"Loved it and the information but overwhelming to wrap my head around": Using simulation in a primary education context whilst managing cognitive load

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When educating future teachers in Higher Education contexts, there is often a perceived divide between theoretical and professional knowledge (McGarr et al., 2017). One potential means of bridging between ~~this~~ theory and ~~-~~practice ~~divide~~ is through using simulation. Simulation aims to replicate the interplay between the knowledge, skills and attitudes necessary in real-life situations. It has been found to improve student engagement across professional fields including social work (Meredith et al., 2021), health (Platt et al., 2021), and more recently teacher education (Kaufman & Ireland, 2019).

Through providing an authentic context for difficult-to-teach concepts, simulation can offer a 'safe space' to explore the complex decisions that teachers must make (Ferry et al., 2004), and is associated with improved self-confidence and feelings of preparedness (McGarr, 2021). We therefore developed a simulated Year 2 cohort, consisting of realistic pupil profiles, attendance and attainment data, histories, specialist reports and school policies. Each simulation centred around a distinct scenario, for example developing a support plan for Oscar, a fictional child with special educational needs.

However, research suggests that simulation presents a complex form of learning, leading to high cognitive load which can lessen its effectiveness (Fraser et al., 2015; Sun et al., 2017). Upon first developing simulations to complement our post-graduate teacher education programmes, this issue was highlighted in one student's observation that: '*Some of the challenges were that it was overwhelming. Loved it and the information but overwhelming to wrap my head around*'. For our staff team, this prompted considerable reflection regarding how best to incorporate simulations into our ITE provision whilst effectively managing cognitive load.

Drawing from the work of Reedy (2015), this reflective piece shares some of the ways in which cognitive load theory informed the design of our subsequent simulations. This includes considering students' prior experiences and cognitive schema; adopting a staged approach to allow for reflection and debriefing; and the use of tutors as 'plants' during the session to support learning and reduce extraneous load.

Working with schema

'*Humans are able to maintain and encode slightly more information if we can make sense of it as we take it in; if existing cognitive schema are in place to support the sensory input*' (Reedy, 2015, p. 356). Simulation sessions were carefully timed and sequenced, appreciating students' prior learning experiences, to ensure they had adequate schema into which to assimilate and accommodate new knowledge (Kirschner and Hendrick, 2020).

Although some students suggested it would have been helpful to experience these simulations before embarking on their first placement, their lack of schema at that point may have reduced their ability to engage with the learning content (Chi et al., 1982; Reedy, 2015; Kirschner & Hendrick, 2020). Instead, our simulations took place halfway through the academic year, allowing student-teachers to draw from previous placement experiences. The content and focus of simulations were designed to build upon existing cognitive schema relating to assessment data, working with pupils with SEND, and communicating with parents.

Adopting a 'staged' approach

Each simulation adopted a staged approach which enabled reflection between sessions (Moon, 1999), prior to the introduction of more complex scenarios. Prior to the simulation, a brief outline of the focus, together with supporting documents, was shared with students. This allowed students to familiarise themselves with key theories and information, thus lessening extraneous cognitive load (Reedy, 2015). Each simulation also utilised a multi-part structure, consisting of 'live' face-to-face input, interspersed with opportunities for directed learning tasks. Using formative assessment information gathered throughout the 'live' elements of the simulations, tutors were able to adapt content to meet students' learning needs, address misconceptions and give rapid feedback.

Goal-free tasks, with multiple possible responses and solutions, were incorporated into the simulation design, increasing student success and reducing the cognitive load associated with the need to find specific pre-determined answers (Reedy, 2015). When first reviewing simulation documentation, open questions such as 'What do you notice?' were used to allow students to develop several possible appropriate responses. Students were encouraged to work collaboratively within study groups to facilitate the sharing and co-construction of ideas, whilst also supporting students to effectively manage cognitive load (Nihalani & Robinson, 2022). Collaborative tasks included working together to undertake data analysis, and shared drafting of 'paperwork' associated with the simulations, for instance a support plan for a child with SEND.

The fidelity - or realism - of the simulation was informed by students' existing knowledge and practical experience. Extraneous cognitive load was reduced through delivering sessions within a familiar location on campus, providing a 'safe space' for the exploration of potentially challenging ideas and concepts. When designing the simulation scenarios, only the information required to understand the learning focus was given. This consciously reduced any additional information which served only to increase authenticity or fidelity. Furthermore, the simulations offered idealised scenarios, without emergency or particularly surprising situations. This was a deliberate strategy; whilst more complex scenarios do occur in practice, they are less appropriate as learning tasks due to the high cognitive demands for student-teachers at this point in their training (Reedy, 2015).

The use of tutors as 'plants'

Drawing on the ideas of Nestel et al. (2014), tutors with an understanding of students' previous learning experiences were used as 'plants' to support learning and reduce unnecessary extraneous cognitive load. During the simulations, as plants, tutors offered additional support by signposting key information, referencing previous relevant experiences, and suggesting possible next steps. This increased student success through concentrating effort on the focus task (Reedy, 2015), enabling tutors to guide students through the simulation experiences, adjusting the complexity of tasks for those with different levels of experience.

Concluding thoughts

Whilst our own experiences support the work of Kaufman and Ireland (2019) in suggesting the potential benefits of incorporating simulation into teacher education programmes, given the association of this pedagogic approach with high cognitive load, it is clear that ways of managing these demands need to be explored. This reflective piece highlights aspects of our simulation design which were implemented to effectively manage cognitive load and promote learning and engagement through this innovative approach.

We believe that, through careful consideration of students' prior experiences and cognitive schema, adopting a staged approach to allow for reflection and debriefing, and the use of tutors as 'plants' it is possible to maintain appropriate levels of cognitive load to maximise learning. Indeed, we believe that by using simulations in this way, we can continue to better-support professional learning for student-teachers~~, with very positive implications for the professional learning and preparedness of future generations of teachers~~. Furthermore, we suggest that simulation offers a powerful vehicle to support not just those colleagues who are new to the profession, but a means of providing ongoing support for teachers throughout their careers.

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