

**QUIET
REVOLUTION**

**One District's Story
of Radical Curricular Change
in High School Mathematics**

**Michael D. Steele
Craig Huhn**

A Quiet Revolution

**One District's Story of Radical
Curricular Change in High
School Mathematics**

A Quiet Revolution

One District's Story of Radical Curricular Change in High School Mathematics

by

Michael D. Steele

University of Wisconsin-Milwaukee

Craig Huhn

Holt (MI) High School



INFORMATION AGE PUBLISHING, INC.

Charlotte, NC • www.infoagepub.com

Library of Congress Cataloging-in-Publication Data

CIP record for this book is available from the Library of Congress
<http://www.loc.gov>

ISBNs: 978-1-64113-181-0 (Paperback)

978-1-64113-182-7 (Hardcover)

978-1-64113-183-4 (ebook)

Copyright © 2018 Information Age Publishing Inc.

All rights reserved. No part of this publication may be reproduced, stored in a retrieval system, or transmitted, in any form or by any means, electronic, mechanical, photocopying, microfilming, recording or otherwise, without written permission from the publisher.

Printed in the United States of America

CONTENTS

Preface.....	<i>vii</i>
Introduction.....	<i>xi</i>
1. The Quiet Revolution: Three Decades of Mathematics Education at Holt High School.....	<i>1</i>
2. Shifting Tides: National Initiatives, State Policies, and District Demographics.....	<i>17</i>
3. Making It Work: The Implementation of Ongoing Curriculum Reform.....	<i>43</i>
4. Leading and Sustaining Radical Change: Voices From the Trenches.....	<i>67</i>
5. Making a Difference: Student Outcomes at Holt High School.....	<i>93</i>
6. The Anatomy of a Shared Vision: Beliefs About Mathematics Teaching and Learning.....	<i>115</i>
7. Creating Your Blueprint: Professional Learning Activities to Support Systemic Change.....	<i>139</i>
Appendices.....	<i>177</i>
References.....	<i>195</i>
About the Authors.....	<i>201</i>

PREFACE

Daniel Chazan

It is a pleasure to be invited to write this preface and to have recently had the chance to have a short visit at Holt High School (in what for me is the “new” building). Reading these chapters made me think back to interviewing at Michigan State University (MSU) in the spring of 1990 and, as a part of that interview process, being taken by Perry Lanier to meet his collaborators at Holt High School. Holt High School was then newly a Professional Development School. In particular, we met with Bill York and other members of the Mathematics Department. Though their collaboration was just a few years old at that point, there was already energy and a willingness to consider innovations, like having a Michigan State faculty member teach one period a day at the school. I left feeling that this was a unique context for collaborative work.

Those recollections make the stories related in this book all the more meaningful for me; they suggest that it is important to keep learning from a setting in which there is such a rare, long-standing, and deep relationship between school and university. For example, Holt High School has been a part of the MSU teacher education effort for a long time; secondary mathematics interns (as well as interns in other content areas) have been learning to teach from faculty in the Holt Mathematics Department for over 30 years.

A Quiet Revolution:
One District’s Story of Radical Curricular Change in High School Mathematics, pp. vii–ix
Copyright © 2018 by Information Age Publishing
All rights of reproduction in any form reserved.

And, of course, there has been much more to this relationship than only teacher education efforts; Holt teachers and their collaborators examine mathematics teaching and work to improve it within their building as well as more broadly in the state. It has been fascinating to read about how the teaching and learning of mathematics at Holt High School have continued to develop and change through shifts in policy context over the last slightly more than a decade. For example, this book documents how, as a part of the larger effort to change mathematics education in the United States, at Holt High School, there have been shifts in expectations for students; graduates of the school have gone from not needing to study “college bound” mathematics like Algebra 1, from only needing to studying arithmetic in the late 80s, to the expectation currently met at Holt that every student take and pass a mathematics class whose content would be labeled as Precalculus in other school contexts and which is labeled Algebra 2 at Holt. A quiet revolution, indeed! This is a compelling story that is worthy of attention given our country’s decades-long efforts to help high school graduates be prepared to choose to go to college in general and to pursue STEM careers in particular.

As documented in the coming pages, the Holt High School Mathematics Department, as a professional context, continues to afford unique learning opportunities for Holt faculty members and for inducting new teachers into an important image of professionalism. Coming back to visit Holt from a different context where it feels like there is much less stability and greater flux in the work lives of teachers and therefore fewer rich learning opportunities, it was wonderful to meet with a number of teachers who I remember as MSU interns and who have now been in the profession and working together for almost 20 years; it was wonderful to read about how at Holt High School teaching continues to be a life-long career opportunity with supports for professional growth, like participation in the writing of this volume, as well as other opportunities for engaging mathematics education stakeholders outside of their building. It was wonderful to once again be immersed in an environment that treats the teaching of mathematics seriously as a long-term matter of great importance and to engage with teachers about the policy context in which their work plays out. The experiences and expertise that are evident in the rest of this volume are now being offered to a larger professional audience with suggestions for making similar professional engagement available in other sites.

To be sure, there are many parts of this story that involve local characteristics that are unique. For example, Holt is a school district with just one high school (that lately enrolls about 1,800 students). It is much different than the school districts of about 150,000 student in my current local context that have more than 20 high schools most of which are larger than Holt High School. There are ways in which the size of a district change

what it means for teachers to have the sorts of professional opportunities outlined in this book. The local economy shapes the story that is told in this book as well. The economic forces that shape high school students sense of their possibilities after graduation, as well as mathematics teachers professional experiences, are different across this country. And, Michigan State's ongoing role in supporting the efforts of Holt teachers is clearly an important part of the story. Not every high school has this sort of relationship with a teacher certification granting institution, but many more schools could have such a relationship, particularly if we as a country organize to respond to looming teacher shortages, particularly in STEM fields.

I do not believe the authors of this book would ever argue that their story has some magic bullet in it that will transform mathematics teaching in all high schools across the United States. Interested readers will need to work hard to analyze the offerings in this book and to figure out what is most applicable to their own contexts. As I read, and think about my own experiences at Holt High School, what stands out to me is a deep commitment to conversation across differences of perspective and opinion and to ongoing efforts to experiment, innovate, and improve. Building on the image of mathematics teaching at Holt, I hope that readers of this book engage deeply with it, argue with it, and draw their own conclusions.

INTRODUCTION

Craig Huhn

In college, when I was about to enter my fourth year, I had no idea I was about to become radicalized.

I had decided on teaching, and had enjoyed the generic education courses that pushed my thinking on the purpose of schools and issues of equity. I knew from a discussion-based part of my own sixth grade experience that being a teacher meant having the opportunity to engineer discussions among a group of students that could expand their brain and their world-view. In my mind, teaching history at the secondary level had the best opportunity for dissecting the moral dilemmas of our past (Should the U.S. have dropped the atomic bomb? Is the Electoral College a fair system? Have there been circumstances where assassinations or torture could be justified?). I saw myself as the architect of class discussions where students grappled with complex ideas and learned to listen to ideas from peers. But when push came to shove and I had to choose my major and minor, my still-teenage self shied away from a history major and all the papers and reading the coursework would entail. Knowing that I could still teach my minor, I selected history in that slot and considered something easier to make my major. In a fateful move, I chose mathematics, and subsequently began my path of collegiate courses to earn those credentials. What I did not know at the time was that the way the teacher preparation program at MSU was set up, the methods courses would focus almost exclu-

A Quiet Revolution:

One District's Story of Radical Curricular Change in High School Mathematics, pp. xi–xv

Copyright © 2018 by Information Age Publishing

All rights of reproduction in any form reserved.

sively on my major. What was at the time an oversight ended up igniting a lifelong passion for math ed.

I walked into those methods courses assuming that to be a quality math teacher, all I had to do was be personable, and explain math really well. Over the course of the next several months, I was challenged to think about what it means to learn math—what it means to understand mathematics in a way I was quickly learning I lacked, even with a degree from a major university in mathematics all but complete at that point. I was challenged to reconsider what I thought mathematics actually *was*. And throughout this fourth year, while I watched classmates struggle with being pushed in this way, I welcomed this shift in world-view. I loved the discussions we had, trying to debate the nature of infinity and countability; dissecting the words of Aristotle as he grappled with continuity. *Arguing* about math! Thinking about who knows what and how we come to know truths. And wondering how one truly comes to understand ideas.

In that year, I reconceptualized for myself what math ed can look like. And going into the fifth year of the program, where teacher candidates were immersed in a year-long student teaching internship, I found out I was placed at the local high school that we had become familiar with in our courses as a math department that was working to teach mathematics in the way we were learning to teach it. During that fifth year, we also took a second year of methods courses at the university where we continued the journey to make sense of what I was realizing was a really complicated endeavor. I was immersed in a professional culture as an intern at Holt High School and trained to become a revolutionary in my coursework at the university. In my mind, it was no longer good enough to strive to teach well (with this new idea of what that means), I also felt a moral imperative to make sure this idea found traction in classrooms all over.

Around this time, the National Council of Teachers of Mathematics (NCTM) published its Principles and Standards for School Mathematics. This document, NCTM's second attempt at a national policy document for teaching and learning mathematics, was intended to be a more moderate document—a treaty in the Math Wars that had been pitting conceptual understanding and procedural fluency against one another. Both the push and pushback were playing out in real time as I was figuring out how complex working with 150 teenagers can be. In a continuation of fate, a position opened up at Holt the next year, and I have spent the past 17 years still working to get as many teenagers to learn and understand as much math as possible. I consider myself one of the most fortunate people in the world to have been trained under one of the top teacher ed institutions, under some of the best math ed thinkers in the world, placed in a school that had a professional community with ties to that program, and

been able to continue my career among some of the best educators I have ever known.

It was in this first year or so that one of my math ed instructors (one of the aforementioned best in the world), Dan Chazan, came to us to try and tell the story of how Holt High School and Michigan State had forged their alliance and how it had created a laboratory for working to improve mathematics education. It was my first year teaching when I became involved in that project and wrote for *Embracing Reason* (Chazan, Callis, & Lehman, 2008). In the years following, I have continued to try and extend the conversation about teaching and learning through other articles, chapters, presentations, workshops, or supervising interns. I have continued to attempt to engage students in understanding mathematics (with successes and failures in almost equal measure), and to fight for structures and systems that support our ability to do so (with failures seeming to outnumber successes). And I have continued to think about how *Embracing Reason* would sound if it had been written now instead of in the early 2000s.

Often people say change in education is slow, and I do not often disagree. But recognizing how different my job was 15 years ago, both local changes and the state and national landscape, makes a decade and a half feel like a century and a half. Today, there is little argument among the professional community about what quality mathematics education looks like. NCTM has published *Principles to Actions*, which outlines a detailed vision of what the teaching and learning of mathematics with understanding looks like in classrooms that make use of rigorous mathematics standards like Common Core. The Common Core makes it clear that certain practices, consistent with what we now know are best practices, are expected in math classrooms across the country. When I began teaching, Michigan did not even have a state set of standards in force. Since then, they have written and passed several versions up to and including the Common Core. A standardized state test went from one outside measure that teachers used to see how students were doing, to a high-stakes assessment of the quality of your school that determined what degree of sanctions the state would impose. And of course, that state assessment has changed no less than four times at least (although all iterations, from the MEAP to the ACT to the SAT, honored speed and surface-level procedural knowledge of tricks in multiple choice format). My state, hit hard by the recession of 2008 and exacerbated by political choices, has drastically underfunded education. And, purely for political choices, my state has also weakened public education laws, curtailed the ability for teachers to collectively bargain and stand up for students, and made several (unsuccessful, so far) attempts to enact vouchers. One such change was the enactment of “Schools-of-choice,” which allowed parents to take their kids (and the state money that is dedicated to educating them) to any school they want, as long as they

are willing to transport them there. As we will describe later, this has had a significant impact on Holt.

Since *Embracing Reason*, the cast of characters from Michigan State and our department have largely turned over. The political landscape and state expectations have changed. Movements like “formative assessment” and “growth-mindset” have evolved into critical pieces of pedagogy. The population Holt serves has become much more diverse. Curriculum has adapted, evolved, and adjusted. Grading practices have done the same. And yet, we still struggle to engage all students. We still question and evaluate the decisions we make, and push each other to continue to improve, but fail to reach all students. Our struggles are not new, even if some of the circumstances or nuances are. However messy it can be, we have at least gotten to a place (mostly fallen into it, as you will soon see), where we have an urban-fringe, large(ish) high school that requires a course equivalent to Precalculus for all kids to graduate, and gives every student the opportunity to take AP Calculus or AP Statistics if they so choose. And, the world did not implode.

How to Use This Book

The transformation of mathematics teaching and learning at Holt High School is special, but it is not magical. The mathematics teaching and learning outcomes we describe in this book arise from constant discussions, agreements, disagreements, evolutions, and revolutions amongst stakeholders at Holt High School. Our goal in writing this volume is to chronicle the most important aspects of those ongoing conversations and negotiations and to provide you, the reader, with concrete tools to instigate challenging discussions in your school and district that have the potential to lead to transformative change.

Each chapter describes an aspect of the Holt High School mathematics program over the years, ranging from demographics to course offerings to student outcomes. We describe both the changes that took place within Holt High School over the years and the local, state, and national contexts in which those changes were situated. Changing the culture and norms of your school involves persistence and resilience, as the pull of the status quo in education is strong. To support you in effecting change, this book aims to radicalize you. As a *radical mathematics educator*, you will have the data and tools to challenge assumptions, instigate difficult conversations about beliefs and practices, and inquire thoughtfully into your own mathematics teaching practice and how that practice supports student learning. The close of each chapter includes an Investigation and Reflection Activity that prompts you to look both inward at your own classroom, students, and

teaching practice; and outward towards your colleagues, administration, and community. The Investigation and Reflection Activities should begin with written reflections based on the prompt, and follow with concrete actions to prompt meaningful discussion within your school. We provide a framing for each conversation in the form of questions to pose, activities to engage in, and data to collect with your colleagues.

We encourage you to keep a physical or digital *Radicalization Handbook* as a record of your reflections and conversations. Collecting a narrative history of your own journey and the discussions in your school, district, and community can be a powerful tool for identifying levers for change. We also encourage you to reach out to others across districts and states to gain support for engaging in these conversations. Together, we are mighty and we can change the world of mathematics education for all students.

Let's begin.

