
Research by Design: The Promise of Design-Based Research for School Library Research

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The field of school librarianship continues to grapple with the twin concerns of a gap between research and practice and a shortage of usable, middle-range theories generated within the discipline. Design-based research (DBR), a methodology developed over the past two decades in the education field, offers a promising means of addressing both of these concerns simultaneously by placing research, design, practice, and theory generation into a real-world context. This article addresses the need for such a methodology in the school library field, provides an overview of design-based research, summarizes some of the benefits and criticisms of this methodology, and suggests specific ways in which the school library field might make use of this approach.

Age.

"I believe that we should also be open to the possibility that design-based research is a fundamental mode of scholarly inquiry that is useful across all fields of the academy" (Bell, 2004, p. 251).

The field of Library and Information Science (LIS) has long been vexed by two related concerns: first, a recalcitrant divide between research and practice (Bowler & Large, 2008; Crowley, 2005; Cruickshank, Hall, & Taylor-Smith, 2011), and second, a shortage of usable, middle-range theories generated within the discipline (Chatman, 1996; Kim & Jeong, 2006; Kumasi, Charbonneau, & Walster, 2013). Design-based research (DBR), a methodology developed over the past two decades in the education field, offers a promising means of addressing both of these concerns simultaneously by placing research, design, practice, and theory generation into a real-world context. This article addresses the need for such a methodology in the school library field in particular, provides an overview of design-based research, summarizes some of the benefits and criticisms of this methodology, and suggests ways in which the school library field might make use of this approach.

Problems of Theory and Practice in Library and Information Science

Design-based research was developed in part to address the intractable divide between theory and practice in the field of education (Brown, 1992), a divide that has been the focus of much concern in

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educational research since at least the turn of the 20th century. It was then that John Dewey remarked upon the schism between researchers and teachers and the “simple” yet profound differences in their aims and desired outcomes. He likened this blindness of each to the efforts of the other to a “‘great big battle’... fought with mutual satisfaction, each side having an almost complete victory in its own field” (Dewey, 1904, p. 10). Similarly, the LIS field has also grappled with a research-practice gap (Crowley, 2005). A study of LIS research impact in the UK found a widespread disconnect between published LIS research and the community of LIS practitioners (Cruickshank et al., 2011). Practitioners who participated in this research program perceived most LIS research as remote from their daily work and unresponsive to their actual needs. The source of this gap is not singular: differences in knowledge, cultures, motivations, and terminologies between researchers and practitioners all play a role in creating and sustaining the divide, among other elements (Haddow & Klobas, 2004).

Responding to the theory-practice divide, Crowley (2005) called upon the LIS community to develop “useful” theory, which he defined as “mental constructions that reflect, to some degree, ‘how things work’ in real-world contexts” (p. 7). Yet theory development is a second obstacle for the LIS field. In an influential article, Elfreda Chatman addressed the need for LIS researchers to deepen the theoretical knowledge of the field:

As researchers who wish to develop theory, we must identify problems central to our field. The basis for this argument is that once these problems have been identified, we might be led to the formulation of conceptual issues that underline these problems.... [In the LIS field], we have no central theory or body of interrelated theories we can view as ‘middle range.’ In light of this discussion, it would appear we are currently focused on the application of conceptual frameworks rather than on the generation of specific theories. (Chatman, 1996, p. 193)

More recent research confirms the continued relevance of Chatman’s commentary, finding that most published scholarship in the LIS field fails either to contribute to existing theory or to generate new theory (Kim & Jeong, 2006; Kumasi et al., 2013; Pettigrew & McKechnie, 2001). In fact, the very definition and nature of theory are still under negotiation in LIS (Gregor, 2006), which is perhaps not surprising given the multidisciplinary nature of the field. All of this is not to say that there are no LIS-specific theories to be found or that LIS research never employs theory; in fact there are quite a number of theories that have been developed or widely used by LIS researchers (c.f. Fisher, Erdelez, & McKechnie, 2005 for an overview of these theories). However, calls for additional and novel theory development work in LIS continue, particularly for theories that might help to address the research-practice gap (Crowley, 2005; Kumasi et al., 2013). To borrow once more from Dewey (1904), “We should remember that there are times when the most practical thing is to face the intellectual problem, and to get a clear and comprehensive survey of the theoretical factors involved” (p. 42). In other words, despite the perceived differences between theory and practice, sometimes the former is the best way to solve the problems encountered in the latter. Design-based research, as explained below, has the potential to help school library researchers and school librarians address both the research-practice divide and the shortage of useful theory being generated within the field.

Design-Based Research

Design-based research is based on the work of Brown (1992) and Collins (1992), who attempted to systematically design and study classroom innovations in real-world contexts using engineering

principles with the goals of developing student knowledge, design principles, and theory simultaneously. Other phrases have been used to denote this approach, such as “design experimentation” or “design research,” but in general the term design-based research is preferred since design experimentation implies a controlled experiment and thus is too narrow to encapsulate DBR, while design research is overly broad and may be confused with studies in which a design is developed and refined out of context (Sandoval & Bell, 2004). It is worth noting that DBR is also distinct from Hevner’s (2004) “design science,” a framework in use in the Information Systems field. The DBR approach emerged from an acknowledgement of the inadequacy of laboratory studies for generating valid, useful theoretical knowledge about teaching and learning and the inability of ethnographic methods to affect change in classroom practice (Barab & Squire, 2009). Design-based research is an iterative approach that focuses on the *in vivo* development and implementation of an educational intervention (such as a new curriculum). DBR studies have the twin goals of developing an intervention in the real world and generating new theoretical knowledge that impacts practice (Anderson & Shattuck, 2012; Barab & Squire, 2009; Design-Based Research Collective, 2003; McKenney & Reeves, 2013).

In the early 2000s, a series of special issues in influential journal articles put DBR on the map within the field of education and helped to define and delimit the approach (these special issues are *Journal of the Learning Sciences*, 13(1), *Educational Researcher*, 32(1), and *Educational Psychologist*, 39(4)). Since that time, increasing numbers of DBR studies have been published each year in educational journals and the field has continued to refine the boundaries and key features of the methodology (Anderson & Shattuck, 2012). One recent literature review of DBR identified eight defining characteristics of a DBR study: 1) situated in a real context, 2) focused on the design and testing of an educational intervention, 3) using mixed methods, 4) involving multiple iterations, 5) involving collaboration between researchers and practitioners, 6) yielding design principles and theoretical knowledge, 7) distinct from action research, and 8) having a practical impact on practice (Anderson & Shattuck, 2012). A response to this review also highlighted one additional defining feature of DBR, namely that it departs from a problem of practice (McKenney & Reeves, 2013). These features are summarized in Table 1.

One example of a prototypical design-based study in education is the passion school model developed and tested by Diana Joseph and others (Collins, Joseph, & Bielaczyc, 2004; Joseph, 2004). The problem of practice identified in this case was a lack of learner motivation and engagement in traditional classrooms. Joseph and a team of co-researchers and practitioners designed the passion school model as an intervention designed to combat this problem. The initial design was informed by existing literature and educational theory. In the passion school model, students were grouped not by age level but by interests, and they were taught core skills and concepts by engaging in work that was personally meaningful. Specifically, Joseph’s initial intervention involved a curriculum in which groups of students created films on topics of shared interest. This intervention was tested in a real classroom with real students, and was refined both during and after the initial implementation. A variety of data was collected using mixed methods to assess the effectiveness of the design related to student learning. The project went through two additional phases of design, refinement, and testing over the course of several years. Project outcomes included the refined curriculum design itself, evidence of student learning among the project participants, a set of more general design principles to guide the development of engaging curriculum outside of the initial context of the study, and contributions to theory on learner engagement and motivation.

Table 1. Defining features of design-based research. Based on Anderson & Shattuck, 2012 and McKenney & Reeves, 2013.

Situated in a real context	DBR studies take place in vivo in real-world contexts such as a classroom rather than in artificial settings such as laboratories. This contributes to the ecological validity of the study.
Departs from a problem of practice	Identification and thorough understanding of an existing problem of practice are necessary first steps for a design-based study. Initial design of the intervention is in response to this problem and is informed by relevant literature, theory, and practice.
Focuses on the design and testing of an educational intervention	An initial intervention is designed, carefully documented, and continuously refined throughout the study.
Uses mixed methods	The DBR approach does not restrict researchers in their specific choice of methods of data collection or evaluation. Methods are chosen based on their ability to address research questions and may be changed as necessary based on the progression of the design.
Involves multiple iterations	The designed intervention is continuously refined throughout the study and may go through many iterations before the research program is complete.
Involves collaboration between researchers and practitioners	Researchers and practitioners work closely with one another to design and implement the DBR study. In many cases, the researcher and practitioner are one and the same.
Yields design principles and theoretical knowledge	The goal of a DBR study is not only to fine-tune a specific intervention, but also to derive more general design principles, models, and middle-range or grounded theory. DBR studies should result in knowledge that is usable beyond the original context of the research.
Distinct from action research	The focus on advancing theoretical knowledge and generating theories that “do real work” distinguish DBR from action research, which is typically conceived only to meet local needs.
Has a practical impact on practice	A primary focus of DBR studies is improvement of educational practice, not only within the research setting but also for practice more generally conceived. This connection to practice is heightened by the situated nature of DBR studies.

The Role of Theory in Design-Based Research

As with any methodological approach, not every project under the banner of design-based research hews as closely to the prototypical DBR study as the passion school model described

above. One area in which many design-based studies fail to adhere to the idealized norms for this form of research is in theory development (Dede, 2004; diSessa & Cobb, 2004). While most definitions of design-based research emphasize theory development as a primary goal of this form of research (e.g., Cobb, Confrey, diSessa, Lehrer, & Schauble, 2003; Design-Based Research Collective, 2003), published scholarship in the field does not always contribute new theoretical knowledge (Dede, 2004; diSessa & Cobb, 2004). Yet, a focus on the generation of theory grounded in real-world context is precisely what sets design-based research apart from other methodologies such as laboratory experiments, action research, or engineering design studies (Anderson & Shattuck, 2012; Barab & Squire, 2009). It is also the feature of the DBR approach that could be most useful for the school library field, so the role of theory in design-based research deserves a bit more attention.

DBR is fundamentally pragmatist in nature (Anderson & Shattuck, 2012; Barab & Squire, 2009) and always maintains an eye toward the usefulness of its findings to practitioners in the field. Theories generated by such research are accordingly not judged primarily by their usefulness to scholars but by their “ability to produce changes in the world” (Barab & Squire, 2009, p. 6). Cobb et al. (2003) described DBR’s relationship to theory in this way: “Theories developed during the process of experiment are humble not merely in the sense that they are concerned with domain-specific learning processes, but also because they are accountable to the activity of design. The theory must do real work” (p. 10). Theories generated by design-based research typically occupy the middle ground between grand theories that are relatively context-independent and narrowly-tailored accounts of a single system (Anderson & Shattuck, 2012; Cobb et al., 2003). Since they are developed in real-world environments and in direct response to problems of practice, they “are filtered in advance for instrumental effect” and have the potential for immediate practical use (Cobb et al., 2003, p. 11). These middle-range, useful theories are precisely the type of theories that are most needed in the school library field (Chatman, 1996; Gregor, 2006).

Theory-building in DBR studies typically follows the grounded theory approach (Glaser & Strauss, 1967; Strauss & Corbin, 1990) or a similar approach in which theoretical concepts and relationships between those concepts emerge simultaneously with the data as researchers read and re-read raw data, identify and define themes, connect those themes into coherent theoretical propositions, and eventually develop a unified model that accurately explains the data set. Future studies undertaken by the researcher or other scholars may test the original theory (for example, by determining whether it applies in a novel context), revise or expand the theory, or falsify the theory. DBR studies may contribute to theory work in LIS at any of these points – original theory generation or testing, revision, or falsification of existing theories.

Prior DBR studies can provide valuable guides for LIS researchers who wish to contribute to theory work but who may be unaccustomed to the creative and inductive work of theory generation, for which “there are no sure methods” (Wildemuth, 2009, p. 41). Hoadley (2005) described how he and his research team developed a theory of socially relevant representations for learning over the course of a DBR study investigating the design and impact of an online discussion tool. Because they wanted their online tool to facilitate learning via collaboration, the researchers examined existing theories of collaboration and learning, knowledge communities, and communities of practice to inform the initial design of the system. Hoadley noted that these theories did not always directly address specific design questions, so the intuition of researchers and developers also came into play. The researchers were initially unsure which particular elements would be most critical to the success (or failure) of their system, but in examining their data they “stumbled on” (p. 44) the idea that social cues in the interface might be influencing

student motivation, sensemaking, and cognition. From there, the researchers began intentionally manipulating these social cues to develop and test hypotheses about how those cues influenced learning within the context of their system. Hoadley identified four specific ways that the DBR approach helped them generate what later became a unified theory of socially relevant representations for learning:

- 1) The great deal of data collected over multiple iterations of the project combined with the research team's familiarity with this data and their context made induction of theoretical propositions more straightforward and rigorous than in many other types of studies.
- 2) The researchers worked in a real-world context and therefore were quickly oriented to what worked and what didn't work relevant to their design in that context.
- 3) DBR allowed for *post hoc* theory testing. Because such rich data was collected during every iteration, the researchers were often able to test or falsify newly generated claims or hypotheses by looking at data that was collected in earlier iterations before those claims were considered.
- 4) DBR allowed the researchers to incrementally increase their understanding of their intervention over time by allowing them to "poke it, prod it, and continuously monitor the results" (Hoadley, 2005, p. 46). As the relationship between intervention and outputs became better understood in one context, it also allowed researchers to better understand where their model might be generalized and where generalizations may fail.

Criticism of Design-Based Research

Design-based research is not without its drawbacks or detractors. The flexibility and breadth of the DBR approach that are praised by some researchers cause others to question whether design-based research might not exhibit some of the same flaws of multipurpose tools, which "do a little of everything, but usually do nothing particularly well" (Dede, 2004, p. 104). DBR has also been criticized for the copious amount of data it produces (Collins et al., 2004; Dede, 2004), the lack of standards to decide whether an initial design is "good enough" to undergo successive iterations, frequent underspecification of theory in published work (Dede, 2004), and the difficulty of comparing effectiveness across designs (Collins et al., 2004).

Design-based research also faces unique validity concerns, primarily due to its interventionist nature (Barab & Squire, 2009; Bell, 2004; Cobb et al., 2003; Sandoval & Bell, 2004). In a design-based study, the researcher is intimately involved in every stage of the study from initial design to implementation, revision, and assessment. Furthermore, the researcher is not simply a passive observer as the designed intervention is implemented. Instead, the researcher is "implored to intervene where possible" to improve upon and test the design as it is being delivered rather than waiting until a complete cycle of implementation has occurred before making design changes (Barab & Squire, 2009, p. 10). There are two commonly-raised validity concerns related to this level of researcher involvement: first, that the researcher's involvement makes it difficult or impossible to determine whether it was researcher or intervention that produced the study's outcomes, and second, that researcher bias may make research claims suspect (Anderson & Shattuck, 2012; Barab & Squire, 2009; Sandoval & Bell, 2004). To the first concern, scholars in the DBR field have responded that researcher intervention throughout the design process is not only the best, but often the only way to thoroughly understand the systems at work in the project, and that sterilizing the research context by removing the researcher's involvement is counter to DBR's primary goal of developing theory in naturalistic contexts (Barab & Squire, 2009). To the second

concern, it has been argued that the intense and long-term nature of a DBR study demands a researcher who is enthusiastic about the project (Anderson & Shattuck, 2012), and while this may lead to some bias, there are well-established means of minimizing this threat to validity and establishing the trustworthiness of the research (Hoadley, 2004; Lincoln & Guba, 1985). In particular, design-based research relies on careful documentation and thick description by the researchers to assist in identifying the mechanisms by which interventions produce outcomes (Hoadley, 2004).

Of course, while some validity threats are magnified by the use of DBR, others are reduced or eliminated. Specifically, one of DBR's greatest strengths is its ecological validity, especially when compared to laboratory studies or studies in other artificial contexts (Barab & Duffy, 2000; Bell, 2004; Sandoval & Bell, 2004). Studies done in artificial contexts are quite common in the LIS field as in many other disciplines, and the DBR approach can help complement these studies to gain a greater understanding of how LIS systems, services, and users actually behave in the real world.

Applications of Design-Based Research in the School Library Field

Design-based research holds great promise for the school library field as an approach that can help us address the twin concerns of a research-practice gap and a shortage of useful theories generated within the field. Bowler and Large (2008) discussed the potential usefulness of the design-based approach for LIS but focused primarily on applications of this approach within the user-centered paradigm of information systems research. Moreover, this article did not offer many specific ideas for application of this methodology in the LIS field beyond a list of general research areas that might benefit from the approach, including such broad topics as information literacy, information technology, and information retrieval systems. The discussion below will begin with a description of a research project in the school library education field that uses design-based research methodology. We will then suggest some other instances where this methodology might be of use to school library researchers.

The Synergy for Science Project

Many researchers in the field of library and information sciences are interested in LIS education, and within this subfield, design-based methodology can be easily employed with little or no modifications. For example, the first author of this paper is currently working on the "Synergy for Science" project, a mixed-methods, design-based study. This project began with the identification of a problem of practice in K-12 school libraries: school librarians rarely collaborate with science teachers, to the potential detriment of their students (Hoffman & Mardis, 2008; Mardis, 2005). Researchers have noted the significant overlap in goals and needs between science teachers and school librarians (Subramaniam et al., 2013), but practitioners themselves seem not to observe the potential for collaborative teacher-librarian relationships to improve student learning in science.

Montiel-Overall's (2005a, 2005b) theory of Teacher-Librarian Collaboration (TLC) informed the design of an intervention to address this problem of practice, which has been implemented twice so far with a third iteration to be completed in Fall 2015. The intervention took the form of a semester-long collaborative project undertaken by graduate library science students enrolled in a core course of the school library program and senior undergraduate education majors enrolled in a science methods course. In both iterations of the project thus far, students worked in groups containing one preservice librarian and three to six preservice teachers to develop a collaborative lesson plan designed to teach both information literacy and science content. The primary

researchers were also the instructors of these courses, as in Joseph's (2004) passion school project. As in Hoadley's (2005) study, TLC Theory did not address all elements of the design process (for example, what online platform would work best for group communication outside of class?) and researcher intuition and experience also played a role in the initial and subsequent designs. Data came from a variety of sources including pre- and post-project surveys, interviews, focus groups, classroom observations, and student work samples. In keeping with traditional design-based research principles, the assignment was modified and tested as necessary both during and after each implementation in response to arising circumstances, including student feedback. Throughout data collection and analysis phases, the researchers have compared their emerging themes and findings to the claims and relationships proposed in Montiel-Overall's (2005a, 2005b) TLC Theory in order to better understand where this existing theory is supported or challenged in the new context of collaboration among pre-service educators. Where TLC Theory has failed to address research findings, other theories are being investigated for fit and new theoretical propositions are in development.

The results of this project have included practical, scientific, and societal outputs (Herrington, McKenney, Reeves, & Oliver, 2007). On the practical side, the project has resulted in a refined assignment along with accompanying materials (such as syllabi, student work samples, and student instructions), which can be shared with other school library educators who might want to implement a similar project with their own students. On the scientific side, this research has resulted in more generalized design principles that can inform future development of such collaborative projects, as well as some nascent contribution toward theoretical knowledge related to teacher-librarian collaboration (Rawson, Anderson, & Hughes-Hassell, 2015). Societal outputs include the professional development of the students who participate in this project, who have reported an increased willingness to participate in science-focused teacher-librarian collaboration once they are in their fields of practice.

The Synergy for Science project meets all of the defining features of a design-based research study listed in Table 1. Since this project focuses on learning, albeit within an LIS program, the design-based methodology has been directly applied with no modifications. Many other projects within the field of LIS education research may also be ripe for the application of DBR methods. For example, LIS schools wishing to redesign their LIS curricula on a large scale, or individual professors seeking to design or overhaul a single course, may benefit from this approach. The field as a whole would also benefit as a result of the theories and design principles developed in the course of such research.

Other Potential Applications in School Library Contexts

Over the past several decades, school libraries have seen momentous shifts in trends impacting schools, including dramatic changes in student demographics, the adoption and implementation of a number of reform efforts (i.e. common core, PLCs, etc.), an increasing emphasis on technology integration, and decreases in funding. In response to these shifts, school librarians have developed many innovations related to their instruction, spaces, collections, and services. The existence of so many pressing problems of practice in school libraries makes them perfect settings for design-based research. Moreover, many school librarians may be facing identical problems of practice and could therefore greatly benefit from the development of theory or generalized design principles related to those concerns, another benefit that the DBR approach could offer.

One example of a school library-focused research area in which the DBR approach might be beneficial is the development of a theory or framework of culturally relevant pedagogy for the

school library field. For the first time in U.S. history, youth of colour¹ are projected in the 2014-2015 school year to make up the majority of students attending American public schools (Krogstad & Fry, 2014). Today, more than one-fifth of America's children are immigrants or children of immigrants (O'Hare 2011). These demographic changes have implications for school librarians in the United States, the majority of whom are middle aged, white, English speaking females (ALA, 2012). As Mestre (2009) notes, "many librarians are now struggling to connect with a completely new set of learners, with cultural backgrounds distinctly different from each other and from their teachers. It may be a challenge for the [librarian] who has only used teaching strategies and examples based on his or her life experiences" (p. 9).

Overall (2009) has produced a comprehensive conceptual framework for the LIS field. She defines cultural competence as:

the ability to recognize the significance of culture in ones' own life and in the lives of others; and to come to know and respect diverse cultural backgrounds and characteristics through interaction with individuals from diverse linguistic, cultural, and socioeconomic groups; and to fully integrate the culture of diverse groups into services, work, and institutions in order to enhance the lives of those being served by the library profession and those engaged in service (2009, p. 189-190).

Overall's framework focuses on three facets of cultural competence:

1. Becoming knowledgeable about diverse cultures and using this information in ways that lead to greater understanding of diverse cultures, thus increasing library use,
2. Creating and maintaining equitable environments for library users, and
3. Establishing and maintaining relationships among diverse groups (2009, p. 199).

The school library field is concerned with an additional facet of cultural competency – culturally responsive teaching. Culturally relevant teaching is defined as a pedagogy that "empowers students intellectually, socially, emotionally, and politically by using cultural referents to impart knowledge, skills, and attitudes" (Ladson-Billings, 2009, p. 20). Culturally relevant teaching recognizes the linguistic, literate, and cultural practices of communities of colour as resources to honour, explore, extend, and build on in formal educational settings. In practice, culturally relevant pedagogy uses the "cultural knowledge, prior experiences, frames of reference, and performance styles" of students of colour to make learning more relevant, meaningful, and validating [Gay, 2000, p. 29]. It has been shown to lead to improved academic achievement, resiliency, expanded educational opportunities, and equitable life outcomes for youth of colour (Hanley & Noblit, 2009).

School library practitioners and researchers have speculated on what culturally responsive teaching looks like in the school library setting (c.f. Mestre, 2009, Hughes-Hassell, Kumasi, Rawson, & Hitson, 2012), but to date, no general principles or theoretical frameworks have been developed as a result of empirical research. Design-based research offers one avenue to explore these issues.

¹ The researchers prefer the terms *youth of colour* or *people of colour* to refer to people of African descent, people of Asian descent, people of Latin American descent, and Indigenous peoples, as opposed to the terms non-White or minority. The term non-White normalizes whiteness and reinforces the privileged position of whites in the U.S. As the demographic data shows, the term minority is inaccurate.

One possibility for a DBR study in this arena could focus on the development of a planning tool that would be used by school librarians and classroom teachers when designing instruction. Many school librarians already use some form of collaborative planning document to help structure their instructional design sessions with classroom teachers (Dickinson & Repman, 2015). A DBR study might seek to develop and test the impact of a planning document that helps school librarians and classroom teachers focus on elements of culturally responsive teaching (such as those identified by Ladson-Billings and Gay, discussed above) while designing instruction in any subject area. In such a study, one iteration would be a single collaboratively-planned lesson; thus, over the course of just a few weeks, the document could be tested in a variety of contexts and refined over many iterations. Data sources for such a study could include successive versions of the planning sheet itself, reflective notes from the librarian and teachers, student achievement or engagement data, and potentially schoolwide performance data if the intervention was employed over a long enough period of time. Following refinement in one school context, the tool could then be tested and further honed in other schools or grade levels until general principles of effective instructional design for culturally responsive teaching in a school library setting begin to emerge. Such a project would result not only in a useful tool for practitioners (the planning document), but also could contribute valuable and novel knowledge about “what works” in terms of culturally responsive school library services. Over time, this knowledge could be synthesized into a theory of culturally responsive school library services –a theory that, having been developed and tested in real school library contexts with the goal of improving practice, can “do real work” for school library researchers and school librarians alike.

Another pressing problem that might be explored by a DBR approach is summer reading loss. According to Allington & McGill-Franzen (2013), summer reading loss is the “most potent explanation for the widening achievement gap between rich and poor children across elementary schools and middle schools” (p. 7). A number of factors have been identified as contributing to summer reading loss, particularly among lower-income students, including: a lack of access to books during the summer, a lower sense of self-efficacy which is linked to past academic performance and being labeled a ‘struggling reader,’ a lower level of motivation and engagement to read voluntarily, and a lack of autonomy in text choice due to one-size-fits-all reading curriculums that require all students to read the same book or programs like Accelerated Reader that are more focused on readability levels than student interests (Allington & McGill-Franzen, 2013). In addition, in the United States summer is typically associated with relaxation and vacation; as a result, both students and their parents often view summer as a time to take a break from learning. A national survey of parents of school-age children found that regardless of income level, most parents’ primary goal for their children over the summer was for them to relax and have fun; only 13% of parents indicated that learning new things or preparing for the next school year was a top priority (Le Menestrel, 2003).

Many interventions have already been implemented by librarians seeking to prevent or mitigate summer reading loss, although most published examples come from public rather than school libraries. For example, the Grande Prairie Public Library in Alberta, Canada paired elementary students with teen “Reading Buddies” who served as mentors and reading partners during the summers of 2011 and 2012 (Dolman & Boyte-Hawreluk, 2013). Other public libraries have added gaming elements to their summer reading programs in an effort to make these programs more relevant and enjoyable for participants (Landgraf, 2011). Many of the librarians designing and implementing these interventions are already collecting qualitative and quantitative data related to their impact on participants; some are also repeating and refining their interventions over multiple summers. These programs might easily be expanded into design-based

research studies if the librarians also took the extra steps of connecting their work to existing theory (for example, theories of literacy development or reading motivation) and developing general design guidelines that other librarians could use to design similar interventions in their own settings.

Projects that address how school libraries in particular might work to address summer reading loss could be especially helpful. School librarians have knowledge of the literacy curriculum and knowledge of students as individuals and as learners that public librarians may lack. This knowledge, in addition to their material collections which often go unused over the summer months, makes school librarians uniquely positioned to design and implement effective summer reading programs. Because there is usually no mandated summer curriculum and because this season has traditionally been associated with fun and leisure, summer may be the optimal time for school librarians to facilitate non-traditional learning experiences for their students that capitalize on students' non-academic, local, and/or social interests. The Connected Learning model (Ito et al., 2013), which provides a framework for such learning experiences, could provide a starting point for theory development and design guidelines for summer reading programs that acknowledge summer's traditional association with fun and play. For example, using their print and digital collections, school librarians might design and facilitate virtual summer reading and media production groups centered on topics chosen by students. Such groups might have broad definitions of what counts as reading material to include items of popular interest such as video game manuals, Twitter feeds, or online comment boards. Done in the context of a DBR study, such projects could help the field as a whole to develop general guidelines for summer reading programs and theories of literacy development and reading motivation.

These two examples are just the tip of the iceberg in terms of the many potential applications of the DBR methodology within the school library field. Other problems of practice that might be targets for design-based studies include the implementation of a school-wide inquiry model, the impact of maker spaces on student learning, budget shortfalls, needs for repurposing physical space, and outdated library policies and procedures. It is important to note that because this approach places the researcher in the role of participant-observer and blurs the line between research and practice, DBR studies could be undertaken not only by school library researchers but also by school librarians themselves, or by school librarians and researchers working closely together.

Why the Time is Right for DBR in School Librarianship

In an influential article on the intellectual past, present, and future of LIS, Marcia Bates highlighted the multidisciplinary nature of the field and remarked that "the two most important methodological traditions we draw on are the social sciences and the engineering sciences" (1999, p. 1049). By combining engineering design principles with qualitative and quantitative methods from the social sciences, design-based research capitalizes on both of these strains of library and information sciences DNA. In recognition of the fact that fields other than education may adopt design-based research, Bell (2004) adapted the traditional, learning-focused definition of DBR such that it could be applied across the academy, defining it as "the theoretical and empirical study of complex human interventions as they can be used to promote and sustain innovation in everyday settings" (p. 251). Or, in even simpler terms, "design-based research boils down to trying to understand the world by trying to change it" (Hoadley, 2005, p. 46). Evidence of a research-

practice gap in LIS as well as a shortage of middle-range theories generated within the field suggest that library and information sciences are in need of just the type of innovation that design-based research can provide. The sample studies discussed above are merely a few of the many potential applications of design-based research in the school library field, and the value of this methodology for school library research is limited only by the creativity of the researchers employing it.

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