ELEVATING CLINICAL PRACTICE IN MATHEMATICS EDUCATION

Cases that Showcase Teaching Practices in Action

Drew Polly & Christie S. Martin, Editors

A VOLUME IN CONTEMPORARY ISSUES IN CLINICALLY BASED TEACHER EDUCATION IN ACTION

Elevating Clinical Practice in Mathematics Education

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A Volume in
Contemporary Issues in Clinically Based Teacher Education in Action

Series Editors

Eva Garin
Bowie State University
Rebecca West Burns
Kutztown University of Pennsylvania

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edited by Drew Polly and Christie S. Martin

Elevating Clinical Practice in Mathematics Education

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CASES IN ACTION

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SERIES FOREWORD

Rebecca West Burns and Eva Garin
Series Editors

Since the call to transform teacher education to center clinical practice and school-university partnerships in the preparation of teachers (NCATE, 2014), teacher educators have been working to identify, enact, and refine strategies and approaches in their teaching that actualize that call. In this quest, they are working individually and collectively to more systematically investigate what they do and how they do it to improve the learning experience for teacher candidates. They also have moved beyond the boundaries of universities to work hand-in-hand with practicing teachers as school-based teacher educators and partners in better understanding how to teach teachers so that those future teachers are equipped to meet the ever-changing and demanding needs of classrooms to support PK–12 student learning; This is especially true in mathematics teacher education.

Clinical practice in teacher education can vary greatly. It can range from hypothetical written or video cases where teacher candidates dissect problems of practice writ large to microteaching episodes where teacher candidates practice teaching on each other to teacher candidates analyzing examples from their concurrent clinical experiences collectively "in class" to teacher candidates engaging in peer coaching and lesson study in their clinical experiences with other teacher candidates, as well as everything in between those examples. Centering clinical practice in the work of teacher education is a massive, and potentially daunting, endeavor. It is easy to become overwhelmed with where and how to begin. The beauty

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of this book, *Elevating Clinical Practice in Mathematics Education: Cases that Showcase Teaching Practices in Action,* is that it provides teacher educators and those seeking to deepen their understanding of mathematics teaching practices with extensive, concrete examples and images of the possible of these concepts in action. Editors, Drew Polly and Christie S. Martin, have successfully curated a collection of more than 50 cases of exemplary practice in mathematics education from across the United States as well as one example from around the world. The cases spell out in detail the intricacies and complexities of both teaching mathematics and teaching teachers to teach mathematics.

We hope that as you explore each chapter, not only will you be awed by the extensiveness and thoughtfulness of how to teach mathematics to teachers, but you will also consider how these ideas and concepts can translate to your practice; we hope that you will be inspired to move toward action and integrate some of these examples in your own practice. We encourage you, as you experiment with deepening your own practice, to engage in both teacher educator inquiry and self-study so that you, too, can then share out what you have learned and contribute to our collective understanding of what it means to teacher teachers how to teach mathematics meaningfully to PK–12 students. Now, enjoy …

REFERENCE

National Council of Teachers of Mathematics. (2014). *Principles to action: Ensuring Mathematical success for all*.

ACKNOWLEDGMENTS

We would like to acknowledge the contributions of each of the authors of the cases included in this book.

We would also like to acknowledge all university-based teacher educators and clinical educators who support and mentor teacher candidates. Your impact is immeasurable.

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INTRODUCTION AND ORIENTATION TO THIS BOOK

Drew Polly and Christie S. Martin

When we decided to embark on this edited book, we had two primary goals: (1) to bring to light the importance of clinical practice experiences in the development of future teachers (referred to as teacher candidates) in the area of mathematics; and (2) provide a platform for mathematics teacher educators to share their innovative and impactful work related to designing and implementing clinical practice experiences. As a case book that includes a total of 51 cases from across the United States and one from Turkey, we feel that this book has potential to be a valuable contribution to the field of mathematics education, especially for those who are administrators, faculty, or school-based leaders who work with clinical practice.

Each case in this book includes a set of discussion questions and an example of a possible clinical practice activity. These features have been included in order to give readers various options on its use. For example, readers may decide to use the cases and discussion questions as part of university coursework, a book study, or shared reading among those interested in or working with clinical practice. The example of clinical practice activities has been included to provide mathematics teacher educators with ideas related to each case that may be adapted for their own context.

This book was framed around the research-informed Mathematics Teaching Practices described in the National Council of Teachers of

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Mathematics *Principles to Action* document (see NCTM, 2014, p. 10). Table 1 provides a description of each teaching practice. Since this case book was created from an open call for cases, we worked with authors who submitted proposals, so we do not have an equal number of cases for each practice. We think this imbalance across teaching practices is telling about the emphases that mathematics teacher educators are having when they design clinical practice experiences. Specifically, we had a lot of chapter proposals related to teaching practices focused on 4: Facilitating Mathematical Discourse, The Teaching Practices. The least number of submissions related to this text was 1: Establish Mathematics Goals to Focus Learning. We acknowledge that many cases addressed multiple teaching practices. However, for the sake of organization, cases were assigned to the section of the teaching practice that was the best fit.

Table 1

Number of Cases for Each NCTM Mathematics Teaching Practice

Teaching Practice	Number of Cases in Book
1. Establish Mathematics Goals to Focus Learning.	4
2. Implement Tasks That Promote Reasoning and Problem Solving.	6
3. Use and Connect Mathematical Representations.	7
4. Facilitate Meaningful Mathematical Discourse.	11
5. Pose Purposeful Questions.	7
6. Build Procedural Fluency From Conceptual Understanding.	4
7. Support Productive Struggle In Learning Mathematics.	4
8. Elicit and Use Evidence of Student Thinking.	8

As we close this Introduction, we hope that this book fulfills our two goals of bringing to light the importance of clinical practice in the preparation of mathematics teachers, and provides our authors a platform to share their impactful. Thank you again for continuing your learning journey with us as you examine the cases in this book.

REFERENCE

National Council of Teachers of Mathematics. (2014). *Principles to action: Ensuring mathematical success for all.*

CHAPTER 1

ESTABLISH MATHEMATICS GOALS TO FOCUS LEARNING

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NCTM Mathematics Teaching Practice (NCTM, 2014, p. 10) states:

> ***Establish mathematics goals to focus learning.*** *Effective teaching of mathematics establishes clear goals for the mathematics that students are learning, situates goals within learning progressions, and uses the goals to guide instructional decisions.*

INTRODUCTION

Teachers who have clear mathematics goals know what big mathematical ideas they want their students to explore and make sense of during a lesson. Mathematics goals help teachers to focus on their tasks, questions, and facilitation of discourse in ways that best align with the goals. While the research-based recommendations in the NCTM (2014) *Principles to Action* clearly state that daily lesson goals do not need to be stated, the inclusion of broad goals or essential questions can motivate students and help them see a purpose for the tasks and activities (McTighe & Wiggins, 2013).

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SUMMARY OF THE CASES

This chapter includes four cases—one broad case that addresses multiple NCTM Mathematics Teaching Practice and three focused specifically on establishing mathematics goals. In the first case chapter, "A Focus on Professional Noticing to Improve Mathematics Teaching," Conway and Hammonds address multiple teaching practices. The authors describe their creation and refinement of a noticing tool that was created as part of a National Science Foundation project. The authors developed the tool, which has been used to give feedback to both practicing teachers and teacher candidates.

In the second case, "Supporting Teacher Candidates With Planning and Implementing Interventions by Establishing Goals to Focus Learning," Livers describes a case of elementary teacher candidates who conducted a pre-assessment, used those data to make mathematics goals, and then used those goals to plan tasks that they implemented in their clinical practice setting. With support in their course, teacher candidates were successful at enacting their lessons in classrooms.

In the third case, "Math Club Should be Fun!: Establishing Mathematics Goals That Focus Learning and Show the Joy of Mathematics," Taylor shares her iterative approach to having teacher candidates work with elementary school students in an after school math camp. Using the learning trajectories and associated materials from Clements and Sarama's (2021) resource (https://www.learningtrajectories.org), teacher candidates designed a progression of mathematics activities for their students.

In the fourth and final case, "Unpacking Our Work: Establishing Strong Mathematics Goals With Elementary Teacher Candidates," Ward, Hale, and Id-Deen share about their mathematics methods courses and the activities that they have their teacher candidates experience leading up to facilitating mathematics tasks with elementary school learners. Teacher candidates engage in a cyclical process of collaboratively unpacking standards, discussing standards and mathematics concepts with their clinical educator and course instructor, selecting tasks, and then facilitating tasks with students. The authors share the explicit connections between course activities and clinical practice activities.

LOOKING ACROSS THE CASES

The four cases shared in this chapter provide examples of how clinical practice can help teacher candidates and practicing teachers hone their knowledge and skills as mathematics teachers with a focus on goal setting and mathematical goals. While the NCTM Mathematics Teaching Practices

(NCTM, 2014) synthesize research that effective mathematics teachers establish goals, the cases here provide examples of how the establishment of goals was connected to other NCTM Mathematics Teaching Practices. This connection was seen in each of the four cases in this chapter.

In the first case, Conway and Hammonds describe their development of an observation protocol that focused on multiple mathematics teaching practices, one of which was the establishment of mathematical goals. In that case, goals were simultaneously observed with other practices, and were not foundational. In the second and third cases, Livers and Taylor, respectively, worked with teacher candidates to focus on mathematical goals during clinicals that occurred during the school day (Livers) and in after school math club (Taylor). In both of these cases, establishing mathematical goals first allowed teacher candidates to then attend to other mathematics teaching practices, such as using mathematical tasks, posing questions, facilitating discussions, and using formative assessment practices. In the final case, Ward and colleagues used a systematic process of unpacking the standards prior to establishing mathematics goals, and then used those goals to then design or select the mathematics activities they would complete during clinical activities. While the process of establishing mathematical goals is important, this teaching practice is hardly ever seen in isolation. Establishing mathematical goals often serves as a foundational process before teachers enact the other mathematics teaching practices.

REFERENCES

Clements, D. H., & Sarama, J. (2021). *Learning and teaching early math: The learning trajectories approach.* Routledge.

McTighe, J., & Wiggins, G. P. (2013). *Essential questions: Opening doors to student understanding.* Association for Supervision and Curriculum Development.

National Council of Teachers of Mathematics. (2014). *Principles to action: Ensuring mathematical success for all.*

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CASE 1

A FOCUS ON PROFESSIONAL NOTICING TO IMPROVE MATHEMATICS TEACHING

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In 2020, the Cooperative Collaborative of Columbus (C^3) was formed under the guidance of the Mathematics Teacher Education Partnership (MTEP) as a local Networked Improvement Community (NIC). C^3 is a partnership among the Muscogee County School District (MCSD) teachers and principals, the Columbus Regional Mathematics Collaborative (CRMC), and Columbus State University. C^3 aims to align the three partners's goals for mathematics education outcomes and expectations of teachers that relate to:

- the implementation of Mathematical Teaching Practices (National Council of Teachers of Mathematics [NCTM], 2014),
- purposeful engagement of the Common Core Standards for Mathematical Practice (National Governors Association [NGA] & Council of Chief State School Officers [CCSO], 2010), and
- awareness and application of the five Equitable Teaching Practices (Aguirre et al., 2013).

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C^3 followed the organizational structure of NICs (Bryk et al., 2015) and used Plan Do Study Act (PDSA) cycles to measure, monitor, and improve the implementation of these goals to purposefully include teachers, teacher educators, mathematicians, and district leaders (Strutchens et al., 2016). To achieve these goals, the team researched strategies to improve these practices and rubrics to measure outcomes toward these goals.

Literature Review

Much of the research included observational rubrics and protocols for developing teachers and ensuring validity and reliability (Boston, 2012; Boston et al., 2015; Eddy et al., 2015; Gleason et al., 2017; Hill et al., 2012). Recent instruments have varied in emphasis, as mathematical needs and purposes have developed over time. Table 1 summarizes some of the major instruments and their foci to assist in developing mathematics teachers over the last two decades.

Table 1

Observational Rubrics and Their Purpose

Instrument Name and Author	Purpose
Reformed Teaching Observation Protocol [RTOP] (Sawada et al., 2000)	measured the degree to which mathematics and science teaching are reform-oriented
Mathematical Quality Instruction [MQI] (Hill et al. 2012)	measured richness and development of the mathematics, response to students, connecting classroom practice to mathematics, language, equity, and presence of mathematical errors
Instructional Quality Assessment Mathematics Toolkit [IQA] (Boston, 2012)	assessed the quality of instruction based on the mathematical work that students do and discuss in the classroom
Mathematics Classroom Observation Protocol for Practices [MCOP2] (Gleason et al., 2017)	measured the Standards for Mathematical Practice (SMP) within the classroom for teaching lessons that are goal-oriented toward conceptual understanding
A Classroom Observation Tool Assessing Evidence-Based Teaching Practices for Active Learning in Large Science, Technology, Engineering, and Mathematics Classes (Eddy, 2015)	measured the alignment of best practices for active learning