Insights

'Titrating' simulation training intensity

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Scaling training intensity to individual needs is one of the major advantages of simulation-based education. Among the many questions that educators and instructors have to deal with is the extent to which trainees should be challenged during simulation-based training (SBT). Being the deputy head of the Clinical Skills Center at our university, and also in charge of delivering *in situ* SBT at our neonatal and paediatric intensive care unit, this topic has challenged me during many SBT sessions.

Stress and excessive demands on trainees have been researched and discussed in the context of simulated patient death, i.e. the 'death' of the mannequin in a scenario.[1] Adding emotional stressors to SBT has been shown to be associated with significantly better advanced cardiac life support performance during a standardized assessment 6 months after an educational intervention.[2] But how does neurobiological and behavioural science appraise the continuum from boredom to excessive demands in education?

Sandi et al.[3] proposed that learning memory function and both intrinsic stress (i.e. caused by the cognitive challenge itself) and acute extrinsic stress follow an inverted U-shaped function, where lower levels of learning are associated with very low and very high stress levels, and where optimal acquisition of spatial/explicit information is seen with moderate to high stress levels.

A meta-analysis of acute stress effects on core executive functions found that acute stress impaired working memory, cognitive flexibility and cognitive inhibition, whereas stress enhanced response inhibition.[4] Among the sub-findings reported was the fact that a high working memory load moderated the effects of stress on working memory, and that cognitive flexibility was impaired with an increased severity of stress.[4]

Another recent study showed that states of high arousal, achieved by watching either an erotic or violent episode, compared with a control cinematographic scene, impairs the implicit acquisition of the spatial and sequential context of an event.[5]

The evidence cited is based on animal research or neurobehavioural experiments, and therefore the results may not be extrapolated directly to clinical education; however, there are some conclusions that can be derived from these findings. Educators need to thoroughly differentiate between intrinsic and extrinsic stress, and carefully titrate both of these during

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SBT. Besides stress intensity, both the timing and the duration of the stressor must be considered.[3] Although a certain level of stress allows us to selectively focus on a distinctive goal, which certainly is of help or even vital to manage dynamic, demanding medical situations, important executive functions such as working memory, and thus possibly learning outcomes, are diminished by high levels of acute stress or arousal.[4,5]

Based on my personal experience in conceptualizing and delivering SBT both for undergraduate and postgraduate target groups, incorporating these academic findings may pose a challenge. Yet, when planning SBT based on experiential learning theory with a sound evidence base, some of the above-mentioned aspects can easily be included in educational practice. The process of experiential learning has to start with the identification of a (medical) problem; then, this problem can be used to define learning needs for the specific target population. After having defined the educational goals and the specific measurable learning outcomes, educators must select specific curriculum content and decide on the best suited educational strategy.[6] During the whole process of curriculum design, educators must bear in mind that learning experiences have to be relevant, authentic, consistent and plausible to the trainees, allowing for the maximisation of psychological engagement and, thus, learning outcome.

From a stress perspective, it is critical to specifically know about the needs of your target population to titrate demand levels accordingly. When planning SBT for novices, one must acknowledge the intrinsic stress caused by the medical task itself and consequently limit extrinsic stressors, e.g. the emotional stress caused by relatives being present during resuscitation. Deliberately choosing the most appropriate simulation method – from role playing to crisis resource management-based team training – to reach educational goals and to convey the selected curriculum content does further help titrating training intensity appropriately.

For multi-professional target groups with different clinical backgrounds, levels of training and practical experience, the educational high-wire act of stress titration may be even more demanding. In this instance, I find it helpful to define one or two overarching, profession- and specialty-independent educational goals (e.g. the identification of a deteriorating patient or effective and safe team communication), as well as to draw individual educational maps and vignettes for each trainee, detailing the level of training and clinical expertise, thus presenting a step-by-step educational road map to track both assessed learning outcomes and individual improvement.

Undoubtedly, stress is a multifaceted construct involving numerous moderating variables. Therefore, addressing the topic of stress and its relationship to performance and learning solely based on experimental research would be one-sided. Still, we should take into account the results of current studies from neurobiology and behavioural science that suggest impaired learning effects especially in situations of too high or too little demand. It is now our goal as clinical educators to further challenge this theory based on sound studies.

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