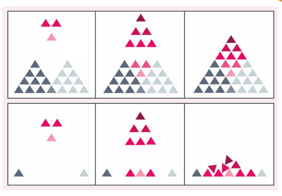
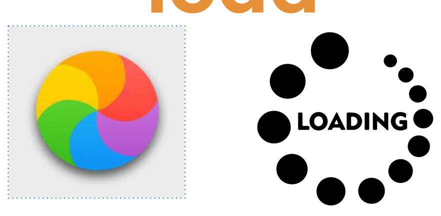
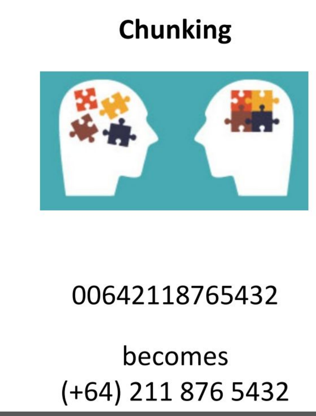
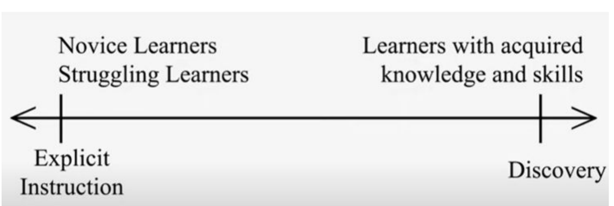
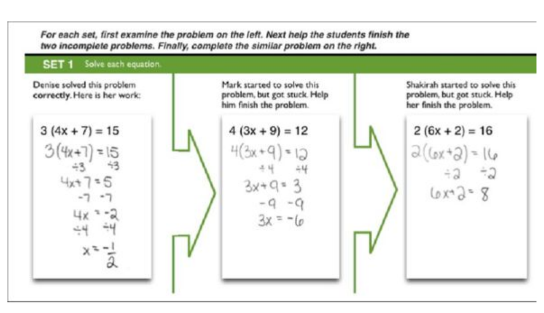
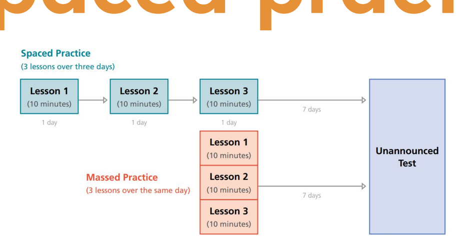
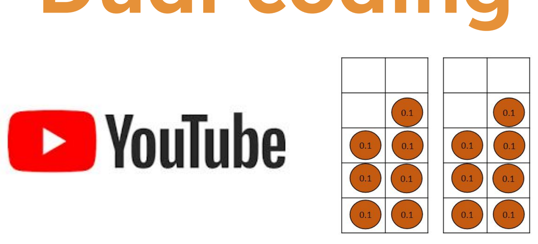
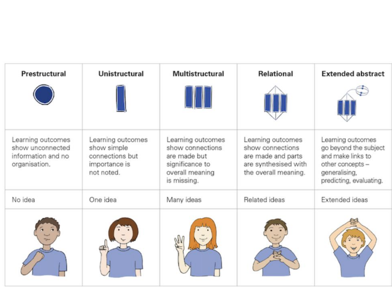
Science of Learning	Definition and research	How to implement
Activate existing knowledge 	Reviewing previous learning and eliciting students' existing ideas provides 'hooks' on which students can then build the new concepts.	Find out what ākonga already know. Link learning to their interests, culture, language and home experiences. Use familiar contexts to introduce new concepts.
Reduce cognitive load 	Our working memory is only able to hold a small amount of information at any one time and that instructional methods should avoid overloading it in order to maximise learning.	Chunk learning. Provide supports, eg writing frame or word bank. Reduce extraneous load by excluding elements that do not contribute to the learning focus. 
Explicit Teaching 	Teaching practices involving teachers clearly showing students what to do and how to do it, rather than having students discover that information themselves. Particularly effective for new learning or students who are finding the content difficult.	Choose important content & engaging context Break it down into steps Interactive instruction Students actively engaged Feedback given throughout Pace is important **Concrete before Abstract** Concrete Abstract 3 + 2 = 5
Worked examples 	Models or provides a step-by-step example or solution to a problem or task. Abstract ideas are easier to understand if we give an example. Students understand and recall information better when they visualise the things they have learned.	Model new skills/learning Use exemplars Shared writing & reading Abstract ideas can be represented by concrete materials & examples
Retrieval practice 	'Bringing information to mind from memory' (Weinstein et al. 2019, p 85). We might think of it as recapping or revisiting, but the crucial factor is that it is the student that does this, and puts in the effort to retrieve the memory. It is not the same as the teacher repeating content or a pupil simply looking at something again.	Low stakes quiz Responding to questions. Mind-mapping or sketch-noting what they have learned Daily or weekly starter activity that revisits previously learned content.
Spaced practice 	Practice a concept over time to provide opportunities to retrieve key information.	Planning to revisit content after a gap in time.
Interleaving 	Switching between work with similar, but different kinds of content, typically maths problems (E.g. finding the area of different shapes), within one session. Problems are arranged so that consecutive problems cannot be solved by the same strategy. It emphases the "mixing up" of topics being studied or recalled in order to facilitate improved retention and retrieval of knowledge and skills.	Once concepts have been learnt successfully: do this 10 - 4 = 7 + 6 = ? - 3 = not this: 10 - 4 = 7 - 5 = 6 - 3 = 8 - 5 =
Dual coding 	Combining visual and verbal materials. We can do a visual task at the same time as a speech-based task.The strategy is to use both modes together to complement one another, such as in a labelled drawing.	Annotated drawings/diagrams. Demonstration plus talking Using concrete materials while verbally explaining Audio visual clip Using a graphic organiser
Transfer 	Transfer of learning is the application of learned concepts or information in new situations. Learners don't simply recall information; they have to use existing knowledge in new and different ways.	Link learning to life at every opportunity Ask students where they might observe or use the learning they are doing in life outside of school. Draw on their out of school experiences in learning discussions. Provide experiences to transfer knowledge to other settings where possible.
Metacognition supported with effective feedback 	Students' sense of self-belief about their ability to learn and knowing how they can learn something new and where to find support greatly impacts their achievement. Non-cognitive skills such as self-regulation and motivation are essential to successful learning. Effective feedback is designed to help ākonga plan the next steps towards achieving the learning intentions or goals.	Encourage students to self-assess, reflect and monitor their work. Reflect and communicate about the learning task with students. Provide students with detailed and specific feedback about what they need to do to achieve growth as a learner. Ensure that students act on feedback that they receive.