MASTERY LEARNING

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Some Background on How we Process and Learn Information

Incoming information acquired by our senses is initially processed in sensory memory. Once the senses perceive the stimulus, it is then processed in our working memory, which connects the new information to what has already been previously learned and stored in our brain. It is the capacity of this working memory that constrains our ability to process new information.

There are three demands, or loads, on working memory:
1. *Intrinsic load* is the difficulty of the task itself.
    -Multiple-step tasks put more of a load on working memory than single-step tasks.
    -"Chunking" reduces this load. It refers to grouping multiple bits of information together as a single working unit. The more exposure or practice you have with a concept/task, the more likely it is that some information or parts of the process become chunked. When this happens, accessing just one part of the chunked information will access the remainder. Long practice at a task that makes a process automatic also reduces the amount of working memory needed.
    -An example of this process is how a toddler first learns to walk. In the beginning, the slightest distraction will cause them to fall as all of their working memory is being used to keep their balance. After much practice, the actions required to keep balanced while moving become chunked. The task of walking hasn't changed but the information has been chunked and practiced until it is automatic, so less working memory is used.
2. *Extraneous load* includes whatever is not really necessary to complete the task but places a demand on working memory.
    -Examples of extraneous load include unclear directions, distractions that occur during a task, poor instructional design, and personal thoughts or emotions.
3. *Germane load* is the load that is required in order to learn or to alter past learning.
    -If a task is too complex or there are too many distractions, little or no room may be left in working memory to learn from what you did. The consequence is that little or no new learning has taken place when the task is completed. The same circumstances may lead to a failure to connect new information to past learning, so previous ideas are not altered in any way.

Learning to create a mastery classroom environment or differentiated lessons follows the same learning process. Taking it one step at a time and avoiding distractions will allow you to learn the process better. With constant effort and continued practice, you understand better and can create lessons more easily.

There are basically two ways to decrease the intrinsic load (difficulty) of a problem:
1. break it down into smaller steps
2. increase the prior knowledge of the person
Decrease both the *intrinsic* load (difficulty) and the *extrinsic* load (distractions) and more working memory is available for the *germane* load (learning).

What Is Mastery Learning?

Students are required to show mastery of a concept before they are allowed to move on to the next concept.

The teacher determines the level of mastery. Students are given opportunities to learn through a variety of instructional strategies and then assessed. If they do not achieve the mastery level for the assessment, they are given additional instruction/resources and then reassessed.

The pace of mastery learning in the classroom can be determined by the teacher, the student, or a blend of both.

Why Do Mastery Learning?

If you do what you've always done, you'll get what you've always gotten.

Traditional classes typically teach to the large middle, leaving some students behind and high achievers either frustrated or bored. Most students will learn, but not all. Once the majority have it, the class moves on. Students left behind won't have the prior knowledge that is so important to acquire new understandings. Students outside the middle become disengaged and perform below their potential.

In addition, traditional approaches send several bad messages to students.
1. It is okay to go through class and not really learn.
2. Everyone learns the same and therefor require the same activities.
3. The class will move on even if some are not ready.
4. Those who can move faster are not allowed to until the middle is ready.
5. Not everyone is expected to be able to understand the content.

In Mastery Learning, low-aptitude students are not left behind and higher-aptitude students are not held back. *All* students, not just the majority, will learn and understand the content. Mastery Learning is a *fair* approach where each student receives whatever support they need to achieve the same standard.

What are the *Benefits* of Mastery Learning?

1. Once students get the format, they are grateful for the freedom to choose how they learn and move through the course content.
2. The flexibility of the mastery learning format allows students to catch up from absences.
3. It is actual learning versus mere grade earning.
4. There are more interactions with individual kids at the personal and academic level.
5. Once the lower-aptitude students get caught up with their foundational knowledge, which may require more time in the beginning, they will likely not need additional time for new concepts.
6. Mastery class students significantly outperform those from traditional classes when tested for retention and understanding, with an increasingly greater gap after a course is ended.
7. Mastery Learning complements standards-based learning as it holds students to a performance standard instead of simply exposing them to required content.
8. Students feel respected in the classroom, which leads to higher motivation, a better work ethic, and greater appreciation for the material they are learning. The emphasis is on student understanding, not teacher control.

9. It is true that teacher preparation is very time-consuming the first year, but then the burden is much lighter in subsequent years as you only need to revise lessons and create a few new materials.
10. Mastery Learning as an approach teaches Twenty First Century skills.
    -*Flexibility & Adaptability*: optional learning choices.
    -*Initiative & Self-Direction*: students decide which learning options to do and when they're ready for a quiz.
    -*Social & Cross-Cultural Skills*: working groups change frequently as students finish and move on. Students learn social skills by working with a variety of people. The key social skills of politeness and patience are learned while waiting for the teacher's attention.
    -*Productivity & Accountability*: students are held completely accountable for their own learning.
    -*Leadership & Responsibility*: students are responsible for their own learning, keeping track of progress, and keeping on pace with the course.

What are the *Observed Results* of Mastery Learning?

1. There is a dramatic increase in student responsibility for learning.
2. There is a large increase in student awareness of their understanding of the material and readiness to move on.
3. The teacher gets to know students more quickly.
4. The gaps of knowledge between students at different levels decreases.
5. There is increased individual accountability.
6. There is more flexibility as kids choose what learning opportunities to do and how quickly they progress.
7. Students are not left behind if they don't get it early on.
8. There is an increased engagement in learning. Having options in how they learn and individual . accountability increases student participation.
9. The classroom is a little more "messy" as many types of learning are going on simultaneously.
10. The teacher is busier during the actual class period.
11. Students feel respected and gain confidence that they can learn the material.
12. After the first year it is *much easier* as considerably less time is needed for planning.
13. The teacher is comfortable with passing a student, knowing that they have actually learned the material.

How do you *Create* a Mastery Learning Course?

1. Decide what content must be mastered and identify the key essential concepts.
    I. Use national standards and your state or local curriculums as resources.
    II. Decide what level of mastery to set as your minimum.
        A. Will you have 70, 80, 90, or some other percent as a minimal mastery for quizzes?
        B. Will you have the same mastery percentage required for tests and quizzes?
        C. Will tests have a different level of mastery required than quizzes? (Ex.: 80% "B" for quizzes but 70% "C" for tests.)
        D. Will only quizzes have a minimum mastery percentage required and tests have no minimum? (It is reasonable to expect passing grades of, say, a "C" on a test if the quiz grades had to be a "B" minimum.)

For Each Unit...

2. Create a Unit Test or acceptable differentiated Final Products that meet your mastery criteria.
   I. Determine the mastery content and terminology that students should understand.
   II. Decide how you expect them to demonstrate their understanding.
   III. Work to accommodate differences in how you test for understanding, but hold all students to the same essential criteria.
   IV. Strive for more open-ended responses. If there is a multiple-choice question, ask a follow-up question that asks the student to explain "why" they chose that answer.

3. Create short quizzes that measure mastery in only one or two closely related concepts.
   I. Create multiple versions of each quiz.
   II. If practical, develop some quiz versions that are differentiated.

For Each Unit: Create differentiated learning opportunities that offer students choices in how they learn.

4. Gather LOTS of resources appropriate to the task to collect ideas.
   I. Consider creating your OWN readings instead of assigning pages from a standard text that may not present the information in the way you believe is best.
   II. Use a class library (ex.: science texts library) as a room resource that students can explore on their own as they research a topic.

5. Plan a cohesive, logical sequence of discovery for students that guides them toward higher levels of understanding.
   I. Plans should accommodate different learning characteristics and allow student choice. Choices could be in content (what they learn), procedures (how they learn), or in product (how they demonstrate their understanding.)
   II. Decide if some activities should be required and develop an option where students can create one activity of their own design.
   III. Check to make sure there is access to all of the equipment and resources you want.
   IV. Realize that the teacher becomes more of a facilitator who organizes learning opportunities and coaches/mentors learners as students are encouraged to take on more responsibility for their own learning. Adjust your plans and thinking accordingly.
   V. Create checklists for each section/unit that students can use to guide their learning.

6. Estimate how much time is *realistically* needed for each aspect of the lesson sequence.
   I. Consider how many *effective* teaching days there are in your school year. This restriction may affect your overall timeline for the year. (ex.: The days before and after a long break may see little learning and certain days may be lost for other reasons.)
   II. It is better to schedule more tightly to keep people on track; you can always add extra time if it is truly needed.

7. Record daily notes as students work through the various learning opportunities and unit sequences.
   I. What worked well?
   II. What didn't go as planned?
   III. While it is fresh in your mind, record suggested changes for next year.
   IV. When a unit is finished, re-type your materials, adding improvements that you noted for next year.

Some ***PRACTICAL CONSIDERATIONS*** in creating differentiated learning opportunities...

8. Will you have:
    I. A final mastery test that everyone takes as part of the grade?
    -or-
    II. A final product as part of the grade ?
        (will product choices be differentiated, and how?)
        (will products be presented to an authentic audience?)
    -or
    III. No final test or product, relying on their total points from the unit?

9. What types of differentiation do you want to focus on in this unit?
    I. Bloom's Taxonomy
    II. The Knowledge Dimension (of Bloom's)
    III. Gardner's Multiple Intelligences
    IV. Learning Styles
    V. Product Types
    VI. Some other way in which students approach learning in different ways.
    VII. A combination of two foci [ex.: Bloom's Taxonomy and Learning Styles].

10. How will you organize the choices?
    I. Establish Low, Medium, and High expectations (as determined by the concept they're mastering).
        A. Students must obtain some level of mastery at all three levels.
            1. Percentage required for mastery is the same for all levels of difficulty.
            2. Percentage required for mastery varies depending on the level of difficulty.
        B. Students may demonstrate mastery at only one or two of the three levels.

    II. Design no difference in expectation levels. Difficulty is determined by the level of content mastery required for each concept.

    III. How many choice options will exist at each expectation level?
        A. Have the same number of options at each level.
        B. Provide more options at the lower level with fewer options at higher levels.
        C. Students are directed to do, for example, 2 of the four options, or 1 of the two options.
        D. There are one or more required activities.
        E. Make a Free Choice option available with written instructions for the student in how to create and submit their proposal for teacher approval.

11. How will you assign point values?
    I. Will lower level assignments be worth fewer points than higher level ones?
    -or-
    II. Will all options be worth the same number of points?

    III. Will you have the number of points required for 100% be:
        A. 100 points
        B. 10 points
            a. When grading, use whole numbers and, if appropriate, half-point values.
        C. Whatever number of points is appropriate when you combine the possible values from each graded assessment.

12. Will you offer an Oral Defense option for any of the graded assessments?

>(Typically when the student completes an assessment, they give it to you. Ask the student questions and base the points/percentage on the degree of understanding displayed by their responses.)

>(Consider that some students' learning styles are more written than verbal and vice versa.)

13. It can be argued that academic grades should reflect only what students prove that they have learned. Other aspects of student work that could still be accounted for in some fashion include:

effort	*completes work on time*
improvement	*uses class time well*
attendance	*class participation*
homework	*attitude/behavior*
work habits (*asks questions, persists, listens, revises work, etc.*)	

REMEMBER:
Like anything you do, this process gets easier the more you do it and the results improve with practice!

Daily Routine

1. Students enter the room.

2. Students pull out their unit checklist to see where they are with their learning opportunities and assessments.

3. Students decide their daily goals.
   I. Students consult the classroom calender and check its suggested section/content to work on for each day to see if they're on track.
   II. Students consult the list of optional learning opportunities and any required activities.
   III. Students set their daily goals and start working.
   IV. Students begin to work. They go to the designated filing cabinet to get any worksheets that they need, view a PowerPoint on class computer, obtain lab materials to work on with a partner, etc.

4. The teacher floats around as needed and checks on student progress.

Details, Details, Details......

Beginnings: The First Day(s)

- Share your belief that students must be frustrated with courses that allow them to skate by and pass without really learning or understanding anything.
- State that you understand students learn in different ways and at different speeds.
- Tell students you believe each of them can learn the content.
- State that not everyone gets concepts quickly. Math whizzes may not be so sharp at spatial manipulations.

- Once students have a more solid foundational knowledge, understanding new ideas takes less time.
- Explicitly state that every student must get at least 80% (or whatever percent you are using) on each quiz, and that you will keep working with them until they get it.
- State that you have enough respect for students who get a concept to let them move on, and enough respect for students who don't get a concept to work with them until they get it. (Continuing to work to understand a concept is not a punishment but a sign of respect that the teacher believes they can "get it" and the teacher will continue to support them until they do.)
- Tell higher-level students that they can move on when they're ready; they don't have to wait.

Beginnings: The First Weeks

- Keep emphasizing the key points for the first two weeks .
  - I.   Self-paced isn't self-taught.
  - II. Every student is responsible for their own learning.
  - III. No student will move on until they have learned the material.
  - IV. The teacher won't give up on a student until they have learned the material.
- Go over the different choices and requirements for the first few sections/topics. Students are used to being told what to do as a group and have little experience with being in charge of their learning, but they catch on quickly and love it!
- For the first few sections or topics, lead them through the process.
  - I.   Get out the unit checklists and fill them out.
  - II. Students look at what options they have for learning opportunities.
  - III. For the first few sections lead the class through a different type of option so that they can learn how they all work. As you do this, introduce other management issues:
    - A. Where to get materials/worksheets and answer keys (student file cabinet).
    - B. How to look at the section goals to see if they're ready for a quiz.
    - C. How to ask for and take a quiz.
    - D. How to have a quiz graded.
    - E. How to complete a lab, etc.

    After all of the option styles are introduced, they are free to choose on their own. Modeling the self-directed learning process at the start is important and younger students may need more time at this stage than more mature students.
- If the course is in the sciences, set up the back of the room for labs with desks in the front.
- Reserve areas in the room for quizzes and either solo or group work.
- Introduce parents to the mastery concept with a class syllabus that is sent home on the first day. Include a description and explanation of mastery learning on the class website. Speak to parents about mastery learning during back-to-school night and/or parent night. In general parents are very supportive since their child gets whatever they need to learn and it's a flexible environment.

Student Checklists

- At the start of each unit students are given a checklist/daily journal packet.
- Checklists include the following: Course
                                         Unit/Theme
                                         Essential Questions

           For each Section: Objectives
                                 Learning Opportunities, both optional and required
                                     (check those that are completed)

Suggested Completion Date
Date Completed

Columns for: Today's Date
What did I accomplish yesterday?
What are my goals today?
What sections, activities, labs do I want to get done today?

•Students start the period by updating and completing their checklists.
•Checklists help students to know if they're ready for the quiz on each section.
•Checklists are turned in with the Chapter/Unit Test.

Lectures

•Lectures in a mastery class exist in a better, more flexible format than the traditional class.
1. Three or four students approach and ask you to explain something.
2. Ask if there are other students working on the same section and if they want to join in.
3. This small, attentive, motivated group then gathers by a whiteboard for a mini-lecture or small group discussion.
4. These small, mini-lectures can effectively include student input and may generate those precious "lightbulb" moment side discussions.
5. The teacher may have to do the same lecture with other students later on when they are ready, but it is better than one single lecture where many students aren't prepared for it. Repeating a lecture to a fresh and interested audience is worth it!
•Plan ahead by creating notes for each unit on which to base any spontaneous lecture requests.

Discussions

•Depending upon whether your *students* find it valuable, consider doing a formal, large-group discussion once every week or two on the general topic where most students are currently working. Those who are ahead or behind could opt out and work on their learning opportunities so long as they were quiet during the discussion time.
•For younger students, consider having required group discussions on the general topic where most students are currently working.

Laboratory Learning Opportunities

•Set up the back of the room for labs with regular desks in the front or have 1-2 designated lab days a week when any lab they are working on is done. If a student not ready for lab or completed it previously, they can work on their normal tasks in the lab room
•Have bins set up with materials, directions, and a list of what is *not included* but needed for each lab. There will be a need for several bins for each lab in the beginning. As the course moves on, two bins should be sufficient. Make sure that labs are set up ahead for fast movers.
•When a student lets you know that they are ready for a lab, find them a partner. Grab a bin and take it back to the lab area with the students. Talk them through how to use the equipment and impart any special information. Tell them that they can call you over at any time.
•Go back often to check on lab safety and see how the students are progressing.
•It may be necessary to conduct a group lab all at once for logistical reasons.
      ---- *CAUTION*: don't do labs out of context or they aren't nearly as useful.

•Labs usually can't be graded when they are completed. Grade them as soon as you can.
•Have students "check out" of the lab with a brief explanation to you of their understanding of the key points or their conclusions. Ask a few questions (2-5 mins.) to ensure they got what you wanted out of the lab. It may be necessary to ask them to look at their data again, think about something differently, or even repeat a trial if they results are invalid.
•Students will most often work in pairs or small groups (true cooperative learning, not the artificial construct). In this way they learn by necessity to work with kids other than their own friends and acquire better social skills.

Practice

•Students with low levels of prior knowledge have a large intrinsic load and thus don't have the room to learn much from solving traditional practice problems. These kids work best by studying worked examples in a meaningful way. Teach them self-questioning techniques, such as "Where did that number come from?" or "Why did they do that step next?" Use their working memory to learn from the solution rather than simply stumble through it. [ex.: Give a math problem along with the final answer with kids explaining how to get from one to the other.]
•Use backward-faded worked examples (see attached sample) that have progressively less information. Start with a completely laid-out problem and gradually remove information from each step. This allows the student to focus on the relationships one at a time until all of the supporting information is gone.
•More difficult problems are given more supporting information to compensate for the additional intrinsic load.
•Answer keys for learning opportunities *must* be kept at the front of the room (or wherever you designate) so that everyone can find them. Use 3-ring binders and put the keys in sequentially. Create a separate binder for worksheets, text questions, etc. Having different answer key notebooks means less waiting time for students. Putting them in binders keeps them from getting scattered, lost, or misplaced.
•The answer key should show the work for each step of a practice problem so that kids can check the process and find their mistake. If they can't find the error, they can consult with the teacher or another student.
•Since practice sheets aren't graded, copying is pointless for students since it doesn't help them pass the quiz. Copying results in their not learning so they end up failing the quiz and have to redo the learning anyway. Copying is not beneficial behavior.
•Problems arise if practice problems of *worked out* examples are *required* of *proficient* students. It is best to have practice problems for both kinds of learners; problems that are partially worked or backward faded for beginners and non-worked problems for more proficient students.
•Practice doesn't make perfect, it makes permanent. Perfect practice makes perfect. Encourage students to check their work after a problem or two. As they gain confidence, have them check after several problems. Changes in their reasoning processes can be made while it is still fresh and their minds can be altered.

Quizzes

•Treat quizzes as formative assessments. If students don't pass, talk with them to figure out why and which learning opportunities they may work on to learn the idea better. This takes the experience beyond "What's my grade?" to "What were my mistakes?" This style of formative assessment has a huge impact because it is timely, meaningful, and corrective.
•Quizzes are so commonplace that they become very low risk events and, as a consequence, you may see test anxiety decrease. Quizzes are done with little fanfare and they can be retaken as often as necessary.
•Keep five or more versions of the same quiz, with more in the beginning (5-10 versions). Keep quizzes

collated and stored in a filing cabinet or box that students do not have access to. When a student asks for a quiz, give them the first version in the front of the folder. Versions number two, three, etc. follow until version one appears again. Chances are slim that any retake is one they already tried, but you can check the failed copy they return (which was used as a study aid – *see below*) to make sure that this retake is different. Some textbooks have computerized question banks that make it easier to create multiple quiz versions. Variables can also be randomized, like mass and volume.

•Keep quizzes brief; perhaps five questions with one or two closely related concepts. This makes it easier to tell what students don't get as you can identify specific misconceptions. (If 4 out of 5 questions are correct, that indicates 80% mastery.)

•Use colored paper for quizzes, which makes it easy to tell who is taking them. Quizzes could be coded by topic with all versions from one unit the same color.

•Grade a quiz immediately after the student is done and they are present while you grade it. This is a key component of effective, immediate feedback while it is fresh in their mind. Consider discussing the quiz as you grade it. If you think the student is ready, they could try another version or try some other learning opportunities before retaking the quiz.

•Use short answer quizzes or two-part questions where a multiple choice question is followed with a question that asks the student to "explain why you answered as you did".

•If a student fails a quiz, return it to them as a study aid. They MUST give it back in order to get a retake so you can make sure that they get a version that was not previously tried and the various versions don't accumulate amongst the students.

•Although you could record all quiz attempts, it is easier to just record the passing grade.

•Maintaining an ongoing grid of class quiz scores gives a quick view of where each student is working.

•You may record passing quiz scores on the class grid initially and enter them into the computer later on.

•Store passed quizzes in an individual file for each student. Allow them to have it when studying for a unit test. They *must return it* before leaving the room or asking for the test.

•At the start of the year, you may allow rapid retakes to make the point about learning and help students recognize when they are ready. Consider limiting retakes to one or two before requiring that some learning opportunity be completed.

•For lower level/age courses you may require a minimum of three learning opportunities (that the student chooses) before students may request a quiz. Depending on the group, consider relaxing this requirement as the year progresses. Upper level courses may have no minimum requirement for learning opportunities.

Grading Miscellanea

•The students' final course grade anticipates that they complete the curriculum for the year. If they do not, it could be considered only fair that their final score is dropped a letter grade for each major unit/chapter not completed. (Or some variation of this idea that you consider fair and reasonable.) Whatever you do, make sure it seems appropriate. Even if they only did half the work, but at a mastery level, a "C" is acceptable for a final grade. It is better to master fewer concepts than being exposed to many but mastering none. (Note that perhaps 15% of students in a typical mastery class may be behind at year's end, and even then by not more than a chapter.)

•Grade quizzes, labs, and tests; anything that you do where the student proves that they learned something. Everything else is a *learning opportunity* (not an assignment!). Students quickly learn that if they don't do learning opportunities, they won't pass the quiz. The name change is important since the emphasis is not "I have to do it but I don't really see why other than to get points." to "The reason I'm doing this is to learn.".

•Consider the possibility of grading learning opportunities for lower level classes for completion rather than accuracy, with the understanding that they must still pass the quiz to move on.

•If it seems wise, include a daily "work" component in the grade. Making a student's daily progress and work ethic worth 10% of the grade can help motivate some pupils and give undesirable consequences for those not working ahead as quickly as they could. If mastery is 80%, and if 10% is effort, 70% is still considered an acceptable level of academic mastery.
•If desired, supplement regular grade reporting with other reports on progress toward expected standards or goals. Other aspects of student work that could be accounted for in some fashion include:

effort	*completes work on time*	*class participation*	*homework*
improvement	*uses class time well*	*attitude/behavior*	
attendance	*work habits* [*asks questions, persists, listens, revises work, etc.*]		

Fast and Slow Learners

•High-aptitude students should be on task and engaged appropriately throughout the class period.
•If students have worked ahead, they could be encouraged to create a personal project to work on that connects somehow to the course. Or they may choose to use the time they've earned for alternative work, such as reading or drawing. As long as they don't disrupt class and make good use of their time (no naps), there is no real problem.
•Consider that extra-curricular projects that are completed satisfactorily could be awarded extra credit (so long as they already have a minimum 70-75-80% academic score). If their extra-curricular project is not completed as they proposed and agreed to, the consequence may be that their daily participation grade would suffer, or some other appropriate alternative.
•Allow students options in how they present their projects, including class presentations or presenting before an authentic audience.

•If students move too slowly, try to understand why. Is it due to absences or a lack of effort? If so, what is the underlying cause? Can you make the content more relevant, help them over a rough spot, or reduce the difficulty of the material so they can finally understand it?
•If a student is moving slower than expected, at least they are being allowed to understand the work as they progress. Moving slowly but with appropriate effort and work ethic is totally acceptable. Students at least succeed at what they are attempting.
•If students are slow in the beginning (probably due to inadequate background knowledge), they will often begin to catch up because: 1) they see you won't give up on them, which increases their self-confidence and self-efficacy, and 2) as they gain a better understanding of the basic background knowledge they move more quickly through the application of that knowledge later in the year.

Technology

•Narrate and publish online PowerPoint presentations that serve as mini-lectures for students to access as a learning opportunity.
•Check the internet for ways to convert the PowerPoint presentations to Flash, a web page, MP4, or MPEG.
•Maintain a class website through the district or school resources.
    -Develop a page describing mastery learning and the class structure in general.
    -Create a separate page for each unit that includes files for the checklist, learning opportunities, narrated presentations, and other resources.

Technology Resources:
www.authorgen.com for authorStream or autherPointLite; allows uploading narrated presentations and stores them online for students to access (FREE).

www.impatica.com converts PowerPoint files to movie files or web pages.
www.ppt-to-dvd.com can convert presentations to MP4 format (or podcast) for mobile devices.
Upload and house podcasts in www.itunes.com or your classroom website.
www.schoolrack.com or www.educatorpages.com;free teacher website hosting services so students can access information anywhere.

Some Additional Thoughts......

• Keep all learning opportunities and lab worksheets in a student-accessible file cabinet. There is no need to copy enough for everyone since not everyone does the same thing. Anyway, you can always make more copies.
• Some possible learning options (see the CHOICES differentiation materials for other ideas):

-guided reading worksheets	-taking notes
-discussing a concept with peers or teacher	-section questions
-section practice worksheets	-creating diagrams or drawings
-watching narrated powerpoint lecture on computer	-completing content organizers

• Do not *require* any work or quiz-taking outside of class time. Requiring this would be counter-productive in several ways. If a student requests an after-class quiz or wishes to work at home, that is their choice; honor it.
• If concepts reappear later on in the year, the questions will undoubtably be more difficult compared to the first exposure to the idea as their understanding has improved and thus the mastery expectation has also increased.
• Keep a classroom calendar on a whiteboard with the suggested course of action for the week. This time schedule should reasonably account for completing all of the course work for the year. If kids are close to this schedule, they could complete the whole year's curricular expectations. If they are behind (ex.: absences), they know that it is within their control to speed up and catch up.
• Other teachers and administrators typically won't see a neat, orderly classroom if it is run on the mastery model since students won't all be doing the same thing. However, it should not be chaotic! You still have to look and move around the room and redirect students if needed. It would not be unusual for students to have a few minutes transitioning between activities or waiting, and a little down-time is a good thing for our psyche and brain function.
• Plan ahead!! Know how things will run and have the infrastructure and resources in place ahead of time.
• The amount of initial preparation time and poorly structured, overly prescribed "how-to" resources of the past are major reasons why Mastery Learning has not been used a lot in today's classrooms. Remember that after the first year of intense but thoughtful planning, subsequent years are fairly easy as plans are merely tweaked or new components are added. Remember also to use your own best judgement, deciding just how mastery learning will take shape in your own classroom.
• Self-paced is not self-taught. The teacher of a mastery class is still needed, but in different ways and at different times than in a traditional class. Be open to a new paradigm!
• If you are already using a Layered Curriculum approach (a form of differentiated learning), it can be modified to fit the mastery model. The C-level work becomes learning opportunities (non-graded); the B-level and A-level work are for proving mastery. It is possible to keep students working together with a deadline to finish a unit menu. This is NOT as effective as full-on mastery learning, but still better than a traditional class.

ADDITIONAL TEACHER RESOURCES

www.ScienceMasteryLearning.com
www.ubdexchange.org (UbD Exchange; Understanding by Design)
www.help4teachers.com Layered Curriculum

Physical Science Daily Journal   Unit 3, Motion

Student:

Today's Date	What did I accomplish during the last class?	What are my goals today? What activities do I want to get done today?

Physical Science Unit 3
Theme: Motion

ESSENTIAL QUESTIONS:

1. ....
2. ....   (As many essential questions as apply.)

Section	Objectives	Learning Opportunities (Check those that you complete.)	Suggested Completion Date	Date Completed
3.1		☐ Reading guide ☐ Powerpoint 3.1A ☐ Practice 3.1A ☐ Powerpoint 3.2 A ☐ Practice 3.2A ☐ Worksheet 3.1A ☐ Worksheet 3.1B ☐ Discuss with peers ☐ Discuss with teacher ☐ *OTHER OPPORTUNITIES*.......		
3.2		☐ Required Lab 3.2		
etc.				
etc.				
Review & Test	Demonstrate knowledge from Unit 3	☐ Review section quizzes ☐ Unit review ☐ Discuss with peers ☐ Discuss with teacher		

SAMPLE TEACHER GRADING GRID

Name	3.1	3.2	Lab 3.2	etc.	etc.	Test 3
Robin Hood	5	5	28			
Little John	4					
Maid Marian	5	4				
Friar Tuck	4					

In this example each Quiz is 5 points, each Lab 30 points, and the Test 50 points.

Name_____   **Date**_____   **Period**_____

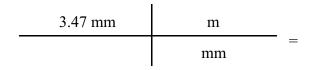# Worksheet 1.4 --- Unit Conversions

1. Convert 20.33 cm to m

$$\frac{20.33 \text{ cm} \quad | \quad 0.01 \text{ m}}{\qquad\qquad | \quad 1 \text{ cm}} \; = \; 20.33 \times 0.01 / 1 = 0.2033 \text{ m}$$

2. Convert 12.06 L to cL

$$\frac{12.06 \text{ L} \quad | \quad 1 \text{ cL}}{\qquad\qquad | \quad 0.01 \text{ L}} \; = \; 12.06 \times 1 / 0.01 = 1{,}206 \text{ cL}$$

3. Convert 32.27 kg to g

$$\frac{32.27 \text{ kg} \quad | \quad 1{,}000 \text{ g}}{\qquad\qquad | \quad 1 \text{ kg}} \; = 32.27 \times 1{,}000 / 1 =$$

4. Convert 13.09 m to cm

$$\frac{13.09 \text{ m} \quad | \quad 1 \text{ cm}}{\qquad\qquad | \quad 0.01 \text{ m}} \; =$$

5. Convert 3.47 mm to m

$$\frac{3.47 \text{ mm} \quad | \quad \text{m}}{\qquad\qquad | \quad \text{mm}} \; =$$

6. Convert 33.81 kg to g

$$\frac{33.81 \text{ kg} \quad | \quad}{\qquad\qquad | \quad \text{kg}} \; =$$

7. Convert 9.92 kL to L

$$\frac{9.92 \text{ kL}}{}\Bigg| =$$

8. Convert 2.61 g to mg

$$\frac{2.61 \text{ g}}{}\Bigg| =$$

9. Convert 24.37 g to mg

10. Convert 22.87 L to cL

11. Convert 22.04 mL to L

12. Convert 9.42 L to mL

13. Convert 2.03 cm^3 to mL

14. Convert 23.28 L to mL

15. Convert 9.72 mL to L

16. Convert 1.47 g to mg

$$\frac{1.47 \text{ kg}}{}\Bigg| \frac{\text{g}}{\text{kg}} \Bigg| \frac{\text{mg}}{\text{g}} =$$

17. Convert 7.18 mL to cL

$$\frac{7.18 \text{ mL}}{}\Bigg| \frac{\text{L}}{} \Bigg| \frac{}{\text{L}} =$$

18. Convert 33.21 cg to mg

19. Convert 30.62 mg to cg

20. Convert 16.43 mg to cg