The Learning Curve

A regular feature sponsored by the Central Council Education Committee
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Perfection versus holism

It is healthy once in a while to seek the views of people other than 'expert teachers' whose wider experience can shed light on the way we do things. In July Pip Penney wrote about motor learning. This month she tells us about some more interesting research results. We asked: '*when teaching bell control, what are the relative merits of insisting on perfection at every step before moving on, compared with moving as rapidly as possible to let the learner experience the whole action, and then going back as required to sort out any problems?*'

Research into learning

Researchers identify two different ways to organise the practice of a new skill: blocked practice and randomised practice.

With 'blocked practice', each component of the skill is rehearsed over and over again with minimal interruption by other activities. This used to be seen as the best way to train motor skills because it improved performance quickly. Some recent scientific research has shown that this performance does not efficiently transfer into the overall activity, and moreover that blocked practice can give a false sense of skill.

With 'randomised practice', tasks are presented in a varied order, and a mix of skills rehearsed across the practice period. In 1979 in a ground-breaking experiment, scientists John Shea and Robin Morgan revolutionised our understanding of the comparative efficiency of these two approaches. They showed that people learning motor skills learned more quickly when exposed to randomised practice than to blocked practice.

This result was unexpected, because blocked practice appeared to lead to better performance. But randomised practice produced quicker overall learning because it led to better retention of the skills between practice sessions. Skill retention ten days after the last practice was significantly better with randomised practice than with blocked practice. If ringers only have one session per week, then skill retention between sessions is very important.

Why is randomised practice so effective? Blocked practice leads to only one set of neural connections (nerve pathways) whereas randomised practice develops many different neural connections to form a neural network (an interconnected series of nerve pathways). This leads to greater flexibility and speed of reactions (neural plasticity) when learning a motor skill.

This neural plasticity is required in other areas of learning including skills such as mental arithmetic. Suppose you ask a ten year old to do three division sums in her head, say 24/3, 18/2 and 12/4. In blocked practice you first ask 24/3 and the child struggles to come up with the answer 8. Then you ask 24/3 again, and the child remembers the answer 8, without going through the processes to generate the solution. The same thing happens the third time, and so on. The child's performance in blocked practice becomes essentially perfect because her body (or in this case her mind) has remembered the solution. But she has not been forced to go through the full processes needed to generate the correct solution each time, only on the first trial.

In randomised practice you ask the child three different sums and by the fourth she has probably forgotten the correct solution to the first one. So she has to generate it afresh when asked again. Her performance will be slower and more difficult, but her learning will be enhanced as she has been forced to 'generate' more solutions.

You can't always apply randomised practice from the very start when developing motor skills, but you can begin as soon as the learner acquires a 'rough approximation of the movement'.

Correcting motor skill errors

Correction is an important part of teaching motor skills, however the practice is organised. If the action is incorrect, then the stimuli going to the brain that then instruct the muscles and co-ordinate their actions to perform the desired task (a 'motor program') are also incorrect. The longer this continues the harder it is to change because the body accepts the incorrect pattern as normal, ie correct. To replace the incorrect pattern you **must change the stimuli** and continue until the body accepts the new pattern as correct. New stimuli can be sensory, verbal or visual or a combination of all three.

There are three stages to achieving change:

- Recognition
- Correction
- Establishment

1. Recognition (or perception) of the problem is an essential first step The learner must actually believe that something is wrong, and perceive what it is - being told is not enough. Verbal explanation (or a video camera) can help, and more emphasis can raise the profile.

2. Changing the motor program can be difficult. Demonstrating the correct action (and the fault) helps, but might need repeating. Focusing on small areas helps, eg 'You do it right up to here, but this point is incorrect, then OK from here ...'. Verbal cues at precise points in the action help, with continual verbal feedback - "nearly", "a bit better", "not quite", "like that!" Altering the sensory input helps, eg ringing a different bell or ringing it at a different speed.

3. To establish the correct action, spot the pivotal moment when it is correct **once** and come in with heavy repetition. It won't be correct at every attempt but should gradually change from more incorrect to more correct with positive reinforcement and repetition.

Practical application

Our thanks to Pip for describing some interesting research. Experienced trainers with a systematic approach to teaching might be blanching at the idea of 'randomised practice' - it sounds chaotic and badly managed - but look behind the jargon and it does not mean uncontrolled, just exposing the trainee to a varied sequence of stimuli and exercises. So can these research results help us, and how do they relate to current views on good practice in teaching ringers through the various stages from basic bell handling to full bell control in method ringing?

First consider teaching basic bellhandling. How should we interpret 'a 'rough approximation of the movement' which is suggested as the starting point for 'randomised practice'? What is the movement we are trying to train? It is the whole two-stroke action. Precursor actions (eg ringing backstrokes only) are stepping stones, and include some artefacts that are not part of the final movement. The sooner the whole movement is achieved, the less need to unlearn the leisurely 'move and pause' action, and replace it with the busier, continuously moving two-stroke action. Many teachers aim to achieve this in the first lesson, having worked rapidly through the steps of whichever scheme they are using.

Ringing two strokes albeit imperfectly and under close supervision, would seem to qualify as 'having a rough approximation of the movement', ie the point from which the researchers recommend 'randomised practice'.

Having got rapidly to a two-stroke action, in subsequent sessions, you need to revise all the steps, until you are happy that there are no residual problems. Going through the sequence again is not random in the normal sense, but it fits the researcher's definition of rapidly switching the stimulus. In practice, the sequence will vary anyway, if every time you see a point that needs working on, eg transfer of grip to the sally, vertical hand movement, rope length adjustment or strength of pull, you switch to an exercise that focuses on it. There are many such (for example listed in *The Tower Handbook).* Ringing the same bell might seem a safe option in the short term, but switching between bells stimulates the ability to feel what the bell is doing and adapt, rather than just relying on the fact that it always feels the same. Ringing at different speeds, and learning early to raise and lower also strengthen the motor programme.

This is certainly not 'blocked practice', which can come from the desire to get each step perfect before moving on. Many learners have spent weeks (or even months) ringing backstrokes on the same bell, followed by a similar period of handstrokes, before even attempting to put the two together. Some very competent trainers will even admit to doing this before they realised there was a better way.

The research advice also recommends verbal cues for reinforcement. There is ample opportunity for this - 'lift your hands higher, keep both hands on the rope, pull harder, etc. - and by by observing carefully and varying how you phrase your prompts, you are more likely to 'hit the spot' in the learner's perception. This too helps to vary the input stimulus.

To 'handle a bell' is a long way short of fully competent bell control, which must be developed in parallel with learning other things like call changes and methods. This is just as big a step in terms of motor skill development. The need for a diet of varied physical tasks and stimuli still applies. It should include ringing very heavy and very light bells, long and short drafts, odd struck and poor going bells. Different methods stimulate the motor programme in different ways with for example extended dodging, wrong place leading, snaps and odd places.

So 'randomised practice' fits with what many teachers do for other reasons. Perhaps thinking about it will help more teachers to provide their pupils with varied physical stimuli to help develop robust skills, to handle any situation.

Tail End

The Tower Handbook is available from CC Publications,.

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