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Getting Students to Mastery

A Day in a Mastery-Centered Classroom

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What learning might we unleash if classrooms were more like tutoring programs?

After eight years of teaching high school science, I turned my classroom upside down. Over the years, I'd put together a real-world applied curriculum and made progress toward inquiry-based teaching, but I felt like my classroom was still far short of what it could be.

I realized that a student could essentially copy all the homework, ride on the coattails of lab partners, and flunk every test, yet walk out of my course with a *D*. That student would have an endorsement that they passed my chemistry course while learning essentially nothing. I was giving these high school juniors and seniors zero responsibility for assessing their own knowledge and determining next learning steps. I wasn't doing my part in preparing these students for learning in the real world, where they would have no teacher to assign appropriate work, assess progress, and let them know when they do and don't understand something.

These realizations meshed with my study of Bloom's "2-Sigma Problem."[1] Bloom compared the effects of tutoring to those of traditional classroom instruction and found that 98 percent of students in a tutoring situation scored better than average students in a traditional classroom setting. The thought of essentially all my students performing above average was too enticing to ignore.

But I was one teacher in a classroom full of students—far from a tutoring environment. How could I change my classroom to come as close to tutoring as possible? What aspects of tutoring could I incorporate into my teaching?

To show how I answered that question, I'll describe a typical day in a 10th–12th grade chemistry course I taught several years ago. The active class period I'll depict reflects a lot of time spent at the beginning of the school year helping students learn classroom routines—where things are located, what they need to do each day when they enter the room, and so on. When I taught these classes, I'd at first have to remind students of these things (they're teenagers after all), but after a few weeks, they'd function quite independently and take responsibility for their learning time.

Beyond "It's Not Fair"

When I first began teaching for self-paced mastery, I needed to overcome the idea that being fair means keeping everything the same for everyone. Although "fair doesn't mean equal" may sound obvious, believing it was hard for me. How could I incorporate aspects of tutoring-based education—like asking some students to repeat a learning task or having a struggling student do one activity while a different student tackles another—without students and parents complaining that conditions weren't fair? Or even believing it myself?

I finally changed my conception of "fair" to this: Fair is making sure that every student has what he or she needs to learn and understand the content. After all, is it fair to ask a student who understands a concept to keep working on it because others in the class haven't reached that point yet? Or to move on from a chapter when several kids haven't mastered its lessons yet, simply because the majority of the class—or the schedule—is ready? Once I made this shift, I shared my thinking with students and parents. I've never had a complaint about fairness. Now let's view a typical day in the chemistry class.

All In a Day's Learning

The Class Grid

Before the class period begins, I glance at the class grid. This lists students' names in the left-hand column and all the required activities for this class—section quizzes, labs, chapter tests, and chapter performance assessments—along the top. As soon as a student successfully passes a quiz or completes a lab, test, or performance assessment, I enter the grade into this grid. This gives me a quick visual assessment of where students are in the course. I can see which students are several sections behind—and consider what those learners and I can do to address this lag—or see who's moving ahead—and start preparing labs or copying materials those kids will need.

As students enter the classroom each day, they get out their unit organizers and choose seats at one of several clusters of desks scattered around the room; there's no assigned seating because students may collaborate with different peers each day, depending on what they're working on.

For example, Carla successfully passed a section quiz on naming chemicals during the previous period. She's now ready to start a section on writing formulas—but the classmates she's been working with for a while aren't ready yet. So Carla finds a new group that's currently studying that topic. With this system, a student who's been absent can pick up right where he or she left off just by asking which group of students are working on the content that learner was immersed in.

As they settle in, students write in their organizers the date, what they accomplished during the last class, and what goals they have for this period. This chance to refresh themselves on what they did the previous class is especially important because this class uses block periods; it's been two days since these kids have been in my classroom. The organizer contains a grid for each of the different sections of the textbook that students are working on. This grid lists each of that chapter's sections in the first column; the other columns contain the learning objectives each section addresses, a list of learning opportunities available to fulfill those goals (with *required* activities for that section, like labs, marked in bold), and suggested completion dates for each item, as shown in Figure 1.

The Unit Organizer

FIGURE 1. Student Grid for Section on Antacids

Chapter 2: Antacids

Essential questions:

- How is science a human endeavor?
- How do scientists work to gather, analyze, communicate and validate data to form and change models?
- How does the structure of a compound determine its properties?
- How does matter undergo changes and how do we use chemical equations?
- How are mixtures different from pure substances?
- What are the characteristics of acids and bases?

Section	Objectives	Learning Resources (Check those that you complete)	Suggested completion date	Date completed
2-1	• Define and distinguish between pure substance (elements and compounds) and mixtures (homogeneous and heterogeneous)	• Reading guide • PowerPoint • Practice 1–1 • Discuss with peers • Discuss with teacher		

2–2	• Explain and practice nomenclature rules in naming chemicals: binary ionic, multivalent ionic, polyatomic ionic, and covalent	• Reading Guide • PowerPoint • Worksheet 2–2 • Practice 2–2 • Discuss with peers • Discuss with teacher
2–3	• Explain and practice nomenclature rules for writing chemical formulas: binary ionic, multivalent ionic, polyatomic ionic, and covalent	• Reading Guide • PowerPoint • Worksheet 2–3 • Practice 2–3 • Discuss with peers • Discuss with teacher
2–4	• Define and distinguish between acids and bases • Explain and practice nomenclature rules for naming and writing acids and bases	• Reading Guide • PowerPoint • Worksheet 2–4 • Practice 2–4 • Discuss with peers

As students plan for the day's class, many glance at the whiteboard, where I've written a "suggested" set of goals for this week. This suggested schedule may not match theirs, and I often need to remind them that it's fine to be ahead of or behind it. When I first implemented student-paced learning, I didn't give students any suggestions, fearing that doing so would reflect the teacher-paced approach I was moving away from. Yet students seemed to need some measure of whether they were on track, so I began posting this guideline.

Choosing Opportunities

After setting goals for the period, students select learning opportunities to meet those goals and set off to accomplish them. Jane chooses to read a section in the chapter on antacids and answer end-of-section questions. Frank and Adam use a printed reading guide (available in a self-serve file drawer and on the class website) to work through the textbook for the section they are studying. Xavier and Rick move together to a classroom computer with headphones to watch a PowerPoint presentation I created about balancing chemical reactions.

Five students who failed their last section quiz come to their folders, which are hanging in a milk crate, to review their unsuccessful attempts (all graded quizzes are kept there—unsuccessful ones so kids can study for their next attempt and successful ones to review for chapter tests). One of these individuals, Marly, feels ready for another attempt. She hands me her unsuccessful quiz, I hand her a new one, and she sits at the front worktable to complete it.

Meanwhile, a group of students working together on a practice worksheet sends a representative up to the front desk, where the answer key notebook is located. Students aren't given credit for worksheets and reading guides; these are considered "learning opportunities." Thus, learners are encouraged to check often with the answer key. Practice doesn't make perfect, I believe; practice makes permanent—and I don't want students practicing incorrect algorithms because that could turn into a habit that is extremely difficult to correct!

The representative, Sara, reports to the group that they still aren't getting it right and turns to me for help. "Wait for me at the front board," I reply. "I'll be back after I get this group started on their lab."

I head back to the lab area (the back half of my classroom), grabbing a tub that has the materials for the lab Chris and Stephanie are ready for and meet these two at a lab table. We go through a pre-lab, discussing techniques and equipment that are new to them, making sure they're ready for the lab, and reviewing safety information. When they complete the lab, the girls will come find me. I'll ask them a few questions to ensure they got what I wanted them to get out of the experience. Later, I'll grade the lab worksheet they've completed.

Meanwhile, I hurry back to the front of the room where Sara and her group wait for a minilecture and discussion. We spend five minutes discussing the type of problem they're struggling to understand, working through some examples. When I think they're getting it, I send them back to try more problems on the practice worksheet. They only need to do as many as they feel are necessary to ensure they've mastered writing chemical formulas.

I notice Marly has finished her quiz. I sit down with her and we grade it together, talking over the one problem she got

wrong. Marly takes her successfully passed quiz to her folder while I record her grade, then peruses her unit organizer for possible learning opportunities within the next section.

Students continue to move through activities, working in flexible groups, seeking me out when they have a question or need help, making decisions about when they are ready to be assessed with a quiz. They take responsibility for their own learning until the bell rings.

Filling in Gaps

A common concern about student-paced courses is that some students will fall behind—and continue to fall. However, the readings I've done about tutoring and mastery learning described exactly what I saw in my classrooms: Some students struggled in the beginning of the course because they didn't have the same prior knowledge as others, but as they learned at their own pace and with individualized feedback, the holes in their knowledge closed up. Once the gaps were addressed, students often caught up with the "suggested" schedule.

In a teacher-paced classroom, gaps in prior knowledge are often not addressed by teacher or textbook. It's assumed that all students have the knowledge. Also, gaps may be different for each individual. The class moves on before those struggling students can catch up. In a course that continually builds on prior knowledge (such as in math courses or many science courses), lagging learners might never catch up, as their foundation is never fortified.

Occasionally, I discussed this idea of filling in knowledge gaps with students who were trying unsuccessfully to keep up with the suggested schedule so they wouldn't feel frustrated and give up. It's key that students understand the importance of background knowledge. Later in their lives when there's no teacher guiding their learning, they'll need to be able to assess their knowledge gaps and find ways to close them.

"Yes, But"—Why It's Worth the Work

As you can see, this course wasn't self-taught; it was self-paced. Flexible communities of students worked together to understand and then to individually demonstrate their understandings.

Teaching a student-paced mastery learning course was the hardest work I've ever done. I had to juggle the work of several small groups, monitor students' use of time, make sure I had materials prepared in advance for the fastest moving students, and in general be on my toes. However, the results were more than worth it.

I saw students begin to self-regulate their learning. Yes, in the beginning they asked for quizzes immediately after an unsuccessful attempt and just tried to "get through" the sections. But within several weeks, they realized that approach wouldn't get them anywhere, and they began to take time to learn the content before retaking a quiz. They learned to judge when they were ready and when they needed more time or practice. By choosing their own path through the material, they saw that some learning opportunities work better for some types of content or some people.

I required students to show mastery (at least four out of five correct) on section quizzes but placed no such requirement on chapter tests. Because students had mastered each section before the test, however, no student got lower than a *C* on any chapter test (tests that were identical to those I gave before I taught this way).

Yes, I had to repeat a minilecture several times to different students, because I delivered content when students were ready for it. But I'd much rather repeat a discussion when I know all students are prepared for the material and are engaged than lead a discussion once with a whole class—some of whom aren't ready, aren't listening, or aren't getting it.

I was able to quickly deliver individualized feedback. Yes, at times students had to wait a few minutes for me if I was, say, discussing a quiz with someone. But the benefit of individualized feedback is immense in terms of understanding and progress. And often students solved their own problem or figured things out for themselves while waiting!

My self-paced classrooms weren't quiet, but I was OK with that. Classes more closely resembled a real-life work environment. Occasionally, students were off-task, but they were far more engaged in course content in this environment than were my students from previous years who sat silently listening to my lecture.

Yes, some students finished the required course content early (and got to choose independent study projects). Some didn't finish it at all.[2] But I'd rather send a student out the door with a *B* that reflects mastery of eight of nine units in a course than have a student who demonstrated none of these competencies "complete" that course with a *D*.

Most important, students felt the respect I had for them. The students who understood a concept quickly and were ready to move on were allowed to do so. Students who took more time knew that I wasn't going to move on without them. It took these learners a while to get used to the idea that they couldn't hide or slide by and that they were going to have to learn the content and demonstrate their understanding before moving on. Such a class may be the first experience a lagging student has had with someone saying, "I'm absolutely not going to leave you behind."

Once my high school learners realized I meant this, the stragglers caught up. Respect is powerful.

Endnotes

[1] *Bloom, B. (1984). Educational Researcher, 13(6), 4–16.*

[2] *I reduced each student's grade by one letter grade for each required chapter they didn't complete by the end of the year, prorating deductions for a chapter only partially completed.*

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KEYWORDS

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