



Foreword

Too often a disconnect exists between what researchers study and what teachers do. This says neither that education researchers are undedicated to teaching, nor that working teachers are uneager to enlarge their classroom experience of what works and what doesn't. Findings of research, as reported in the language of scholarly literature, simply do not usually, and certainly not promptly, find their way into practice. Teachers are too busy teaching to engage with the scholarly community, and researchers often do not engage in the questions of practice through which their work can take root. Unless the working teacher is enrolled in advanced university courses, or attending conferences or local in-service training, the interface between the scholar and the teacher has been at best indirect.

James Middleton and Amanda Jansen are determined to change that. Their book is an account of the entire body of research on motivation in mathematical education, written for teachers in the language of practice.

Jansen is a former classroom teacher who has become a researcher in order to improve opportunities for students to be successful. Middleton is a learning scientist who wants his work to affect teachers' and students' lives. The result of their collaboration is a book that makes the reader feel that he or she is peering over the shoulders of attentive, perceptive teachers into a wide variety of individual students' minds and behaviors, set against a backdrop of research findings that adds depth and meaning to every classroom incident. As is always true in the classroom teacher's world, the setting is local, and the students' needs only partly generalizable. Yet, patterns of resistance and response exist that, once the teacher learns about them—and this is the purpose of this book—will be easier for the teacher to negotiate.

Bringing these perspectives to bear on any topic in mathematics learning would have made an interesting read. But this book's treatment of them is especially timely and important because of what the authors describe as a *motivational epidemic* in this country—a motivation to avoid mathematics.

Although the emphasis on improving mathematics achievement is growing, U.S. students' desire to achieve in mathematics and to choose mathematically sophisticated college programs and occupations is shrinking.... Compared with other countries, far fewer U.S. citizens, proportionally, choose science or engineering career paths than our foreign counterparts.... Teachers and school systems must begin to address the issue of why smart people choose to disengage from mathematical pursuits and how we can reverse this trend for the betterment of our students and the betterment of our nation (Middleton and Jansen 2011, p. 176).

Motivation, then, is the core issue: how to seed and cultivate it in a wide variety of classroom settings; how to maintain it as the mathematics becomes less obvious to the beginning learner; how to recognize and overcome task-specific resistance, and,

where present, the more insidious manifestations of math anxiety. The goal for every mathematics classroom teacher, the authors state unequivocally, goes way beyond cultivating “mastery” in their students. It is to enable their students to “develop mathematics as a personal long-term interest.”

The book is both text and triptych. The beginning of every chapter transports the reader to a classroom setting to interact imaginatively with individuals and groups of students. As the “teacher”—a composite of many teachers—tells their story, a bevy of researchers hovers in the foreground providing insight and guidance about what is taking place. Indeed, from my experience in the field, I would say that they’re all there helping the teacher overcome students’ resistance. There’s Altschuler and Eccles, Bandura and Dweck, Schoenfeld and others, and, not far behind, John Dewey. Even Belenky’s analysis of *connective knowing* in one instance helps the teacher make contact with a particular student. In sum, the book offers a comprehensive review of literature on mathematics motivation. But without the narratives that launch each chapter, the review would not be so compelling, nor could the classroom teacher use it as immediately.

Insights emerge, as they always do in teaching, from individual encounters. But when the body of research illuminates them, they become all the more potent. That is what the authors are trying to convey. Each author brings a different perspective to motivation as a topic. Middleton’s derives from his training in psychological and cognitive science. Jansen’s focus is on motivation’s social nature, particularly as students’ need for affiliation and connection affects their willingness to engage in mathematics. If one thinks of *interest*, to take one example, not as a *trait*, intrinsic to an individual, but instead as *situational*, then one should never understand *lack of interest* as either a label or an excuse, but as a signal yet to be turned on.

In a culture that judges children to be “good in math” or “bad in math” quite early, the thrust of this compendium on motivation is quite revolutionary: Students are all motivated, Middleton and Jansen are telling us. Teachers need to understand in what ways students are motivated, and why, if they are to make mathematics a long-term, personal interest of them all.

Sheila Tobias, February 2011

Author, *Overcoming Math Anxiety* (1978, 1993), *Succeed with Math* (1987), *They’re Not Dumb, They’re Different* (1990), *Breaking the Science Barrier* (1992).

References

Middleton, James A. and Amanda Jansen. *Motivation Matters and Interest Counts: Fostering Engagement in Mathematics*. Reston, Va.: National Council of Teachers of Mathematics, 2011.

Introduction

This book is an outgrowth of the recent NCTM Strategic Initiative to link research and practice. So much research is locked up in university libraries or is published in journals with small, very elite audiences—researchers talking to one another—that it is difficult to figure out exactly what information teachers receive in professional development, or in print distillations, is trustworthy. Furthermore, attempts are often made at linking research *to* practice. This implies that research should guide practice, but the equally important goal of practice guiding research gets somehow lost. Instead, NCTM rightly has placed emphasis on linking research *and* practice so that, together, we can work to improve the mathematics experiences of young people.

The authors of this book are Drs. James Middleton and Amanda Jansen, but we prefer to be called Jim and Mandy. Jim is a psychologist who, while studying students' motivation, broadly realized that mathematics was somehow special, that content mattered, and that there appeared to be no good reason for students and some teachers to hate mathematics aside from how it is taught. This spurred him to change his career to focus exclusively on improving mathematics teaching and learning. Mandy was a middle school mathematics teacher who valued getting to know her students, building positive relationships in the classroom while learning and doing mathematics, and fostering classroom experiences that reduced mathematics anxiety for her students. We are also both researchers who do *classroom* research. We have spent countless hours with teachers and students in mathematics classrooms as both teachers and researchers. The students and teachers whose stories we showcase in this volume are an amalgam of these experiences. We owe them a deep debt of gratitude.

We believe that these common experiences in research *and* practice justify the audacity of writing a book about motivation for mathematics teachers. We have tried motivating our students and failed, tried again, listened to others who have had similar experiences, and, through our research and through our practice, we have become better at both.

Research-Based Strategies

We are strongly committed to the goal that the strategies we implement in our classrooms can be research-based. What do we mean by this? When we say research-based *strategies*, we do not mean that we will offer a checklist for instruction. Rather, we will share principles about students' motivation and recommendations for teachers that these principles inspire.

The strategies we present are like the pirate's code in the film *Pirates of the Caribbean*—*guidelines* that have been successful under real conditions of practice. We do not intend to provide explicit decision rules for your practice, because there are none. We do not know your students, your school, or your community. Indeed, we think that part of motivating your own students involves getting to know them and determining which strategies introduced in this book apply to them and to what degree the strategies apply.

We do provide some guidance about how principles of motivation might inspire us or other teachers, because what teachers do clearly matters. Teachers set the agenda, inspire, cajole, select the tasks, and give the feedback that engages students and supports students' development as mathematics learners. We hope that our readers think about students' motivation in new ways, ones that affirm some of their currently productive ways of thinking about motivating students. We hope that this book will touch on teachers' motivations to create more exciting, productive mathematics classrooms inspired by research-based principles.

Navigating a Tricky Territory

This book represents our perspectives on ways to think about students' motivation, led by both our work as teachers and researchers and that of other researchers. A quick look at this book's reference lists will reveal a huge number of research studies conducted on students' motivation. We have spent time reading and thinking about other researchers' studies of students' motivations, and we've conducted our own research. The ideas and principles we discuss in this book *are not simply our own opinions*. This book's content is a careful analysis of the most useful *evidence-based* principles about students' motivation from research. When we say *research-based*, then, we appeal to an accumulated knowledge base, gathered over years by hundreds of scholars studying thousands of classrooms and teachers, involving tens of thousands of students across the grade span.

Despite this, identifying research-based principles is still tricky territory. For some potential principles, research findings have not been established at strong levels of certainty. For others, research results actually conflict, forcing us either to make a value judgment regarding the quality of the research or to step back and assess under what conditions the studies' conflicting implications might be valid. So in our effort to distill principles from the body of evidence, we exercised some level of interpretation, but we have done so cautiously. Where contradictory evidence exists, we present this fairly, but we take a stand where we believe the evidence is most compelling.

We recognize that some readers may hope for clear, definitive directions for classroom practices, despite that we may not have empirical evidence that clearly gives such directions. We share your frustration; we, too, hope for clearer direction in thinking about what teachers should do, and we believe that the principles shared in this book are a helpful step in that direction.

The Structure of the Book

This book is about motivation and how teachers can create more motivating classrooms to improve students' opportunities, experiences, and—ultimately—learning in mathematics. The principles we espouse in each chapter are the direct implications from decades of research in mathematics education and in the broader fields of educational psychology, sociology, and policy. In each chapter of part 2 of this book, we present one of these six principles of motivation with a compelling case that shows the focal principle in context. But rather than attempt to isolate these principles as if they could be clearly conveyed in a sterile, decontextualized, but deceptively easy textbook, we have chosen to provide examples taken from real classrooms. These examples emphasize human learners as complex, sometimes contradictory, but intensely *interesting* subjects. Grace is but our first encounter.

In each chapter of part 3, we will examine one of five categories of instructional strategies drawn from the research that can potentially affect students' motivation and learning positively. Although we do not hesitate to point out effective strategies that teachers in our stories attempt, nor do we shrink from suggesting some compelling opportunities you might try in your classroom, we reserve this section for explicit discussion of research-based strategies—how to begin implementing them, and what each strategy's likely outcome could be. In particular, we will discuss the following categories of instructional strategies.

1. **Judicious use of contexts (chapter 8)**—their tie to cognitive benefits, the utility of mathematics in solving problems, and the development of a value for mathematics in any context
2. **Providing challenge (chapter 9)**—optimizing the inherent trade-offs between challenge and control for students with diverse interests and abilities
3. **Limiting the use of rewards and other reinforcers (chapter 10)**—understanding the hidden cost of rewards and their relation to the development of performance goals versus mastery goals, and explicitly promoting a wider range of opportunities to demonstrate competence in mathematics
4. **Exploiting interests (chapter 11)**—building the individual curiosity, persistence, and personal relevance of one's students into the design of learning tasks
5. **Building relationships (chapter 12)**—enhancing the connected learning between teacher and student, between student and student, and between student and mathematics as a field of study

We conclude the book in part 4 (chapter 13) by drawing implications across all the cases presented, showing them not as a set of individual situations, but as two compelling arguments—that all students are motivated, and that by coming to understand our students’ individual and collective characteristics, we can do something to affect their lives positively. After all, that is why we are engaged in education—because together we can make the world a better place by investing our time and energy in the nurturance of young people, such that they themselves can effect change on the world, perhaps using some of the mathematics we have taught them to do so.

So, this book is really about teachers’ motivation. To what extent will we choose to make changes in our own practices that reflect the best evidence available about motivation’s role in teaching students? If we can help students learn to motivate themselves in mathematics, we have won more than half the battle; we have won the war. A teacher has choices to make. We wrote this book to guide and orient those choices toward your own success as reflected in that of your students.