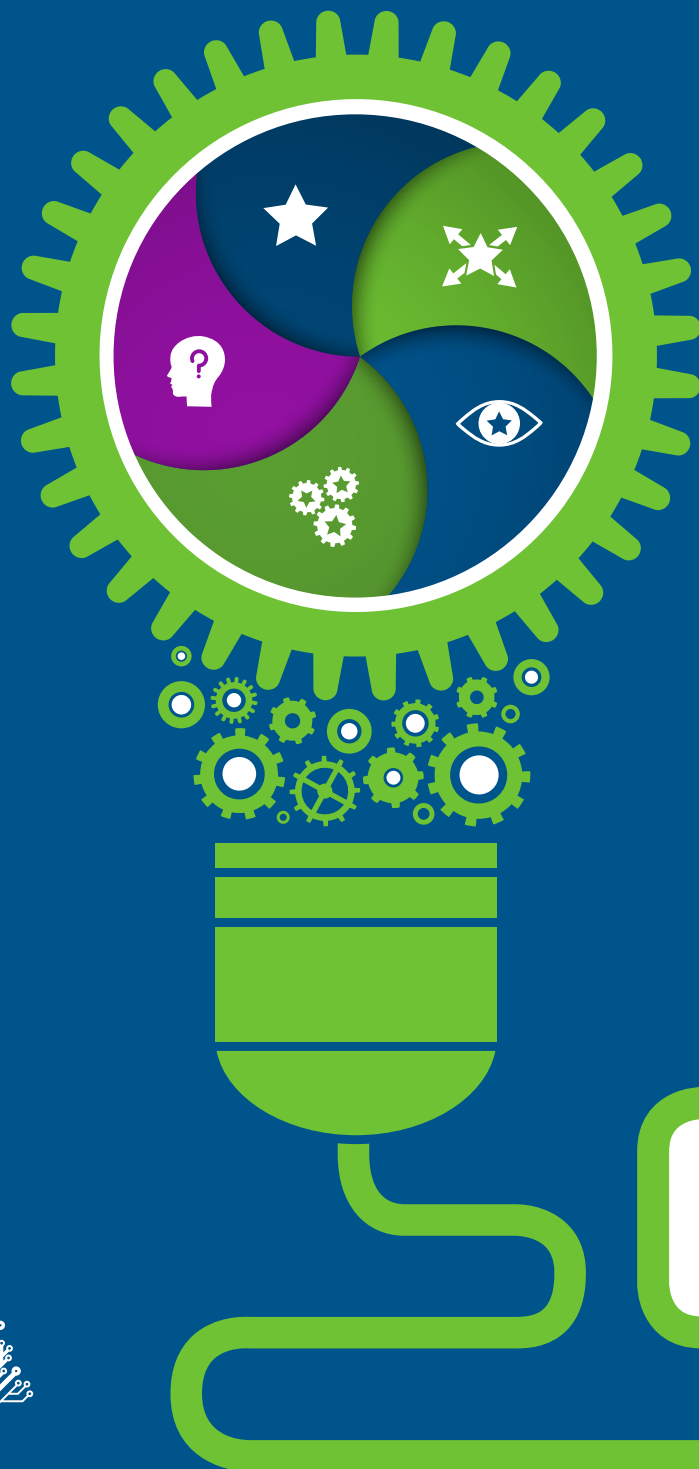


GETTING SMART ON MASTERY LEARNING



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Introduction

Getting Smart Staff



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DOES MASTERY MEAN MASTERED?

Ask a teacher, “How do you know your students can add fractions?” Ask a project manager, “How do you know if team members are really collaborating?”

It is challenging to define competencies that are clear and signal important priorities without being oversimplified. Assessing and **tracking skills is complicated**. In a Common Core **Toolkit**, standards authors warned that “fragmenting the Standards into individual standards, or individual bits of standards, erases all these relationships and produces a sum of parts that is decidedly less than the whole.” They worried about their rich standards being turned into checklists.

If one of our goals is for students to be challenged every day and to master important skills, they need a better way to progress through school than counting birthdays.

For demonstrations of mastery to be the standard mechanism for progress and foundational architecture of the K-12 education system, getting standards and assessments right is key—but it’s enormously difficult, particularly within the scope of a system transformation. When considering the challenging transformational shift to a new learning model such as competency-based education (CBE), determining mastery for competencies is critical for success. In an **overview of K-12 CBE**, Competency Works and iNACOL define CBE as:

- Students advance upon demonstrated mastery;
- Competencies include explicit, measurable, transferable learning objectives that empower students;
- Assessment is meaningful and a positive learning experience for students;
- Students receive timely, differentiated support based on their individual learning needs; and
- Learning outcomes emphasize competencies that include application and creation of knowledge, along with the development of important skills and dispositions.



Interwoven into these traits is the need to provide strong assessment protocols to recognize learning needs, and to celebrate learning growth. Both of these are essential for building learner agency and both are ideally communicated in progress reports, data dashboards, and report cards.

Making the shift to a mastery grading system requires strong protocols, transparent and consistent communication, and supportive policies. Any grading system must be rooted in a defined learning model to be truly impactful; a learning model that defines graduate outcomes, instructional practices, and recording/reporting systems. Choosing the right digital management systems is a critical step in moving toward a CBE system. Whether a district is considering a learning management system or a stand-alone assessment dashboard, the choice will be impactful for learning systems. All but a few recent learning platforms were not designed for personalized and competency-based learning. Supporting good practices with the right tools continues to be a challenge for the sector.

In CBE, learning organizations strive to define mastery beyond philosophical terms. Systems need to define what showing mastery means and what rating systems are used for communication, such as defined likert scales, rubrics or scoring guides. Systems should also consider how often a learner needs to show mastery and the variation of assessments. Mastery will then describe the level of achievement of a particular standard or how well a student needs to know something in order to apply that skill. These protocols can be defined within instructional learning models or in an assessment framework.

When CBE receives criticism, it's often focused on the grain size of the targeted learning objectives and to what level it is assessed. Mastery within a competency system is focused on application and creating a larger body of knowledge. Competencies should emphasize the application of skill and lead to an understanding of theories or conceptual knowledge. Mastery is defined in terms of application and retention, not checklists.

Organizations transitioning to a CBE system will require a transcript translation for Carnegie crediting. While there are varied beliefs on the importance of this translation, learners still live in a world that uses this benchmark for postsecondary pathways. In addition to this understanding, learners may leave or transfer out of a system for a variety of reasons and reporting systems must be in place to appropriately capture their learning for their next learning organization.

This series explores what mastery is and how it is determined, recorded and managed. If this is something your learning organization has been tackling, we'd love to hear from you. Join the conversation using [#MasteryLearning](#) on Twitter.

What Is Mastery Learning?

Scott Ellis, Founder and CEO of MasteryTrack

Mastery learning is THE transformational education innovation of our time. At its core, mastery learning enables students to move forward at their own pace as they master knowledge, skills, and dispositions. Effective implementation at scale will completely change how students learn, how teachers teach, and how schools work. It will revolutionize state testing, education research, and the labor market. It will transform how curricula are developed, how learning is measured, and how teachers are trained.

Yes, it is THAT big.

That is why it is so critical, and also why it is so difficult.

Recently an education colleague said to me, “I don’t understand why you talk about mastery learning as if it is so new. You act like you suddenly discovered fire--but fire has been around for a long time. So has mastery learning.” She’s right. Mastery learning as a concept and even as an instructional practice is not new, it has been around since at least the 1960s. If we think about licensure more broadly, the requirement of demonstrating mastery has existed where it mattered for centuries, from medieval guilds to modern driver’s licenses. Over the last several years a growing number of teachers, schools, and systems across the country have gradually started to move in this direction, with increasing awareness of mastery learning and its potential benefits for students and teachers. But it is challenging work. Most schools still use letter grades and manage the education process based on seat time requirements and pacing guides where teachers teach groups of students the same content at the same time. The entire system, including college admissions, scholarships, financial aid, and athletic eligibility, expects traditional grade point averages and often translates them into a four-point score. The current system is driven by teaching rather than learning, and all of its complex and deeply-rooted systems and practices are based on this paradigm. Educators have heard of mastery learning and some have even tried it, but America’s education system is not mastery-based.

WHY A MASTERY LEARNING APPROACH IS THE FUTURE OF STUDENT INSTRUCTION

Over the past several years, educators have heard about and increasingly been exposed to terms like “personalized learning” and “blended learning.” These are closely related to mastery learning and often include concepts like differentiated instruction and the effective use of real-time data. “Competency-based education” and “proficiency-based education” are often used as synonyms for mastery learning in different regions and by various groups. But the essential and truly transformational element in all of these is the same: enabling students to move forward at their own pace as they master content.

Today, through technology, tools, and expertise, we have the ability to scale this model at a national level. We have reached a point where for the first time we could implement mastery learning across the entire American education system. We have defined the required elements and all the pieces exist.



The question is: will we choose to do it?

It will require innovation--in software tools, classroom practices, and policies. And innovation is challenging, especially in education.

ENABLING MASTERY LEARNING STRATEGIES WITH TECHNOLOGY

Over the past several years we have made tremendous progress as a country in implementing the enablers necessary for mastery learning. More schools than ever before have sufficient internet connectivity to enable online systems to be an essential component of classroom learning. Laptops and tablets are widely available, and students (and increasingly teachers) are very comfortable using them. Teacher practices like rotation models and data-driven instruction have been defined, and many coaching organizations exist to help educators implement these practices effectively. Many software and online learning platforms have been developed and widely adopted as part of daily classroom learning.

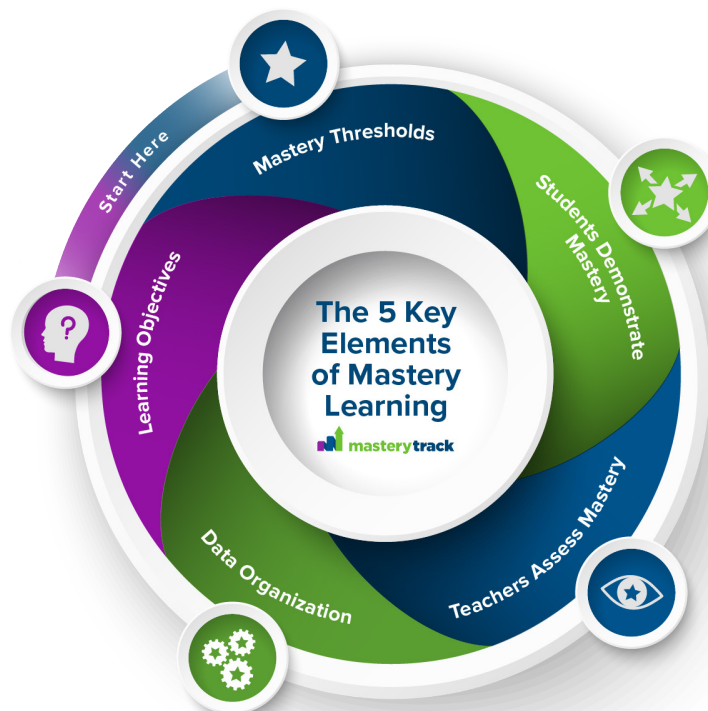
The pieces are in place, the ecosystem is ready. It is now time to take the next step in the journey of innovation. System-wide implementation will, of course, require action at state, district, and school levels to address thorny topics like mastery-based high school transcripts, transitions from traditional grades to mastery-based measures of progress, alignment with parents and school boards about expectations, and numerous other critical issues. But an important catalyst to support this essential work is clarity about what exactly happens in the classroom. How do the student, the teacher, the learning resources, and the data actually interact on a daily basis to nurture the kind of mastery learning we are seeking? As the sector gets more experience the answers are getting clearer. It is time to transform America's education system and implement mastery learning at scale.

What is required for this to happen?

5 KEY ELEMENTS OF MASTERY LEARNING AT SCALE

In addition to continued implementation of the enablers described above, five key elements need to be present for mastery learning to occur at scale:

- 1 Specific, clear, demonstrable **learning objectives**. We must be clear what we want students to know and be able to do when learning has successfully occurred. Traditional high-level standards do not enable mastery learning; greater precision is essential.
- 2 Clear **mastery thresholds** for each learning objective. Students and educators need to know exactly what mastery means and how we know when the student is ready to move on to the next learning objective. Historically we have been mushy in our thinking about this topic; we must be clear. This applies to all learning objectives--the simple objectives that require computation and memorization as well as the very advanced objectives that require complex collaborative synthesis and application. All objectives must have clear mastery thresholds!
- 3 Clear processes for **students to demonstrate mastery**. The processes must be fully scalable: for every student and every learning objective. This also works to ensure equitable access for all learners.
- 4 Clear processes for **teachers to assess mastery**. These processes must also be fully scalable so it is feasible for teachers to assess mastery for every student and every learning objective (remembering that some students may need multiple attempts to demonstrate mastery depending on their level of readiness and the potential variety of assessment options available).
- 5 A system to effectively **organize and display the data** about mastery-based student learning progress. The data must be immediately and easily available to students, teachers, principals, and parents.



Once these elements are in place, mastery learning can occur. And once mastery learning systems are in place, they will improve over time. As teachers become accustomed to teaching in a mastery-based system, they will get better at using effective classroom practices and continue to hone their craft. Curricula will re-align to specific learning objectives and mastery thresholds, and they will support mastery-based teaching and learning more effectively. As schools generate and then review data about mastery-based student learning progress, they will be able to identify promising practices to adopt and scale. These parts of the system do not need to be in place at the beginning, but rather will develop over time. But without the five key elements described above, mastery learning simply cannot occur at scale.

None of these elements are particularly revolutionary or complex at first glance. However, very few of them actually exist today at scale or in ways that are scalable.

But innovation is starting. The enablers are in place.

The time has come.

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Mastery Learning Objectives and Mastery Thresholds in the Classroom

Scott Ellis, Founder and CEO of MasteryTrack

To implement mastery learning and enable students to move forward at their own pace as they master content, five elements must be in place. It does not matter whether they are in MasteryTrack or another system, but without them, mastery learning at scale is not possible.

- Specific, clear, demonstrable **learning objectives**.
- Clear **mastery thresholds** for each learning objective (what a student needs to do to demonstrate mastery).
- Clear processes for **students to demonstrate mastery**.
- Clear processes for **teachers to assess mastery**.
- A system to effectively **organize and display the data** about mastery-based student learning progress.

Over the last several years we have partnered with over 100 schools to implement mastery dashboards for over 10,000 students in a wide range of subjects. Although our focus is the U.S., our journey has taken MasteryTrack to Europe, Singapore, China, and other markets across Asia. Some schools are in their fourth year of implementation. Through this journey we have learned a tremendous amount about these five elements, what success looks like, and the kinds of challenges we face in bringing them to life at scale. The critical starting point, and in my view the foundation for mastery learning, is the first two elements: learning objectives and mastery thresholds.

MASTERY LEARNING OBJECTIVES ARE CRITICAL

Learning objectives are the critical starting point for mastery learning. As educators we must be crystal clear what we want students to know and be able to do once the learning process has finished. These objectives must be specific, clear, and demonstrable: everyone must know exactly what the objectives are and the learner must be able to demonstrate that they have learned them.

Most existing standards do not enable mastery learning because they are not specific, clear, and demonstrable. On the contrary, many are high-level and intentionally vague, and some have multiple parts. I have had multiple conversations with schools using traditional models in which teachers of the same subject in the same grade did not agree about what they were supposed to teach students. On the other hand, I recently talked with an educator who had implemented MasteryTrack along with her colleagues and she shared that one of their most powerful initial experiences was talking together as an instructional team about what exactly they each wanted their students to learn. They quickly identified several differences (some minor nuances and some deep philosophical disagreements) but the requirement of specific, clear, demonstrable learning objectives helped them have focused professional instructional strategy conversations and come to an agreement about exactly which objectives they were all going to use.

A teacher who implemented MasteryTrack last year shared with me how surprised he was to discover that his students did not know or understand their learning objectives--in some cases they were able to execute the desired skill but could not explain what it was! As a result, he changed his teaching approach and began the learning process for new content by ensuring that the students actually understood the learning objective. This clarity about the desired outcome of learning is absolutely critical to student success.

MASTERY LEARNING EXAMPLES TO CONSIDER

To illustrate how difficult it is to apply mastery learning concepts with current standards, consider this English Language Arts standard: "Determine a theme of a story, drama, or poem from details in the text; summarize the text". This is actually six different objectives--determining a theme is different than summarizing a text, and stories, dramas, and poems are different from each other. (We could take the magic word "or" seriously, but then an educator might conclude that they don't need to teach poetry. This interpretation seems unlikely). It is easy to be confused about what teachers need to teach and what students should be learning.

In order to eliminate this confusion we should be clear about what we want students to know and be able to do once learning has successfully occurred. While it can be feasible to combine multiple skills or areas of content knowledge into a single learning objective, we should be clear what we mean (and if we write "or" we must be certain we mean it).

Or consider these math standards: "Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right" and "Interpret a multiplication equation as a comparison, e.g., interpret $35 = 5 \times 7$ as a statement that 35 is 5 times as many as 7 and 7 times as many as 5." How might a student demonstrate that she has mastered these objectives? I have not been able to come up with a better approach than solving problems effectively.



If we cannot develop specific, clear ways for students to demonstrate mastery of these concepts besides solving problems successfully and fluently, is it more appropriate to consider these as instructional approaches toward objectives like “Round three-digit numbers to the nearest ten” or “Multiply two one-digit numbers” rather than standalone learning objectives? I think so.

SETTING MASTERY LEARNING THRESHOLDS BENEFITS STUDENTS

Every learning objective must have a clear mastery threshold. In a mastery-based system teachers no longer move students forward to the next learning objective simply based on the calendar. In today’s world teachers may just have to give the student a C+ and start teaching the next topic because it’s Tuesday and the district pacing guide says it is time to move on.

Instead, students move forward only once they have mastered a learning objective. In order for this to work, students and teachers must know what it means for a student to “master” an objective. The mastery threshold must be defined and clear. In some cases the threshold is actually embedded into the learning objective itself (e.g., this is the case for many objectives in Spanish Interpersonal Oral).

The first step in defining mastery thresholds is to determine the type of demonstration a student will use for a particular objective, activities like giving a presentation, writing an answer, solving a problem, or completing a project. For example, for an objective in math like “multiply two one-digit numbers” an appropriate approach for a student to demonstrate mastery might be to accurately and fluently solve problems. For an English objective like “Determine a theme of a story” a student would write a response or perhaps give an oral response or presentation. For an objective in social and emotional learning like “Treat others’ belongings with respect” the approach is more complex and would include three parts: the student must demonstrate that he knows what it means to treat others’ belongings with respect (write something or give an oral response), show that he can do it once (show he is capable of taking the action), and then do it consistently.

In the MasteryTrack system, for many math examples I have set the mastery threshold as 9 problems out of 10 correct within a generous time limit. For more advanced and time-consuming problems like “Multiply two three-digit numbers” the threshold is 4 correct out of 5--since students already know how to multiply and it takes so long to do this type of problem, it seems unnecessary to require them to solve 10 problems.

MASTERY LEARNING OBJECTIVES AND MASTERY THRESHOLDS ARE CLOSELY LINKED

For some objectives the mastery threshold is somewhat incorporated in the wording of the objective itself. I spent several months working with a wonderful Spanish educator to create an entire mastery-based structure for a Spanish Interpersonal Oral course. Lower level objectives are relatively straightforward--for example, “Answer 6 memorized closed questions about self using phrases.”

There is lots of specificity in this objective: six questions, memorized (rather than original), closed (rather than open), using phrases rather than either single sentences or paragraphs. Because of the nature of the wording, the mastery threshold is clear and inherent in the learning objective. This is also true for more advanced learning objectives, such as “Answer two open, original questions that call for the description of familiar people with lists of sentences containing two or more sentence patterns and some detail.” This level of clarity enables students and teachers to understand what learning we hope to achieve and how we will know if it has occurred.

Once learning objectives and mastery thresholds have been established, we can move on to the rest of the key elements of mastery learning. But these first two elements are the skeleton that provides structure for the entire system. Once they are in place we are ready to establish the other key elements: how students demonstrate mastery, how teachers assess mastery, and how to organize and display the data.

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Demonstrating and Assessing Mastery, and Managing Mastery Learning Data

Scott Ellis, Founder and CEO of MasteryTrack

The starting point for mastery learning is the learning objectives and mastery thresholds; what do we want students to know and be able to do, and what does success look like? Once these two elements have been defined we are ready to address the remaining key elements required to bring mastery learning to life in the classroom: how students demonstrate that they have mastered the learning objectives, how teachers assess those student demonstrations of mastery, and how the data about the mastery learning progress of the students is organized and displayed.

HOW STUDENTS DEMONSTRATE MASTERY KNOWLEDGE AND SKILLS

With learning objectives that are specific, clear and demonstrable and with mastery thresholds that are clearly defined, determining approaches for students to demonstrate mastery is a relatively straightforward two-step process. First, we must determine the type (or types) of demonstration(s) a student will use for a particular learning objective or subject area. For example, in the case of many elementary math objectives, solving problems accurately and relatively fluently is a common approach. For an English Language Arts objective like identify the theme of a story' a teacher may have a student write a response or perhaps present her learning. In the case of some objectives in Social and Emotional Learning, like treat others' belongings with respect, the student will need to consistently exhibit a particular behavior.

Once the type of mastery demonstration has been determined, the next step is to define specifically how it will work for the particular learning objective, what exactly will the student do? If they are solving problems, what kinds of problems and in what format? If they are doing a presentation, what kind of presentation, in what context, how long, etc.? There can be multiple approaches for students to demonstrate mastery as long as each of them is equally valid and sufficient for demonstrating mastery.

It may be helpful to walk through a couple of examples of this thought process. If a student says, I know how to multiply, how might we think about how the student would demonstrate mastery? First, we would need to clarify the learning objective since the student's statement could mean a variety of different things. A more precise objective would be I can multiply two one-digit numbers. This is specific, clear, and demonstrable. How would we know if the student has mastered this objective? We need a mastery threshold.

Sometimes the nature of both how the student demonstrates mastery and how the teacher assesses mastery are inherent in the definition of the mastery threshold, and the first step in defining the mastery threshold is to determine the appropriate type of mastery demonstration. In this multiplication example, a reasonable way for a student to demonstrate that she can multiply two one-digit numbers is for her to solve problems accurately and reasonably fluently. So the threshold might be nine problems correct out of 10 within three

minutes. With this clear learning objective and mastery threshold, the approach for the student to demonstrate mastery is straightforward, she is presented with 10 problems of one-digit multiplication and she tries to solve them. In Spanish Interpersonal Oral we might use a similar process to come up with a learning objective such as answer three highly familiar, open questions about daily life with single, complete sentences, and for the mastery demonstration, the teacher would ask the student appropriate questions and evaluate the responses.

The other key success factor for students demonstrating mastery is that the approach (or approaches) must be scalable; every student must be able to effectively attempt to demonstrate mastery for every learning objective. And since in a mastery-based system students may need multiple attempts to succeed, the approaches must enable this as well.



HOW TEACHERS ASSESS AND ANALYZE MASTERY LEARNING STUDENT DATA

Once it is clear how students will attempt to demonstrate mastery, the approach for teachers to assess whether these attempts have been successful must be just as clear. The approach to be used is directly related to the method used by the student. There are a few key considerations:

- **Feasibility.** The teacher must be able to effectively determine whether the student has demonstrated mastery. This may seem self-evident, but it is still very important to be sure that the teacher is able to evaluate the student's work and decide either that the student has demonstrated mastery of the learning objective and is ready to move on, or that the student did not do so and needs to keep working on the same objective, perhaps with a different approach for learning. If the teacher cannot provide an accurate determination, this usually means that the learning objective or the mastery threshold is not sufficiently clear, and so the remedy is to work on these other elements to enable effective assessment of mastery by the teacher.
- **Inter-rater reliability.** Different teachers must give relatively comparable assessments of mastery. This issue is not unique to mastery learning, but it is an important element of the process. Teachers should have a common understanding of the learning objectives and the

mastery thresholds as well as how they will assess the student demonstrations of mastery. This will help to ensure that the mastery determinations made by different teachers are consistent. Inter-rater reliability is also honed within teacher learning communities when teachers can use specific, clear data about student performance on objectives to align, share, and grow.

- **Scalability.** The process must work for every student, every learning objective, and every teacher. This is particularly important in content areas where students may demonstrate mastery of more discrete learning objectives (rather than just taking a big comprehensive test as they would in the existing system). The workload for the teacher must be managed so the task of assessing mastery does not become overly burdensome and therefore detract from the learning process.
- **Workload from repeated attempts.** Since students may need multiple attempts to successfully demonstrate mastery, teachers need time to assess multiple attempts. This will add to the teacher's workload, and so the process must be designed to be manageable even when some students need multiple attempts.
- **Automatic grading.** This capability could improve the overall process in several ways. First, it saves teachers significant time. This is extremely valuable since teacher time is so scarce and precious. It also forces clarity about the mastery threshold--without a very precise threshold it is not possible to design a productive automated assessment. It eliminates any questions about teacher judgment when determining whether students have demonstrated mastery. And finally, it resolves any concerns about inter-rater reliability. However, many content areas and learning objectives cannot be assessed automatically, and even the most effective implementations of automatic grading are most productive when combined with teacher judgment. Educators need to diagnose assessment outcomes and may even override the results when necessary based on the educator's knowledge of the individual student and her learning needs.

Student	Counting & Comparison	Money & Time	Addition	Subtraction	1-digit number sense
Christal Alonzo	6 1	4 2 2	3 3 1 1	3 1 1 1	3 2
Nigel Apotek	6 1	6 1 1	5 1 1 1	3 1 2	1 4
Andrew Davis	5 1 1	2 3 3	4 3 1	2 1 1 2	5
Claudia Espino	4 2 1	1 5 2	6 1 1	3 1 2	1 4
Sofia Gonzalez	4 1 2	5 1 2	2 1 1 1 2	3 1 2	5
Mychal Humphrey	5 1 1	3 1 2 2	2 1 2 1 2	2 1 3	1 4
Daniel Lee	3 4	4 1 1 1 1	4 1 3	2 1 3	5
James Nash	3 1 3	4 1 3	5 1 2	3 3	5

HOW TO ORGANIZE AND DISPLAY THE MASTERY LEARNING DATA

The last essential element is a system to effectively organize and display the data about mastery-based student learning progress. This can take many forms and be provided by a variety of software or online systems. The key is for students and teachers (and also principals and parents) to instantly be able to see where students are in their learning. Dashboards and similar formats serve this purpose well. The main challenge in creating a good dashboard is to show the right kind of data at the right level of detail, and much of this is based on the learning objectives and mastery thresholds. The system must also be scalable at a minimal cost.

With a mastery dashboard (example above) in place along with the other four key elements, mastery learning can thrive in the classroom and scale broadly.

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Examples of Mastery Thresholds to Enable Mastery Learning in Multiple Subjects

Scott Ellis, Founder and CEO of MasteryTrack

Over the last few years, we have worked with educators and networks to develop learning objectives and mastery thresholds in a wide range of subjects. In this process we have found that different types of **mastery thresholds** make sense for different types of objectives. Some of these examples may be helpful in continuing to define thresholds for other subjects and objectives.

For any objective or topic area, it is important to begin by determining what type of demonstration would be appropriate for a student to show that she has mastered a learning objective—should the student solve problems, complete a project, do a presentation. This will help us determine what the associated specific demonstration of mastery should be (remembering that the mastery threshold will be the same).

Below are some examples of how we have collaborated with particular schools and networks to create mastery thresholds associated with specific learning objectives in multiple content areas:

- Spanish interpersonal oral
- Elementary math
- Mandarin Chinese reading
- Social and Emotional Learning (SEL)

SPANISH INTERPERSONAL ORAL

Over the course of several months, we worked with a leading language educator to develop mastery-based learning objectives for Spanish Interpersonal Oral. Because of the nature of the subject matter and the complexity of the objectives, they have been designed so that the mastery threshold is incorporated into the wording of the objective. Simple objectives like “answer three highly familiar, open questions about daily life with single, complete sentences” and more complex objectives like “answer two open, original questions that call for the description of familiar people with enough detail to visualize familiar people with organized and connected sentences (i.e., using and, but, however)” enable an educator to determine if the student is able to meet the specific learning objectives.

Some advanced objectives also have a frequency or repetition component—for example: “When speaking, greater than 90 percent of the time, choose the correct forms of articles and adjectives according to gender, singular, and plural.” This approach has worked very well in Spanish and been replicated in French and Arabic, and we are considering other subjects with complex topics where the mastery threshold may be implicitly included in the learning objective itself.



ELEMENTARY MATH EXAMPLE

For most elementary math learning objectives, solving problems accurately and relatively fluently is a reasonable way for students to demonstrate that they have mastered the objectives. For objectives like “multiply a one-digit number by a two-digit number” or “round three-digit numbers to the nearest hundred” or “identify the equivalent equation,” we would know that a student has mastered the objective if they can accurately solve the appropriate type of problem. There might be another learning objective that has students apply this learning in context by solving word problems of a particular level of complexity.

The mastery thresholds in **MasteryTrack** for objectives like these are 9 questions out of 10 within a generous time limit. The threshold is not 10 out of 10 because making a mistake does not mean a student has not mastered an objective. However, if the student makes too many mistakes they probably should keep working on the objective. Similarly, the purpose of the time limit is not to force the student to work quickly; the time allowed is ample and students who have a good understanding of the concept should be able to complete the problems. But if the student takes a very long time to complete the questions they should probably keep working on the objective even if they get the answers right.

As a reminder, these are only thresholds for demonstrating mastery—not daily assignments, activities for practice, formative assessments, etc. A teacher using the mastery thresholds above may still facilitate students’ learning of math through a wide variety of approaches, curricula, project-based learning, or other methods.

MANDARIN CHINESE READING

A common option for students to demonstrate mastery of reading in Mandarin Chinese is for a student to read a passage of a certain level of complexity and correctly answer questions about the passage. The questions are multiple choice and based on learning objectives for that level of text. The incorrect answers in the assessment are intentionally designed to force the student to make specific distinctions that demonstrate their understanding of the passage and the relevant concepts. There are objectives for language and vocabulary and also for reading comprehension, with a separate passage for each. A passage has eight to 20 questions depending on the number of learning objectives for that reading level, and a student must master 90 percent of the objectives in order to master the level.

SOCIAL AND EMOTIONAL LEARNING (SEL)

In our work to define mastery thresholds for SEL we have found that there are two broad types of objectives that require different approaches to mastery thresholds. Many objectives require a student to show that they know something or can identify something. For example, for objectives like “Recognize and accurately name feelings” or “Explain situations in which one needs to seek help from an adult” a student could demonstrate mastery by writing something or telling an answer to the teacher. So mastery thresholds for these kinds of objectives would be a student doing this correctly a number of times (for example, recognize and accurately name 4 feelings, describe 3 situations in which one needs to seek help from an adult and why).

However, some SEL objectives require students to exhibit a behavior. One example is “treat others’ belongings with respect.” The mastery threshold for this kind of behavioral objective has three parts:

- The student needs to be able to describe what it means to treat others’ belongings with respect, to show that they know what it means and what they are supposed to do (this is similar to demonstration of mastery for the other SEL objectives);
- The student needs to be able to treat others’ belongings with respect once, to show they are capable of doing it;
- The student needs to treat others’ belongings with respect consistently and repeatedly.

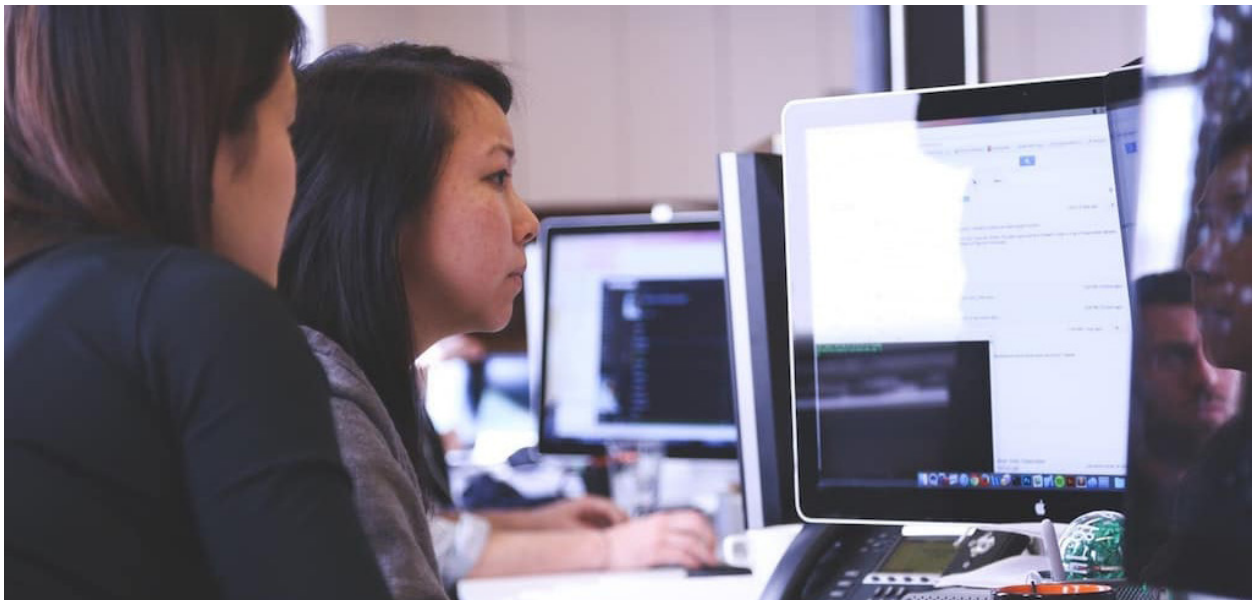
This approach is similar to other work we have done to develop mastery-based dashboards for teacher professional learning, since many of those learning objectives also have a behavioral component. The learner needs to show that they know what they are supposed to do, but also that they are capable of doing it and can do it consistently.

As is evident from these examples, the structures and types of thresholds emerging from each of our collaborations vary widely. In all cases the process is focused on student mastery of defined objectives, but the approach to learning does not need to be the same. Learning objectives and mastery thresholds are the starting point for mastery learning and the skeleton that organizes the content for learning and assessment.

How to Develop a Mastery Dashboard That Works

Scott Ellis, Founder and CEO of MasteryTrack

A key challenge in mastery learning is how to organize and display the data about student learning progress. A web-based data dashboard is a common and reasonable approach for accomplishing this task—and scalable in a way that a Google spreadsheet is not. But how should the dashboard be structured? And what kind of underlying data architecture makes this possible? In developing **MasteryTrack** we confronted these issues and sought to develop a scalable approach that would work for students and teachers as well as principals and parents. We learned many lessons on the way, and these along with the details of our ultimate solution may be helpful for others trying to grapple with the thorny issue of organizing and displaying data to enable mastery learning.



5 MASTERY DASHBOARD DESIGN TIPS

- 1 Grain size.** Early in our efforts, we struggled with what “grain size” of objectives to include in the dashboard and how to organize them. After experimenting with a few different structures we ultimately implemented a five-level hierarchy to describe learning content in any course:
 - Subject (math)
 - Course (Late Elementary Math II)
 - Unit (decimals)
 - Concept (basic operations)
 - Objective (multiply decimals up to hundredths)

We initially had an additional level between Unit and Concept called Topic because we thought we might need a sixth level in the hierarchy, but we eventually found that it was never used. Five levels have been sufficient for a range of courses and course “types” (e.g., math, computer science, SEL, world languages, etc.). All courses use Subject, Course, Unit, and Objective, and some (but not all) use Concept as well. We have also found that the structure can vary for different sections of the same course—some have enough levels of detail that they need the Concept level while others can be accurately displayed without it.

- 2 **Dashboard types.** We created two types of dashboards: the overview dashboard and the objective dashboard. We found that teachers wanted to see a high-level view of student mastery status across an entire course and all its units (the overview dashboard), and then they wanted to be able to dive into the status for every objective within a unit (the objective dashboard). These two views enable users to quickly and easily understand where students are in their learning.
- 3 **Structures of courses.** Structures of courses vary significantly by subject area and grade level, so in MasteryTrack we have implemented several different types. Some dashboards are designed to cover roughly a year of learning content. This is common in some math courses (e.g., Algebra, Geometry, Algebra II, etc.) and high school science courses. This may simply be an artifact of the existing time-based system, but it might actually be a reasonable long-term approach to structure mastery-based content in a way that is feasible for teachers and students. Learning trajectories like Algebra/Geometry/Algebra II are well understood, and structures like Chemistry/Honors Chemistry/AP Chemistry may provide an established mastery-based course architecture. So although mastery learning generally drifts away from grade levels, we have found one-year courses helpful in some cases.

Many subjects are moving towards a grade band structure. This is easy to display in MasteryTrack and enables teachers to see the data for students who are at widely different places in their learning—it is easy to see the progress of students who are far ahead as well as those who are earlier in their learning. This has worked well for structuring courses like SEL, Computer Science, Elementary Math, and Social Studies, and could easily apply for others. One downside of this approach is that if there are too many units or too many objectives visible on the screen, the dashboard starts to become more cumbersome and less useful. A “course” that includes content for multiple current grade levels may have large sections that are not used simply because students have not learned much of the content.

We have developed a few courses that include several years of content. This has particularly been true in languages—this is the structure for Spanish Interpersonal Oral and Mandarin Chinese Writing. In Spanish Interpersonal Oral we initially designed a dashboard that included all content from beginner through advanced-intermediate, which covers several years of learning. This course has 10 units. The early units have one to six learning objectives each, while the advanced units have 14. This has been useful for teachers to see the full learning trajectory for students. Recently, however, we have received requests from teachers to restructure the Spanish content to create separate courses designed for earlier learners since so much of the advanced content is not relevant for them.

- 4 The number of objectives.** A final dashboard architecture issue is the number of units and the number of objectives. The overview dashboard may become cumbersome if it has so many units that the user needs to scroll far to the right to see everything. In these cases, it can be helpful to split the course in two, or else to consolidate units so the full content can be seen in one view. In the objective dashboards, if a particular unit has too many objectives (more than 15-20), it can become hard to read and also require scrolling to the right that the user may find undesirable. We found that in these cases the best solution is to divide it into more than one unit so there is a more manageable number of objectives per unit. On the other hand, we have encountered some situations where a unit only had one to two objectives. While this is feasible, it becomes a bit cumbersome for the user, and so it can be more efficient to consolidate multiple units so there are at least four to five objectives in a unit.
- 5 Our best advice?** Don't over-engineer your dashboard. If you're building your own dashboard, initiate two or three trials with a simple prototype and commit to continuous iteration so you can start to identify the right foundation in your context. The risk of building a solution on the wrong architecture is too high to justify trying to create a complete tracking system without getting user feedback along the way.

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The Key to Enabling Data-Driven Instruction in the Classroom: Getting Teachers the Right Data

Scott Ellis, Founder and CEO of MasteryTrack

Before I began my career in education, I worked at a technology company where I managed a team that conducted sophisticated analyses and developed software tools. One client hired us to develop a system to forecast demand for new products. As part of this project, we interviewed the forecasters--the experienced and knowledgeable individuals who created the current forecast. They were hoping our new tools would offer them new algorithms that would be much better than their existing manual process. We did end up developing some helpful new algorithms. However, as we conducted the project, we also made an important discovery, the expert forecasters actually spent only about 20 percent of their time forecasting. They had lots of experience and expertise, but they did not spend much time using it to generate better forecasts. What did they do instead?

Gather and clean the data.

These talented and experienced individuals spent roughly 80 percent of their time gathering, editing, and re-formatting the data they needed every month to create the next forecast. So we restructured our project; the tool we developed still had an innovative new algorithm, but it also organized and cleaned the data, so the forecasters spent only about 20 percent of their time doing this activity. As a result, these experts had much more time to analyze the data and use their skills to create better forecasts.

A PARALLEL NEED IN EDUCATION: ENABLING TEACHERS TO ANALYZE DATA TO IMPROVE STUDENT LEARNING

I was reminded of this experience a few years ago when a school invited me to attend one of their monthly teacher data sessions. The instructional leader of the school and several teachers had set aside three hours to work together using data. I had been impressed by these educators in my previous interactions with them and was excited to see how they were going to approach this critical work. I was hoping to see them look for patterns across students and classes, and talk about what they were seeing and what it meant for teaching and learning. The overall context of the session was something I see as the core of effective teaching, using data gathered from reviewing student work to inform instruction.

It was heartbreaking for me. I saw and heard the magic happen, but only a few minutes of it. Instead, most of the three-hour session was spent by the teachers independently grading student work. They had to use their precious collective time to gather and organize the data about student learning, which meant they had almost no time to analyze it or talk about what they were seeing, what it meant, and what they should do. They had such expertise but were not able to apply it effectively for its primary purpose.

I spent some of this time with the administrator to review the data he had gathered and to help him think about how to analyze and display it. His primary goal was to predict what percentage of students would be successful on the state test later that year. My heart sank as we reviewed multiple spreadsheets of detailed data to assess the accuracy of his projections from the preceding year and tested new algorithms to use for this year's forecast. While I fully understood and appreciated the work being done by both the teachers and the administrator, I couldn't help feeling they were missing a huge opportunity. They could have spent three hours together analyzing data about student learning to inform future instruction and improve the teaching and learning process. Instead, they were generating data and conducting analyses that had no impact on learning.

They reminded me of the forecasters from my previous career. These educators had so much expertise and so much wisdom; they knew the intimate details of the lives and learning challenges of their students. But they didn't have the right data at their fingertips; therefore, they missed the opportunity to apply their skills and knowledge effectively to improve student learning.



BETTER MASTERY DATA CAN ENABLE DATA-DRIVEN INSTRUCTION

With specific, clear, demonstrable learning objectives and well-defined mastery thresholds, we can clearly track student learning progress. We can make this information available to students, teachers, principals, and parents with a single mouse click. With this information at their fingertips, teachers can do true data-driven instruction.

Last year I had a video chat with a group of teachers who had been using MasteryTrack for several months and experienced this new reality. I asked them about their approach towards data-driven instruction, and they responded:

“When we have our team data meetings, we start by reviewing our MasteryTrack dashboards. We look for things that are working well and places where students are struggling, and we compare dashboards across classes to look for patterns and trends. Then we discuss specific teaching approaches to meet the various needs of our students and look for ways to help each other. For example, earlier this year we saw that several of our most advanced students were missing a key skill they should have learned much earlier, so we changed the curriculum to be sure students learn this skill earlier. Really, it is just data-driven instruction. Since we now have the data at our fingertips, it is pretty straightforward.”

My favorite part of the conversation was how mellow the teachers were as they discussed their implementation of a transformational educational approach. They know how to use data; they know their students and can strategize effectively about how to support diverse learning needs. If we can organize and display mastery-based data for teachers and make it instantly available, they can figure out how to improve student learning, and they also know how to find help if they need it. The key is to free up their time so they can actually do data-driven instruction.

This is a problem we can solve.

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Pulling It All Together: Examples of Integrating the 5 Elements of Mastery Learning

Scott Ellis, Founder and CEO of MasteryTrack

This series has described the goals of mastery learning, its key elements, and important related topics like generating the right data and steps for designing mastery dashboards. As educators start taking their first steps in bringing mastery learning to life in their classrooms, it might be helpful to see a few examples of all the key elements coming together.

Over the last few years, we have implemented MasteryTrack in a wide range of subjects. By describing exactly what we used for learning objectives, mastery thresholds, and demonstrating and assessing mastery, these mini case studies may provide some helpful guidance for effective implementation. They also show the remaining work still to be done—different subjects are at different levels of maturity, and the journey of innovation in this work is still in its early stages.

ELEMENTARY MATH

Learning objectives. We used the Common Core standards for K-5 math as the starting point but quickly determined that many of them were not specific, clear, or demonstrable. We restructured the standards to enable mastery learning. Then we worked with the math content lead at [Open Ed](#) (which was subsequently acquired by [ACT](#)). We went through every objective to fill any gaps, eliminate duplicates, and ensure that they were all appropriate. There are three types of learning objectives: computation (e.g., multiply two one-digit numbers), number sense (e.g., replace the unknown number or identify the equivalent equation), and word problems (broken into medium and high complexity).

Since there are several years of content in K-5 math and it would be overwhelming to have them all in a single dashboard, we broke the objectives into three courses: Early Elementary (counting and comparison, money, time, addition and subtraction), Late Elementary I (topics like multiplication, division, area, perimeter, rounding, estimation and factoring) and Late Elementary II (topics like decimals, percentages, exponents, order of operations and unit conversions). This grouping makes it easy for students and teachers to see related content while avoiding grade levels (e.g., there is no “third grade math” since grade levels do not exist in a full mastery-based system).

Mastery thresholds. For most objectives the mastery threshold is nine questions correct out of ten within a generous time limit (it can range from two minutes to 20 depending on the objective). These questions all test the exact same skill, so they have the same level of complexity. For objectives that require more significant effort (e.g., multiplying two three-digit numbers) the threshold is four out of five. The time limit is quite long and is not designed to reward rapid work, but is simply a rough measure of fluency.

How students demonstrate mastery. The learning objectives for this subject lend themselves well to automatic grading, so this is an option. MasteryTrack has automated grading for the K-5 math content, so students can demonstrate mastery directly in the system. Like any other course, however, the teacher can also manually mark students as “mastered.” We have seen situations where teachers have students demonstrate mastery in another system and then change the mastery status manually in MasteryTrack.

How teachers assess mastery. Teachers can use the automatic grading built into the system, or else they can either grade assessments manually or have students use another system and then manually enter the data into MasteryTrack.

Organizing and displaying the data. For elementary math as well as the other examples the teachers used MasteryTrack to organize, display and monitor the data about mastery-based student learning progress.



SPANISH INTERPERSONAL ORAL

Learning objectives. We worked with an experienced Spanish educator and curriculum designer to review the existing approach for characterizing student knowledge in Spanish Interpersonal Oral. We started with existing categories like creativity, text type, frequency, and comprehensibility that each had a range of approximate descriptions of capability. We converted these into a series of specific, clear, demonstrable learning objectives in a progress structure that aligns with established descriptions of student capabilities at various levels of novice, intermediate and advanced. Novice and lower intermediate levels have up to five objectives each while more advanced levels have approximately 15.

Mastery thresholds. The mastery thresholds for most objectives are inherent in the learning objective—for example, “Answer 3 highly familiar, closed questions about daily life with single, complete sentences.” In most cases, the student needs to be able to achieve the objective once (e.g., they don’t need to do what the objective says multiple times, as is sometimes the case in other courses), though some objectives may require a student to ask or answer multiple questions.

How students demonstrate mastery. Students are interviewed by a teacher and answer questions of various levels or conduct a role play.

How teachers assess mastery. The teacher conducts an interview with the student and tracks whether the student masters specific objectives. If the teacher is just beginning to use MasteryTrack with the student, the first interview may be a longer one with the goal of establishing a baseline of the student's current learning level. Future interviews are shorter and focused on assessing the student's mastery of specific learning objectives. The student's mastery status is entered manually into the system.

Since the learning objectives are specific and clear, the assessment of mastery does not need to be done by the teacher. Aides or even parent volunteers can be used to assess mastery with relatively limited guidance and training, as long as teachers or administrators are confident that this will provide reasonable inter-rater reliability. We saw this work well in a school that started with teachers conducting the interviews and then transitioned to have volunteers do many of them. Over time teachers come to trust the assessments of mastery provided by others, similar to how a doctor trusts the results of a blood test performed by a laboratory and does not feel compelled to replicate the test herself.

SOCIAL AND EMOTIONAL LEARNING (SEL)

Learning objectives. We worked with researchers at the [Collaborative for Academic, Social, and Emotional Learning](#) (CASEL) and determined that their well-established framework provided the appropriate high-level structure for learning objectives in SEL. We then looked at the work done by many of CASEL's state and district partners across the country and determined that [Austin ISD in Texas](#) has done an outstanding job of converting the CASEL framework into specific, clear, and demonstrable learning objectives. Austin's structure organizes the objectives by grade band (K-2, 3-5, 6-8, 9-10, and 11-12) and this aligns well with what we have seen in other content areas. We connected with the SEL team in Austin and then created mastery-based dashboards for SEL in MasteryTrack using the CASEL framework and the Austin objectives.

We think the grade band approach does a nice job of bridging between the current grade-level system of U.S. education and a pure mastery-based approach in which the age and grade level of the student is irrelevant. In many courses, it also works well because the resulting number of learning objectives to be displayed on the mastery dashboard is feasible for users to read. When schools have multiple courses use the same grade bands they can easily generate a consistent view of student learning across subject areas.

Mastery thresholds. We did not find strong existing mastery thresholds for the learning objectives in SEL. Educators were often quickly able to describe what success looks like for a few objectives, but not many. We created "version 1.0" of mastery thresholds for part of K-2 SEL and shared it with several educators. The responses contained some nervousness about assessment, but also excitement that the clarity of mastery learning and everything it entails (growth mindset, low-stakes assessment, no such thing as failure, etc.) could provide a path towards more effective teaching and learning in SEL.

How students demonstrate mastery. For many objectives that ask a student to show they know a fact, students either write an answer or tell it to a teacher. In cases where students need to demonstrate a behavior consistently over time, they show mastery simply by doing so—for example, “Demonstrate the ability to respect personal space.”

How teachers assess mastery. Teachers assess mastery in SEL in various ways depending on the nature of the learning objective and the associated student demonstration. In situations where students are writing or saying answers to show they know a fact, the teacher can manually grade student written or oral responses. For learning objectives that require behaviors, teachers can assess these themselves or use other approaches that may include group work or peer feedback.

OTHER SUBJECTS AND THE PATH FORWARD

Over the past few years, we have worked with educators in social studies, English language arts, science and other subjects. These are similar to the structure of SEL described above: there are often existing standards or other sources of learning objectives, but mastery thresholds and approaches for demonstrating and assessing mastery need to be defined. This is a key part of the work ahead for mastery learning, but it is very feasible.

To support integration of the five elements of mastery learning, we’ve created this infographic:



As this work evolves, MasteryTrack is excited to work with additional innovators and share the learning objectives, mastery thresholds, and everything else we create together, helping all schools nationwide move forward with mastery learning.

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Using Mastery Data to Measure Growth in Student Learning

Scott Ellis, Founder and CEO of MasteryTrack

What is the most important data in K-12 education? If we think the primary purpose of classrooms, schools, and our education system as a whole is to cultivate and facilitate learning by students, then the most important data is clear, accurate information about student learning progress. While this seems self-evident, it is a huge challenge for the existing education system. Mastery learning offers the potential to provide this incredibly valuable data at scale and in real time so it can be used by educators in their efforts to continuously improve their ability to support students. It can also be used by the students themselves to guide their individual learning journeys--this is a key element in growing student agency.

TWO TYPES OF MASTERY LEARNING DATA: STATUS AND PROGRESS

The first level of data that can be provided by mastery learning is **mastery status**: the learning objectives a student has mastered at a point in time. This data is extremely useful and can be used to guide teaching and learning on a daily basis; once we know what a student knows and what she is ready to learn, we can figure out how to support her effectively. Students can also help drive this process; if a student has a gap in her learning or a skill she needs, she has a clear structure that gives her the words to ask for help, seek resources, or say she is ready to try to demonstrate mastery.



However, after several months of mastery learning, it becomes possible to generate the next level of data: **mastery progress**. This is calculated by comparing a student's mastery status at two different points in time and determining which new objectives have been mastered. This is a very simple calculation, and once the five key elements of mastery learning are in place (learning objectives, mastery thresholds, etc.) the data is very easy to gather and analyze. This can be examined for each individual student, but it can also be aggregated, sorted, and analyzed for classrooms, schools, and even districts or states. In MasteryTrack we call this aggregated summary of student learning a Mastery Learning Report. Although this data can be generated in real time over any time period, one logical time period that aligns well with the current education system is an annual view.

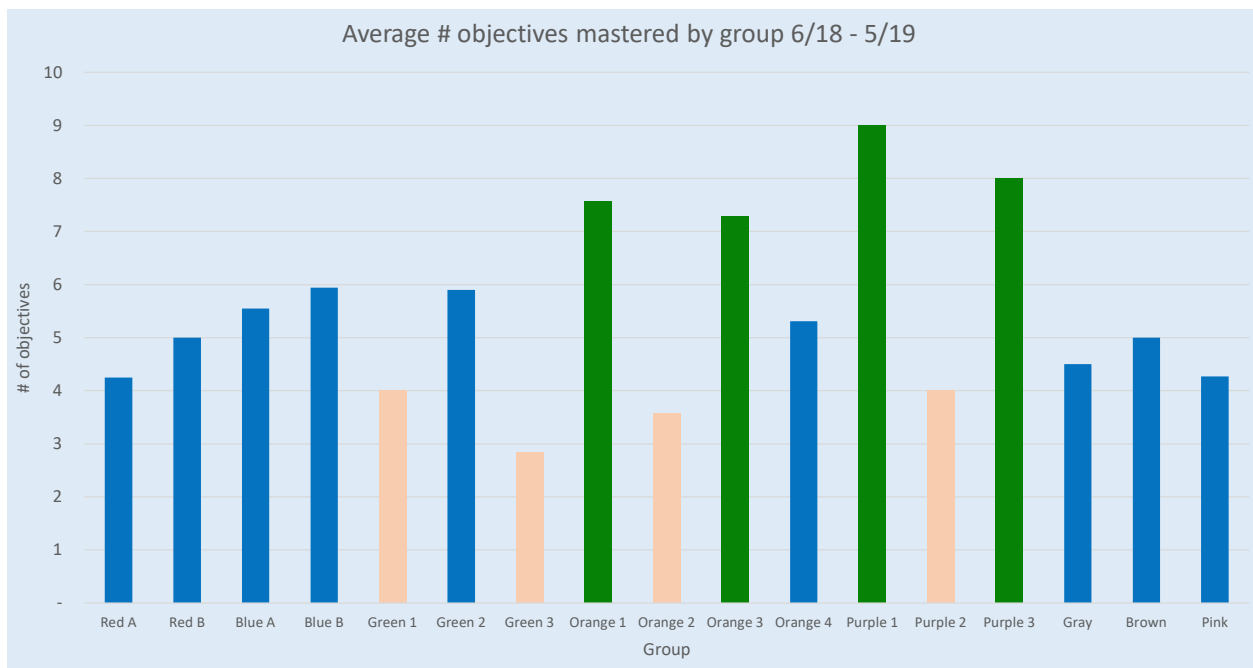
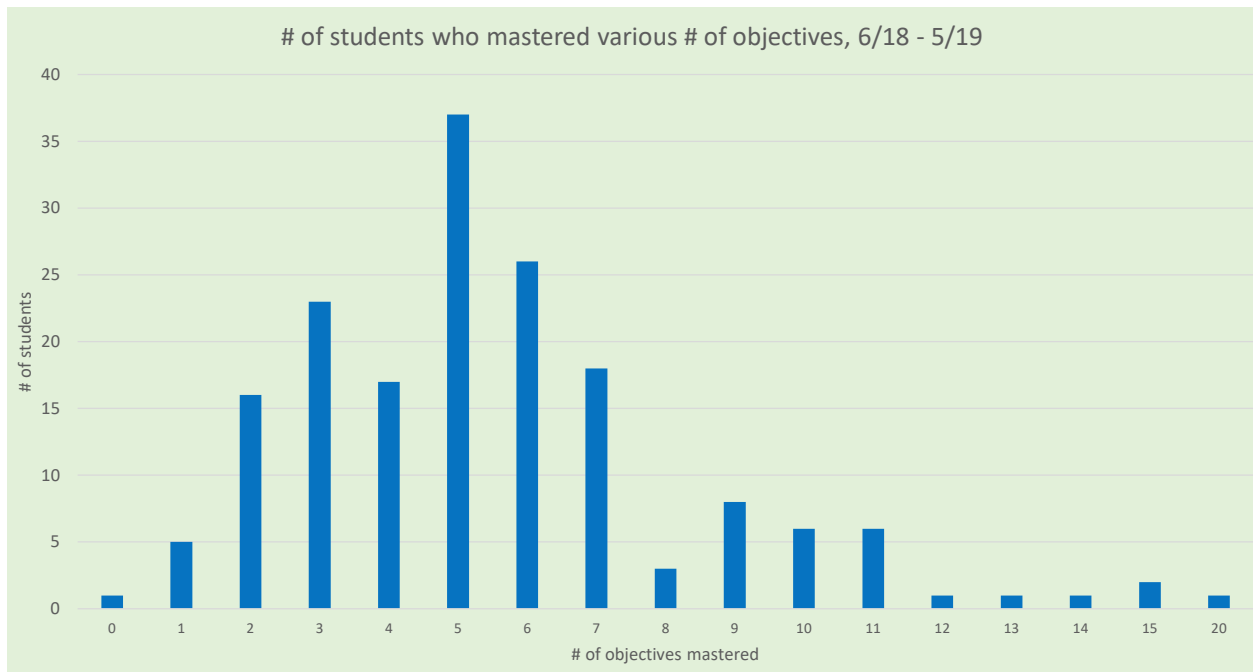
THE MASTERY LEARNING REPORT

We recently generated a Mastery Learning report for the 2018-19 school year for a school that has been using MasteryTrack for Spanish Interpersonal Oral with 170 students and several teachers in multiple classes. The school had actually been using the system in the previous year as well, so by June of 2018, we had a very solid starting point for measuring mastery-based student learning progress. We took the learning status of each student in June 2019 (the endpoint) and subtracted the status in June 2018 (the starting point) to determine the amount of learning that took place during the 2018-19 school year.

Spanish Interpersonal Oral is organized into several ability categories (multiple levels of novice, intermediate, and advanced) and each level has several specific learning objectives. For every student we calculated the amount they learned during the year: the number of learning objectives mastered. We then sorted this data in a few ways and calculated a few useful averages:

- Sorted based on number of learning objectives mastered
- Sorted based on student group (classroom)
- Sorted based on initial learning level (not all objectives are of comparable size and some are more difficult than others)
- Calculated average number of objectives mastered for all students
- Calculated average number of objectives mastered by student group (classroom)
- Calculated average number of objectives mastered by initial learning level

Overall, students mastered 5.5 objectives during the year. Students who started at the novice level mastered nearly 7 objectives on average, while students starting at intermediate levels averaged closer to 4.5. Several students mastered 10 objectives or more, while others mastered 2 or fewer. Some groups of students mastered more than others, and some groups had very consistent growth for all students while others varied widely.



This data is not complex, and it is very easy to manipulate. However, it is the **right** data and it enables educators to ask several types of questions that can guide continuous improvement in the teaching and learning process:

- How did we do last year as an instructional team in our efforts to enable learning for students in our school? Are we happy with these results? Why or why not?
- What went well that we might want to continue or expand in the future to help enable our students to learn more?
- What did not go as well as we hoped or what challenges did we encounter, and what associated changes might we want to make in the future?
- What can we learn from the stories of individual students who excelled or struggled?
- What can we learn from groups that enabled more learning for students or from those groups where students learned less?
- What can we learn about groups that enabled more consistent learning for students or more varied results?
- What broader patterns do we see, and what might we do to continue them, reinforce them, or change them?

In a conversation with educators to discuss the Mastery Learning Report and analyze the results, teachers were quickly able to describe the cases of individual students and identify patterns. For example, one teacher noted that several of the students who learned the most are actually multi-lingual because they speak English as well as another language at home, and this helps them adopt Spanish more quickly. A few students were quickly characterized by teachers as particularly diligent and hard-working students, leading to outstanding results in Spanish as well as their other classes. And teachers knew that a few of the students had traveled to Spain with their families recently, and this led to an improvement in their performance in Spanish Interpersonal Oral.

MASTERY LEARNING DATA ENABLES CONTINUOUS IMPROVEMENT

However, while this kind of student-by-student analysis is exactly what the progress data from MasteryTrack is designed to enable, the focus now needs to shift towards continuous improvement. The individual stories of each student are critical data points, but the key is what actions educators can take to build on approaches that are working well and to change approaches that are generating less student learning. This will be the next stage of the conversations we have together in our ongoing journey of innovation. All of this now can be driven by clear and detailed data about student learning, and a mastery-based structure makes this all possible for any teacher and every student. We now have the most important data in K-12 education. Let's use it to help our students!

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Conclusion

Rebecca Middles, Vice President of System Design, Getting Smart

MOVING TOWARD MASTERY LEARNING: PRACTICAL STEPS FOR MAKING PROGRESS

The education of today is adapting in order to enable learners to meet the future of tomorrow. In recent years we've seen strides and attention placed on personalized and blended learning, but the question of scale persists. How might teachers and leaders apply personalization at scale? How can equity of learning pace, style, and preference be implemented in both large schools and small schools alike?

One solution could be mastery learning; a combination of student-centered learning objectives and thresholds supported with strategies that can create powerful, replicable results. With mastery, the focus should be on the application in order to create a larger body of knowledge. This data would emphasize the application of skills as well as conceptual knowledge. Ideally, mastery learning is defined in terms of application and retention, not checklists.



In our Mastery Learning series, we have been exploring what **mastery is** and how it is determined, recorded and managed. Scott Ellis and his team from MasteryTrack have outlined **five key elements**, listed below, and how these can be enabled with a technology information system. The mastery platform is Scott's effort to create "a world where students, teachers, principals, and parents can instantly see where students are in their learning. This data is the starting point that enables personalization of learning to actually happen effectively in the classroom."

Learning Objectives

- Specific, clear, demonstrable objectives to clearly describe what we want students to know and be able to do.

Mastery Thresholds

- Clear descriptions of what mastery means and how to determine if a student is ready to move to the next learning objective.

Students Demonstrate Mastery

- Clear processes for students to demonstrate mastery.
- Processes are scalable and provide equitable access to all students.

Teachers Assess Mastery

- Clear processes for teachers to assess mastery.
- Processes must be viable and scalable to support teachers to assess mastery for every student and every learning objective.
- Protocols to support multiple attempts by students to demonstrate mastery depending on their level of readiness and the variety of assessments available.

Data Organization

- A system to organize and display learning data that is efficient in time and easily available to students, teachers, parents, and school leaders.
- Mastery-based student data shows progress and reflects a student's learning journey.

These key elements are essential for the implementation of Mastery Learning. Toward the end of this series, in the blog titled *Pulling It All Together*, Scott provides examples that take you through the five key elements within specific subjects and areas of growth, such as elementary math, world languages and social-emotional learning. The series also provided **examples of thresholds**, how to gather and use the 'right data,' and tips for **designing a data dashboard**.



These examples can begin to make this work tangible if a system or team is new to the work, and reaffirms steps a site or district may already be taking. Scott shares in *Getting The Right Data* that “with specific, clear, demonstrable learning objectives and well-defined mastery thresholds, we can clearly track student learning progress. We can make this information available to students, teachers, principals, and parents with a single mouse click. With this information at their fingertips, teachers can do true data-driven instruction.”

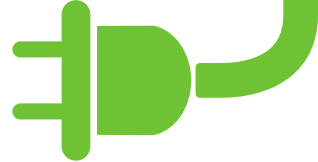
Technology has enabled us to observe progress and impact over time like never before. Through a marriage of robust dashboards, a dedication to equity and an agile mindset, we can begin to scale personalized learning that works and inspires.

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