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## Review

# Educational theory and its application to advanced life support courses: a narrative review

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## Abstract

The knowledge, skills and attitudes taught on Advanced Life Support (ALS) courses are an important learning requirement for healthcare professionals who are involved with the care of acutely unwell patients. It is essential that the course design and delivery is appropriately planned to ensure that it optimises the learning opportunities for all learners. This paper offers a narrative review of how the application of educational theory has positively influenced the evolution of ALS courses since their inception in the late twentieth century. By embracing and understanding the relevant educational theories, the ALS course design has transformed from a predominantly lecture-based and behaviourist approach, to a more participative and social constructivist approach to learning. In addition, the advent of smarter technology and the challenges posed by the COVID-19 pandemic have facilitated a more connectivist approach to learning. It can therefore be demonstrated that the ALS course is influenced by a combination of theoretical approaches and provides a diverse framework of teaching and learning strategies that cater for many individual learning styles. Any further evolution and development of the course should be based upon contemporary educational theory to ensure that it remains fit for purpose.

**Keywords:** Education, Advanced life support, educational theory

## Introduction

'Educational theory' is an overarching term that describes a collection of theories that explain the application, interpretation, and purpose of learning and education.<sup>1</sup> Theoretical concepts help to explain the learning process and have the potential to inform educational approaches, curricula, and assessments.<sup>2</sup> They can also help the learner reflect upon and understand their own unique learning processes thereby maximising opportunities for the intended learning outcomes to be achieved. As such, they are important as they enable us to understand, evaluate, and improve the methods of teaching.<sup>3,4</sup> A limitation of this approach is that there is no one theory that will describe learning and teaching in all contexts. By looking through the lens of different theoretical frameworks, however, alternative ways of

teaching can be highlighted that may benefit the diversity of learners attending courses.

Modern day advanced life support (ALS) courses are an important aspect of healthcare professional education. The American Heart Association (AHA) began running Advanced Cardiac Life Support (ACLS) courses in 1979 and, over the next two decades, the concept became a global entity. The AHA ACLS course is now recognised in over sixty countries worldwide. The Resuscitation Council UK ALS course, which was first introduced in the early 1980's, was adopted and modified for local use by the European Resuscitation Council (ERC)<sup>5</sup> and the Australian Resuscitation Council. These accredited courses, referred to hereafter as ALS courses, are undertaken by over 1.3 million participants every year across low, medium and high resource settings in the world.<sup>6</sup> Courses for paediatric and newborn cardiac life support, as well as

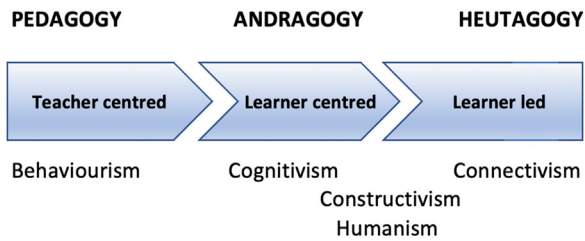
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**Fig. 1 – Concepts of learning.**

trauma life support, have also been developed utilising similar instructional design principles.

This narrative review will describe the overarching concepts of education, the educational theories most relevant to ALS, their relationship with each other, and how they have positively influenced the design and evolution of these courses.

## Theoretical concepts and approaches for education

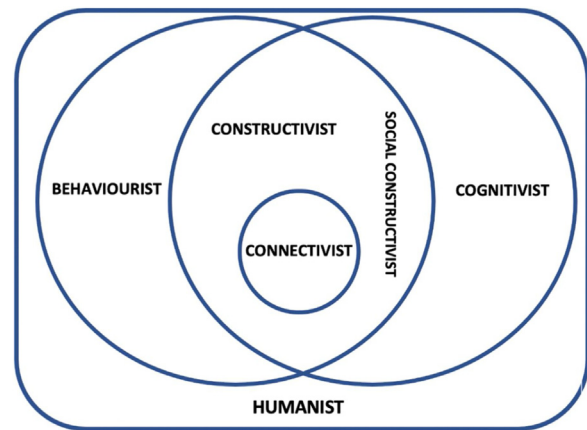
The scientific study of human learning using educational psychology is an approach that dates back over 2000 years to Aristotle and Plato.<sup>7</sup> Theories relating to education have been postulated by many philosophers in the intervening years, with a particularly rapid growth in the development of theories in the last thirty years.<sup>8</sup> The majority fall under four broad theoretical approaches. These are behaviourism, cognitivism, constructivism (including connectivism), and humanism.

The relationship between a learner and a teacher, as depicted in Fig. 1, is a continuum between three key concepts; namely pedagogy, andragogy and heutagogy.<sup>9</sup>

The term pedagogy describes a process of teacher-centred learning and is often used when discussing the education of children.<sup>10</sup> The learner is dependent upon the teacher with little need for intrinsic motivation and the focus of learning is on specific aspects of a planned curriculum. In contrast, andragogy relates to the art and science of adult learning and primarily relates to a learner-centred approach. It is based around five assumptions: self-concept, adult learner experience, readiness to learn, orientation to learning, and motivation to learn.<sup>11</sup> The third concept, heutagogy, goes beyond the limits of a didactic classroom-based experience, encouraging learners to adapt an autonomous approach in managing their own learning.<sup>12</sup> Heutagogy requires a high level of learner maturity and a low level of control from the teacher. The range of educational theories that will be described in this review relate in differing ways to these three concepts (Fig. 1) and also overlap with each other in many respects (Fig. 2). The underpinning principles of these theories and their relationship with each other will now be described, along with discussing how each theory is relevant to the ALS course (Table 1).

### Behaviourist theory

Medical education in the late 20<sup>th</sup> century aligned predominantly with behaviourism, which was originally described by Skinner.<sup>13</sup> The basis of this approach is that behaviour can be shaped by rewarding good behaviour (positive reinforcement) and not rewarding undesirable behaviour (negative reinforcement). In this model of learning, the role



**Fig. 2 – Educational learning theories.**

of the teacher is pivotal as they are in total control of the educational experience dictating what is right and wrong with little opportunity for learner reflection.<sup>14</sup> As such, it is an example of a pedagogical approach to learning. A strength of this approach is the emphasis on the mastery of prerequisite steps before building on these and progressing to more complex topics, which is also consistent with the concept of 'mastery learning' as described by Bloom.<sup>15</sup> It is an appropriate approach for establishing ground rules and learning contracts that can enhance the learning environment. Learners are regarded as a 'blank slate' and they are the recipient of learning with no recognition of any prior experience or learning. A weakness of such an approach, however, is that it risks cognitive overload. Cognitive load, as described by Sweller, details the used amount of memory resources and the ability of the limited 'working memory' to process information into longer-term memory.<sup>16</sup> By overloading this ability, there is a risk of lower learner engagement and associated reduced motivational impact.<sup>17</sup> Didactic teaching sessions involving lectures to mass audiences, tutor-led tutorials, and negatively marked MCQs all contribute to the behaviourist approach.<sup>18</sup>

### Cognitivist theory

Cognitivist theory was developed in the early 1900's from Gestalt psychology as described by Kohler.<sup>19</sup> It focuses on the processes involved in learning including the integration of new information into existing knowledge.<sup>20</sup> It involves acquiring, storing, and retrieving information.<sup>14</sup> In contrast to the behaviourist approach where thinking is regarded as a behaviour, the cognitive approach states that thinking is separate as it impacts upon behaviour.<sup>21</sup> This approach is based upon cognitive psychology, which describes how the working memory is used to formulate longer term memory.<sup>2</sup> Processing information into long term memory can either be achieved superficially through rote learning, or more effectively through the process of understanding. The learner uses cognitive tools such as insight, information processing, perceptions, and memory to facilitate learning. An example of such a tool is the 'Advance Organiser' theory by Ausubel<sup>22</sup> which states that learners find it easier to learn if they have already been presented with information that enables them to orient themselves to the topic. The role of the teacher is to facilitate the learner to 'learn how to learn'.<sup>14</sup> As the approach is learner-centred, it is therefore an example of an andragogical approach. Cognitivism is

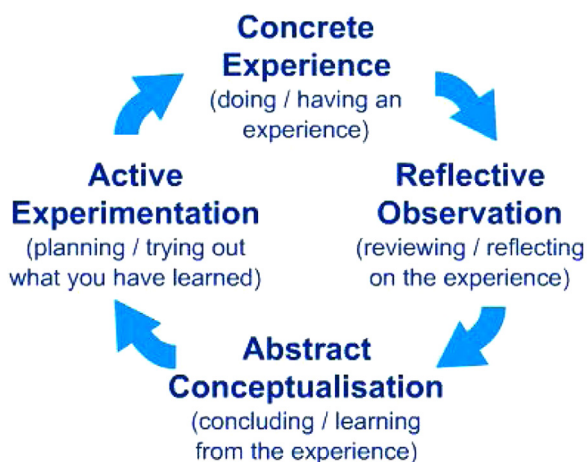
**Table 1 – Linkage between educational theories and aspects of ALS course delivery.**

Theory	Relevant aspect of ALS course delivery
Behaviourist	Pendleton's feedback, mastery learning, skills and scenario simulation
Cognitivist	Problem-based learning in workshops, reflective learning
(Social) Constructivist	Peer learning, team working, scenario-based simulation
Connectivist	Blended learning approach to ALS
Humanist	Underpins the educational environment for all other theoretical approaches

advantageous when there is a need to process and retrieve information and apply new knowledge. It is particularly relevant for exercises involving reflective thinking and problem solving. A weakness of this approach is that it cannot be directly observed or measured. Another disadvantage of cognitivism is that the working memory, on which it is reliant, is limited in capacity and declines with advancing age.<sup>2,23</sup> This is consistent with published data identifying that advancing age may be associated with poorer educational outcomes for participants on an ALS course.<sup>24–26</sup>

### Constructivist theory

Constructivism, as detailed by Piaget (1953) and Bruner (1966), describes the construction of understanding and knowledge through experiencing phenomena and reflecting upon them.<sup>27,28</sup> The underpinning principle is that learners compare new information and experiences with their prior held beliefs and actively change behaviour or disregard the learning based upon their analysis of the material. As with cognitivism, constructivism represents an andragogical approach to learning, although the exploration and inquiry elements of it are also form the basis for the concept of heutagogy.<sup>29</sup> It has been stated that technological advances in education have shifted the style of learning from a behaviourist towards a more constructivist approach.<sup>30</sup> The implication is that constructivism and behaviourism are not two distinct entities but lie at either end of a continuum.<sup>31</sup> In addition, constructivism has been described as an amalgamation between the behaviourist and cognitive approaches.<sup>32</sup> A version of experiential learning that forms the foundation of constructivism is the Kolb Experiential Learning Cycle (Fig. 3).<sup>33</sup> Kolb stated that "learning is the process whereby knowledge is created through the transformation of experience".<sup>34</sup> He described four specific learning styles based upon his Learning Cycle, with learners preferring either

**Fig. 3 – Kolb Experiential Learning Cycle.**

concrete experience (feeling), reflective observation (watching), abstract conceptualisation (thinking), or active experimentation (doing).

The constructivist model of learning avoids direct instruction and enables learners to scaffold their learning from simple to complex topics through a process of guided discovery.<sup>35</sup> An advantage of such an approach is that it can promote self-confidence as it guides the learner to discover knowledge on their own.<sup>32</sup> A weakness however is that there may be pressures on available teaching time if learners find difficulty learning with this model.<sup>32</sup>

### Social constructivist theory

The overlap between constructivism and cognitivism is called social constructivism. This theory, according to Vygotsky, describes how learners build upon a platform of experience in order to introduce and understand new concepts, but underpinning this is the importance of social interaction and the social processes in learning.<sup>36</sup> Vygotsky's theory argues that individuals consider and discuss problems in a social environment and stresses the fundamental role that social interaction contributes in cognition development. Social constructivism describes a learning environment where learners flourish by observing and imitating others, thus placing their learning in a social context.<sup>37</sup> It recognises that learners interact and learn from others and this can also include learning from observing positive and negative reinforcement in their peers. The face-to-face interaction with peers also improves motivation<sup>38,39</sup> and enables learners to bond and realise the importance of team working.<sup>40</sup> The term 'situated learning' has been used to describe the process of learning through participation in collaborative activities with other professionals. It has also been described as a 'community of practice', where learning occurs when embedded within activity, context, and culture.<sup>41</sup> Meanings and identities are constructed through these shared activities rather than in environments that work independently of social context. Learning can be unintentional rather than deliberate particularly when learners are not the direct focus of teaching and passively observe the experience of their peers. This has been described by Lave and Wenger as "legitimate peripheral participation".<sup>41</sup> The aim is to move learners towards full participation by allowing newcomers to learn through observation and shared activity. 'Communities of Practice' further identifies learning as an integral aspect of social practice and is described as "groups of people who share a concern or passion for something they do and learn how to do it better as they interact regularly".<sup>42</sup> Lave and Wenger emphasise the importance of joining a community of practice where meanings and identities are constructed through shared activities rather than environments that work independently of social context. Integral to this community of practice is the concept referred to as the 'Zone of Proximal Development'.<sup>36</sup> This is defined as the difference between what a learner can do without help and what they can do with help. It is

an area of learning that is assisted by a teacher or peer with a skill set that is higher than the learner.

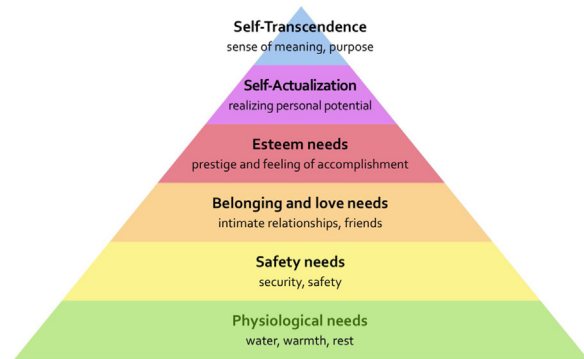
### Connectivist theory

Traditional theories like behaviourism, cognitivism, and constructivism are primarily based upon classroom learning. With the introduction of the internet, social media, blogs, and online discussion forums, the approach to educational theory has further radically changed. Learning can no longer be regarded as an individual trait as there are now networks, resources, and opportunities available that were previously unimaginable. This has led to the development of the connectivist theory by Downes and Siemens.<sup>43,44</sup> The principle behind connectivism is that learning is dependent on multiple sources of opinion. The ability to learn in this context is influenced by the diversity of the network and also the strength of the bonds between the information sources and may also utilise 'non-human appliances' (e.g. virtual and augmented reality). The process of identifying these sources is itself part of the learning process and can enable the learner to gain a greater comprehension of the subject. As such, the use of technology with the flexibility and interactivity that it provides has been described as leading to an enhanced constructivist learning environment.<sup>45</sup> By transforming the experience to a learner-led approach, connectivism is a good example of heutagogy. One of the key strengths of connectivism is that it enables flexible learning time.<sup>46</sup> If a learner feels like learning, they can do so at that moment and not be reliant upon formal and organised programmes that may conflict with work, family commitments, or location difficulties. This ability to repeat learning at the learner's convenience until mastery is achieved is a significant attribute particularly as a lack of available time for slow learners has already been identified as a weakness of the traditional constructivist approach. Another strength of connectivism is that it has the potential to expose the learner to a vast range of information. This in itself is also a potential weakness if that information is inaccurate or the amount of information is overwhelming. Another limitation of this approach is that it may place those with a lack of digital literacy skills at a disadvantage. There are also concerns about the potential harmful effects of an addiction to technology and the social isolation that this may foster.<sup>46</sup>

### Humanist theory

In contrast to the aforementioned theories, the humanist approach regards learning as a personal act to achieve fulfilment. It was developed in response to the perceived limitations of behaviourism, and its underpinning principle is for learners to progress towards self-actualisation and creativity.<sup>47</sup> Whilst described by one of its founders as 'learner centred' (implying andragogical roots),<sup>47</sup> it is also a learner-led approach and along with constructivism was the basis for development of the heutagogical concept.<sup>29</sup> There is an emphasis on person-centred wellbeing enabling choice and autonomy with the aim of promoting self-confidence and self-esteem.

One of the main proponents of humanism was Maslow, who developed a 'Hierarchy of Needs' (Fig. 4).<sup>48</sup> This is visualised in the form of a pyramid with the bottom four layers defined as "deficiency needs". These relate to physiological, safety, belonging and esteem factors. If these are not met, then the environment is not conducive to learning. The top layers are termed "growth needs". The initial model had self-actualisation as the top of the pyramid, which is the desire for a learner to reach their full potential. Self-transcendence was added to



**Fig. 4 – Maslow's Hierarchy of Needs.**

the model later and describes the development of actualisation amongst others.

## Relevance of educational theory to ALS course training

The educational delivery of ALS has evolved over the years from instructor-led didactic courses to approaches that utilise technology and promote self-directed and problem-based learning. In the early days, educational theory was not always comprehensively applied in the development of ALS curricula. The same is evident in the development of digital education with a recent review identifying that only one-third of digital education interventions designed for health professionals implemented a learning theory.<sup>49</sup> The modernisation of instructional design (the practice of designing, developing and delivering instructional products and experiences) and the implementation of learning theories are factors that are likely to have contributed to more effective acquisition of learning outcomes. There is also evidence that more contemporary ALS courses have translated into increased patient survival rates when compared to their historical equivalents.<sup>6</sup>

Whilst there are many similarities and differences between the various educational theories, they also represent learning in context with different stages and situations of learning.<sup>14</sup> The earlier iterations of the ALS courses strongly reflected the behaviourist approach to education that was commonly used at that time with a significant proportion of the teaching delivered by a series of lectures. There was an emphasis on rote learning and repeated practice to achieve competency with learners expected to memorise resuscitation algorithms and mnemonics.

Another example of the behaviourist approach concerns the preferred format of learner feedback commonly used on ALS courses throughout Europe until the last decade. 'Pendleton's Rules' provided a rigid feedback structure centred around a discussion about what went well followed by what could be improved.<sup>50</sup> Learners were asked for their understanding of each concept first ("What did you do well", "What could you do better?"), followed by the views offered by the instructor ("This is what you did well", "This is what you could do better"). This utilised the positive and negative reinforcement that underpins the behaviourist approach, and critics have cited this approach as being too rigid and formulaic.<sup>51</sup>

In contrast, there are aspects of the behaviourist approach that continue to be implemented successfully. The use of manikins for

skills and simulation-based training has existed since the inception of these courses. Learners benefit from the 'trial and error' approach to learning without the fear that they will cause actual harm to patients. They learn from positive outcomes, but also from situations in which the simulation has a negative conclusion.<sup>52</sup> Simulation-based learning in this way has been shown to have a positive effect on skills retention following ALS course completion.<sup>53</sup>

Over the years, the emphasis of the ALS course has moved away from a predominantly lecture-based summative-assessed approach to a more participative focus involving group work, active participation and formative assessment. Learners build upon their prior experience and either the new learning will resonate with what they already know, replace what they thought was correct, or can be ignored. Learners originate from a variety of backgrounds, professions, and levels of expertise and they are encouraged to share that expertise with their colleagues. The intention is that they will bond as a group through this situated learning experience. This approach is particularly beneficial for the teaching of non-technical skills, including team leadership and communication, which was added to the ALS course curriculum in 2014. As part of the debriefing, learners are expected to reflect on their experiences in a safe educational environment followed by a process of action planning to identify what can be improved. In reviewing the evolution of ALS courses, it can be demonstrated that they have progressed along the spectrum of educational theories to embrace a more social constructivist approach. This broadly reflects the trends that have taken place in health professional education.<sup>54</sup> However, the constructivist approach is not necessarily beneficial for all learners as there are some who benefit from a more didactic approach to support the achievement of their intended learning outcomes. The value of the 'group approach' fostering a more social approach to learning can also be challenged as it may potentially mask the important minority viewpoint. In other words, valuable contributions from quieter and more passive learners may be missed. Considering the other extreme, group work can be less effective as a learning strategy if there are learners who do not cooperate with this educational approach which potentially disrupts learning for others.

In its purest sense, constructivism avoids direct instruction and relies on the facilitator guiding the learners to discover knowledge on their own. However, within the time frame of an ALS course, this approach is not always feasible, and some direct instruction is still required. Most ALS courses therefore still retain a small number of lectures relating to key learning objectives. Whilst the workshops are designed to facilitate discussion, there are also a clear set of learning objectives for each session and instructors will inevitably guide learners towards the things they need to know. This formal structure for the sessions contradicts the approach that constructivists may promote as there may otherwise be insufficient time for self-learners to attain the desired learning outcomes.

There are important elements of cognitivism that are relevant to ALS courses. Problem-based learning and simulations are a prominent aspect of contemporary courses and these sessions require learners to manage realistic case scenarios in collaborative activities with their peers. However, it is the overlap between cognitivism and constructivism (social constructivism) that is particularly relevant. Scenario teaching sessions, where learners learn how to manage a patient in a simulated environment, are a form of situated learning that enables them to learn as a team in the same context that they will be putting the skills into practice in real life.

In addition, the principles of the 'communities of practice' resonate with the structured approach to skills teaching commonly used on

many ALS courses. Peyton's approach to skills teaching enables learners to become actively more engaged, moving from the periphery to the centre of the learning experience to gain competency.<sup>55,56</sup> The four stages start with a real time demonstration of the skill by the instructor. This is also consistent with Ausubel's 'Advance Organiser' theory<sup>22</sup> as learners observe how the skill should be executed before the second stage when the skill is deconstructed and explained in more detail. After a period of allowing for questions, the learner then talks the instructor through the process of the skill before performing the skill themselves in the final stage. The learner has therefore witnessed the skill being performed at least three times before they actually get to perform it themselves, allowing them to progress along the spectrum from novice towards mastery. Whilst commonly used as a technique on ALS courses, there have been challenges to its validity with some feeling that not all four stages are necessary<sup>57,58</sup> and that a two or three-stage approach can potentially deliver equivalent longer term outcomes.<sup>59,60</sup>

The principles espoused by the theory of connectivity have introduced new opportunities for the delivery of ALS education. Healthcare is a practical specialty and cannot be replaced entirely with e-learning.<sup>61</sup> There is still a need for interaction with experts to develop higher level thinking skills such as the synthesis or evaluation of knowledge.<sup>62</sup> This has led to the increased popularity and effectiveness of blended learning approaches in healthcare education,<sup>63–65</sup> and this format has already been successfully used for ALS course delivery.<sup>66,67</sup> A blended learning approach combines the opportunity for learners to access and repeat online material at their own convenience and pace, whilst also benefiting from the social interaction and peer learning of a face-to-face aspect of the course. Furthermore, if the online elements of a learning programme are appropriately designed, these virtual communities of practice can develop the potential to provide further opportunity for social inclusion.<sup>68,69</sup> The COVID-19 pandemic and the challenges it raises in relation to the feasibility of face-to-face training further increases the relevance of a blended learning approach.<sup>70,71</sup> The added benefit of such an approach is that it can accommodate the range of learning styles described by Kolb.<sup>33</sup> Those who favour concrete experience recognise the strength of face-to-face learning for dealing with communication issues and situations where shared learning needs to be achieved to develop knowledge.<sup>72</sup> In contrast, those who support the abstract approach to learning are more likely to be intrinsically motivated, prefer self-directed learning, and have a preference for the e-learning approach.<sup>72–75</sup> The reality is that learners may possess a spectrum of learning styles and that no one fixed approach is correct.<sup>76</sup> Indeed, exposing learners to environments that do not suit their preferred learning style may lead them to develop otherwise undeveloped styles of learning.<sup>77</sup>

ALS courses should be a challenging but safe place to learn. Instructors are taught to ensure that all of the "deficiency needs" as described by Maslow<sup>48</sup> are addressed within these programmes of education and learning. Accordingly, learners are fed, hydrated and kept warm. The course programme ensures that the day is not too long and that regular breaks are built in. Learners are offered a safe educational environment, and they learn alongside peers who can help nurture and support them. Aligned with the safety needs, they should feel comfortable in stating an opinion without fear of criticism. By acquiring the knowledge and skills necessary to deliver expert clinical care in the real world, learners develop a sense of self-worth which further inspires them to learn. Self-actualization is achieved at the stage at which the learner realises their full potential to deliver

expert care. Furthermore, self-transcendence (the overcoming of the limits of the individual self) is demonstrated in those who progress to be instructors themselves.

## Conclusion

The application of educational theory in the instructional design process of any new course is critical. Early ALS courses may not have comprehensively embedded educational theory in their design. More recently ALS courses have evolved utilising a successful combination of the positive aspects of numerous educational theoretical approaches. The instructional design was initially based upon pedagogy, but subsequently moved towards a more andragogical approach. Learners use a constructivist approach to problem solve and build upon their baseline knowledge, and they do this within a social learning context. They are presented with opportunities to understand the underpinning concepts through problem-based learning thus utilising a cognitivist approach. Embedded in this learning experience are useful behaviourist aspects whereby they learn discrete knowledge and skills via positive and negative reinforcement. The course design includes humanistic elements to ensure that learners safely develop self-confidence and self-esteem. The further development of blended learning approaches aligns in particular with the theory of connectivity, with the utilisation of an online community of learning. This has resulted in a transformation from an initially pedagogical approach to a more heutagogical approach to learning.

By utilising this combination of theoretical approaches for ALS courses, a diverse framework of teaching strategies can be used to optimise learning opportunities for all course participants. The evolution of technology has brought even greater opportunities for the delivery of effective education. The concepts taught on ALS courses remain a key element of education for healthcare professionals worldwide and it is important that it continues to evolve in line with contemporary theory, but also that any significant developments are formally validated to ensure that the educational standards are safeguarded.

## Conflicts of interest

Dr Lockey is Vice President of the Resuscitation Council UK. Both Dr Lockey and Ms Conaghan are members of the European Resuscitation Council Development Committee for Education.

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