2017 cohort

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Why do students forget things? How can we effectively improve the retrieval strength and strorage strength memory of our students?

"We covered this topic last lesson/week/month, why don't they remember it?!". Many (if not all) teachers will be familiar with this cry. Craig Barton writes in his book *How I Wish I'd Taught Maths* (Barton, 2018) that "*I have had a Year 10 student swear blind to me that they had never seen 'one of those wiggly graphs' before*". He places such an emphasis on this topic as to dedicate an entire chapter to recall strategies, stating that "*if students cannot retain knowledge then we are wasting our time*".

This emphasis on recall and retention is echoed by other teachers and professional bodies. As part of my school's improvement plan, there is an increased focus on the Key Stage 3 curriculum, and how we prepare students for the demands of Key Stage 4. In mathematics a lot of the material that students encounter in their GCSEs has in fact been covered much earlier, so Key Stage 3 is an ideal place to lay strong foundations. Indeed, the examiners reports from AQA, OCR and Edexcel all identify areas such as recalling geometric formulae, working algebraically and basic numerical manipulation as weaknesses, all of which have been taught in KS3. This prompted me to focus my research on how best to improve retention of these key skills.

Understanding how information is stored and recalled is vital in developing schemes and resources that help children learn and retain information. Bjork and Bjork identify two aspects of long-term memory: storage strength and retrieval strength (Bjork & Bjork, 1992). The differences between the two are outlined by Yan (Yan, 2016) as follows:

- *Retrieval strength (RS) is a measure of how easily recalled something is currently, given what is relevant to the present situation (does it come to mind now?).*
    - *The retrieval strength of a given piece of information can be high or low, and can fluctuate back and forth between these values.*
    - *Retrieval strength is measured by current performance (e.g., answering questions in class, on a test).*
- *Storage strength (SS) is a measure of whether information is deeply embedded or well learned (is it likely to be recalled later?).*
    - *Barring organic brain damage, storage strength cannot decrease; rather, it is presumed to only accumulate*
    - *Storage strength cannot be directly measured, but must be inferred: Is that information easily recalled in the future? Or, if you forget that information, does it become faster to relearn it the next time?"*

So the question becomes: how can we effectively improve the RS and SS of the students we teach? Two options available are *spacing* and *interleaving* – the former is when the recall of material is

delayed from the initial learning point, and the latter is when different topics are practised in the same session. Both techniques are well supported by the literature (see for instance Bjork & Bjork (2011); Willingham (2002); Yan et al. (2017)).

Unfortunately, running an entire scheme of work designed around these principles was not a feasible option. I therefore decided to augment the current system with a series of homework sheets that revisited old topics (spacing) and mixed them with newer ones (interleaving). Students would be exposed to previous topics on a weekly basis, with the same skills being tested on successive sheets between assessment points in order. After assessments, new topics would be phased into the rotation to improve the RS and SS of these topics. The impact of this intervention would be measured by students' performance on each assessment (compared with previous cohorts), as well as a re-test of an earlier topic.

Additionally, I wanted to understand the views of staff in the maths faculty of this scheme of homework - their perception of the impact on students' retention as well as the impact on their workload in terms of setting and marking homework. I created a short survey to collect these views.

Unfortunately, my project was impacted heavily by the COVID-19 pandemic and the subsequent closure of schools. I was not able to complete the follow up assessment as there would be too many confounding variables if I sent the test for students to complete at home. I therefore had to rely on comparing incomplete assessment data for the 2019/2020 Year 7 cohort with the data from the previous two years. Students in the 19/20 cohort showed a slightly shallower drop in performance from assessment to assessment (−1.53% in 2019/20 compared with -2.13% in 2018/19 and -1.81% in 2017/18), with those in the bottom sets actually showing an improvement compared to previous years. These differences are too slight however to claim any significance without other corroborating data.

The staff overall found the sheets to be beneficial to both their workload and their students, commenting "*they were useful and did make them think and did improve over time*" and "*I could set homework without spending time finding work sheets*". Although it was suggested that the sheets could be further adapted, especially to suit the needs of top and bottom sets.

The project has shown that there is clear potential for this work, but more research will need to be done to fully evaluate its impact. Since the sheets have now been created and the Year 7 scheme of work remains largely unchanged for next year, it will be trivial to run the project again with the next cohort, hopefully with the opportunity to re-test assessments this time. It would also be possible to create similar sheets for the Year 8 scheme so that the students who took part in this one have a consistent experience throughout their school career, with a (perhaps ambitious) view to evaluation at KS4. Many of these principles are also subject independent, so further study could be done into applying them into other areas of the curriculum.

References

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