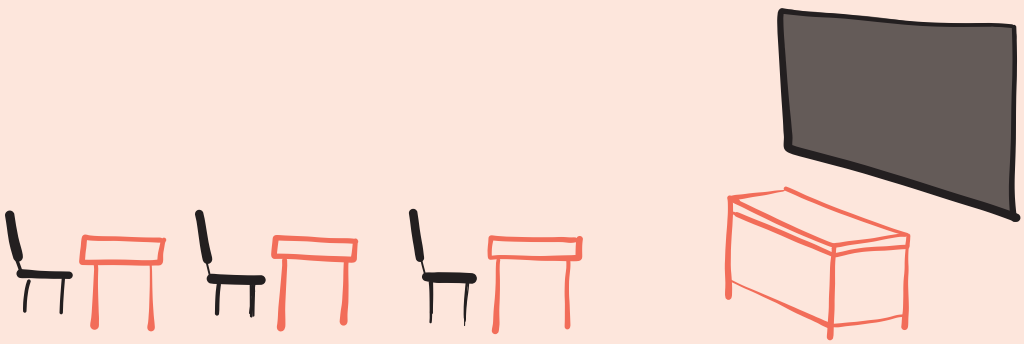
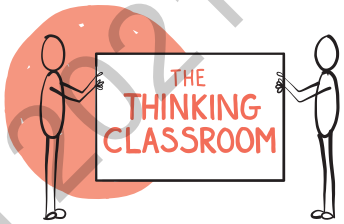


INTRODUCTION



When I first met Jane in 2003, she had been teaching middle school for 15 years. Although she was comfortable teaching math, there was a new curriculum on the horizon—and word on the street was that this new curriculum was going to have a heavier focus not only on problem solving, but also teaching *through* problem solving. In her 15 years of teaching, Jane had never done either of these. So, she decided she should get out in front of the new curriculum, learn something about problem solving, and start playing with it in her classroom.

Jane knew three things about me. First, she knew that I liked problem solving. My research at the time was, in essence, on creativity in problem solving, and I had been doing some workshops for teachers in her school district on this topic. Second, Jane knew that I was working on my PhD, was out of the classroom, and therefore had nothing but spare time on my hands. And third, she knew my e-mail address. I don't know how Jane knew any of these things, as I had never met, or even heard of, Jane. Nonetheless, one day in 2003 I received an e-mail from Jane:

Jane Hi. I'm interested in implementing problem solving in my Grade 7/8 mathematics classroom. Can I get some help from you?

Fantastic! I had been out of the classroom for a few years and I was missing teaching. To me this was an opportunity to not only get back into the classroom, but also do some problem solving with students.

Peter I'd love to help. Why don't we have a meeting to discuss it? I can come to school tomorrow. What room are you in and what time does school end?

So, the next day I showed up at Jane's door at 3:15 with a big smile on my face. This was going to be awesome.

Jane, who had clearly worked with researchers before, was not as enthusiastic.

Jane Look. Before we start talking about problem solving, I want to get a few things straight. First, I don't want any of your glee and enthusiasm in here. I don't want to coteach with you. I don't even want to coplan with you. All I really wanted were some good problems that I could use in my Grade 7/8 math classroom. I don't even know why we are having this meeting.

This was not what I had been expecting. In fact, it was about as far from what I had been expecting as possible. But I would not be deterred, and after 15 minutes of discussion we arrived at a tense agreement—of sorts. I would give Jane *good* problems to try, and she, in return, would allow me to watch her implement them. But she had rules.

Jane First, you have to stay in that desk [pointing at a desk in the back corner of the room]. You are not allowed to talk to the students. And you are definitely not allowed to talk to me.

And so it was that we began our collaboration—of sorts.

The first problem I gave Jane came from Lewis Carroll and was a problem I had used many times with my Grade 8s and 9s. I knew that this was a good problem. The context was engaging, the answer was non-trivial, and it didn't require any sophisticated mathematics to solve. And my students, when I had used it with them, had enjoyed arguing over the various answers they arrived at.

If 6 cats can kill 6 rats in 6 minutes, how many will be needed to kill 100 rats in 50 minutes? (Lewis Carroll, 1880)

So, the next morning I sat in Jane's class and watched her write this problem up on the board for her students to solve. Before I tell you what happened next, let me review a few details. As mentioned, Jane had been teaching for 15 years and until this day had never used problem solving in her classroom. Her students sat in desks that were in rows with some of the rows put together to make student pairs (see Figure i.1). The students did not have assigned seats and sat and worked with who they wanted. A typical lesson, Jane had told me, began with her going over homework. This was followed by a lecture, during which time Jane demonstrated how to answer questions and the students took notes. Toward the end of the lesson Jane would ask students to do what I call *now-you-try-one* questions, which, after a

few minutes, she would then go over. After a few of these she would assign homework out of the textbook, a student workbook, or a handout, and the students would work on this for the rest of the class. In short—it was a typical math class and a typical math lesson. Oh, and it was May—six weeks before the end of the school year.

Figure i.1 Students in a traditional classroom work on a task.
Source: skynesher/iStock.com

With that information in hand, how do you think her first attempt at using a problem-solving task like this with her students went? Yup—it was a disaster. As soon as Jane asked the students to solve the question on the board, a forest of hands went up and Jane started moving. She was going from student to student, from pair to pair, helping students who had questions about what they were supposed to do, if they were doing it right, and if this was the correct answer. Rather quickly, students became discouraged and began giving up, and now Jane was spending as much time encouraging students to keep going as she was helping the students who were still working.

Meanwhile, I was sitting in the back of the room, in my designated desk—not talking to the students and definitely not talking to Jane. The whole time I was watching this train wreck I was thinking that this was it—Jane was going to throw me out of her class, and that would be it for our brief, but spectacularly miserable, collaboration.

After about 25 minutes, Jane shifted gears and got the students onto a different activity, and she came up to me and said, "Give me another one." I was both shocked and impressed. There was more to Jane

than met the eye. So, I gave Jane a second task, and the next morning I was back in my desk watching Jane try it again—same students, new problem.

It went worse. The students were quicker to give up, and Jane now spent more time encouraging and less time helping. At the end of the activity Jane came up to me and said, "Give me another one." This woman had grit. Over the last 18 years I have worked with hundreds of teachers, and not since Jane have I encountered a teacher with such fortitude—such will and determination to keep going in the face of utter failure. So, I gave Jane a third task, and the next morning I was again back in my desk—same students, new problem.

It was the worst of all. The students had absolutely no fight left in them, and for 25 minutes they just sat there, off task, and talking amongst themselves. Jane still had fight in her, however. And for the entirety of the 25 minutes she kept moving around the room trying to get something happening. When she came up to me at the end of the activity, she said, "I think we're done."

I agreed. Everybody in the room was in pain. The students were frustrated. Jane was exhausted. And I was disappointed. It was time to stop. But I wanted to understand why the tasks that I had used with success previously were failing so badly. So, I asked Jane if I could stay for the rest of day and watch her teach. She agreed and added, "You know the rules."

As it turns out, I sat in Jane's room for three full days watching her teach using her aforementioned routine of going over homework, demonstration, notes, now-you-try-one tasks, and assigning homework. Sometimes she was teaching the same students with whom she had tried the problem-solving tasks. Sometimes she taught other students. Toward the end of the third day, I was struck by two epiphanies. The first was the realization that at no point in the three days of observation had I seen Jane's students do any thinking—at least not the kind of thinking that we know students need to do to continue to be successful in mathematics in future grades. This is not to say that there was no activity. There was lots of activity—the students were busy from the beginning of class to the end. They were taking notes, answering questions, filling in worksheets, and starting on their homework. They were busy. They just weren't thinking.

The second epiphany was the sudden realization that Jane was planning her teaching on the assumption that students either couldn't

or wouldn't think. Jane was in a tough position—she had a room full of students who weren't thinking, yet she had curriculum to get through and standards to meet. This is not uncommon. Every day, teachers all over the world find themselves in this exact same dilemma. Even teachers who, by traditional measures, are considered good teachers—who know their content, care about their students, and want to do the best for them—face this dilemma. Jane was considered, in her school and throughout her district, to be a very good teacher—her students performed well on tests, and no students appeared to be falling through the cracks. Jane wanted to do her best for her students, and she was willing to work hard to get there. And yet Jane found herself in this exact dilemma. So, what did she do? She did what many of us do—she structured activities that allowed her to move through the content as quickly and efficiently as possible without requiring her students to think. I'll give you an example.

There was an activity I watched Jane do that can be loosely described as a toothpick problem. The goal of the activity was to have students construct a row of squares out of toothpicks and record how many toothpicks it took to construct rows of different lengths. From these data, students were to then extrapolate and figure out how many it would take to build a row of length 10, 20, and 100 and then express the generalization in some prealgebraic format. These are great thinking activities when students are left to explore. In Jane's class, however, this activity was a set of instructions on a worksheet that she got from one of her resources. This wonderful patterning, extrapolation, and generalization activity had been reduced to a form of cookbook mathematics that ensured that, within 20 minutes or so, every student had completed it while, at the same time, ensuring that no one would do any thinking. Of course, these activities enabled the students to not have to think, which, in turn, forced Jane to keep planning her teaching on the assumption that students either couldn't or wouldn't think. But what choices did she have? Jane was stuck in a sort of endless and vicious non-thinking cycle. This is a problem. Thinking is a necessary precursor to learning, and if students are not thinking, they are not learning.

Thinking is a necessary precursor to learning, and if students are not thinking, they are not learning.

I wondered if this was a uniquely Jane problem, so I visited another teacher in her school. I saw the same thing. I visited another—same thing. In all, I visited five teachers in that building, and everywhere I went I saw the same thing—students not thinking and teachers planning their teaching on the assumption that students either couldn't or wouldn't think. This is now a school problem.

I now wanted to see if this was a uniquely school problem, so I reached out to educators I knew and asked them to recommend to me teachers that they had heard were good. I contacted these teachers and asked if I could come in and watch them teach and watch their students learn. Many of them said yes. So, I left Jane's school and I visited different classrooms in different schools. When I was in those classrooms observing, I would ask those teachers if they knew of a teacher, in a different building, that they had heard was good. And so it was that I hopped from classroom to classroom, from school to school, visiting these good teachers.

Because I was following this thread of good teachers there was a lot of diversity among the schools I visited. I visited classrooms of every grade from kindergarten to Grade 12. I was in low socioeconomic settings and high socioeconomic settings. I was in French-speaking classrooms and English-speaking classrooms. I was in public schools and private schools. In all, I was in 40 different classrooms in 40 different schools. And everywhere I went I saw the same thing—students not thinking and teachers planning their teaching on the assumption that students either couldn't or wouldn't think. And, like Jane, these were all considered good teachers—they knew their content, they cared about their students, and they cared that their students got through the content. And, like Jane, these 40 teachers were all caught in the same sort of endless and vicious non-thinking cycle—they had students who weren't thinking, and they had content to get through. And, like Jane, they were using resources and textbooks that were designed to facilitate this. This is not a Jane problem. Or a Jane's school problem. This is a systemic problem (see Figure i.2).

Everywhere I went I saw the same thing—students not thinking and teachers planning their teaching on the assumption that students either couldn't or wouldn't think.

Figure i.2 Students not thinking.
Sources: Goldfaery/iStock.com and Courtney Hale/iStock.com

STUDENTS NOT THINKING

At this point you may be satisfied with my statement that students were not thinking, and you may be nodding with the realization that that is also happening in your classroom, and you may be keen to get on with the rest of the book about how to change that—how to build a thinking classroom. If that is the case, then you can skip to the next section on institutional norms. If, however, you want a bit more of a description of what I mean by not thinking and how much of this was really happening in these 40 classrooms, then read on.

When I was visiting these 40 classrooms and coming to the realization that everywhere I went I saw students not thinking, what I really had was a *sense* that students were not thinking. I didn't have a good way to either qualify or quantify what I was seeing and not seeing. It was only a sense. It turned out to be true, but at the time it was only a sense.

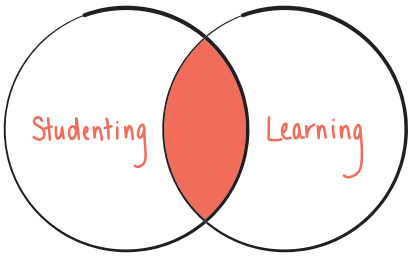
My first effort to more precisely describe what I was seeing came later through a series of research projects into *studenting* behavior. Studenting, a term first coined by Fenstermacher (1986), is the analogue to teaching. As teachers, we do a great number of things that may or may not have to do with the facilitation of student learning. We take attendance, deal with classroom disruptions, make school announcements, collect permission forms, fund raise, and, oh yeah, we also help students learn the curricular content and develop some skills. All of these activities fall under the umbrella term of teaching. For Fenstermacher, studenting is the analogue to this.

> **. . . there is much more to studenting than learning how to learn. In the school setting, studenting includes getting along with one's teachers, coping with one's peers, dealing with one's parents about being a student, and handling the non-academic aspects of school life. (1986, p. 39)**

> **[as well as] 'psyching out' teachers, figuring out how to get certain grades, 'beating the system,' dealing with boredom so that it is not obvious to teachers, negotiating the best deals on reading and writing assignments, threading the right line between curricular and extra-curricular activities, and determining what is likely to be on the test and what is not. (1994, p. 1)**

Studenting: is what students do in a learning setting—some of which is learning.

In essence, studenting is what students do in a learning setting—some of which is learning. And much of which is not. For me, studenting was the perfect way to start thinking about what it is that students are doing if they are not thinking. So, I decided to begin



to research studenting within a number of what are called *activity settings* within the mathematics classroom. An activity setting is a discrete and well-defined activity within a lesson. The activity settings I first researched were now-you-try-one tasks, note-taking, and homework. I will present the results from note-taking and homework in Chapters 7 and 11, respectively. Here, I will present the results from the studenting research into now-you-try-one tasks.

A now-you-try-one task is a task that teachers ask students to do after the teacher has demonstrated to students how to do something. So, for example, we may be demonstrating to students how to multiply two-digit numbers, and after we have thoroughly explained this and done two or three examples, we may turn to our students and say, "Now you try one," as we write up the one we want them to try. And then we wait for 4 minutes and 22 seconds, which is the average amount of time teachers give students to do a now-you-try-one task, before we go over how to solve it. Then, in many cases, we give the students another now-you-try-one task. In my visits to the aforementioned 40 classrooms, now-you-try-one tasks were a foundational and central part of every lesson I observed and, for many of these teachers, were part of the fabric of what it means to teach.

When I asked these teachers to tell me what student behavior they expect to see during these moments, the answer was always the same.

Lillian *I expect to see my students try it on their own.*

Researcher *For what purpose?*

Lillian *To see if they can do it, and to learn from their mistakes if they can't.*

We expect students to try it—and learn from it. Now-you-try-one tasks are a type of self-assessment where students and teachers learn whether the demonstrations were a success. This is pretty straightforward. So, what do students really do? What are their studenting behaviors during this discrete and well-defined learning setting? Well, it turns out that some students behave exactly as we expect—but only about 20% of them. The rest do not. In a study into studenting behaviors across several different classrooms, we found an array of behaviors[1] during the now-you-try-one activity setting (Liljedahl & Allan, 2013b). See if you recognize some of these.

[1] For a deep analysis of the psychology behind these, and other, studenting behaviors, see Allan (2017).

1. **Slacking -** A number of students in each class did not attempt the task at all. Instead, they spent the time looking at their smart phones, talking to other slackers, or literally doing nothing. When they were interviewed, it became clear that the students who slacked either didn't know what was going on or didn't care what was going on.

2. **Stalling -** Like the students who slacked, these students did not attempt the task. Unlike the slackers, however, these students filled the time with legitimate off-task behaviors like sharpening a pencil, getting a drink of water, going to the bathroom, or endlessly rooting in their backpack for some vital piece of equipment. When interviewed, these students told us that they either didn't know how to do the question or knew that if they just waited for a few minutes the teacher would go over it.

3. **Faking -** Some students pretended to do the task but were, in reality, doing nothing. Faking involved studiously looking at the board, flipping pages in the textbook, appearing to ponder, and pretending to write something on their page. But, for all the bluster and show, nothing was being achieved. Like the stallers, these students were hiding behind legitimate student behavior. The difference was that while the stallers hide behind legitimate off-task behavior, the fakers hide behind legitimate on-task behavior. When we interviewed them, we learned that, like the stallers, these students either didn't know how to do the task or were just killing time until the teacher went over it.

4. **Mimicking -** Unlike students in the three aforementioned groups, students who mimicked attempted, and often completed, the task. What they were doing, however, was trying to recreate the pattern of the solutions that had just been demonstrated on the board. This involved constant referencing to the demonstrated example with line-by-line mapping from the example to the task at hand. If the example that the teacher had demonstrated did not match the task they were asked to do, these students were often way off track or completely stuck. When we interviewed the teachers in whose classrooms we were doing the studenting research, all of them stated, with emphasis, that they did not want their students to mimic. Ironically, 100% of the students who mimicked stated that they thought that mimicking was what their teacher

wanted them to do. They were reading the demonstration of an analogous example prior to the now-you-try-one tasks as an invitation to mimic.

5. **Trying it on their own -** The last behavior was to just try it on their own. These students put their heads down and just tried to reason their way through the task based on their understanding. Some of them got it right, some of them got it wrong. Regardless, they were checking their understanding and getting feedback on it—as the teachers had intended.

These same five studenting behaviors were present every time we observed students in a now-you-try-one setting. And the distribution of how many students were exhibiting each behavior was surprisingly similar in each of the 10 classrooms in which we conducted this research (see Figure i.3). In all instances mimicking was exhibited by more than half of the class, with slacking, stalling, and faking combining to account for about a quarter of the students. Those trying it on their own—which is what the teacher wanted—only accounted for about 20% of the students. So, when I said that that I had a *sense* that students were not thinking, what I was actually seeing was slacking, stalling, faking, and mimicking—none of which is thinking.

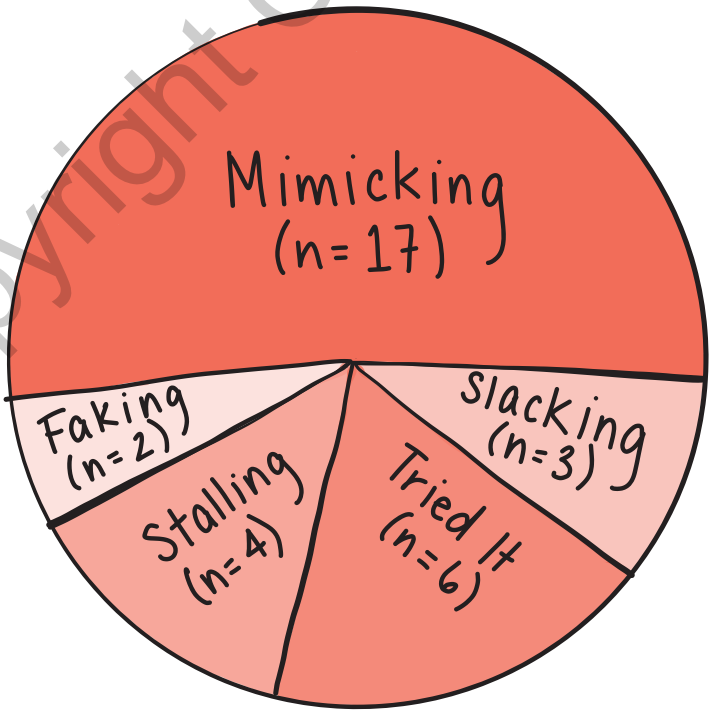


Figure i.3 Distribution of studenting behaviors on now-you-try-one tasks.

When I combined the studenting data for now-you-try-one tasks with the studenting data for note-taking (Chapter 11) and homework (Chapter 7), along with data from other activity settings, a clear picture emerged for exactly how much non-thinking behavior was present within a one-hour lesson. The results were troubling. In a typical one-hour lesson, 75%–85% of the students exhibited non-thinking behaviors for 100% of the time. The rest of the students exhibited non-thinking behaviors for all but 8–12 minutes of the time. This became my baseline data—the baseline from which I was hoping to make improvements.

INSTITUTIONAL NORMS

On my journey through these original 40 classrooms in 40 different buildings, other patterns began to emerge. Everywhere I went, irrespective of grade or demographic, classrooms looked more alike than they looked different. And what happened in those classrooms looked more alike than it looked different. There were differences, to be sure, but the majority of what I was seeing was the same. There were desks or tables, usually oriented toward a discernible front of the classroom. Toward this front was a teacher desk, some sort of vertical writing space for the teacher, and some sort of a vertical projection space. Students sat, while the teacher stood. Students wrote on horizontal surfaces while the teacher wrote on vertical ones. And the lessons mostly followed the same rhythm—beginning with some sort of teacher-led activity like a lecture or note-taking, perhaps shifting to some sort of small or big group discussion, but almost always culminating in some form of individual work. Even in the few more progressive classrooms I observed, the physical space looked the same, and the rhythm of the lesson was the same. What was different was the duration and nature of the activity in the middle of the lesson.

These normative structures that permeate classrooms in North America, and around the world, are so robust, so entrenched, that they transcend the idea of classroom norms (Cobb, Wood, & Yackel, 1991; Yackel & Cobb, 1996) and can only be described as institutional norms (Liu & Liljedahl, 2012)—norms that have extended beyond the classroom, even the school building, and have become ensconced in the very institution of *school*. Much of how classrooms look and much of what happens in them today is

Much of how classrooms look and much of what happens in them today is guided by institutional norms—norms that have not changed since the inception of an industrial-age model of public education.

guided by these institutional norms—norms that have not changed since the inception of an industrial-age model of public education. Yes, desks look different now, and we have gone from blackboards to greenboards to whiteboards to smartboards, but students are still sitting, and teachers are still standing. And although there have been a lot of innovations in assessment, technology, and pedagogy, much of the foundational structure of *school* remains the same.

Toward a Thinking Classroom

Everywhere I went I saw students not thinking and, as a result, teachers having to plan their teaching on the assumption that students either can't or won't think. And everywhere I went, I saw classrooms, and what happened in classrooms, that looked more alike than they looked different. So, I began to wonder if there were a connection between these in some way? Could the very institutional norms that permeate all schools and all classrooms actually be enabling and fostering the non-thinking behaviors I was observing? If this were true, what that would mean is that we would need to fundamentally alter the institutional norms to get students to think.

This assumption became the basis of my research, and for the next 15 years I worked with over 400 K–12 teachers to try to break through the non-thinking behaviors and get students to think. We worked in teams of 8–18 teachers in two-week cycles to deliberately break institutional normative structures and see whether it could increase student thinking. Our goal was simple—try to increase the number of students thinking and try to increase the number of minutes during which students were thinking. In essence, we wanted to improve on the baseline data. And we were willing to break any and all classroom norms to achieve it. Our only restrictions were that we would work within the confines of the classroom and within the confines of the set bell schedule. Other than that, there was no norm we were not willing to turn over.

To illustrate an extreme example of how far we were willing to go, early on in the research I worked with eight teachers who taught for two weeks in classrooms without any furniture. Furniture is an enduring institutional norm, and we wanted to see what would happen if we upended it. I learned three things from this experiment. First, student thinking increased—and radically so. We had more students thinking and thinking for longer. Despite this positive result, however, I also learned that teachers don't like to teach in classrooms without furniture. This realization was important

and formed a structure for much of my research going forward. There is no point in researching a practice that teachers are unwilling to implement—irrespective of how positive the results are. This constrained the scope of what we were willing to try in the classrooms. This is not to say that we were not willing to push into spaces that were uncomfortable, but there were limits to what was reasonable.

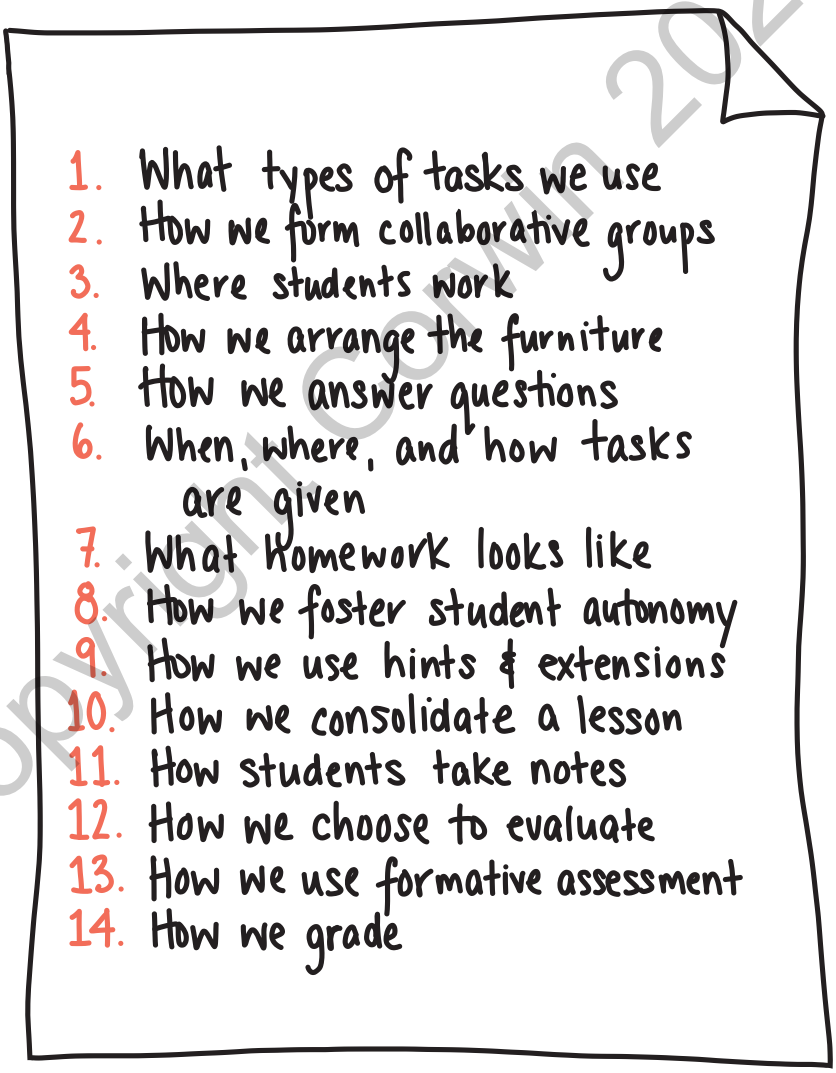
The third thing I learned was that results often came before explanations. This remained true all through the research and continues to be true even today. Knowledge of what works always preceded an understanding of why it worked. As a researcher who is used to starting with theories and then testing them, this was new and exciting territory for me. In the case of no furniture, for example, it took many months of interviews with students in different contexts before I began to even get a glimpse of why having no furniture influenced student thinking. It turns out that when students walk into a classroom that looks like every other classroom they walk into, they assume that the lesson is going to go like every other lesson they have been part of. And, therefore, they bring all of their habits and studenting norms into the room with them. If those studenting norms are non-thinking behaviors, then they are going to not think in this lesson as well. When the students walk into a room that looks very different, however, then they leave their habits and norms at the door and allow themselves to be different—at least to begin with. The reason teaching in classrooms with no furniture had an effect on student thinking wasn't that it, in itself, promoted thinking but rather that it didn't trigger non-thinking habits. And this gave the teachers a chance to make something else happen. I will return to this idea in Chapter 15.

So, we launched into the research with enthusiasm, and almost immediately we started to see positive changes in student thinking. Teachers were reporting back great successes, and, when I would visit classrooms and gather data, I was seeing tremendous improvements in student thinking. In our enthusiasm to create change, however, we lost sight of what changes were having what impact. We were trying so many things at once that we lost control of cause and effect—pedagogy and thinking. We needed to be more systematic in our experimentation. We needed to pick one variable to experiment with for two weeks and measure the effects on student thinking through that one variable. But what were the variables?

The obvious choice was the list of activity settings I had studied during the studenting research—now-you-try-one tasks, notes, homework, review, group work, et cetera. But the list of what influences thinking

in a classroom goes well beyond the discrete moments in a lesson. For example, I have already demonstrated that how a room looks when students walk in has an impact. So too do how we ask and answer questions, the types of tasks we use, and so on.

In an effort to find a list of variables that impact thinking in a classroom, I spent several months visiting classrooms that I was not, at the time, running experiments in. I was looking for a way to disaggregate teaching into discrete factors, each of which could act as a variable in our pursuit to improve thinking in the classroom. In the end, a list of 14 such factors emerged.



This list is comprehensive. Everything we, as teachers, do in the classroom is an enactment of one of these factors, and how we enact each of these factors is what forms our teaching practice—our unique teaching practice.

These factors became the variables we systematically experimented with in our efforts to increase thinking in the classroom. What we were looking for were practices, for each factor, that generated more thinking than the institutionally normative practices I had observed. And of these practices, we were looking for the practices that generated the most thinking—what we eventually came to call the *optimal practice for thinking*. And we found them. Slowly at first. But over the next 15 years they all emerged.

As it turned out, finding practices that generated more thinking than the institutional normative practices was not difficult. The normative practices were far from optimal, and there are many ways to enact each of the 14 factors such that they generate more thinking. In most cases we began our research by enacting a practice that was the exact opposite to what the norm was—if the norm was that students sit, then we made them stand; if the norm was that we answer students' questions, then we stopped answering questions; and so on. In some cases, this contrarian approach produced the optimal practice, but in all cases, it produced a practice that generated more thinking than the baseline data.

Groups of teachers tried each practice for two weeks. If it produced good results, then we tweaked it, and the teachers kept going with it. If, along the way, we tried a practice that was less effective than another practice we had tried, we abandoned it and tried something else. And so on. Eventually, after a number of iterations, we would get to the point where any changes we made to the practice made it less effective. At that point we had what I called a *local optimal practice*—it was optimal for that particular teacher, in their particular setting, with their particular demographic of students. Although these practices were of interest for teaching in general, they were often intertwined with aspects of the teacher's personality, habits, and norms. What I really wanted were practices that worked for any teacher in any setting.

So, I would take these local optimal practices and give them to different teachers in completely different settings, teaching different demographics of students, and see how these practices worked for them. Then we would run two-week cycles of iterations among those teachers, until what emerged was a practice that produced

the most thinking and was transferable across teachers, settings, and demographics. I would then give that practice to a new group of teachers to use for six to eight weeks to see if it had longitudinal fortitude and was not just something that worked because it was new to students. If it passed this last hurdle, then this practice was now what I was willing to consider an *optimal practice for thinking* within the factor we had experimented with.

How To Read This Book

In the chapters that follow, you'll read about each of the 14 optimal practices for thinking that emerged from the research into each of the 14 aforementioned variables. Each chapter begins with a brief description of which factor the chapter is addressing, why it is important, and what you will learn in that chapter. This is followed by an exploration around ***The Issue*** concerning the institutionally normative practices for this factor and what is ***The Problem*** that comes with these normative practices.

These introductory sections are then followed by the main part of the chapter, called ***Toward a Thinking Classroom***, where you'll learn about the optimal thinking practice for the factor in question and how this practice generally addresses some of the problems raised in the introductory sections, along with some grade-band or demographic-specific guidance where there is nuance. This is also the section in which you'll encounter a lot of concrete advice for implementing these practices. In our research into the optimal practices for thinking for each factor, what emerged were a number of what I came to call *micro-moves*. These are the little things within each of the practices that we found enhanced, streamlined, or made easier to implement the optimal practice. These are called micro-moves to contrast them against the *macro-moves* that are the optimal practices for thinking in each chapter. This is not to say they are any less important. In many cases, these micro-moves make the difference between smooth and rough implementation in your classroom.

Some of the things you read in ***The Issues*** and ***The Problem*** sections of each chapter will likely disturb you, as you may read about problems with practices that you are using. You may feel challenged by those ideas, and you may have questions about them. At the same time, some of the results you read in the ***Toward a Thinking Classroom*** sections may be difficult to imagine, and you may have questions about them or how to implement them in your classroom. As such,

the next section in each chapter is called ***FAQ***—frequently asked questions. This section addresses the questions that I find educators are most often curious about. I hope that the questions I address are the same questions that arise for you as you read the chapter.

Each chapter ends with a quick summary of the ***Macro- and Micro-Moves*** and a series of ***Questions to Think About***. These questions can be used as discussion points if you are reading this book as part of a professional learning community (PLC), if you are in a methods course, or in partnership with another teacher. If you are reading the book by yourself, these questions can also be used to push you to think more deeply about what you have read in the chapter and how what you read will translate into your classroom. Some of the questions are also designed to help you uncover some of the implicit beliefs that you have about teaching mathematics that could be the source of some of your challenges with or disbelief of what is presented in the chapter.

The book is written in such a way that you can read the whole book before you begin to build your own thinking classroom. If this is how you choose to engage with the book, then Chapter 15 will provide the results of the research into the optimal sequence for implementation and which practices need to be implemented together. If you want to build your thinking classroom as you read each chapter, then the book is also written to accommodate that. If this is how you choose to engage with the content, I suggest that you read Chapters 1–3 and then implement all three of those optimal practices for thinking together. After that, you can implement each practice as you read about it. To help you along the way, each chapter ends with a ***Try This*** section where you are provided with some tips and tricks as well as thinking tasks that you can use to help initiate that thinking practice in your classroom.

This is not to say that you must implement each optimal practice exactly as stipulated in the chapter. These practices are a framework that is meant to come alongside your current teaching experience. All of your teacherly craft is still relevant and necessary to make each of these optimal practices work in your classroom. The micro-moves will help. And as you enact each practice within your particular setting and with your particular demographic, you will find new micro-moves that allow you to make each practice even better.

Enjoy the journey.