Beyond Proficient

How Three High Schools in Kentucky Implement Mastery Learning

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IRM-2014-U-008147
July 2014

CNA
ANALYSIS & SOLUTIONS

Approved for distribution: July 2014

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Executive Summary

The pedagogy of mastery learning requires students to demonstrate a deep understanding of a given course topic before being allowed to proceed to the next topic. Teachers use formal or informal assessments to monitor students' progress, providing additional support to students whose performance shows they have not mastered the content. Students retake assessments as necessary until they do demonstrate mastery. There is no penalty for needing extra attempts.

Mastery learning has been around for several decades, and much has been written about its effectiveness, reporting varying results. Much less has been written about how schools implement mastery learning. This report describes how three Kentucky high schools in different districts, each working independently with the University of Kentucky to reform their educational practices, define, implement, and report on their mastery learning programs. The schools represent a variety of educational settings and range of experience with mastery learning.

Through interviews and document analysis, this report examines four broad questions about mastery learning in the participating high schools:

- How do the schools define and measure mastery learning?
- Why did the schools choose mastery learning?
- How do the schools implement mastery learning, including use of assessments, instructional differentiation, role of technology, and professional development?
- What beliefs do stakeholders have about the successes and challenges associated with the schools' mastery learning implementation?

Definitions. The schools define mastery learning at two levels: conceptually, and as numeric or letter grade–based performance levels that students must demonstrate. Conceptually, the schools describe mastery learning as closely linked to standards-based learning, view-

ing the two approaches as complementary and virtually inseparable. The schools are also strongly committed to students having to demonstrate that they can *apply* their knowledge as part of mastery. Quantitatively, all three schools use summative assessments as the sole method of assigning student grades, with such assessment being defined broadly. Schools also establish various levels of performance, such as "demonstrates mastery" and "exceeds mastery." The specific requirements to demonstrate mastery varied, however, across districts, within districts, and even among teachers in a single school.

Rationales. The schools and districts offered several rationales for implementing a mastery learning model. The most common rationales were to improve student achievement and reduce achievement gaps in an era focused on college and career readiness for all students. Schools also hope to inform instruction by more accurately identifying students' needs through standards-based grading. Finally, at a time when schools and teachers are held increasingly accountable for students' learning, these schools commonly mentioned a desire to increase students' own accountability.

Professional development. Overall, staff members in all three schools and districts reported receiving limited formal professional development in mastery learning techniques. All three schools expressed the desire to see more examples, lessons learned, and best practices from educators elsewhere who have implemented mastery learning. Meanwhile, schools have conducted brief summer workshops, facilitated book studies, and joined informal online communities to learn more about mastery learning. They also reported incorporating professional development from related topics such as standards-based grading and formative assessment to inform their mastery learning practices.

Differentiated instruction and the role of technology. One key aspect of mastery learning is that after initial group-based instruction, students receive instruction targeted to their needs as revealed in formative and summative assessments. All three schools have the goal of moving teaching practice as close as possible to individualized instruction for each student. Also, all three schools reported that technology has greatly aided their efforts to implement mastery learning. Specifically, they use technology to identify students' needs for specific instruction; provide instructional resources to teachers; and deliver

individualized instruction to students. Schools use a variety of online resources and software programs for each of these tasks.

Assessments. The three schools and districts interpret "assessments" more broadly than paper-and-pencil exams, and they use a variety of techniques both to track students' mastery of the various standards and to inform the individualization of instruction. Assessments include performance tasks, essays, exams, and design projects. Teachers described challenges with developing multiple assessments to support retakes, but they use a variety of resources to support assessment development. None of the schools has a policy about the number of attempts a student has to demonstrate mastery on an assessment before proceeding to new material; that decision is left to teachers' discretion.

Scheduling. One common concern about mastery learning is that it may require more instructional time than traditional instruction does. The schools in our sample, however, reported that their philosophy of mastery over coverage has reduced their concern about meeting state or district pacing guides, preferring students to master a smaller number of standards than cover a larger number of standards without mastery. Further, the schools have implemented a number of creative strategies to manage scheduling challenges. They set aside time specifically for enrichment and remediation within the school day, through flexible study halls and college-like Monday-Wednesday-Friday and Tuesday-Thursday schedules. Schools also use time outside of the school day to provide support, including teacher office hours and 24/7 access to instruction online.

Communicating. The three schools and districts described the importance of communicating with students, parents, and school staff about the purpose, goals, and process of mastery learning. Each stakeholder group has their own perceptions and questions about the new instructional approach Many questions address the grading process (including meaning of course grades and value of ungraded assignments), student placement in courses or content, and teacher evaluation process. Schools use ongoing communication to respond to stakeholders' questions.

Successes. Schools reported several areas of success with implementing mastery learning. At the student level, successes included in-

creased student achievement, improved student engagement, and students demonstrating ownership of their learning. At the school level, staff reported improved instructional strategies and more efficient use of time. Across school systems, staff reported a good fit of mastery learning to alternative programs and increased collaboration across classrooms and buildings.

Challenges. Despite several successes, schools also identified several continuing challenges related to implementing mastery learning. These challenges include changing the culture for students, parents, teachers, and school decision making councils from one of compliance to a culture of innovation and mastery. Schools also reported challenges with implementing standards-based grading and report cards. Finally, schools said it was difficult to document and quantify many of the successes they believe are taking place.

Next steps. Overall, the high schools believe they have come a long way in improving teachers' instruction and students' learning by implementing mastery learning. The transition to mastery learning has required changes in expectations and behavior from everyone in the education system—parents, students, teachers, and administrators. To date, schools and teachers have developed a wide variety of ways to confront challenges associated with mastery learning, often turning to technology for support. Schools and districts see their next steps as determining ways to implement mastery learning more consistently and uniformly across classrooms and schools.

Introduction

Mastery learning is an instructional strategy that has been around for at least 40 years, and it has gained in popularity over the past decade of educational reform that emphasizes college and career readiness for all students. Mastery learning requires students to demonstrate a deep understanding of a given topic, often by scoring 80 percent or more on an assessment or project, before proceeding to the next topic. Teachers provide additional support to students who do not demonstrate mastery on their first attempt, and there is no penalty for needing additional attempts to demonstrate mastery of a topic.

Much research has examined the pedagogical effectiveness of mastery learning, reporting varying results. There has been much less written about how schools implement mastery learning, however. This report describes how three high schools define, implement, and report on mastery learning. It also identifies successes and outcomes associated with mastery learning reported by those schools.

The report has the purpose of promoting collaboration among schools and identifying additional areas of professional development and research that may support mastery learning implementation.

History of the mastery learning approach

Mastery learning is an educational approach that was pioneered in the 1920s and expanded upon and formalized by Benjamin S. Bloom in the 1960s. Bloom (1968) observed that in a traditional learning environment, a teacher presents information uniformly to a class of students over a set amount of time. While the instruction and the information presented do not vary in the traditional environment, students' aptitude for learning does vary. As a result, some students are more successful than others on final exams (Guskey, 2007; Ch.-L. Kulik, Kulik, & Bangert-Drowns, 1990).

Bloom proposed a new approach to instruction: Learning for Mastery (LFM), or mastery learning. Under a mastery learning framework, teachers and students have flexibility to work at a pace necessary to

master the current topic or concept, as determined by a specified threshold on a project or exam, often around 80 percent. After a first round of assessment, teachers provide appropriate remediation, sometimes called "correctives," or enrichment to students based on their needs, then administer another assessment. This cycle repeats as needed. Students progress to new concepts after demonstrating mastery of the current ones.

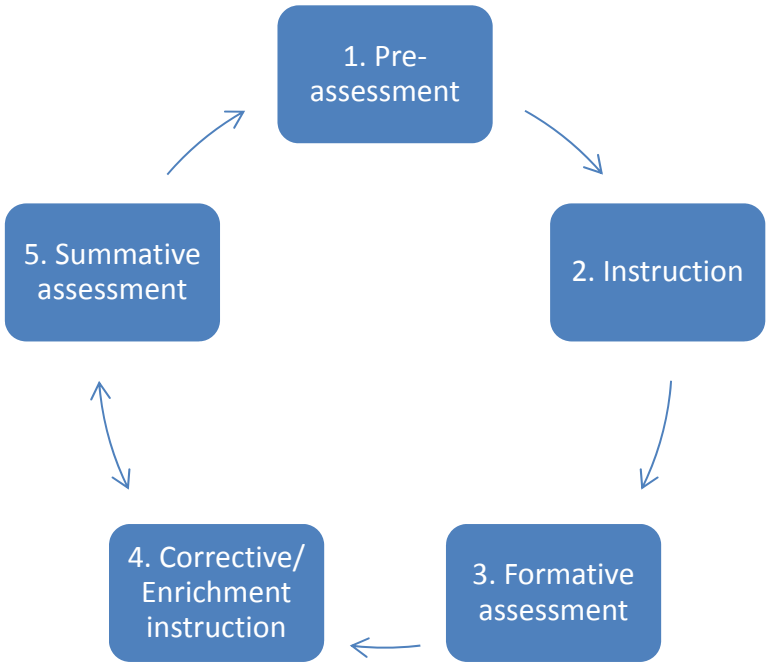
Bloom predicted that because instruction varies with student needs, students would achieve uniform high performance using LFM (Bloom, 1984). The LFM approach calls for group-based instruction, remediation, and enrichment; LFM therefore recognizes some structural limitations inherent to teaching in K–12 classrooms. A similar approach for mastery learning, Keller's Personalized System of Instruction (PSI), encourages further individualization of remedial, corrective materials and calls for personalized lessons for each student (Ch.-L. Kulik, Kulik, & Bangert-Drowns, 1990).

Mastery learning is one of several educational models in which students progress by mastering skills and knowledge at their own pace, rather than by passing courses based on a course grade on a uniform timeline. The mastery learning model is similar to standards-based education, proficiency-based pathways, and competency-based education (Priest, Rudenstine, Weisstein, & Gerwin, 2012). We use the term mastery learning because it is the foundational model from which subsequent competency models of learning were derived.

Core components of mastery learning

Mastery learning requires five core components per instructional unit: pre-assessment, instruction, formative assessment, corrective/enrichment instruction, and summative assessment (Figure 1) (Bloom, 1968; Guskey, 2010).

Figure 1: Mastery learning cycle for an instructional unit



Prior to the start of a unit, mastery learning teachers administer a brief **pre-assessment** to identify whether students have the foundational knowledge and skills needed for success in the upcoming unit. If students do not have the necessary prerequisite knowledge, the teacher may present remediation immediately for those students. If they do, the second component is general group **instruction** on the unit's content**.** This is followed by the third component, monitoring of students' progress through a **formative assessment,** typically administered after one to two weeks of instruction. The assessment identifies what students did and did not learn.

For the fourth component, the teacher provides brief **corrective instruction** (e.g., one or two days) to strengthen areas of student weakness as revealed by the formative assessment. Or, if students demonstrated mastery on the formative assessment, they receive **enrichment activities** that offer challenging learning experiences beyond the mastery level. Instruction for correction or enrichment usually takes place in a small-group setting or individually. The final component of mastery learning is a **summative assessment**. The summative assessment gives students a second chance to demonstrate mastery of the unit's concepts and skills and serves to evaluate the extent to which the corrective (or enrichment) instruction aided stu-

dents. Students repeat the fourth and fifth components until they demonstrate mastery (Block, 1980; Guskey, 2010).

Each instructional unit typically takes about two weeks, although the length of time to achieve mastery necessarily varies by student. This five-component cycle repeats throughout the length of the course for each new unit.

Effects of mastery learning on student achievement

Research to date on the effects of mastery learning is inconclusive. Several studies have found positive effects on student achievement, attitudes, and behavior (Anderson & Burns, 1987; Bloom, 1987; Changeiywo, Wambugu, & Wachanga, 2010; Ironsmith & Eppler, 2007; Ch.-L. Kulik et al., 1990; J. A. Kulik, Kulik, & Bangert-Drowns, 1990; Wambugu & Changeiywo, 2008). Meanwhile, other studies, often involving stricter study requirements, found limited or no effect on student achievement or affect (Deweese, 2012; Slavin & Karweit, 1984; Slavin, 1987, 1990).

The most comprehensive look at mastery learning reviewed studies of Bloom's group-based LFM, Keller's PSI, K–12 and college instruction, and long-term and short-term interventions (Ch.-L. Kulik et al., 1990). Using a meta-analysis approach, the authors estimated that mastery learning has a statistically significant positive effect on student final examination scores. Specifically, LFM raised test scores by 0.52 standard deviation, meaning mastery learning has a moderate positive effect. In contrast, Slavin (1987) used a more restrictive meta-analysis that reviewed only LFM, K–12, and long-term approaches to mastery learning measured by standardized assessments. Slavin found effect sizes of 0.25 standard deviation or smaller, suggesting small impacts of mastery learning.

Part of the difference in these results is a matter of philosophy. Ch.-L. Kulik et al. (1990) were trying to follow Bloom's philosophy of demonstrating what is possible for mastery learning using a variety of conditions (Anderson & Burns, 1987). Slavin, on the other hand, was more interested in what is probable for mastery learning, setting restrictions that more closely matched typical K–12 instructional conditions.

The effects of mastery learning on student achievement appear to vary by student characteristics and course content. Mastery learning appears to benefit low-performing students more than high-performing students. On average, students with high initial test scores improved by 0.40 standard deviation, whereas students with low initial test scores improved by 0.61 standard deviation (CH.-L. Kulik et al., 1990). In addition, some authors have suggested that mastery learning is more effective for hierarchical, sequential courses such as math, physics, chemistry, English, and possibly art (Changeiywo et al., 2010; Deweese, 2012), though the earlier meta-analysis suggested mastery learning may not be as effective for math and science as for other courses (Ch.-L. Kulik et al., 1990).

Research suggests that in addition to student achievement, mastery learning instruction can improve various aspects of student affect and metacognition. These aspects include motivation, self-regulation, self-teaching, sense of control, resilience, and attitude toward the content and instructor (Bloom, 1984; Changeiywo et al., 2010; Guskey, 2010; Ironsmith & Eppler, 2007; Ch.-L. Kulik et al., 1990; Zimmerman & DiBenedetto, 2008).

Effects of mastery learning on learning time

The mastery learning approach to instruction also is associated with a small increase in instructional time, which appears related to the improvements in achievement. That is, a key component of mastery learning is the additional corrective or enrichment instruction provided to students after formative assessments. These activities can increase the amount of class time teachers spend with students reviewing and re-teaching unit concepts, especially for early units when students are acquiring foundational knowledge.

The meta-analysis by Ch.-L. Kulik et al. (1990) found that on average, mastery learning increased instructional time by 4 percent relative to traditional instruction. The increased instructional time may result from adjusted class periods within the school day, additional instruction beyond the school day, or a slower pace of instruction. Guskey (2007) further discusses that corrective instruction may increase instructional time early in a course, but as students become accustomed to the mastery learning instructional cycle and attain mastery of foundational concepts and skills, fewer students will need correctives

in later units. He does not quantify the expected changes to instructional time at different points in a course or the overall effect on instructional time.

Local context

The Kentucky legislature passed education reform Senate Bill 1 in 2009, which placed a statewide emphasis on preparing all students for college and careers by their high school graduation. Since then, the Kentucky Department of Education (KDE) has instituted a large number of policies and decisions to help schools reach specific, local college and career readiness targets. Many of these policies promote a deeper understanding of content standards than previously developed. For example, Kentucky was the first state to adopt the Common Core State Standards in math and English/language arts. These academic standards define the skills and knowledge necessary for postsecondary success and align across K–12 to ensure students develop the requisite depth to master such learning.

Other statewide priorities implemented at the local level, such as increasing enrollment in Advanced Placement and dual credit/dual enrollment programs, also strive to provide students with deeper, richer learning experiences than they traditionally receive.

The KDE and state legislature also are facilitating instructional reform through an emphasis on "learning innovation." This emphasis gives schools the flexibility to create systems where students have more ownership in their education, to promote personalized learning, and to define new learning outcomes and measures related to content mastery. The KDE describes six critical attributes of school systems and of instructional practice that are foundational for helping students reach college and career readiness. These attributes include personalized learning and performance-based learning to demonstrate mastery of concepts.[1]

The University of Kentucky (UK) P20 Innovation Lab has been working with several Kentucky school districts to transform their tradition-

[1] See http://education.ky.gov/school/innov/Pages/What-is-Learning-Innovation.aspx.

al classroom models into modern, flexible teaching and learning environments that are personalized based on students' needs. In particular, several schools have been developing mastery learning and standards-based learning models. In mastery learning models, each student progresses through curriculum at a pace that is his or her own based on how quickly he or she masters the content. In these models, schools are less bounded by blocks of time, buildings, and other structures and processes that are boundaries in traditional classrooms.

Many schools and districts are in the early stages of implementing mastery learning. The three Kentucky high schools described in this report, each in a different district, are working with UK, are in varying stages of implementation, and provide a range of perspectives. The information gathered here provides examples of how schools are approaching mastery learning and questions they still have about its implementation.

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Research Questions and Methodology

Questions to be answered

This study does not aim to resolve questions about the effectiveness of mastery learning. Instead, this study focuses on implementation approaches for translating theory into practice in high schools. In a way, it is a start to documenting the move of mastery learning from the possible to the practical. Because the majority of mastery learning studies occurred before 1990, there is limited information about results or implementation today.

This report describes how three high schools in Kentucky implement mastery learning. Specifically, we were interested in:

- How do schools define and measure mastery learning?
- Why did schools choose mastery learning?
- How do schools implement mastery learning, including professional development, instructional differentiation, role of technology, and use of assessments?
- What beliefs do stakeholders have about the successes and challenges associated with mastery learning implementation to date?

Sample selection

We identified potential study participants with help from the UK P20 Innovation Lab. UK has provided support related to mastery learning and standards-based learning to several school districts throughout Kentucky. UK contacted several of these districts to identify high schools that would be interested in a long-term partnership to study mastery learning implementation. Three districts responded positively, identifying one high school each (Table 1).

The sample is not meant to be representative of all Kentucky districts and schools, or even of implementers of mastery learning. Rather, we chose districts with a strong commitment to implementing mastery learning and a willingness to work with researchers and other educa-

tors to improve its implementation. While the schools and districts all have worked with UK, they have not worked with one another around mastery learning issues.

The three districts we selected are Jessamine County Schools (East Jessamine High School), Eminence Independent Schools (Eminence High School), and Fayette County Public Schools (STEAM Academy). Each district and high school has a different amount of experience with mastery learning, in terms of years implementing the model, courses, and grade levels (Table 2). Jessamine County and Eminence Independent have been implementing the mastery learning approach for several years, although their high schools have less experience. Fayette County recently completed its first year of mastery learning implementation.

East Jessamine and Eminence are traditional, comprehensive public high schools; STEAM Academy is a new magnet school with a focus on science, technology, engineering, art, and mathematics (STEAM) and was founded through a partnership between the district and the UK College of Education. STEAM Academy students are selected via lottery. During the 2013/14 school year, the school included only grade 9. The school will add grades 10 through 12 in subsequent years.

Table 1. Demographic characteristics of participant districts and schools, 2010–11

		Students				
District/School	**Locale**	**Number, grades 9–12**	**FRL eligible**	**LEP status**	**Have IEP**	**White**
Jessamine County	41-Rural: Fringe	2,164	52%	2%	15%	90%
East Jessamine High School	41-Rural: Fringe	1,056	45%	na	na	91%
Eminence Independent	42-Rural: Distant	222	63%	2%	10%	71%
Eminence High School	42-Rural: Distant	316	52%	na	na	78%
Fayette County	11-City: Large	10,329	48%	8%	11%	58%
STEAM Academy	11-City: Large	150[a]	na	na	na	na

a. School opened in 2013/14 with 150 ninth-graders.

Key: FRL means free/reduced-price lunch. IEP means Individualized Education Plan. LEP means limited English proficient. na means data not available.

Source: National Center for Education Statistics (NCES) Common Core of Data

Table 2. Experience implementing mastery learning in participant districts and high schools (Spring 2014)

School	Years implementing mastery learning in school	Years implementing mastery learning in district	Courses with mastery learning	Grades with mastery learning	Type of school
East Jessamine High School	3	5	All	9–12	Regular public
Eminence High School	3	4	All	9–12	Regular public
STEAM Academy	1	1	Math, science	9	Magnet school; students selected by lottery

Data collection

To determine the current state of mastery learning practices in these high schools, we conducted interviews with three staff members in each district, one each at the classroom, school, and district levels. Classroom-level staff members included one math, one science, and one English teacher. School-level administrators were principals or assistant principals, and district-level staff were superintendents or assistant superintendents. We conducted these interviews in person over the course of about one month in spring 2014. We developed separate interview protocols for each level. Each interview lasted about one hour.

Interviewing across three levels provides multiple perspectives about implementation, ranging from where teachers find specific resources to high-level policy issues. In addition, multiple sources of data help triangulate results within a district.

Finally, the sample high schools and districts provided documents that describe their strategic plans for mastery learning.

Data analysis

Researchers transcribed the interviews and coded the data using a framework developed from mastery learning concepts discussed in the literature and implementation themes that emerged during the interviews. Researchers organized coded data into the following categories: definitions, rationales for mastery learning, student assessments, instructional differentiation (remediation and enrichment),

technology resources, pacing and scheduling, professional development, communication with stakeholders, and mastery learning challenges and successes.

This approach allowed researchers to organize and classify responses. After a first round of analysis, researchers went back through the data to determine whether additional categories or re-categorization was relevant based on common information across staff levels or districts. Researchers then reviewed data for themes across schools and districts and synthesized information for analysis.

How the High Schools Define Mastery Learning

The three schools and their districts appear to operate using definitions of mastery learning at two different but concurrent levels. First, they have a high-level, conceptual definition, which helps provide the context for how the term *mastery* is applied. Second, schools also have numeric or letter grade–based performance definitions, which students must reach in order to demonstrate mastery of course content.

Conceptual definition

Participants in our interviews identified several concepts they believe are critical components of defining mastery learning:

- Close link to standards-based learning
- Student demonstration and application of mastered competencies
- Differentiated and individualized instruction

Research consistently relates these concepts to mastery learning as either complementary pieces or integral components (Block, 1980; Guskey, 2010; Lalley & Gentile, 2009).

Close link to standards-based learning

Administrators in all three districts view mastery learning as closely related to standards-based learning and standards-based grading, saying that standards establish the targets for what students need to master in order to make satisfactory progress. In standards-based learning or grading, teachers define specific standards for students to achieve within a unit or course, rather than totaling points across an entire unit or course. Standards-based learning and mastery learning are not requisite components of each other; schools could use either one

without the other. Standards-based learning is a complementary approach to identifying and measuring student learning goals.

According to one district-level administrator, "I don't think you can talk about mastery learning without talking about standards-based learning. You need to know what you have to master." A high school principal in another district defined her school's approach as "standards-based learning with the purpose of mastery learning," indicating that her school changed its grading scale to reflect mastery of specific standards.

Districts are also discussing the possibility of creating report cards that provide information on students' mastery of specific standards, rather than letter grades. With standards-based report cards, students receive multiple grades within a course based on specific standards for that course. The grades may be traditional letter grades (e.g., A, B, C) or may be more narrative and descriptive. Districts are concerned, however, that a standards-based report card could create a reporting burden for schools and teachers, as outlined in the Challenges section of this report.

Student demonstration and application of mastered competencies

Teachers and administrators also define mastery learning in terms of students' abilities to demonstrate and apply standards-supported competencies they have mastered. A district-level administrator described mastery learning as "about [students] being able to use what they've learned and show that they know how to use it." This conceptual definition matters because it affects instruction and grading. Mastery is not defined simply as a specific score on a test, project, or course without regard for how the score is reached. Instead, these districts define mastery in the context of showing competency for specific, individual standards within each unit.

Differentiated and individualized instruction

Further, districts define mastery learning instruction as differentiated or individualized, tailored to students' progress and the competencies they have yet to master. One district-level administrator defined instruction within the context of mastery learning as "prescribed instruction for what [each] student needs next … a continual growth process of moving to mastery."

As such, the pace of instruction tailored to students' progress may not correspond with the traditional school year. That is, a teacher using the mastery learning approach may not cover the entire traditional curriculum within a single school year, but these schools believe that students will have a firm understanding of the material they have learned and be better prepared to tackle subsequent skills. Students who don't master all of the required content may continue with the same course content the following school year or remediate course content during the summer.

Performance definitions/Measurement

In addition to conceptual definitions of mastery learning, each district defines mastery with a set of numeric or letter grade–based thresholds based on summative assessments (Table 3). The definitions and measurements for mastery vary across districts and within districts.

Table 3. Thresholds for mastery and reporting systems

School	Grading scale for mastery	Grading system	Standards-based report card
East Jessamine High School	Exceeds mastery (grade of A) Mastery (grade of B) Not yet mastered (grade of C)	Standards-based	Under discussion
Eminence High School	Exceeds mastery: 90% Mastery: 80% Not yet mastered: <80%	Standards-based (piloted in high school; teachers record targets in Infinite Campus™)	No
STEAM Academy	Mastery: 90%	Traditional grading system	Under discussion

Grading based on summative assessments

In all three high schools, students' grades are based largely on summative assessments, where "assessment" is defined broadly to indicate any method for determining student knowledge. Homework or class participation count little in student grades, although there are some exceptions. Instead, homework and formative assessments act to help students (and their teachers) understand and monitor their progress. This practice, according to one administrator, "allows students to fail in a safe environment. The [formative] grade doesn't define you. It … allows you to work before you get to the summative assessment."

In Eminence High School, for example, students' unit grades are based entirely on summative assessments. In addition, one teacher at STEAM Academy based students' grades entirely on summative assessments during the first semester of this school year. In the second semester, however, grading included 50 percent formative work in response to students perceiving that homework was not important because it wasn't graded. The shift represents a compromise, but the teacher intends to return to summative-based grades as students become more familiar with this system.

Threshold required to meet mastery varies *across* districts

Looking across districts, grading scales in East Jessamine High School and Eminence High School recognize three levels of mastery: exceeding mastery of a standard, mastering it, and not yet mastering it. In Eminence High School, a score of at least 80 percent indicates mastery, and 90 percent or greater indicates exceeds mastery. At East Jessamine High School, students receive an A, B, or C corresponding to their level of mastery. In contrast, STEAM Academy has set a mastery goal of 90 percent, which is slightly below the Fayette County cutoff of 92 percent for an A.

These values all are consistent with research recommendations, which suggest mastery standards of at least 75 percent (Lalley & Gentile, 2009) or as high as 90 percent (Ch.-L. Kulik et al., 1990).

Threshold required to meet mastery varies *within* districts

Looking within each district, a certain level of ambiguity and flexibility is present in each district's performance definitions of mastery. In Jessamine County, schools may establish their own numeric definitions, although the concept of standards-based learning underpins the mastery approach district-wide. Further, while Eminence High School has established that a score of 80 percent or greater indicates mastery, several staff acknowledged that multiple definitions of mastery exist both within the district and among teachers in the high school. For example, some teachers consider three out of five questions correct (60 percent) on a specific learning target sufficient to demonstrate mastery, a score below the official 80 percent threshold for mastery.

This variability seems consistent with at least one study, which found that often schools do not necessarily use mastery learning techniques, even if they claim to do so (Zimmerman & DiBenedetto, 2008).

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Rationales for Implementing Mastery Learning

In two districts, district-level administrators initiated the implementation of mastery learning. In the third district, it began after a high school teacher was introduced to the approach through a university course and began using it in her classroom. Subsequently, her school piloted mastery learning with 10 freshman-level teachers, and then scaled it up school-wide. In all three districts, district-level administrators, principals, and teachers collaborated to implement mastery learning.

During our interviews, the schools and districts offered several reasons for switching from traditional to a mastery learning style of instruction as well as standards-based grading. This section summarizes several of them.

Need to improve low student performance and close achievement gaps

The primary rationale given for implementing mastery learning is to improve learning for all students while closing achievement gaps between subgroups of students. All three schools cited mastery learning as a response to low student performance levels and achievement gaps. Indeed, mastery learning has been shown to help close the achievement gap between low-performing and high-performing students, as well as helping both sets of students improve their performance (Bloom, 1974; Guskey, 2007; Ironsmith & Eppler, 2007).

Fayette County established a group of "innovation schools," of which STEAM Academy is one, to implement mastery learning in response to a lack of student growth. Although the district was performing well relative to others statewide, half of its high school students were not meeting ACT benchmarks. Administrators at STEAM Academy also cited achievement gap data indicating that some students were not being served well academically as a motivator for establishing a school that incorporates mastery learning strategies. Fayette County recognized the need for changes in instruction and student engagement strategies. One administrator there said "It's going to take some real

re-invention of the system," if the expectation is to ensure all students are college and career ready at high school graduation. The other districts and schools that we interviewed echoed this motivation.

Philosophy that purpose of school is for students to demonstrate mastery and application of knowledge

A second impetus for mastery learning stemmed from school- and district-based discussions about the purpose of school. Interviewees expressed commitment to having students demonstrate that they can master content and apply their learning. In the Eminence Independent district, mastery learning is seen as a way to demonstrate that students "could know, use, and understand [the standards] and, ultimately, do better."

Administrators in Jessamine County recognized that their previous instructional approach was allowing students to receive satisfactory grades without mastering the material. For example, a student could miss class sessions, make up points by completing extra credit assignments, and then pass a course without knowing the material. In other words, "kids figured out how to play the game." Mastery learning's focus on summative assessments, and de-emphasis of graded homework or extra credit, was very appealing.

Desire to increase student accountability for learning

Teachers and administrators also hoped to increase students' accountability for their own learning. Through mastery learning, students in Jessamine County now know which standards they have and have not yet mastered. Instead of asking for extra credit, they can target their learning efforts to specific standards, then ask to be reassessed on that content. The students "learn to fix a problem in their learning instead of pulling a rug over a problem." In Jessamine County, many teachers have students keep their own grade books to track their progress.

Desire to accurately identify and document what students had learned

A fourth motivation offered for converting to mastery learning instruction, including standards-based grading, is to accurately identify and document what students have learned. Interviewees in Eminence

Independent emphasized that being aware of students' current knowledge and progress is important because a teacher has a relatively limited time frame—typically one year—for teaching a course-worth of content.

An accurate record of students' progress also can give teachers additional insight on why students might be struggling with a particular standard. Teachers need to know "where a student [is] in math and what prevents her from getting to the next level," whether it is a lack of foundational knowledge or a misunderstanding of a recently taught lesson.

Better communicating of students' knowledge to parents and students

A related rationale is to improve communication about learning. Jessamine County wanted to better communicate the status of students' knowledge and skills to families, and even to students themselves. They believe a standards-based system that clearly identifies individual objectives, combined with a mastery requirement, provides a basis for better conversations about learning. Eminence Independent also cited students' knowledge of their own progress as an important reason to implement mastery learning: "When there is a certain responsibility to [students] knowing the standards and being able to articulate [their] own needs, it changes the conversation with students."

Personal experiences

A final rationale for mastery learning comes from educators' own experiences. One superintendent had implemented mastery learning first while a teacher; in his classes, student achievement had improved from the 10^{th} percentile to the 85^{th} percentile. He now noted, "What's going on district-wide was rooted in my work as a teacher 10 years ago." Likewise, individuals in other districts championed mastery learning based on personal experiences with courses they had taken or their master's degree thesis research.

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Implementation of Mastery Learning

The five core components of the mastery learning instructional cycle are pre-assessment, instruction, formative assessment, additional corrective or enrichment instruction, and summative assessment. Effectively, it is a cycle of determining students' current knowledge and skills, then providing instruction based on that information; the instruction may revisit previous material or proceed to new units. Additional elements supporting the mastery learning cycle include professional development, instructional resources, scheduling, and communicating with stakeholders.

This section describes how the schools implemented mastery learning, looking at each of these factors.

Providing professional development

When implementing new programs, schools and districts often provide professional development leading up to and throughout the implementation. Staff in the sample schools and districts reported that they received relatively limited formal professional development in mastery learning. Prior to implementing mastery learning practices, administrators and teachers in all three districts participated in one- or two-day workshops or other professional development focused on mastery learning or standards-based learning with experts from the University of Kentucky. One administrator and one teacher described these workshops as informative, though primarily theoretical rather than focused on day-to-day implementation. Specific workshop topics mentioned in interviews included mastery learning implementation and student engagement with mastery learning.

Jessamine County conducted book studies on *A Repair Kit for Grading: Fifteen Fixes for Broken Grades,* by Ken O'Connor (focused on the rationale for standards-based grading); *Practical Solutions for Serious Problems in Standards-based Grading,* edited by Thomas Guskey; and *Classroom Assessment for Student Learning* (CASL) by the Assessment Training Institute. The other schools also studied the CASL book. While the CASL formative assessment approach is not

specific to mastery learning or standards-based grading, an interviewee at East Jessamine High School noted that the CASL process had not fit within the school's conventional grading system. Thus, CASL training was the genesis of mastery learning at the school.

There were examples of embedded professional development around mastery learning. In Eminence Independent, professional development is intended to be embedded, flexible, and tailored to teachers' individual needs. Each new hire partners with someone in a similar subject area and grade who models mastery learning instruction. The school provides professional development based on teachers' challenges, such as re-teaching or developing retake assessments. In addition, teachers have professional development sheets through which they can select which sessions they would like to attend. Similarly, although STEAM Academy in Fayette County has not implemented personalized professional development, the district-level administrator noted that those teachers who had used the mastery approach learned a great deal through the implementation process.

Two schools plan professional development related to mastery learning in the coming summer. In Jessamine County, it will address measuring student growth and incorporating it into assessments. The sessions will include how to define high, expected, and low growth, as well as the development of a related rubric. The summer sessions will focus on summative assessments, while subsequent sessions will focus on formative assessment for continuous monitoring of student growth. Meanwhile, STEAM Academy plans to provide further professional development on mastery learning for teachers this summer, and Fayette County will offer a district-wide professional development session for any staff interested in mastery learning.

Beyond these strategies, the schools and districts take an ad hoc approach to learning about mastery learning. STEAM Academy reported visiting a school in Columbus, Ohio, that uses mastery learning. Eminence High School reported participating in informal social media groups that will meet to share information and resources about mastery and standards-based learning. East Jessamine High School interviewees described going to conferences, but that mostly they end up providing more information and professional development to other attendees than they received. All three groups reported that professional development about mastery learning and standards-

based learning is an area of need for them and for the larger education community.

Differentiating instruction

Differentiated instruction for correction (remediation) and enrichment is an important component of mastery learning. Research has identified two extremes in the level of differentiation. On one end, both initial instruction and the corrective/enrichment instruction involve large groups of students. On the other end, corrective/enrichment activities are individualized to the specific student. The former approach is common in many high school settings, whereas the second strategy is more common in college where professors may have fewer courses or students, although many levels of differentiation are possible in many settings. The level of instructional differentiation can affect selection of resources for instruction and assessment.

The schools in our sample fall in between the two extremes. In some classrooms, the majority of instructional time is spent in groups. In other instances, teachers meet one-on-one or with small groups of students during class time and during flexible scheduling periods set aside for differentiated instruction.

In all instances, the goal is to move as close to individualized work as possible.

Interviewees reported that students spend a significant amount of time on independent work, freeing teachers to address students' individual needs. According to one teacher, "After I start a lesson, I can meet with a small group who needed help on a specific topic. If enough [students] perform low, then I can stop the whole class." Another teacher has students watch videos based on their skill levels at home before coming to class. An administrator described this approach as "a flipped classroom model, where the students get the direct instruction at home and come into class for support." Another teacher has developed self-paced modules as a component for some units. This school year, she provided one-on-one support to students during independent work periods, "supporting the students who needed it but not holding back the students who could get it done quickly."

Using resources/technology for remediation and enrichment

The level of differentiation and re-teaching in mastery learning requires additional curricular and instructional materials compared with traditional teaching. Historically, this has presented challenges to teachers and schools.

All three districts use technology to enhance differentiated instruction for mastery learning.

Schools reported three different roles for technology:

- Assessing and monitoring student progress and instructional needs
- Providing instructional resources or materials for teachers
- Delivering direct, relevant instruction to students at individual workstations

Many of the technologies mentioned in our interviews (Table 4) have capabilities to perform each of these roles.

Table 4. Technology resources high schools use to supplement mastery learning instruction

Type	Example
• Course management site	• Blackboard (http://www.blackboard.com/) • Canvas (http://www.instructure.com/) • Haiku (www.haikulearning.com)
• Online instructional platform	• Edgenuity (http://www2.edgenuity.com) • Holt McDougal (http://www.hmhco.com/educators) • Khan Academy (https://www.khanacademy.org/) • PhET (science) (http://phet.colorado.edu/) • PowerMyLearning (http://powermylearning.org/) • Quill (grammar) (http://www.quill.org)
• Video recording and editing (screen-casting) software	• Camtasia (http://www.techsmith.com/camtasia.html) • iMovie (http://www.apple.com/ios/imovie/)
• Student response system	• Geddit (http://letsgeddit.com/) • Socrative (http://www.socrative.com/)

Teachers are using technology to assess and monitor individual and collective student needs.

With traditional paper-and-pencil assessments, it can be difficult for teachers to identify specific instructional needs for individual stu-

dents or trends across groups of students, often due to the time necessary for such analysis. Various assessment and instructional technologies, however, provide detailed feedback on a near real-time basis that can be aggregated and disaggregated by student or by topic.

STEAM Academy reported using the Geddit student response system. Geddit has online quizzes and provides reports for teachers about student performance. Geddit also allows students to rate their confidence about specific questions and topics, providing more information to the teacher about students' own beliefs about their mastery. STEAM Academy has used Socrative™ as a student clicker to get real-time feedback from students during class. In Jessamine High School, one teacher uses technology as part of project-based learning for formative assessments; for example, students use iMovie™ to create videos about what they have learned.

Schools also discussed using electronic course management platforms to track student progress and plan for instruction. These platforms allow teachers and students to post syllabi, assignments, assessments, and conversations online in secure locations. Specifically, schools mentioned Blackboard™, Canvas™, and Haiku™ as examples of course management platforms.

In addition to tracking students' academic progress, Eminence High School uses an innovative technology to track students' physical location. Students use personal devices with QR code readers to scan into rooms when they visit teachers to receive remediation or enrichment support. This technology permits the school to track students during flexible scheduling periods throughout the day. The QR scanner also links directly to individual student files where teachers can record the type of assistance provided during the study session.

Teachers in each district described using online resources to obtain relevant instructional materials for differentiated instruction.

None of the districts has purchased mastery learning programs, but they do rely on available resources to compile lessons based on individual student needs. In reference to her school's decision not to purchase a mastery learning program, one principal said, "We're working from the belief that buying something off the shelf is not as good as when we put it together ourselves, because it helps us understand everything at those deeper levels."

East Jessamine High School and Eminence High School use the online learning platform Edgenuity, which features video lessons and other resources. High school teachers in both schools use it for re-teaching and enrichment, although one teacher found Edgenuity content to be too advanced for some students. Teachers also reported visiting Khan Academy, PhET, and to a lesser degree Kentucky's CIITS, to find materials to address students' remediation and enrichment needs.

Teachers use technology to help deliver appropriate content to individuals and groups of students.

Teachers reported using online resources to offer "blended" instruction, which combines computer-based and teacher-based instruction, and "flipped" instruction, where students access instruction outside of the classroom and use school time to get support on assignments. All three schools referenced Khan Academy as an instructional tool; several of the other online resources discussed above also deliver instruction via videos, interactive lessons, or games.

Teachers at STEAM Academy use the screencasting software Camtasia™ to create some of their lessons. With Camtasia, they can guide students through websites, content on course management platforms, or a PowerPoint presentation. Students can access these videos remotely for remediation. One teacher hopes to build on the Camtasia videos to create online, self-paced remediation modules.

STEAM Academy is piloting several software programs and hopes to select one next year that meets students' needs for self-paced learning. The school's goal is "to have a lab work session where our students can get on the computer and work on a skill set based on where they are." In Jessamine County, English classes already incorporate a lab period once a week, which allows for self-paced learning.

Some students were initially resistant to technology-based supplemental learning because they were accustomed to direct instruction. According to a freshman-level teacher, "One of the biggest revelations this year is that digital natives are not inherently digital learners. They have to be taught how to use [technology] in a school environment." With support from teachers, students in her school have become more adept at using technology for self-directed, self-paced learning.

Documenting student learning through assessments

Assessment practices are one key element of mastery learning. The schools and districts we spoke with interpret "assessment" more broadly than traditional paper-and-pencil exams; assessment is any means of determining what students know and can do. Examples include performance tasks, essays, exams, and community-based design projects. In some cases, teachers accept work from other courses as demonstrations of students' mastery of certain standards.

Formative assessment practices

Frequent formative assessments are mastery learning's primary way of monitoring students' progress and inform teachers' instruction throughout the mastery learning cycle.

In all three high schools, teachers use pre-assessments and later formative assessments to better understand students' initial and subsequent skill levels and to develop differentiated instructional approaches.

Such formative assessments include:

- Exit slips and online student feedback tracking programs
- Standards-based grading rubrics
- Post-assessment student reflection
- Measures of Academic Progress™ (MAP) tests

Teachers at STEAM Academy described using exit slips and other such assessments for continuous formative tracking. One teacher adopted the online feedback tool Geddit™, which measures students' content knowledge through short-answer and multiple-choice questions, as well as their perceived level of confidence. If her students miss all three content questions or self-identify as "not confident," she works with them in small groups or develops other differentiated strategies for remediation.

Once teachers have administered the assessments, they give students feedback on the content or skills they have yet to master. In Jessamine County, students receive teacher-developed rubrics with a grade for each standard the assignment or assessment covered. One teacher

does not offer extensive comments because she wants students "to apply the rubric to the draft [themselves]; students find problems, and conference with the teacher." In Eminence High School, students review formative assessments to identify which problems they answered incorrectly. Students in one Eminence classroom write reflective essays on what they need to work on, and teachers develop instructional strategies to help them master content they have not yet learned.

All three districts and their high schools track students' progress through Measures of Academic Progress™ (MAP) tests.

These computer-adaptive assessments from the Northwest Evaluation Association measure students' reading, mathematics, and language skills. The STEAM Academy offers MAP to students three times annually. Students who score above grade level in the fall are not required to take MAP in the spring. All students take MAP again in the summer and "look at data points to see how well they're doing." Recently, a math teacher at STEAM Academy began conducting sessions to help students better understand their MAP scores, chart their progress, and set learning goals.

Summative assessment practices

Most mastery learning proponents advocate that students' grades be based on end-of-unit summative assessments, not on homework, class participation, or formative assessments. In a mastery learning framework, students are allowed to retake summative assessments multiple times until they demonstrate mastery. One consequence of this practice is that teachers must prepare multiple versions of the summative assessment, so that students do not memorize answers during the course of retaking the same assessment (Lalley & Gentile, 2009). Other issues arise, as well.

None of the districts or schools have established a policy on how many times students may retake a summative assessment.

Each teacher has autonomy over how many retake assessments to offer students before allowing them to move on to the next unit without having demonstrated mastery of the current unit. A teacher sometimes needs to move students on to new content before they have mastered a standard if it takes more than a few extra weeks to

demonstrate mastery. In these cases, teachers continue to work with students on unmastered content during remediation sessions and by spiraling the curriculum.

The STEAM Academy has a response-to-intervention block built into its schedule, when teachers work with small groups of students who have not demonstrated mastery of standards on summative assessments. According to one teacher in another district, even students who may never reach mastery improve their skill levels after relearning a topic. She said this is "a small victory we didn't have before [in a traditional setting], because we just moved on."

Developing retake assessments is a significant time investment, which some teachers find challenging.

One teacher uses items available on the online platform Edgenuity™, which offers supplemental instructional material, to help her develop new assessments. Another teacher is working on improving the design of her initial summative assessments so they remain valid as retake assessments. Other sources schools use to develop their assessments include these:

- Sample assessment items from the Partnership for Assessment of Readiness for College and Careers (PARCC) and the Smarter Balanced Assessment Consortium
- Triumph Learning™
- KDE's Continuous Instructional Improvement Technology System (CIITS)

Schools use a variety of techniques to collect data about their students' mastery.

Eminence High School encourages teachers to "triangulate," or consider multiple data sources to document a student's mastery of a unit or concept. For example, a student might demonstrate mastery through a formative assessment, a summative assessment, and teacher observation. Students might also demonstrate mastery of a skill, for example, if they have learned a more advanced skill that requires the earlier one as a prerequisite.

Scheduling and pacing

A frequent concern about mastery learning is that it requires extra time to implement or significant changes to scheduling. Guskey (2007) suggests, however, that only minor schedule changes are necessary to overcome hurdles associated with mastery learning instruction. In our sample, schools have implemented a number of creative strategies to handle scheduling challenges.

Schools have implemented time specifically for enrichment and remediation through unconventional scheduling within the school day.

Two schools changed their schedules to resemble college courses, with classes meeting either Monday-Wednesday-Friday or Tuesday-Thursday. STEAM Academy dedicates a block of time two days a week for response to invention, where students work with a teacher in small groups based on their specific needs. For example, English students complete assessments through the online grammar site Quill™. Then, the teacher provides mini-lessons during the response-to-intervention period based on small groups' needs.

At Eminence High School, students attend core classes three days each week. Tuesday and Thursday are reserved for Interventions Connections Enrichment (ICE) time, in which students seek extra help or enrichment or attend elective courses. ICE allows advanced students to attend classes at a local college, while others receive additional support in the high school. According to a school-level administrator, "It looks like chaos, like a college campus. Teachers may service different students every Tuesday or Thursday." Since students may visit various classrooms during ICE, the school has developed an innovative QR code system to track students. There is a QR code for each classroom; students scan themselves in with personal or school-provided mobile devices. Teachers also can record the content or skill they worked on with each student during ICE in the student tracking system.

Schools are using time outside of the school day to provide support.

East Jessamine High School teachers arrive early or stay late to work with students, posting their "office hours" availability on boards in their classrooms. In our interviews, they stated that the majority of students take advantage of these opportunities. Students also have

access to their teachers through technology via email or recorded lessons, making the school "open all the time." STEAM Academy also offers Extended School Services (ESS) after school and began offering ESS on Saturdays in response to student requests.

Pacing, too, can be challenging for mastery learning. Students may require more time to learn the material than is traditionally allotted in a single cycle of instruction; yet districts still must make mastery learning work within the traditional school year and the state testing schedule. Teachers and principals acknowledged that outside monitoring factors impose some pressure to ensure students have learned content by the end of the school year. According to one principal, "I would like to say that time isn't a factor, that students can learn at their own pace, but you have requirements: [staffing] allocations for teachers, credits, and retentions." A large number of student retentions reflects negatively on a school.

Despite the pressure teachers and principals may feel to cover material within a set time frame, the administrators we spoke with deemphasized the importance of traditional pacing. According to one district-level administrator, "We would rather kids know it well than just keep moving. The district does not advocate that they just have to keep moving to catch up with where they 'should be.'"

One principal agreed that mastery learning has actually reduced the pressure to cover material quickly. The model has led to a cultural shift within the school. As the principal explained, "We want teachers to pace well and look at standards, but it's not about coverage. We are much more interested in how well [students] know it, rather than how much material is covered." Measuring students' progress via mastery rather than seat time has even allowed the school to accelerate some students, through a dual credit class for 10th-graders. A teacher at another school agreed, saying she would rather teach 80 percent of the standards and have students master them than teach all standards without mastery.

STEAM Academy is beginning to implement new pacing models that work within existing structures. For example, the state offers six testing windows for students to take end-of-course (EOC) exams. STEAM Academy plans to offer EOCs to students when they have mastered course content, rather than at the end of the school year. It also of-

fered a supplemental January term this winter for students who had not yet mastered first-semester material. It plans to offer a summer term for students who have not yet mastered Algebra I content, so they can progress to another course at the start of the 2014/15 school year. These students would be able to take the EOC prior to returning to school and enter an appropriate math class in the fall based on the content mastered during the extra term.

Communicating with teachers, parents, and students

A potential challenge of implementing any new initiative is to effectively communicate its purpose and goals to stakeholders. In all three districts, teachers initially expressed skepticism or experienced challenges with implementation. Likewise, some parents struggle to understand how mastery learning benefits their students. Students had their own challenges with the rigor of the mastery learning thresholds and in becoming the effective learners the new model required. Schools used various strategies to inform each stakeholder group about the purpose and process behind their switch from traditional to mastery learning pedagogy and standards-based grading.

Teachers

Teachers said they had various concerns about the switch to mastery learning:

- Would students do homework if it is not graded?
- Would students need to retake tests many times?
- How can course grades be assigned on such a small number of summative scores?
- How would teachers be evaluated if students did not master all of the standards for a course?

Administrators used various strategies to communicate about each of these concerns. Districts brought in experts from the University of Kentucky to clarify what mastery learning is and how to implement it at the classroom level. One associate principal reported helping teachers realize that while they may assign a small number of grades, each grade conveys a large amount of information about what students know and can do. Regarding the teacher evaluation concern, the message from administrators has remained consistent: that the

schools' and districts' goal is to promote mastery, not to cover material.

Parents

Parents expressed their own concerns about mastery learning, a pedagogy few of them had experienced themselves as students:

- Why are students still working on content they previously covered in other courses?
- What is my student's course grade, and what does it mean?
- What does it mean when a student does not achieve mastery right away and receives a low grade on an assessment?
- How will mastery learning and standards-based grading affect grades for college admissions and scholarships?

Administrators in all three districts work to engage parents to explain mastery learning and grading practices. Schools reported using traditional parent night meetings at the beginning of the year to explain their philosophy and approach. When discussing mastery learning and standards-based learning, teachers and administrators especially try to avoid jargon, which can be a barrier in talking with parents.

Teachers in East Jessamine High School have students document their progress in a notebook, and then teachers use the notebooks to communicate to parents about assignments or justify course grades. Several interviewees, in more than one district, stated that once parents see and understand how assignments build toward a summative assessment, their attention turns away from teachers' grading and toward students' habits and learning.

District-level leadership also encourages schools to view parents as partners and to collaborate with them to make and implement decisions. Eminence High School has created Student Parent Advisor Readiness Committees (SPARC) for students, where the family and school staff discuss specific learning goals in reading and math and how mastery learning will help the student reach those goals.

Students

Students also have concerns and misconceptions about mastery learning:

- Why work hard to master the material when there are multiple opportunities to take assessments?
- Why do homework when it does not count for a grade? And why doesn't it count?
- Why are grades suddenly lower than in the past?

In many cases, it appears that direct communication with students is less effective than with other groups. Students' understanding and acceptance of mastery learning practices evolved with their experience with the new approach. Schools still continually discuss the mastery learning approach and communicate about specific scores and standards. In one classroom, while the teacher did not count homework and other formative assignments towards the final grade, she started marking completion of the assignments in her gradebook as a way to communicate to students that she still valued them. She found that the "checkmarks are important to students, even though they are not graded." Overall, teachers and administrators report that through experience and continual discussion, students now are more focused and have a greater appreciation for the mastery learning model than they did at the beginning of the school year.

Successes and Challenges with Mastery Learning

Successes

In developing and implementing mastery learning and standards-based grading, schools identified several areas of success. These successes extended to students, teachers, and the system as a whole (Table 5).

Table 5. Successes of mastery learning cited by staff

	Description	Evidence
Student-level	Higher student achievement	State assessment scores
	Smaller achievement gaps	State assessment scores
	More student engagement	Teacher observations
	Students taking ownership of their learning	Conversations and student language
Teacher-level	Improved practice	Alignment of instruction and assessment to standards
	More efficient use of time	Principal and teacher observations
System-level	Successful implementation of mastery learning strategies at an alternative school	District administrator observations
	Increased collaboration among teachers and administrators	More conversations across grades and schools

Student successes

Most frequently, administrators and teachers cited increased student achievement and engagement as successes of implementing mastery learning. According to an administrator in the Eminence Independent district, the personalized instruction of mastery learning is reducing the achievement gap in his district. Students also are taking ownership of their learning and using more sophisticated language to describe what they've learned. They also are being more honest about their work, since there is less of an incentive to cheat due to the de-emphasis on grades.

In Eminence High School, students now approach teachers to discuss the content they have yet to master, how they think they could demonstrate mastery, and where they need help. There is less stigma associated with asking for help. When students take responsibility for understanding the standards and articulating their own learning needs, "it changes the conversation with students."

At STEAM Academy, teachers see students taking ownership of their work, and some are "truly becoming scholars." Although teachers concede that mastery learning does not guarantee greater student engagement, even students who are not engaged are more accountable for their learning. "They're owning the fact that they're not doing it, and that's a huge improvement."

This is not unexpected. Studies on mastery learning widely cite increased student engagement and ownership of learning as potential benefits of the approach (Changeiywo et al., 2010; Guskey, 2010; Ironsmith & Eppler, 2007; Zimmerman & DiBenedetto, 2008).

Teacher successes

District and school administrators perceive that mastery learning has improved teachers' practice. Teachers are more focused on the standards. According to one district-level administrator, "The approach has forced teachers to focus on what standards say and what students can do. … It forces teachers to think about what they are looking for to have students demonstrate mastery." A teacher in the administrator's district agreed that her lessons and class activities more closely align with the standards than prior to the implementation of mastery learning.

Teachers in her district also are moving away from "getting close" to student mastery of a standard and toward ensuring students actually know the material. The grades students receive "represent where the learning is, more so than ever before." Teachers and administrators in Jessamine County and Eminence Independent cited teachers' more productive and efficient planning and instructional time as one of the successes of mastery learning. Bloom (1974) theorized efficient use of classroom time was a potential benefit of mastery learning.

System successes

Two district-level administrators noted that mastery learning is a good fit with alternative schools in their districts, where instruction is individualized and there are multiple options for demonstrating performance. According to one administrator, the alternative school in his district "has been doing some version of [mastery learning] for a long time. … It's very much personalized programming." According to Guskey and Jung (2011), mastery learning can work well within the context of response to intervention programming.

Mastery learning also has fostered collaboration among some stakeholders who did not work together in the past. In Jessamine County, vertical content alignment in grades 6–12 has improved. Teachers at the middle and high school levels who teach in the same content areas have begun to discuss the meaning of the standards together. At STEAM Academy, teachers developed a stronger rapport during their school's inaugural year, and their understanding of mastery learning increased as they implemented the approach.

Challenges

As we would expect for any new initiative, implementation of mastery learning in the three schools has not seen only successes. Study participants also identified several school- and system-level challenges (Table 6).

Table 6. Challenges of mastery learning cited by staff

	Description
School-level	Creation of a school culture less focused on test scores Skepticism among teachers, parents, and students Traditional views of school-based decisionmaking councils
System-level	Implementation of mastery learning within traditional testing and grading requirements Alignment of mastery learning and state testing systems Implementation of mastery learning within the traditional school calendar

A major challenge for districts has been implementing mastery learning within traditional structures, such as state assessment requirements and existing grading systems. According to teachers and administrators, the system's student information software, Infinite Campus, is not configured for standards-based reporting and grad-

ing. Standards-based grading therefore creates "double work" for staff entering grades into the system. According to news accounts, schools in New Hampshire, for example, faced a similar challenge when implementing mastery learning (Gewertz, 2010).

In addition, because standards-based grades may not be reported in terms of averages or GPAs, schools are unsure how external entities such as athletic associations, scholarship providers, college admissions officers, and employers will interpret standards-based reporting.

Another challenge with existing structures is that state testing does not align well with the mastery-based model. State end-of-course examinations do not document which standards a student has mastered and do not chart student growth. One educator said, "Honestly, the state test means nothing to us. What means more is the MAP testing and growth." Another district-level administrator found it challenging to change school cultures that are used to emphasizing the importance of test scores. Although he instructed teachers not to worry about test scores, they were still concerned that low scores would have a negative impact on their schools and evaluations.

Participants identified several additional challenges, as well. One district-level administrator found that school-based decisionmaking councils sometimes hold more-traditional views about instruction than mastery learning allows. Traditional school calendars can also be problematic, with grade-level promotion expected at the end of the school year. There can be consequences for schools that have low promotion rates, although mastery learning does not define a timeline for promotion.

Finally, schools have had to work against skepticism about the mastery learning model among teachers, parents, and students, as discussed in the Communicating section above.

Next Steps

We asked stakeholders what additional information they would like on mastery learning to improve their practices. The administrators and teachers said they are interested in learning from others who have worked with or had success with mastery learning, noting relatively limited information is exchanged among schools and districts implementing the approach. In response to this interest, the participating schools and researchers intend to form a partnership to share information and pursue additional research.

Chief among the information that administrators seek is how to define and implement mastery learning consistently across a school or district. Interviewees view setting and measuring performance thresholds that accurately, consistently represent mastery of a subject as critical next steps for scaling mastery learning. As one example of the importance of consistent definitions, one administrator explained that the district's career and technical education center serves students district-wide. Currently, high schools may take different approaches to mastery and standards-based learning that could lead to inconsistencies for students attending the center.

Further, administrators and teachers are especially interested in information on how to monitor both students' progress toward mastery and the mastery learning program overall more effectively. They specifically mentioned:

- A system to monitor student outcomes and growth in student achievement based on mastery learning and standards-based learning.
- A system to track students' progress across grades and transitions from elementary to middle to high school.
- More user-friendly, sophisticated, teacher-controlled mastery tracking software, which would include learning objectives and help teachers monitor student progress.
- More time and ability to work with real-time data that merges with standards and benchmarks.

Finally, teachers and administrators would like more information on assessment and reporting. One district-level administrator is interested in exploring additional ways that students can demonstrate mastery other than written summative assessments, such as performance tasks. Another district administrator referred to this same need as "creating mastery-based courses." School administrators and teachers would like more information on how to decide which of the hundreds of standards for each course should be reported. They also are interested in whether it is possible to identify cross-discipline competencies that are relevant across courses and subjects.

Although still relatively inexperienced with mastery learning and related concepts such as standards-based grading and standards-based reporting, the study participants believe they have made considerable progress in implementation and in student achievement. Nevertheless, many questions remain about how to improve on both. These questions and research needs are not only relevant to the three Kentucky districts and their high schools, but also would be of interest to educators elsewhere who are exploring or scaling up mastery learning programs. The practitioners and researchers involved in this study will continue to examine definitions, practices, and student outcomes related to mastery learning to further inform implementation of this promising instructional approach.

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