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Introduction

If you are a teacher of mathematics, then this book is for you! Whether you are a novice or a master teacher; an elementary, middle, or high school teacher; a rural, suburban, or urban teacher; this book is for you. It is for all teachers and support professionals who are part of the K–12 mathematics learning experience.

Teaching mathematics so *each and every student* learns the K–12 college-preparatory mathematics curriculum, develops a positive mathematics identity, and becomes empowered by mathematics is a complex and challenging task. Trying to solve that task in isolation from your colleagues will not result in erasing inequities that exist in your schools. The pursuit and hope of developing into a collaborative community with your colleagues and moving away from isolated professional practice are necessary, hard, exhausting, and sometimes overwhelming.

Your professional life as a mathematics teacher is not easy. In this book, you and your colleagues will focus your time and energy on collaborative efforts that result in significant improvement in student learning, as students participate in the formative learning process of *reflect, refine, and act* over and over again throughout the school year.

Some educators may ask, "Why become engaged in collaborative mathematics teaching actions in your school or department?" The answer is simple: *equity.*

What is equity? To answer that, it is helpful to first examine inequity. In traditional schools in which teachers work in isolation, there is often a wide discrepancy in teacher practice. Teachers in the same grade level or course may teach, assess, assign homework, and grade students in mathematics quite differently—there may be a lack of rigor consistency in what teachers expect students to know and be able to do, how they will know when students have learned, what they will do when students have not learned, and how they will proceed when students have demonstrated learning. Such wide variance in potential teacher practice among grade-level and course-based teachers then causes inequities as students pass from course to course and grade to grade.

These types of equity issues require you and your colleagues to engage in team discussions around the development and use of assessments that provide evidence of and strategies for improving student learning.

Equity and PLCs

The PLC at Work™ process is one of the best and most promising models your school or district can use to build a more equitable response for student learning. The architects of the PLC process, Richard DuFour, Robert Eaker, and Rebecca DuFour, designed the process around three big ideas and four critical questions that placed learning, collaboration, and results at the forefront of our work (DuFour, et al., 2016). As DuFour, Eaker, and DuFour explain in their large cadre of work, schools and districts that commit to the PLC transformation process rally around the following three big ideas (DuFour et al., 2016).

1. **A focus on learning:** Teachers focus on learning as the fundamental purpose of the school rather than on teaching as the fundamental purpose.
2. **A collaborative culture:** Teachers work together in teams interdependently to achieve a common goal or goals for which members are mutually accountable.
3. **A results orientation:** Team members are constantly seeking evidence of the results they desire—high levels of student learning.

Additionally, teacher teams within a PLC focus on four critical questions (DuFour et al., 2016) as part of their instruction and task-creation routines used to inspire student learning:

1. What do we want all students to know and be able to do *in class*?
2. How will we know if they learn it *in class*?
3. How will we respond *in class* when some students do not learn?
4. How will we extend the learning *in class* for students who are already proficient?

The four critical PLC questions provide an equity lens for your professional work during instruction. Notice the intentional adaption of the four critical questions around the words *in class*. This is intentional, as this book is all about the student learning process in class during the lesson and the potential gaps that will exist if you and your colleagues do not agree on the rigor for the mathematical tasks you use to answer the question, What do we want all students to know and be able to do in class today?

Imagine the devastating effects on students if you do not reach team agreement on the lesson-design criteria and routines used during the lesson (see critical question 2) as you engage your students in the mathematics lesson each day. Imagine the lack of student agency (their voice, ownership, perseverance, and action during learning) if you do not work together to create a unified, robust formative process for helping students *own* their response during class when they are and are not learning (PLC critical questions three and four).

For you and your colleagues to answer these four PLC critical questions well during the lesson requires the development, use, and understanding of lesson-design criteria that will cause students to engage in the lesson, persevere through the lesson, and embrace their errors as they demonstrate learning pathways for the various mathematics tasks you present to them.

The concept of your team *reflecting together and then taking action* around the right mathematics lesson-design work is an emphasis in the *Every Student Can Learn Mathematics* series. The potential actions you and your colleagues take together improve the likelihood of more equitable mathematics learning experiences for every K–12 student.

The Reflect, Refine, and Act Cycle

Figure I.1 illustrates the reflect, refine, and act cycle, our perspective about the process of lifelong learning—for you, and for your students. The very nature of the profession is about the development of skills toward learning. Those skills are part of an ongoing process you pursue together with your colleagues.

More important, the reflect, refine, and act cycle is a *formative* learning cycle described throughout all four books in the series. When you embrace mathematics learning as a *process*, you and your students:

- **Reflect—**Work the task, and then ask: "Is this the best solution strategy?"

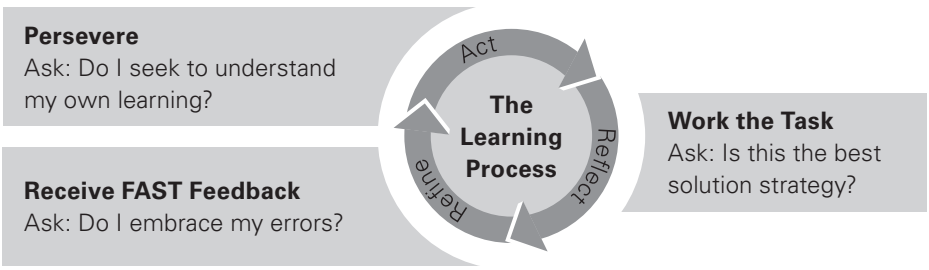

Figure I.1: Reflect, refine, and act cycle for formative student learning.

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- **Refine—**Receive FAST feedback and ask, "Do I embrace my errors?"
- **Act—**Persevere and ask, "Do I seek to understand my own learning?"

The intent of this *Every Child Can Learn Mathematics* series is to provide you with a systemic way to structure and facilitate deep team discussions necessary to lead an effective and ongoing adult and student learning process each and every school year.

Team Actions and the Mathematics in a PLC at Work Framework

The *Every Student Can Learn Mathematics* series has four books that focus on a total of six teacher team actions and two mathematics coaching actions within four primary categories.

1. *Mathematics Assessment and Intervention in a PLC at Work*
2. *Mathematics Instruction and Tasks in a PLC at Work*
3. *Mathematics Homework and Grading in a PLC at Work*
4. *Mathematics Coaching and Collaboration in a PLC at Work*

Figure I.2 (page 4) shows each of these four categories and the two actions within them. These eight actions focus on the nature of the professional work of your teacher teams and how they should respond to the four critical questions of a PLC (DuFour et al., 2016).

So, who exactly should be working with you on a collaborative team to develop high-quality, essential, and balanced lesson-design elements and then use the lesson-design elements to provide formative feedback and student perseverance? With whom does it make the most sense for you to collaborate and learn to fulfill team actions 3 and 4 from figure I.2?

Most commonly, a collaborative team consists of two or more teachers who teach the same grade level or course. Through your focused work addressing the four critical questions of a PLC, you provide every student in your grade level or course with equitable learning experiences and expectations, opportunities for sustained perseverance, and robust formative feedback during the lesson, regardless of the teacher he or she receives.

If, however, you are a singleton (a lone teacher who does not have a colleague who teaches the same grade level or course), you will have to determine who it makes the most sense for you to work with as you strengthen your lesson design and student feedback skills. Leadership consultant and author Aaron Hansen (2015) suggests the following possibilities for creating teams for singletons.

- Vertical teams (for example, a primary school team of grades K–2 teachers or a middle school mathematics department team for grades 6–8)
- Virtual teams (for example, a team comprising teachers from different sites who teach the same grade level or course and collaborate virtually with one another across geographical regions)
- Grade-level or course-based team *expansion* (for example, a team of grade-level or course-based teachers in which each teacher teaches all sections of grade 6, grade 7, or grade 8; the teachers expand to teach and share two or three grade levels instead of only one in order to create a grade-level or course-based team)

About This Book

Every grade-level or course-based collaborative team of mathematics teachers in a PLC culture is expected to meet on an ongoing basis to discuss how its mathematics lessons are designed to ask and answer the four PLC critical questions as students are learning during class. In this book in the series, you explore two specific team actions for your professional work.

- **Team action 3:** *Develop* high-quality mathematics lessons for daily instruction.
- **Team action 4:** *Use* effective lesson designs to provide formative feedback and student perseverance.

You might be surprised, but there is a theme that runs through mathematics instruction and lesson design when working as part of a collaborative mathematics team within a PLC at Work culture. Ready?

It's *balance and perseverance.*

***Every Student Can Learn Mathematics* Series Team and Coaching Actions Serving the Four Critical Questions of a PLC at Work**	**1. What do we want all students to know and be able to do?**	**2. How will we know if they learn it?**	**3. How will we respond when some students do not learn?**	**4. How will we extend the learning for students who are already proficient?**
Mathematics Assessment and Intervention in a PLC at Work				
Team action 1: Develop high-quality common assessments for the agreed-on essential learning standards.	■	■		
Team action 2: Use common assessments for formative student learning and intervention.			■	■
Mathematics Instruction and Tasks in a PLC at Work				
Team action 3: Develop high-quality mathematics lessons for daily instruction.	■	■		
Team action 4: Use effective lesson designs to provide formative feedback and student perseverance.			■	■
Mathematics Homework and Grading in a PLC at Work				
Team action 5: Develop and use high-quality common independent practice assignments for formative student learning.	■	■		
Team action 6: Develop and use high-quality common grading components and formative grading routines.			■	■
Mathematics Coaching and Collaboration in a PLC at Work				
Coaching action 1: Develop PLC structures for effective teacher team engagement, transparency, and action.	■	■		
Coaching action 2: Use common assessments and lesson-design elements for teacher team reflection, data analysis, and subsequent action.			■	■

Figure I.2: Mathematics in a PLC at Work framework.

Your daily lesson design and planning for a mathematics lesson can easily fall into a routine that is unbalanced in its mathematical task selection, strategies used to teach the lesson, and student discourse and engagement during the lesson. Without ongoing team discussion with your colleagues about your daily lesson design, you can unintentionally cause deep inequities in student learning.

Do you know the following daily lesson routines of your colleagues?

- Do you each declare the mathematics standard to be learned each day?
- Do you each connect every mathematics task used during the lesson to the standard for the day?
- Do you each balance the use of lower-level-cognitive-demand tasks (procedural knowledge with rote routines) with the use of higher-level, open-ended mathematical tasks?

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- Do you each use application and mathematical modeling tasks during the unit?
- Do you each teach the academic vocabulary of the daily lesson?
- Do you each use a formative learning process that actively engages students during the lesson?
- Do you each use technology or other mathematical models as a routine part of the lesson design?

Wide variances in your daily decision making can cause a *rigor* inequity for students in the same grade level or course. In a vertically connected curriculum like mathematics this variance can cause learning gaps as students progress through the grades.

Significant lesson-planning differences may exist with how the lesson begins and ends, as well. You may use prior-knowledge warm-up activities every day with a student-led closure activity. However, your colleagues may not.

Mathematics lessons then have a lot of daily choices you must make. And those choices should be designed to help your students demonstrate "productive perseverance" during a mathematics lesson and persevere through the variety of mathematics tasks they must do to demonstrate their learning (M. Larson, personal communication, July 30, 2017).

In this book, *Mathematics Instruction and Tasks in a PLC at Work*, there is intentional guidance to help you and your colleagues reflect on your current lesson-design elements, compare your current practice against high-quality standards of mathematics lesson design, and then develop and use lessons that effectively engage students with those lesson elements.

The benefit of these lesson-design elements will be improved student perseverance in class, and they are most likely to result in retention of learning the expected mathematics standards for your grade level or course.

In this book, you will find spaces to write out reflections about your practice. You are also provided team discussion protocol tools to make your team meeting discussions focused, mindful, and meaningful.

The team discussion tools and protocols are designed for you to eventually feel confident and comfortable in conversations with one another about your lesson content and process, and in moving toward greater transparency in your instructional practice and understanding of the standards with colleagues. In this book, you will also find personal stories from the authors' experiences that shed light on the impact of your team actions on classroom practice.

This book is divided into two parts. Part 1 focuses on the third team action—*Develop* high-quality, essential, and balanced lesson-design elements. The chapters in part 1 explore six research-affirmed lesson-design elements for highly effective daily mathematics lessons. The final chapter in part 1 presents the Mathematics in a PLC at Work lesson-design tool that helps ensure your team reaches *daily and unit* mathematics lesson clarity on all four of the PLC critical questions. Part 2 focuses on the fourth team action—*Use* the lesson-design elements to provide formative feedback and sustained student perseverance during the lesson. The chapters in part 2 explore the *how* of the lesson-design process using the six essential lesson-design elements.

This *Every Student Can Learn Mathematics* professional development series is steeped in the belief that as classroom teachers of mathematics, your decisions and your daily actions matter. You have the power to decide and choose the mathematical tasks students will be required to perform during the lesson, during the homework you develop and design, during the unit assessments such as quizzes and tests you design, and during projects and other high-performance tasks. You have the power to decide the nature of the rigor for those mathematical tasks, the nature of the student communication and discourse to learn those tasks, and the nature of whether or not learning mathematics should be a formative feedback process for you and your students.

Most important, you have the power to decide if you will do all of this challenging mathematics work of your profession alone or with others. As you embrace the belief that together the work of your PLC can overcome the many obstacles you face each day, then *every student can learn mathematics* just may become a reality in your school.