The Depth and Breadth of Improvement Science: A Review of the Improvement Science in Education Series

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ABSTRACT

The Improvement Science in Education series, initiated in 2019 by Robert Crow, Brandi Nicole Hinnant-Crawford, and Dean T. Spaulding, seeks to broaden and strengthen the understanding and use of improvement science in education. Interest in improvement science in education has sharply risen in recent years, positioning this series to support the field and those interested in improvement science. This review of the Improvement Science in Education series is organized by brief summaries and discussions of the six currently available books in a suggested order based on their content (not necessarily publication date), followed by a conclusion considering the books’ significance, relevance, and target audience.

KEYWORDS
improvement science, book review, EdD

SUMMARIES AND DISCUSSION

The review of the Improvement Science in Education series is organized by brief summaries and discussions of the six currently available books in a suggested order based on their content (not necessarily publication date), followed by a conclusion considering the books’ significance, relevance, and target audience.

Overview of Improvement Science

Hinnant-Crawford’s, Improvement Science in Education: A Primer, furnishes a brief overview of improvement science for readers new to improvement science and those in need of a quick refresher. The book’s introduction establishes a shared understanding of improvement science for the reader, which allows for the transition into the second section of the book that provides a thorough, and important, discussion of problem identification needed to initiate the improvement science process. It is here that the complexity of improvement science begins to emerge, with the commonly referenced, but sometimes intimidating, step of root cause analysis (RCA) and related fishbone diagram.

RCA, conceptually and in practice, can be overwhelmingly complex based on need and intent, but Hinnant-Crawford clarifies...
RCA through the included tool of The Five Whys by Sakichi Toyoda. This tool, as presented, allows for a simple one-sentence identification of the problem, which is then expanded by asking “why” five times. This tool could serve as a great first step into problem identification before shifting to the more systemically analytical fishbone diagram, created by Karou Ishikawa and named for its shape and structure that loosely resembles a fish skeleton. The head of the fishbone diagram contains the simply stated problem with the bones each containing a possible cause to the problem. Fishbone diagrams have become arguably synonymous with improvement science, so their inclusion in a primer on improvement science is essential. Hinnant-Crawford demonstrates the creation and evolution of a fishbone diagram, including how The Five Whys tool can be used to expand the contents of the fishbone diagram. This expansion is particularly important if the initial fishbone diagram is too limited, as this will weaken or stall RCA efforts. Hinnant-Crawford concludes the discussion on problem identification with equity audits, which are useful in gaining insights on possible causes, especially those related to inequities, that may be difficult to identify or codify through internal brainstorming. Equity audits also encourage broader and inclusive stakeholder engagement in the early stages of the improvement science process.

The final section of the book gives an overview of implementation-related strategies of improvement science. As improvement science emerged from the statistically grounded quality improvement work commonly found in business management and healthcare, Hinnant-Crawford appropriately makes this connection at the start of the section, showcasing several ways to visualize statistical patterns to capture and analyze process and outcomes related to the identified problem. These statistical underpinnings of improvement science could be uncomfortable to readers not quantitatively minded, but the included narrative explanations help to ease this discomfort. Systems and process mapping, a set of tools that can help to see the interconnectivity between previously unseen parts, are included to illustrate how the understanding of process and outcomes are more than just the aforementioned statistics.

Hinnant-Crawford concludes the book with creating a plan for change using improvement science, moving from theorized solutions via driver diagrams to measurable implementation plans, including the Plan Do Study Act (PDSA) cycle. Along with the fishbone diagram, the PDSA cycle is commonly synonymous with improvement science. The PDSA cycle, popularized by W. E. Deming, is a core component of continuous quality improvement that encourages iterative innovation and evolution through learning from previous cycles. Hinnant-Crawford illustrates the connection between PDSA and traditional research thinking, including the scientific method and inductive/deductive inquiry to establish useful parallels for readers beginning to explore this methodological approach. While the four phases of PDSA can be intuitive to understand, concise explanations of each phase are included to clarify understanding. Given the importance of measurement in improvement science, several ideas about measures and designs are discussed to ensure that the PDSA cycle, and the improvement science process, is supported and fruitful.

Applications of Improvement Science

The Educational Leader’s Guide to Improvement Science: Data, Design, and Cases for Reflection, edited by Crow, Hinnant-Crawford, and Spaulding, features 17 chapters, organized into three sections, that share varying thoughts and applications of improvement science throughout educational leadership. Educational leadership can be broadly inclusive of any context in which education and leadership are key components. As a result, this book features perspectives from both inside and outside traditional education contexts, which demonstrates the wide-ranging value of improvement science in practice. The Educational Leader’s Guide to Improvement Science: Data, Design, and Cases for Reflection was the first book published in the Improvement Science in Education series.

The first section of the book is situated to help the reader acculturate (or reacclimate) to improvement science as a concept before the more context-specific discussions of the other chapters. The first section could arguably be viewed as a multi-part introduction to the book, with each chapter in this section written by a combination of the book’s editors furthering that view. Crow’s chapter, Considering Improvement Science in Educational Leadership, is particularly effective in its introductory approach, providing snapshots of the components and history of improvement science. Spaulding and Hinnant-Crawford’s chapter, Tool’s for Today’s Educational Leaders: The Basic Toolbox, includes detailed overviews of improvement science essentials, such as RCA, the fishbone diagram, and the PDSA cycle. Finally, Hinnant-Crawford’s chapter, Practical Measurement in Improvement Science, demonstrates how the measurement aspects of improvement science function in practice via two case studies, making this sometimes-complex part of improvement science more palatable.

The second, and largest, section of this book includes nine chapters that focus on a range of contexts within higher education, highlighting conceptual and practical discussions about improvement science. Conceptual chapters give accessible insight into the connection between systems thinking and improvement science (Chan Hilton & Cruz, Ch. 4) and addressing equity concerns through improvement science (Biag, Ch. 5). Other chapters illustrate how education organizations, such as the Carnegie Project on the Education Doctorate (Perry & Zambo, Ch. 7) and University Council for Education Administration (Cunningham, Young, & Spicer, Ch. 6) are using improvement science to support university students and programs. Real-world examples of improvement science components, such as RCA, the PDSA cycle, and emergent theories for improvement can also be found throughout this section. Specifically, these implementation-oriented chapters detail how university faculty used improvement science to enhance principal preparation (Peterson & Carlile, Ch. 8) and medical (Hubner, Robinson, & Lawson, Ch. 12) program practices, refine university-wide student retention (Smith, Ch. 11) and organizational culture (Corman, Ch. 9), and increase the equity focus of university curriculum and instruction (Carlile & Peterson, Ch. 10).

The final section shifts to K-12 education, which further showcases the potential impact of improvement science in practice. As before, these chapters include examples, as well as templates, to help the reader understand the related concepts and prepare them to use improvement science. Unsurprisingly, given the focus on K-12 education, the overarching theme of these chapters is on using improvement science to help K-12 students, such as addressing high failure rates of males and students of color (Thonstad, Ch. 13) and developing ways to provide social-emotional support (Facin & Dailey, 16). Some chapters highlighted the notable impact of integrating improvement science within professional learning communities to improve student learning (Carpenter & Peterson, Ch. 14), while also providing an additional benefit of meaningful professional
development for teachers (Hawkins, Henry, Jones, Santl, & Butcher, Ch. 15). Spaulding and Hinnant-Crawford’s chapter, The
Methodology for Educational Leaders, concludes the book with a
summation of the chapters’ overall content by reaffirming the value
of improvement science as a beneficial form of inquiry for readers
interested in something beyond traditional research approaches.

Improvement Science: Promoting Equity in Schools, edited by
Deborah S. Peterson and Susan P. Carlile, expands upon a broader
premise of their chapter, Improvement Science in Equity-Based
Administrative Practicum Redesign, from another book in this series,
The Educational Leader’s Guide to Improvement Science: Data,
Design, and Cases for Reflection, through 15 chapters that explore
the intersection of improvement science and equity-based practices
that target or benefit US and international K-12 education. Peterson
and Carlile set this K-12 context in their introductory chapter, noting
that the authors of the book chapters either work directly with or are
K-12 practitioners. Chapters use an approachable voices from the
field to describe their improvement science endeavors, which
should increase the comfort for readers not intimately familiar with
improvement science. The chapters in this book are organized by
common K-12 subject areas, including reading, writing, math,
science, and health, each showcasing how improvement science
can be used to target problems of practice in specific subject areas.
Equity-minded improvement science tools, such as equity audits and
empathy interviews, can be found in each section throughout the
book, solidifying the connection to the book theme of promoting
equity. Due to the timing of this book, many chapters noted the
limiting impacts of the COVID pandemic, though these limitations did
not lessen the quality of the chapter content.

Chapters in the reading section discuss how increasing diverse
representation in collaboration (Rasberry, Odell, Kennedy, Dyer,
Pedersen, & Simmons, Ch. 3) and reading materials (Young, Ch. 5)
can increase student reading performance. Other reading-focused
chapters show the benefits of merging other methodological
approaches with improvement science, such as design thinking
(Zhao, Anderson, Locheck, & Vasta, Ch. 2) and participatory action
research (Tredway, Miliello, Machado, & Bossette, Ch. 4) to
increase literacy among underrepresented race and ethnic groups of
students. The writing section features chapters that share strategies
to improve writing performance in male students (Meyer & Bendikson,
Ch. 7) and student with disabilities (Stimson Clark, Ch. 8), while also
highlighting ways to overcome classroom management challenges to
increase student engagement in writing (Barnard, Ch. 6).

The math and science subjects are combined into a single
section, with some chapters including content on both and other
related subjects. Chapters in this section largely focus on closing
achievement gaps that exist in underrepresented student groups,
such as through building a district-wide inclusive vision (Grosse, Ch.
13), improvement science driven iterative change (Pedersen, Odell,
Kennedy, Dyer, Simmons, & Oliveras-Ortiz, Ch. 9), increasing
access to advanced instruction (Larkin & Jenks, Ch. 10), creating
targeted small intervention groups (Altiero, Ch. 11), and utilizing
problem-based learning (Brown, Ch. 12). The health and wellness
section contains one chapter, which offers how incorporating a
culturally responsive lens with improvement science can increase
physical engagement in underrepresented groups, namely
Indigenous students (Milko, Ch. 14). Thonstad, Carlile, and
Peterson’s final chapter, Moving Forward, concludes with a call to
action to seek the equity-minded change that is exhibited throughout
the book.

Improvement Science as a Tool for School Enhancement:
Solutions for Better Educational Outcomes is the second book in the
series edited by Peterson and Carlile and continues the equity focus
on improvement science in K-12 education found throughout
Improvement Science: Promoting Equity in Schools, though without
the specific emphasis on K-12 education subject areas. Peterson,
Carlile, and McDaniels-Hall further the point in their introduction that
improvement science is well suited as a methodology to examine
and promote equity in K-12 educational contexts. As with the
previous book edited by Peterson and Carlile, the 18 chapters
included in this book feature real-life experiences of US and
international K-12 practitioners who have used improvement science
to target a specific problem of practice in their decidedly diverse
school or district. The format and tone of the included chapters will
be instantly recognizable to readers of Peterson and Carlile’s
previous book in this series, including the use of practitioner-friendly
lessons learned style conclusions. Frequently used improvement
science tools, such as RCA, theories for improvement, and the
PDSA cycle, are included and demonstrated, as well as equity audits
and empathy interviews often associated with equity-focused
improvement science initiatives.

While the chapters are not organized into sections, chapter
topics include how improvement science was used to examine
school or district-wide problems of practice related to social-
emotional learning, student attendance and discipline, academic
success, school culture, and family engagement. Many of the
included problems of practice are complex, as is typical for
improvement science, and address more than a single issue or area.
Student equity and inclusiveness are predominant foci throughout
the book, with improvement science being used to facilitate
increased K-12 student equity in social-emotional learning (Cieminski
& Morgan, Ch. 2; Carpenter, Hargrave, & Oropallo, Ch. 4), discipline
(Thonstad, Ch. 7), behavioral interventions (Brown, Ch. 8), advisory
programs (Bennett, Ch. 9), high school graduation (Rahaman, Ch.
10), academic supports (Eagle & Connolly, Ch. 11; Melloy & King,
Ch. 12), and disability-related assessment (Birmingham & Sanders,
Ch. 13) in ways that are applicable to all students, regardless of their
gender, race, ethnicity, language, or disability.

School culture is another featured focus in the book, with
specific chapters sharing the value of an equity-focused, student-
centered school culture (Li, Ebersole Lacroix, & Braun, Ch. 17),
including how changing the school culture can impact student
achievement (Carrillo Rowley, Odell, & Kennedy, Ch. 3) and reduce
or remove power hierarchies to allow for authentic engagement of
student voice (Waters, Ch. 14). Engagement of, and collaboration
with, families is also shown in some chapters to be a key strategy in
efforts to reduce absenteeism (Nelson, Ch. 5; Anderson, Ch. 6),
student reading performance (Abayomi, Ch. 16), and create
a collaborative school culture (McDaniel-Hall, McCarty, & Brown, Ch.
15). While many of the ideas and strategies shared throughout the
book will be familiar to readers from K-12 education contexts, the
use of improvement science to discover and unpack these ideas and
strategies provides a novel perspective of the familiar, as well as a
roadmap for those faced with similar problems of practice. The book
concludes with Peterson’s, Sustaining One Another While Leading
Equity-Focused Improvement Science Efforts, which frames a set of
behaviors and dispositions to help continue the equity work shared
throughout the book.
Improvement Science for Higher Education Faculty

As previously discussed, other books in this series provide overviews and examples of improvement science, but *The Improvement Science Dissertation in Practice: A Guide for Faculty, Committee Members, and Their Students*, written by Jill Alexa Perry, Debby Zambo, and Robert Crow, adds a detailed layer of support to university-based programs seeking to support student research using improvement science. Organized into eight chapters, this book takes the reader from developing a doctoral program that can support the use of improvement science to the key components of a dissertation in practice (DIP). The DIP is mentioned throughout the *Improvement Science in Education* series, as it is a common vehicle and product for the use of improvement science in education doctorate (EdD) programs. Perry, Zambo, and Crow use the introductory first two chapters of this book to explain the DIP, laying out its origins with detailed rationales for its use in EdD programs, which conveniently serves to also define and advocate for improvement science quickly for the reader. Connections between improvement science, the DIP, and CPED are included, such as CPED guiding principles and related terminology, but the content is sufficiently general and applicable to still be useful to readers not affiliated with CPED.

Perry, Zambo, and Crow initiate the multi-chapter journey through the components of the improvement science DIP (ISDiP) with Chapter 3 and the identification of a problem of practice. Common improvement science tools such as fishbone diagrams, empathy interviews, and process maps are presented to be well suited to systematically identifying a problem of practice for the ISDiP. The next chapter builds upon the problem of practice by connecting this concept to the literature review, comparing the purpose of the literature review between traditional dissertations and the ISDiP, including the nuanced relationship between the problem of practice and the literature review. While the comparison between the two types of dissertations reveals language and concepts that will be more similar than different, the practice-oriented intentionality of the ISDiP is evident to show the reader some distinction between the dissertation types should exist.

The development and inclusion of a theory of improvement discussed in Chapter 5 begins the stark departure from the traditional dissertation. The theory of improvement is the articulation and formalization of ideas for changing the problem of practice, the development of which is facilitated using the driver diagram that organizes a plan for measurement as discussed in the following chapters. The plan for measurement serves as the empirical research part of the dissertation process, though unlike most traditional dissertations, is multi-staged (occurring in cycles) and multifaceted (utilizing outcome, process, driver, and balance measures), which represents a rigorous empirical process. The PDSA cycles, another common improvement science tool, is used to organize the data collection process. Perry, Zambo, and Crow provide an alternate, more intentional, form of the PDSA cycle, the Strategize, Implement, Analyze, and Reflect (SIAR) cycle, and while overall similar the PDSA cycle, has some subtle differences that may be more logical for some readers when applied to a dissertation-formatted project.

As part of the conclusionary content, Perry, Zambo, and Crow provide a discussion on how the ISDiP fits within EdD programs, which includes an informative comparison between EdD and traditional PhD programs to help readers distinguish between the two program types. A suggested plan for incorporating the ISDiP within a typical three-year EdD program is also included, noting that work towards the ISDiP starts in the first semester of the program to signal the importance of a program-wide commitment to improvement science at the onset. *The Improvement Science Dissertation in Practice: A Guide for Faculty, Committee Members, and Their Students* ends with summative arguments for why improvement science is useful as an inquiry tool for the EdD dissertation, sharing several helpful suggestions related to admissions, teaching, course structure, and student mentoring intended to help readers facilitate a smoother transition from the traditional dissertation to the ISDiP.

*Teaching Improvement Science in Educational Leadership: A Pedagogical Guide*, edited by Spauleung, Crow, and Hinnant-Crawford, reads somewhat as an extension to the pedagogical suggestions from *The Improvement Science Dissertation in Practice: A Guide for Faculty, Committee Members, and Their Students* by offering 11 chapters that showcase a variety of examples for both beginning and experienced faculty of how improvement science can be integrated in curriculum and instruction, as highlighted in Spauleung, Hinnant-Crawford, and Crow’s introduction. In this book, readers will find several chapters that share strategies and experiences related to program-wide use of improvement science, including a resource-oriented tips and tricks discussion for instructors teaching improvement science in support of the development of student research projects (Perry & Zambo, Chapter 3), such as the improvement science dissertation in practice (ISDiP). Another chapter shares a specific multi-step, program-wide project that efficiently frames the improvement science process to maximize learning (Crow, Chapter 1), which could also be helpful to readers structuring an ISDiP. The Carnegie Foundation’s Networked Improvement Community (NIC) initiative, mentioned in several chapters in other books throughout the *Improvement Science in Education* series, is detailed here with recommendations for teaching improvement science based on NIC-related experiences (Parkerson, McMahon, & Shreve, Chapter 7).

Other chapters in the book emphasize the benefits and impacts of teaching improvement science throughout a program to increase the skill and confidence of educational leaders in using improvement science in their practice (Peterson, Carille, Olivar, & Thonstad, Chapter 6) and to enhance targeted support of partner school districts (Eubanks, McLaughlin, Snell, & Coleman, Chapter 8). Readers of this book will also find specific instructional practices that demonstrate different ways that improvement science can be taught in the classroom, including a set of activities and assignments that can be used to develop leaders as change agents in complex systems (Hawkins & Martens, Chapter 5). Illustrative cases of improvement science in action are shown to be helpful in developing educational leaders (Carpenter & Oropallo, Chapter 10), including in analysis via improvement science-organized, problem-based learning to teach specific elements of the improvement science process (Lochmiller, Chapter 4).

As is revealed throughout the *Improvement Science in Education* series, improvement science can be an effective methodology in the examination of problems of practice related to inequity and social justice. Chapters in this book continue, both explicitly and implicitly, to demonstrate this methodological compatibility, through the explanation of the process to change a course using improvement science to make students’ work more actionable to address issues of inequity in their educational contexts (Carille & Peterson, Chapter 5) and using a pedagogical framework for the teaching of improvement science with an educational justice
lens to encourage connections with those most impacted by an identified problem of practice (Hinnant-Crawford, Nazario y Colon, & Wiggan Davis, Chapter 2). Heath, Shreve, Gomez, & LeMahieu’s conclusionary chapter summarizes the broader themes of the book and challenges the notion of teaching and scholarship existing separately for faculty by explaining that the infusion of improvement science into courses makes, and solidifies, teaching as a scholarly endeavor.

SIGNIFICANCE AND RELEVANCE

Though other books and publications exist that present and discuss improvement science (many of which are cited throughout the series), the *Improvement Science in Education* series exhibits the most comprehensive coverage of improvement science currently available. Crow, Hinnant-Crawford, and Spaulding have curated a collection of books that showcases the breadth and depth of improvement science appealing to a variety of audiences, regardless of backgrounds, expertise, and readiness levels. For those new to improvement science, *Improvement Science in Education: A Primer* (Hinnant-Crawford) provides a concise overview of improvement science, including definitions of related terms and tools that would help readers to navigate the sometimes foreign language of improvement science. For those looking for what improvement science looks like in action, *The Educational Leader’s Guide to Improvement Science: Data, Design, and Cases for Reflection* (Crow, Hinnant-Crawford, & Spaulding), *Improvement Science: Promoting Equity in School* (Peterson & Carille), and *Improvement Science as a Tool for School Enhancement: Solutions for Better Educational Outcomes* (Peterson & Carille) feature dozens of real-world examples that would be informative to both the inexperienced and experienced reader.

At its core, however, the *Improvement Science in Education* series is consistently focused on the instruction of the concepts presented to help readers use and adapt improvement science, which is exemplified by the inclusion of discussion questions, activities, and lessons learned throughout the series. For higher education faculty interested in more explicit connections to instruction, *The Improvement Science Dissertation in Practice: A Guide for Faculty, Committee Members, and Their Students* (Perry, Zambo, & Crow) and *Teaching Improvement Science in Educational Leadership: A Pedagogical Guide* (Spaulding, Crow, & Hinnant-Crawford) include guides and suggestions for incorporating improvement science in both university classroom and program contexts. Books in this series feature several chapters that could also serve as illustrative cases for the purposes of instruction, which would be effective companions to the teaching of improvement science. When teaching something conceptually and technically complex, such as improvement science, parsimony is imperative to promote and maximize learning. All books in the series are commendably restrained in their complexity, allowing for a level of accessibility that is inviting, not intimidating, and should greatly assist in helping readers learn more about improvement science.

Readers may notice the repetition of names serving as editors and authors throughout the series. While some may note this as a limitation, it can be argued that this reflects the relative infancy of improvement science in its use in educational contexts. The featured editors and authors in this series have established themselves as experts in improvement science, which is showcased by the different ways improvement science is discussed, with minimal repetition, throughout the series. With the help of the *Improvement Science in Education* series, perhaps additional experts will emerge that can contribute to the series’ future volumes. Additionally, the current books in the series may not sufficiently connect with those readers interested in improvement science and may not be affiliated with the field of education. Improvement science has potential use across disciplines. Yet, the content throughout the series maintains a through line of education-specific language and contexts, which is likely attributable to the affiliated disciplines and programs of the contributing editors and authors. This relatively singular focus may limit scope and impact beyond those in education, though this could be addressed with future additions to the series, including those already planned.

Ultimately, the *Improvement Science in Education* series encourages readers to take on the complex problems that are increasingly common in education by offering scaffolded, multifaceted, flexible, and systematic strategies that are purposefully designed for the demands of complexity. Books in this series consistently emphasize that included strategies work best in collaboration with diverse voices within the target system, which should comfort readers, no matter their background or context, to know that they do not take on the burden of complexity alone. Certainly, improvement science is a challenging undertaking, but this series empowers those ready and willing to try.

The *Improvement Science in Education* series has an active slate of planned texts. Forthcoming books in this series include:


The cost of the books in this series currently ranges from $24–$43 in paperback and can be ordered directly from the publisher’s website: [https://myersedpress.presswarehouse.com/](https://myersedpress.presswarehouse.com/)

REFERENCES