

Big Picture mp4

Learners who

- have many learning gaps,
- find new learning difficult to acquire,
- quickly forget the learning of the lesson
- and at least as quickly forget feedback,

are going to struggle to learn as effectively as their peers. It is no wonder that learners with these barriers to learning develop additional barriers to learning which most of their peers do not:

- their infrequent success leads to low motivation and poor effort,
- their numeracy skills have not grown fast enough and are no longer sufficient for the maths they are expected to learn,
- they often won't or can't revise effectively or at all,
- and they don't develop the ability to solve problems, nor use, nor create generalisations.

timely practice helps teachers to consistently remedy the first 4 barriers in a joined up manner.

- timely practice organises granular diagnostic assessment for the teacher,
- timely practice helps teachers use this assessment for learning, so teachers only ever teach on firm learning foundations,
- timely practice makes sure that nearly all teaching becomes learning which is retained for years after the lesson and
- although sometimes teachers will need to give feedback, we make a space in the lesson for the teacher to do so and ensure that the feedback will be applied by the learner before it can be forgotten.

In our trials, we've seen that, within 1 to 2 years, most learners using timely practice, in the set of lowest attaining learners, caught up with and in many cases overtook their peers in the set above, who were not using timely practice.

Intrigued?

Watch the **barriers into steps mp4** where I'll share more detail on how timely practice turns the first 4 barriers into steps towards impressive progress.

How applying these 4 steps consistently for a year or two, will help most learners overcome, at least 7 if not all 8 of the barriers. So that low attaining learners and underachieving learners can learn at least as effectively as their peers.

Watch the **changes in long term memory mp4** where I'll explain what we believe goes on in learners' brains when teaching becomes deeply embedded learning and why changing the timing of what goes on in lessons can make teaching "smaller working memory friendly". By doing this, it will be possible to open up unexpected and dramatic progress for the lowest attaining learners.

Watch the **tweak teaching and next steps mp4** where I'll explain what teachers will no longer need to do, what they will do less of and what they will do more of in order to ensure they tap into the hidden potential of the currently low attaining learners in their maths classes.

For the learners you know, who are currently stuck with most or all of these barriers, we hope you'll want to continue to watch and find out more.

Barriers into Steps mp4

In this mp4 I'll describe how timely practice works with the teacher to turn fundamental learning barriers into these learning steps.

- Firstly timely practice provides the teacher with easy to use, accurate and pertinent assessment for learning data - we find those learning gaps.
- Secondly the teacher uses the assessment for learning data to teach each learner a bite of learning from a topic. By virtue of the size of the bite - small - and the fact that the bite is chosen to be on the learners' firm learning foundations, each learner is very likely to be able to independently recall this learning in order to accurately answer a question on it, in their next maths lesson - we make learning in the lesson easier.
- Thirdly timely practice schedules personalised increasing interval retrieval practice, beginning the lesson after teaching, on every bite of learning the learner has learned from every topic. This gradually stretches the durability of the recall-ability of learning from a few days to a few years - we make remembering learning easy.
- Finally the teacher has time and headspace, within each lesson, to give personalised feedback to the learners on the the small bites of teaching, which haven't yet become learning. The teacher can give feedback because most of the learners in the "timely practice" part of the lesson are engaged in answering a personalised set of questions on their "timely practice PDF assignment". The teacher gives feedback, knowing that they are giving the learner the best chance of fixing the accuracy or completeness of their learning because the timely practice app ensures the learner will use the feedback soon - we make feedback both possible and effective.

Each bite of new learning relies on all 4 steps. Each of the steps supports and is supported by the others in a virtuous spiral. The teacher will spiral through teaching most, if not all, of the topics from the scheme of learning several times a year, because the teacher only teaches one small bite per learner, per spiral and because learners find their small bite easy to learn. In fact the teacher must spiral through the curriculum several times a year, both to fill lesson time and because otherwise learners would be disadvantaged by learning less than they otherwise could.

With traditional each-topic-once-a-year schemes of learning, learners encounter bites of learning, which are just too big for most low attaining learners to chew and digest. With timely practice, learners are only required to chew and digest a small bite from each topic per spiral. Within an academic year, the sum of the small bites in each topic is greater or equal to the too large bites in the traditional scheme of learning. So with timely practice, most learners in the class can learn as the very best learners in the class previously could.

The way we, at timely practice, have split traditional maths topics into small bites, and provided a plethora of maths questions for each bite means timely practice is able to assess at granular detail and the teacher is able to teach the bite that each learner can most easily learn next.

The other unique feature of timely practice is that it enables the teacher to apply retrieval practice, which is the gold standard for learners to embed learning. Without this, the granular detail in assessment and teaching would be virtually useless. We use increasing interval retrieval practice which is responsive to feedback, which is the gold standard of retrieval practice. This standard is hard enough for one teacher to apply to one learner in a tutoring situation. Without timely practice a teacher could not teach their class with this quality and effectiveness of retrieval practice.

Now as learners cycle through the curriculum it is easy to see how the remaining barriers might become steps.

- Success, being able to answer nearly all questions asked of them in nearly all maths lessons will increase learners motivation and pace of work.
- Being taught numeracy skills alongside mathematical skills, both of which now stick in the learners' long term memory, means each makes the other easier to learn.
- Avoiding the need to reteach means the pace of learning is increased and there will be little need for time to be set aside for formal revision.

Putting these 7 steps together means that, at least some of these previously low attaining and underachieving learners, can take the final step: which is to be able to apply their skills in novel ways to solve problems and by building larger, connected chunks in long term memory some learners will also have the headspace to use and create generalisations.

Changes in Long Term Memory mp4

In this mp4 I'll answer the question "how can low attaining learners build large, accurate, interconnected chunks with well developed triggers in their long term memory?"

Learning begins as transient. If it does not become embedded as chunks in the learners long term memory it will be soon forgotten. Unfortunately learners with smaller working memory capacities experience a double whammy:

Learners with smaller working memory capacities are less likely to build chunks in long-term memory than their peers.

Learners with smaller working memory capacities are more dependent on chunks than their peers to process the content of lessons.

Chunks in long term memory reduce the number of slots in working memory, which are needed to follow procedures and solve problems. The large interconnected chunks in long term memory enable experts to appear to have a super-human working memory in their field of expertise. We are not aiming for the lowest attaining learners to become masters in the field of mathematics, instead we repurpose research on how experts become experts in order to improve the learning outcomes of low attaining learners.

Let's look at how learners might overcome that double whammy because with timely practice they can more easily build, bigger, better, more accurate and more accessible chunks in their long term memory.

In terms of chunk-based theory, why find learners' firm learning foundations?
... because then we can find what, chunks relevant to the teaching of the topic,
the learner already has in long-term-memory.

... why only teach on firm learning foundations?

Chunk-based theory tells us it is easier, and more useful for the learner, to
attach new learning to existing chunks in long term memory than for learners
to build new chunks. However it is not enough just to teach on firm learning
foundations. Sweller, who by the way calls chunks mental schema, tells us that
we need to teach the "right grain size" too. If we attempt to teach too much,
we are likely to see symptoms of working memory overload:

muddling methods, missing steps and giving up,

when we ask the learner to recall learning the next lesson. These symptoms let
us know that our teaching hasn't, **yet**, become an accurate or complete chunk in
the learner's long term memory.

Assuming for the moment that the learner could have recalled and accurately
applied what they learned last lesson to answer a question: we can be sure, if
we don't ask that question, that much of the learning of the lesson will be soon
forgotten. Our experience, at timely practice, is that most low attaining
learners forget most of the learning of each lesson within a few days.

The learner's brain, during the nights sleep after a lesson, will modify the
synapses on the dendrites of neurones - this process is called consolidation.

Consolidation ensures that what was learned during the day can be recalled - let's be more specific - at least some of the learning can be recalled for a while. It is not clear if all learning during the day forms chunks at night but:

It is clear that those chunks will only remain accessible for a while unless they are used. If the chunk is not used the learner's memory of the learning of the lesson will soon fade away.

It is clear that learning situations that make the learner uncomfortable (emotionally) will fade away faster.

It is clear that finding out if teaching has become learning within the lesson just won't work. We can't find out what changes in long term memory will occur until after the subsequent night's sleep.

It is clear that we've a brief window to do something to stop learning becoming forgetting. The very best thing we can do prevent forgetting is to ask the learner to answer a question on the learning of the lesson the next day or if that isn't possible, the next maths lesson.

For now let's assume that the learner can independently recall and accurately apply their learning from last lesson to answer that question.

After each wait + retrieval practice + a nights sleep combo, learners will be able to recall the learning for a longer duration before their memory fades. The process of retrieval of the learning results in reconsolidation, the brain modifies the synapses on the dendrites of neurones during the next night's sleep ... and in doing so the recall-ability of the chunk will be stretched.

We can repeat this wait-practise-sleep combo a number of times, stretching the wait and the durability of the recall-ability exponentially more each time. Practising a number of different bites, so the learner must identify which bite of learning to use to answer each question, makes the trigger of each chunk become better developed.

When "doing their timely practice" - answering their personalised timely practice questions within their PDF assignment - learners are usually independently engaged and on task. The questions are not so easy that the learners don't need to concentrate yet the questions are easy enough that the learners can answer the vast majority of them independently. Best of all, while the learners are doing their timely practice they are embedding their learning more deeply, because of the timely practice, the well timed wait between retrieval practice questions.

After a while the bite of new learning has a well enough developed chunk and trigger that it will form firm enough foundations upon which to teach another small bite from the topic.

... but what about when the learner can't independently recall or accurately apply the learning to answer their retrieval practice question?

The quiet "timely practice" time gives the teacher a perfect opportunity to interrupt learners to give 1-to-1 feedback. During the feedback the teacher's aim is to help the learner become less reliant on the scaffolding of the lesson. The night after feedback the brain does more reconsolidation, it makes modifications to improve the trigger or make the chunk more accurate or complete.

The learner gets the opportunity to use the new and improved chunk soon, because the app schedules questions which needed feedback with shorter wait times.

Using these 4 steps, most learners can learn at least one small bite from a topic per lesson and many learners can learn more. If the teacher finds that some or all learners can learn more in a lesson, rather than getting each learner to learn 2 or 3 small bites from ONE topic we encourage the teacher to plan to teach 2 (or for some learners, on some occasions 3) topics per lesson. Teaching a few small bites from different topics each on firm learning foundations, all learners, especially learners with smaller working memories, are more likely to build accurate chunks, in long term memory, without recourse to feedback.

Let's recap

With a traditional each-topic-once-per-year scheme of learning **without** retrieval practice, most of the practice questions are practised within the few consecutive lessons where teaching occurs. Small chunks are added to most learners long term memory most of the time. The chunks built are often but not always accurate, however the majority of the teaching is quickly forgotten.

With a traditional each-topic-once-per-year scheme of learning **with** retrieval practice, the teacher will need to give more feedback than they have capacity to give. If we increase the capacity to give feedback, at the expense of needing several learning assistants or tutors per class, we are likely to see

larger but more inaccurate chunks built and have to allocate more lesson time to feedback and still feedback will not always be effective.

With a more tightly spiralled scheme of learning, where a small bite is taught a few times per year from each topic but **without** retrieval practice, most of the practice questions are practised within the the lesson where teaching occurs. Small chunks are added to most learners long term memory most of the time. The chunks built are often but not always accurate, however too often, the chunks will fade away to forgetting before the next teaching on the topic.

With a more tightly spiralled scheme of learning, where a small bite is taught a few times per year from each topic **with** retrieval practice, which is what timely practice was built for and facilitates, small additions are made to chunks in long term memory several times a year. There is little need for feedback and when feedback is required, the teacher has time and headspace to give effective feedback.

So by changing the timing of what goes on in lessons, timely practice makes "smaller working memory friendly" teaching both possible and effective and opens up unexpected and dramatic progress for the lowest attaining learners.

tweak teaching and next steps mp4

In the tweak teaching part of this mp4 I'll explain what teachers will no longer need to do, what they will do less of and what they will do more of in order to ensure they tap into the hidden potential of the currently low attaining learners in their classes. Every teacher likes to hear about what they will do less of, so lets start with that:

- less time planning,
- less time writing lesson plans,
- less time searching for resources that learners can do,
- no time marking - writing explanations/messages etc to learners which they barely seem to read, let alone act on,
- less time listening to learners say that their work is too easy or too hard or won't be useful when they are adults,
- less time on discipline,
- less time reteaching,
- less or no time revising and so no call for the teacher to spend their non directed time revising,
- no time, after tests, trying to boost learners confidence back to level at which they will once again engage with learning.

It's true the teacher will spend more time on assessment. After each maths lesson the teacher (and, if appropriate, support staff) will assess a PDF assignment for each learner - which takes about a minute per learner for a 10 to 15 minute session of timely practice. Of course, with learners answering more questions in class, there will be more printing - but far less call to print practice exam papers - and when practice exam papers are printed there will

be far less paper and motivation wasted on questions the learners clearly can't do.

In terms of teaching skills, what is the same and what different?

- Planning of lessons will be easier for the novice, but more experienced teachers will be able to, when appropriate, make use of knowing exactly what each learner already knows, in order to direct questions and plan the activities of the lesson to maximise learning.
- In terms of teaching, the teacher will still teach a number of bites of learning from the topic, to the class. However the teacher will know which learners should be learning which bites, and so needn't try to get all learners to learn everything. Hence the teach-learn part of the lesson will be quicker and far less traumatic for the learners.
- In terms of practise-learn, when learners move on to practise what the teacher has just taught, each will only practise the bite that the teacher decided was the bite for them. The teacher will rarely need to spend time helping learners who "are stuck", because each learner is only asked to complete practice questions which are built on their existing firm learning foundations. The teacher may be able to spend some of the practise-learn lesson time teaching small groups something easier or something harder or assessing some timely practice assignments or giving personalised feedback.
- In terms of the new part of the lesson, "doing timely practice", which for most teachers replaces the start of lesson warm up, the learners will be engaged in answering questions. The teacher will have time and headspace to engage in feedback-dialogue with learners. As a consequence of the lesson time spent by the teacher on feedback-dialogue, the teacher will quickly

become experienced at giving effective feedback. Feedback-dialogue also provides excellent, non threatening, fine detail, teacher training on how to teach topics more effectively in future.

What next?

I hope listening to these mp4s has given you dissatisfaction and hope:

- Dissatisfaction that too many learners, especially learners living with poverty, trauma and special educational needs (who are the learners who are more likely to have smaller working memories) are not reaching their potential because we teach them as if they can learn in exactly the same manner as their peers.
- Hope that we can do better by learners by applying research on learning.
- Hope that those learners who would be judged by society to have failed, will have a far better chance to no longer be judged in such a way.
- And hope that learners growing up with poverty, trauma or special educational needs will be more likely to buck the trend and become adults who don't live in poverty.

If you want to know more, please use the links to

- find out about the theory and research in our explaining and training program;
- or contact us to sign up to use timely practice as described in these mp4s;
- or contact us to provide INSET on applying chunk-based and retrieval practice theory - which is applicable when teaching every subject, not just maths;

timely practice website homepage scripts

- or contact us to run a trial to compare in fine detail the progress of low attaining learners in your school e.g. compare the progress when teaching a unit or two from your current scheme of learning with the progress, within the same time frame of teaching, when teaching in the timely practice way.