemented to influence the learning of others. Education is facilitated as teachers and learners work through and with artifacts to shape learning. Artifact characteristics can be analyzed in two directions – either from the perspective of the features that designers build into artifacts to influence learners or from the affordances that learners perceive as the key characteristics of the artifacts. An artifact-based design perspective illustrates how education research can be conducted to investigate intended design outcomes, to critically study the mismatch between stated and unstated intentions and outcomes, or to evaluate studies that trace learning outcomes from designed learning interventions. We also trace how a design-based model can both capture the strength and spirit of current approaches to educational research and also integrate previously fragmented approaches into a unified model for educational research.

Our approach is intended neither to decry the low status of our field nor to elevate one perspective of the research landscape at the expense of others. Instead, we hope the design perspective will show how our research methods follow from distinctive characteristics of our interests, and we will illustrate how a unified design perspective allows educational researchers to ask new questions that bring educational inquiry into a more mature state of disciplinary self-sufficiency.

Symposium Presentations

1. A Modest Proposal: A Design Framework to Unify Educational Discourse

Rich Halverson and Erica Rosenfeld Halverson

We begin our discussion of a unifying framework by defining education as *design for learning.* By understanding education in terms of designs to influence learning, educational research then becomes about the development, implementation, and study of artifacts that influence learning. Seen from this perspective, educational research necessarily draws on methods and theories developed in psychology, sociology, economics, linguistics or neurology, but the focus on design sets its interests apart from these disciplines and establishes the need for an independent discourse.

We propose a framework that centers on a concept of the *artifact* (Halverson, 2002; 2004). Artifacts can be policies, programs, or pedagogical tools that individuals employ to promote, evaluate, or understand learning. Artifacts are the devices or tools implemented to influence action. The concept of artifact plays a central role in a design theory of education. Artifacts belong to the family of "meditational means," that is, the networks of tools, structures and languages that co-constitute human action (Wertsch, 1998). In common use, artifacts refer to material things such as pens, computers, cars, or groceries (c.f. Norman, 1991). These products are created for purposes that address, extend, or transform the practices of others.

The central analytic concepts involved with artifacts are *features* and *affordances*. Designers build features into artifacts, and these features reflect the ways that designers hope to influence the thinking and practices of artifact users. Designers create artifacts with certain intended uses in mind. They "inscribe" intended uses into the features of the artifact. A feature is an aspect of an artifact developed to support a possible use. Light switches, radio dials, cup handles, and paperclips all have features designed to support intended uses. More abstract artifacts, such as policies and textbooks, include features such as incentives for compliance and assessments with answer keys. Affordances, on the other hand, describe the ways that users perceive artifact features. Affordances reflect the perceptions, sense making, and pre-conceptions of users. We argue that the gap between artifacts and features, between intended and actual uses, and between design and implementation, constitutes the field in which most education research takes place. Artifacts completely enclose the space in which educators work, live, and even think. While the importance of artifacts are clearest in the context of research in classroom-based learning environments, artifacts are also central to non-classroom based research such policy research that measures the impact of teacher pay-for-performance models in school districts or essays criticizing the theoretical conceptualization of the achievement gap.

The visual representation of the design framework (see Figure 1) positions an educational "artifact" in the center of the research endeavor, as represented by a triangle. Within the triangle are the features and affordances of the artifact. The features of the artifact are generated based on the *intentions* of the artifact's designers, such as

increasing student learning outcomes, decreasing drop-out rates, or improving teaching retention. Since the intentions are established by the designers, who are often external to the setting in which the artifact will be implemented, the artifact's features represent use as idealized by designers. When we examine the intentions, we find that they inform the artifact that is developed all the way through the design process.

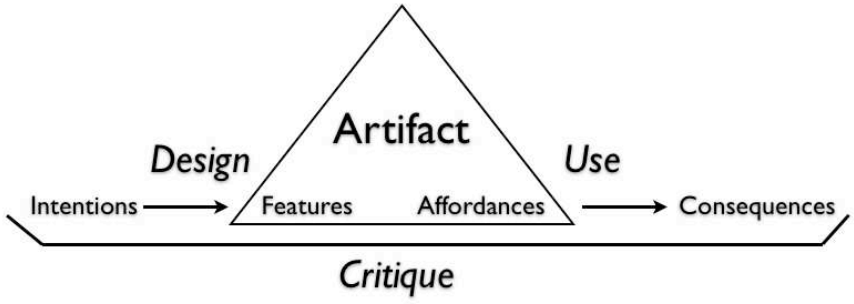

Figure 1: Visual representation of the design framework. Focus is on deconstructing the artifact by examining its intentions, consequences, and critical aspects.

On the right side of the artifact triangle are the *consequences*, or intended outcomes, of the design. Consequences are informed by the artifact's affordances, that is, the way the artifact is taken up by users. By examining consequences, we may find the answer to questions like: As a direct result of the implementation of this design, did students' test scores increase? Did drop-out rates decline? Or did the school retain a higher percentage of teachers, compared to previous years? The consequences of a design can be used to evaluate the artifact and determine whether a program, policy, or initiative was successful, as measured by the outcomes' congruence with the original intentions. In addition, consequences can and should be used to inform future designs, whether these are iterations of the present design or new design innovations.

And finally, the entire design framework is subject to the *critical* perspective, which sets the design within a sociocultural and historical framework. The critical perspective allows us to analyze how the implementations of designs are products of social and political contexts, how schools use designs to effectively (if unintentionally) reproduce dominant cultural ideologies, and how the positionality of designers can significantly affect the design process and, therefore, the potential success of implementation. When we consider education as design for learning, educational artifacts are ubiquitous and, consequently, the design framework serves as a visual representation for multiple aspects of the domain of education.

Artifacts provide occasions for tracing how practices occur and evolve. By studying how artifacts are developed and used in educational contexts, researchers can not only observe how teaching and learning changes, but they can also investigate practices prior to alteration. Much of educational research can be characterized as advocacy research in which a group promotes a particular method/artifact/program as a viable path to changed practice. A design-based perspective can reveal how artifacts might change practices and also shed light on the practices that artifacts intend to change. Artifact design and use can be analyzed as a form of asynchronous communication between designers at every level, from policy makers to local school curriculum creators, and the practitioners who work with artifacts.

The potential for understanding education as design for learning comes from the ways in which this imperfect method of communication fails, iterates, compounds, or is exapted by the circumstances of practice. A design perspective illustrates the four key occasions in which artifact design allows for investigating education: 1) translation of intention into artifact features; 2) the perception of features as affordances; 3) impact of affordances on practice; and 4) the relation of the artifact design/implementation cycle in a wider institutional, social, and political contexts.

Applications of the Design Framework

We will present three applications of the design framework to different fields of educational inquiry. The first focuses on how the design framework can be used to encourage collaboration between classroom teachers and researchers. The second contemplates the design framework as an organizational tool for understanding the

practices of youth media arts organizations. The final examines the mismatch between features and affordances as a path toward understanding the implementation of a large-scale instructional policy.

2. Using the Design Framework as a Metarepresentation to Facilitate Teacher-Researcher Collaboration

Dana Gnesdilow and Jen Scott Curwood

Often, when one educational design fails, the response is to try another design rather than closely inspect the potential disconnects between the designers' intended features and users' perceived affordances. A design-based perspective on classroom curricular interventions may inform subsequent iterations of the design, which can benefit teachers, researchers, and students alike. Our theoretical work draws from the field of participatory design research to highlight the need for the utilization of the design framework as a metarepresentation to foster collaboration between teachers and researchers. Furthermore, it highlights six ways in which the design framework can be applied throughout the process of planning educational innovations to minimize disconnects that may occur between design, implementation, and iteration.

Metarepresentations allow individuals to more readily perceive and comprehend patterns that the unaided mind may overlook or dismiss. This alleviates an individual's need to keep track of complex information, providing "mental space" for higher order thinking (Norman, 1994). Several researchers in the participatory research field advocate for the use of a tool, such as a metarepresentation, to address perspectives of all members of a design team (Arias, Eden, Fischer, Gorman, & Scharff, 2000; Blomberg, Suchman, & Trigg, 1996; Kankainen, 2003; Maguire, 2001; Veryzer & Borja de Mozota, 2005). With this in mind, we suggest that the design framework will function as both a visual and a temporal metarepresentation to illuminate the design process. As Edelson (2002) notes, "Engaging in design as a research process means taking the elements of design that typically remain implicit in design and making them explicit" (p. 117). We seek to emphasize how the design framework can serve as a tool to facilitate productive interactions between teachers and researchers by explicating the entire process of educational research by serving as a metarepresentation.

We envision the design framework as having six specific applications within educational research: 1) as a visual tool to elucidate research design and development to all constituents involved in the design process, 2) a co-planning tool, 3) as a reference point for reflection during design implementation, 4) as a means to summatively assess the effectiveness of the research design and its implementation, 5) as a tool to re-envision the design for future iterations, and 6) as a means to record the intentions, implementations, and outcomes of the design process over multiple iterations. We conceptualize each of these six applications as a way to promote communication and collaboration between teachers and researchers during the design process manifesting greater fidelity in implementation and resulting in enhanced educational outcomes. Additionally, we believe that the design framework as a metarepresentation can be used to examine policies and craft interventions by deconstructing the design process after it occurs, in order to understand disconnects or implementation issues.

3. Artifact Families: An Affordance of the Design Framework

Michelle Bass

The design framework affords us the opportunity to see sameness and difference between similar artifacts. Many artifacts share similar, or sometimes identical, components which include features, intentions, and stated outcomes. Here, I present the idea of *artifact families* as a way to organize and describe artifacts that share design framework components.

The structure for the idea of organizing artifacts into families comes from the field of organization studies. Organization studies researchers are starting to explore positioning their work as a science for design, which "puts the interplay between organizational entities and phenomena as artifacts and as social facts at the center" (Jelinek, Romme, & Boland, 2008, p. 320). The authors contend that science for design can "bridge the worlds of theoretical and practical significance" (Jelinek et al., 2008, p. 317). They continue,

> According to Simon (1969) *science* views existing organizational systems as empirical objects from an outsider perspective, while *design* envisions systems that do not yet exist…Simon foresaw that a design science approach could help overcome the isolation of specialists by providing a common ground for

> bringing our diverse interests together in a search for more desirable states of (organizational) affairs. (p. 317-318)

The idea of isolation of specialists is true amongst researchers who study youth media arts organizations (YMAOs). YMAOs vary by participant demographics, geographic location, types of media produced, mentorship practices, and many other features. The complex variety of possible feature combinations results in difficulty comparing across organizations. Despite this fact, researchers continue discussing YMAOs as one type of artifact. I provide a worked example of organizing YMAOs into artifact families. This discussion begins with a critique regarding the field of multimedia literacy's overly simplified comparison of all varieties of YMAOs to draw overarching conclusions about these programs' impacts on youth. I then focus on a nested family in the larger artifact family of YMAOs, those that work specifically with youth to help them create identity-focused films (IFF).

Intentions of the organizations are determined through analysis of mission statements, followed by an examination across programs' major features, identified as staffing, entrance, core process, and retention, for the similarities and differences that make each a unique member of the identity film focused YMAO family. I also propose the idea of creating cross family memberships for IFF members by adding to their intentions and features, looking specifically at how these programs could focus on serving as a piece of their adolescent participant's transition process to college.

Identity film focused youth media arts organizations are one of many artifact families in the field of educational research. The idea of artifact families should not be conceived of as revolutionary or subversive. Rather, I hope that using the frame of science for design from the field of organization studies can help make discussions of artifacts in the field of education more understandable and less ambiguous.

4. Branching Up, Out or Off: How Features Become Affordances

Anne Karch

I look at the section of the design framework between intentions and consequences, where the designed features of the artifact become affordances, or not, in the use or operation of that artifact. I suggest that the process by which artifact users afford themselves of its features is an organic one in which emergent uses can sprout and grow from the original designed features. I offer the metaphor of a tree and its branches for this process and show how the design framework gives us a closer view of the mismatch between features and affordances than in fidelity of implementation analysis.

The artifact I examine is a policy for educational reform: the Wisconsin Student Achievement Guarantee in Education (SAGE) program, which is in place in over 500 elementary schools across the state. The design for this program is laid out in Wisconsin state law with the intention of increasing the levels of academic achievement of low-income students. SAGE law calls for schools to use four "improvement strategies," including: reducing student/teacher ratio to 15: 1 in grades K through 3rd; keeping schools open extra hours in order to provide recreational, educational, social and community services to students and their families; offering a "rigorous curriculum" in those smaller classes; and "staff development and accountability" (General School Operations, §118.43(3)). These strategies are the four main features of the law.

SAGE is an interesting artifact because its features are clearly spelled out in the law, yet researchers who have followed the progress of schoolchildren participating in SAGE have found that 'achievement' is not 'guaranteed' to all; SAGE schools have shown widely varying levels of academic success (Graue, Hatch, Rao, & Oen, 2007; Graue, Rauscher, & Sherfinski, 2008; Zahorik, Molnar, & Smith, 2003). Perhaps not surprisingly, researchers have found that SAGE does not look the same in each of the schools, even within the same district or sometimes across grades in the same school. A fidelity of implementation analysis would look at the enactment of SAGE, searching for ways it had not been "done right" at the low performing schools (Firestone, Fitz, & Broadfoot, 1999; Lee, Penfield, & Maerten-Rivera, 2009; O'Donnell, 2008; Spillane, Reiser, & Reimer, 2002). A design approach requires us to look first at the policy itself to see intentions, and then examine how its features are seen as affordances and whether those affordances still match the intentions (Norman, 1994; Spillane et al., 2002).

I consider each of the four features of SAGE, plus the fifth feature of funding, looking at its designed intent, the affordance(s) or perceived affordances it offers, and the way it is appropriated by the users, highlighting mismatches between intent and affordance where they occur. Then, using the tree metaphor, I trace the branching growth of the feature as schools afford themselves of it, sometimes causing more branches to grow up or out, sometimes breaking off. Where there is a match between a feature's intentions and affordances, there is growth. When there is a mismatch, the branch breaks off, although the user may adapt it for another purpose. I also show how the interaction between affordances, like interlocking tree branches, can lead to more vigorous growth. For education policy, the

design framework allows for detailed analysis of what happens between intentions and outcomes and offers the possibility of fine tuning, through the recursive process of redesign, of features to create better matches between intentions and affordances.

Implications

We argue that the design framework can facilitate the examination of the design and implementation of educational initiatives by supporting cognition, communication, reflection, and generative questioning across space and time. By tracing the design process from its inception to its implementation and through its evaluation and subsequent iterations, we will suggest that policy makers, researchers, educational leaders, and teachers can clearly communicate their goals and needs to each other while working to increase the fidelity of reform initiatives. In addition, by integrating users (and their experiences) into the design process early on, real-world practices can inform an iterative design process, leading to greater faithfulness in enacting the intentions of the artifact.

We believe that the design framework can be used to communicate and explicate educational initiatives to all stakeholders, including superintendents, principals, community members, parents, and teachers. In this symposium, we look specifically at three examples: educational interventions that involve teacher-researcher collaboration, a youth media arts organization, and an intervention program for low-income elementary students. In each, we note that, on a very basic level, designs or reforms are often unsuccessful due to what Bernstein (1990) refers to as problems with *recontextualization*. In this model, researchers in any domain in academia work in a primary context, concerned mainly with the construction of new knowledge and the production of particular types of discourse. Those who make decisions about what takes place in schools, a secondary context, make judgments about what discourse and knowledge, produced within the primary context, is important to teach as well as how this information should be taught. In other words, those who make decisions about what is important for student to know, such as text book writers, policy makers, arts organization leaders, government officials, and superintendents, recontextualize what has been produced in the primary context for use in the secondary context.

When policy makers and designers designate schools and teachers who have not been privy to the design process as the agents of implementation, disconnects between the intentions of the innovation and actual school and classroom enactments often occur. To alleviate problems such as this, several researchers have advocated for the development of overarching representations to facilitate intersubjectivity (Arias, Eden, Fischer, Gorman, & Scharff, 2000; Blomberg, Suchman, & Trigg, 1996; Kankainen, 2003; Maguire, 2001; Veryzer & Borja de Mozota, 2005). Using the design framework as a metarepresentation for the field of education, the papers presented in this symposium focus on investigating the issues of fidelity of educational policy initiatives and the coordination and organization of ideas to minimize the disconnects that can occur. We suggest that, as a metarepresentation, the design framework can serve three key purposes. First, it can be used as a tool to understand the design process; in this way, it can be useful to those who work to plan, create, and implement reform initiatives. The design framework can be invaluable for individuals who seek to research teaching and learning, and it can offer an analytic, research-based perspective on the process as it occurs. Second, the design framework can also be used as a way to understand how to examine policies and craft interventions, and it can offer perspective on the process of making and implementing policy. Lastly, it offers a way to deconstruct the design process after it occurs, in order to understand the resulting disconnects or implementation issues.

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