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Working in Creative Partnership with Students to Co-Produce Neuroanatomy e-Learning Resources in a New Era of Blended Learning

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Anatomists are well placed to tackle the transition from face-to-face to blended learning approaches as a result of the rapidly forced changes brought about by Covid-19. The subject is extremely visual and has, therefore, previously been a target for the development of technology-enhanced learning initiatives over the last ten years. Today's students have come to expect the integration of technology in the classroom and remotely. They adjust quickly to the innovative use of new applications and software and have begun to integrate it within their own workflow for note taking and study aids. Given the intense drive toward blended deliveries of anatomy as a result of the Covid-19 pandemic, it is easy to picture how the benefits of working in partnership with students (in order to achieve many of these aims) would be possible, particularly in difficult subjects like neuroanatomy. In doing so, it provides anatomists with new opportunities to engage students in a way that aligns well with best practice frameworks for engaging students through partnership. The current United Kingdom guidelines set out by Advance HE (a professional membership organization for promoting excellence in higher education) strongly encourages the higher education community to seek out appropriate academic contexts where a balance of power can be struck between staff and student to create a community of practice. If such an approach can be fully embraced by anatomists, a strong argument can be made for seizing the opportunity to optimize the benefits of student partnership work in this discipline. Anat Sci Educ 0: 1–9.

Key words: neuroanatomy education; medical education; blended learning; student engagement; online learning; community of practice; student partnership; distance learning; Covid-19

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INTRODUCTION

Like many academics all over the world, anatomical educators have had to respond quickly to the demands placed upon its discipline by the raft of restrictions put in place as the Covid-19 pandemic took hold in March 2020 (Evans et al., 2020). At the time the initial and immediate United Kingdom (UK) response was to convert all teaching to an online format so that what remained of the academic year could be completed and students could progress within their programs of study (Brassett et al., 2020). Many of the early reports in the literature reflected on the experience of delivering lectures, either synchronously or asynchronously across a computer screen (Longhurst et al.,

2020). Additionally, anatomists carried the burden of having to teach their subject during this period without their principal learning resource—the human cadaver. Since the initial Covid-19 outbreak, some small group practical teaching (with appropriate distancing measures in place), has been permitted in the United Kingdom, particularly in allied health or medical programs that require vocational training or patient contact. It is likely that many institutions within the United Kingdom were advised by their central educational leadership groups to adopt a blended learning (BL) approach, along with referral to best practice guidelines for remote teaching. The concept of BL is not so much innovation, but rather a by-product of the gradual supplementation of multimedia approaches to support in-person teaching. Blended learning is considered to be a style of educational practice which involves carefully integrated technology and digital media alongside traditional instructor-led classroom activities (Graham, 2006). The benefits of which are that the student can have more flexibility over the time, place, path or place in which they learn.

Despite the many challenges of adapting to the new educational landscape, those within the discipline of anatomy are already familiar with supplementing their curricula with innovative online resources due to the insufficient time available for laboratory-based face-to-face (F2F) teaching (Turney, 2007; Drake et al., 2009). Despite a receding curriculum, the publication of the regional core syllabi offered by the Anatomical Society made it clear that there had been no major reductions to what anatomy it expects graduating doctors to know (McHanwell et al., 2007; Smith et al., 2016).

Even before the impact of Covid-19, the piece-meal application of technology-enhanced learning had played an increasingly larger role in anatomy educational practice over time (Clunie et al., 2018). Anatomy lends itself well to multimedia approaches, whether that be through animated drawings or via more advanced immersive technologies, such as 3D rendering or virtual reality (McMenamin et al., 2014). Many institutions now have a growing collection of bespoke resources that they choose to integrate within their own curriculum. Those at the frontline of anatomical education are regularly evaluating the efficacy and impact of these interventions on the student experience and knowledge (Lochner et al., 2016). This practice has become so common it has led to the design of a holistic pedagogical framework to ensure a robust appraisal (Pickering et al., 2019). While many faculties have learning technologists or digital learning teams to support their scholarly requirements, it has become possible to build professional-looking resources without the need for specialized technical training or coding knowledge (Lochner et al., 2016; Guy et al., 2018).

Students today are quickly able to navigate around new applications in the classroom and adapt very easily to any new interface such as Microsoft Teams, version 1.4.00.497 (Microsoft Corp., Redmond WA), learning management systems such as Blackboard Learn and Blackboard Collaborate version 9.1 (Blackboard Inc., Washington, DC) or lecture capture software such as Panopto, version 10.14 (Panopto, Seattle, WA), which have become three of the most commonly used platforms in the United Kingdom to support remote education since the beginning of the pandemic. At the University of Southampton, a system is in place whereby medical student volunteers are trained to assist lecturers in setting up Panopto recordings in lecture theaters, (including troubleshooting common problems), to make sure teaching is kept to time and they have the resources they need. Students are continually moving more toward digital note taking and are capable of being creative around structuring their own portfolios of learning (Ruzycki et al., 2019). With the introduction of the first-generation iPad Pro tablet computers and Apple Pencil (a wireless stylus pen) in 2015 (Apple Inc., Cupertino, CA) and access to industry-standard graphic design, video editing, and web development software such as Adobe Creative Cloud, version CS6 (Adobe Systems Inc., San Jose, CA), Final Cut Pro, version 10 (Apple Inc., Cupertino, CA) or Procreate®, version 5.1.5 (Savage Interactive Pty Ltd., North Hobart, Tasmania, Australia) some students very quickly become capable of producing impressive results that have potential for wider appeal beyond their own study purposes (Abachi and Muhammad, 2014). Many examples in anatomy make their way onto social media as a basis for inspiration or to boost study motivation (Douglas et al., 2019).

The importance of student engagement in Higher education has become increasingly recognized in recent times (Cook-Sather and Luz, 2015). Although the student partnership model has been utilized previously in higher education settings, including examples in languages (Horwitz, 2000) the arts (Cook-Sather and Luz, 2015), the social sciences (Jarvis et al., 2013), geography (Moore-Cherry et al., 2016) and health care programs (Loke and Chow, 2007). There appears to be a certain logic behind adopting this approach at the present time in anatomy education, particularly when physical distance restricts staff and students being together in the same space and communities of practice are more difficult to establish and maintain online. Given the current educational territory, where high demand for digital content exists, and while, also appreciating the unique skill set of both parties, there appears to be a clear opportunity for students and staff to work in partnership to co-create resources for curriculum deployment during an unprecedented time.

It is of course possible for all areas of anatomy education to benefit from such a process, but one area of concern is how anatomists might successfully teach what has long been considered the most feared and difficult topics within its curriculum (under Covid-19 conditions), such as clinically orientated neuroanatomy (Jozefowicz, 1994; Sotigu et al., 2020). Neuroanatomy is widely considered to be one of the most challenging medical topics in anatomical sciences education globally (Zinchuk et al., 2010; Chang and Molnár, 2015) which is why it has frequently been a focus for developing novel tools and resources (Arantes et al., 2018; Elmansouri et al., 2020; Sotigu et al., 2020).

The purpose of this viewpoint article is to make a case for using a student partnership approach as a way of maintaining high-quality teaching standards in clinical neuroanatomy, when restricted by the conditions imposed by Covid-19. It will focus primarily on how it applies to blended teaching, learning, and scholarship strategies (including resource development). Using a case study example but firmly grounded in the context of the existing literature, it will also address the broader benefits of the model that may be appealing to anatomists in what will become a re-shaped educational landscape.

DESCRIPTION

Making a Case for Staff Student Partnership in Covid-19 Anatomy Education

First, it should be acknowledged that the conceptual model for partnership offers much more than just a solution to discrete problems or as standalone initiatives. However, the current set of global circumstances might be considered more

than enough to encourage the development of partnership learning communities (Dickman et al., 2017). It has already been argued that the strengths of a partnership approach become more pertinent when faced with long periods of remote teaching exchanges (Scott et al., 2014), not least of all because it has modified existing relationships between staff and students that are conducive to many of its core principles, such as shared values, inclusivity, more equal power balance, recognition and identity (Cook-Sather et al., 2014; Bryson, 2016; Healey and Healey, 2018). The transition to a blended anatomy delivery offers mutual benefits to be garnered from such relationships, just as when working in physical environments (Curran, 2017). This is because when applied effectively, such projects have demonstrated that they can assist in establishing and supporting communities of practice. Engaging students in the activities of learning, teaching, and assessment practices, see them as active participants in their own learning, allowing for them to take greater interest and responsibility (Cook-Sather and Luz, 2015). By recognizing that we can involve them in attempting to find solutions to maintaining the student experience during prolonged periods of remote or blended teaching can potentially empower students and make them feel valued.

The creative process in itself acts as a form of subject-level engagement in terms of making connections or developing ideas and may well serve as a process for deeper learning than simply reading over previous notes or lecture slides (Cropley, 2001). The opportunity to create something for others may also increase motivation to engage with the subject (Loveless, 2002). There is good evidence to suggest that from a meta-cognitive perspective, this process utilizes specific brain circuitry which influences the working memory buffer of the pre-frontal cortex. Since this holds the content of consciousness, it can, therefore, be enhanced through novel creative activities (Dietrich, 2004). So, when this is the result of deliberate control (e.g., with an objective to create a resource) it leads to an interaction between existing knowledge and creative thinking which has a positive impact on memory (Ashby et al., 2002). This would suggest that creativity is a worthwhile metacognitive strategy for learning compared with popular activities, such as re-reading over old notes (Ebersbatch et al., 2020). In clinical neuroanatomy education, student partners at Southampton have profited from the creative procedure through the process of active learning, which mirrors the active processes of drawing within a live lecture (Pickering, 2015). Additionally, their creative activities extend to generating questions for multimedia quizzes, case-based scenarios, and clinical problem solving. There is evidence in favor of this type of engagement being superior for learning when compared to knowledge testing because it enhances both factual recall and transfer knowledge (Ebersbatch et al., 2020).

Some medical schools in the UK decided to consolidate their summative assessments into formative processes in 2020—the impact of which was that all students progressed, despite their examination performance. Seeing as assessment is a prime extrinsic motivator to drive learning, co-creative activities have the potential to serve as a form of intrinsic motivation for continued engagement with anatomy. It might also be effective in establishing longitudinal integration of clinical anatomy throughout the clinical phase of the medical programme, where formal opportunities to revisit the subject are scarce.

Partnership in Neuroanatomy Teaching During Covid-19

Student staff partnership models have four main areas of focus: learning and teaching, subject-based research and enquiry, scholarship of teaching and learning, and curriculum design (Healey et al., 2014). These may overlap considerably, but in the current context the authors refer mainly to the role students can play in teaching or learning and pedagogic consultancy—particularly where Covid-19 and post-Covid-19 strategies are concerned. At the University of Southampton, the first module second year BM5 (BM/BS) students encountered within a Covid-19 restricted environment was the Nervous System. From an anatomy perspective, this module contains all the learning outcomes for both neuroanatomy and head and neck anatomy. Under normal circumstances, students would receive 11 anatomy lectures alongside 14 hours of formal laboratory-based practical teaching. In the academic year 2020–21, all lectures were replaced with a combination of both asynchronous and synchronous online teaching along with an extensive re-working of four dissecting room practical workbooks into an interactive e-booklet. This process involved embedding a large amount of colorful co-created digital resources, such as summary sheets, simplified diagrams, podcasts, self-examination resources, and 14 (~10 to 15 minute) cadaveric prosection video demonstrations with narration. Socially distanced F2F teaching was blended with this, but on a smaller scale. Students received only two hours of laboratory exposure, along with a further four hours of synchronous online activities. All of these sessions were democratically co-developed and co-taught with existing student partners and much of their focus centered on testing knowledge from the e-learning resources.

Peer-Led Synchronous Online Teaching

For the many anatomists already deploying forms of traditional peer-assisted learning programs, it might also be possible to convert peer-assisted learning programs to an online model too. Although aspects of this practice have been tried before in distance education, the literature appears to mainly refer to web-based threaded discussions (Brescia et al., 2004) or through social media engagement (Hennessy et al., 2016). Early indications have revealed that it can, at least during a crisis, appear to provide many of the same benefits as traditional peer-assisted learning programs (Border et al., 2017). These predictions align well with existing evidence that suggests that peer involvement in establishing online peer distance learning support increases engagement and retention in the subject matter (Boyle et al., 2010). In a recent cohort study comparing online delivery and F2F cranial nerve delivery, it was reported that there was no detriment in knowledge gain as a result of these differences. However, the student experience was reported as significantly less positive (Stevenson et al., 2021). It is likely that the congruence factors that make near-peer teaching unique may not translate quite so well via synchronous online methods as they do F2F. During the development of this initiative student partners were given extensive autonomy and independence to shape and negotiate this intra-curricular project, rather than a more traditional approach where staff ultimately lead and supervise students to achieve the aims which they set out.

Multi-Media Neuroanatomy Resource Co-Creation at Southampton: An Instructional Design Case Study

The Center for Learning Anatomical Sciences at the University of Southampton already has a well-established history when it comes to the development of innovative learning support for the study of clinical neuroanatomy and other gross anatomy modules (CLAS, 2021). It is home to the UK's National Undergraduate Neuroanatomy Competition (for the past nine years) and the established learning platform, Soton Brain Hub which hosts a YouTube channel (SBH, 2021), which at the time of writing has received 2.6 million views worldwide, with over 26,200 subscribers (Geoghegan et al., 2019). Data collected from the YouTube Studio analytics revealed that it received 69,000 views in April 2020, which is a 61% increase compared with the same monthly average in 2019. This demonstrates that increased demand for online undergraduate neuroanatomy resources occurred as a result of a shift in teaching practices. Despite Soton Brain Hub being a UK-based initiative, it has a significant international following, with only 5% of the video viewings coming from the United Kingdom and 21% of the viewings, (the highest for any single country), coming from the United States (Hall and Border, 2020).

Screencast and Video Creation

Over time SBH has developed and sustained an effective streamlined workflow for multi-media creation, demonstrating how staff and students develop quality assured screencasts and educational videos in partnership (see Fig. 1). The instructional design methodology has increasingly become more strongly aligned to the principles of the cognitive theory of multimedia learning (CTML) (Mayer, 2005). This is a pedagogy that has already demonstrated some degree of efficacy in anatomy education (Pickering, 2017). During the process of multimedia creation, students begin to understand and appreciate the theoretical rationale for why transfer and retention is enhanced when words and pictures are presented together. Students can use this theoretical knowledge to shape their creativity toward best practice, which would be unlikely to occur if they were working alone, without faculty consultation.

For example, all modern editing suites allow for precision adjustments of video footage which allows the user to actively apply the spatial contiguity principle (students learn better when corresponding words and images are presented closer together on screen) and the temporal contiguity principles (presenting words and images simultaneously rather than spaced apart). The current workflow pays close attention to the modality principle too which proposes that animation and narration (rather than animation and text) work better for reducing cognitive load during playback. For audio, the coherence principle can be adhered to, by ensuring that scripts are produced without unnecessary anecdotal information that could distract the learner from the core learning outcomes. This practice is supporting student partners to understand and apply evidence-based learning strategies to their creative designs so that their resources are underpinned by sound pedagogy.

There is a marked difference in the popularity of those videos narrated by students compared to those narrated by staff (Border, 2019). Although this does not provide evidence for more effective learning and retention, it does suggest that the important factors which make peer-led instruction successful (such as social and cognitive congruence) can be successfully achieved across a computer screen to influence the learner remotely (Border et al., 2020).

It is hypothesized that when students narrate videos, they do so with a different rhythm, stress, and intonation of speech (prosody) which is received in a less authoritative way by the listener. This may assist in its accessibility and might be considered to be endearing to those learning a difficult subject for the first time. This observation leans toward a conceptual model of collaboration called "Value Co-Creation" where student's intellectual capabilities, personalities and outputs

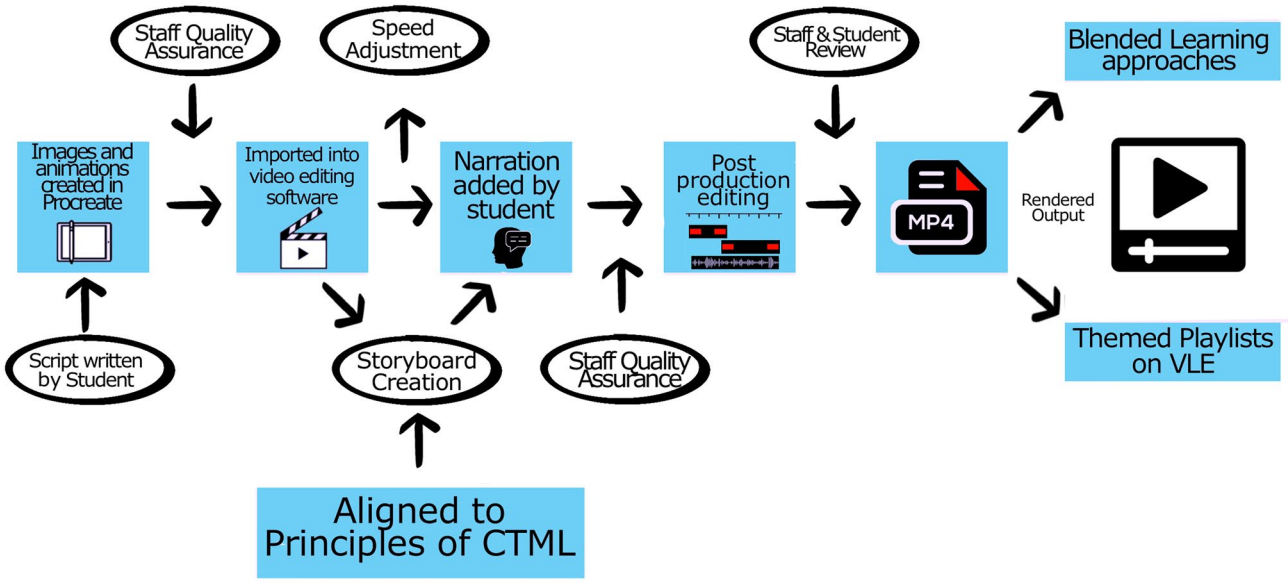

Figure 1.

Workflow process of student staff co-creation of educational videos for Soton Brain Hub. The input of staff and students is seen at each stage along with when the cognitive theory of multimedia learning is considered during the instructional design process and the eventual upload to the virtual learning environment. CTML, cognitive theory of multimedia learning; VLE, virtual learning environment.

are integrated alongside institutional resources and offer mutual value to both staff and students (Dollinger et al., 2018).

Live Streaming Neuroanatomy Demonstrations

To give an example of how the team has facilitated the process of recreating the dissecting room online, student partners have worked up the logistical possibilities using the free open-source software, Open Broadcast Studio, version 26.1.0 (hosted by GitHub Inc., San Francisco, CA) to live stream laboratory cadaver demonstrations using prosections. This tool can be effectively used to broadcast multicamera angle and integrated scenes with motion animation to offer fluid content delivery using presets for existing streaming platforms. The generational context of this application to the classroom is directly informed by students because OBS studio is mainly utilized recreationally on social media, whereas the role of anatomists is to influence how these tools should be deployed most effectively within the curriculum. This type of development lean toward a conceptual model of democratic collaboration called "value co-creation" where student's intellectual capabilities, personalities, and outputs are integrated alongside institutional resources and offer mutual value to both staff and students (Dollinger et al., 2018).

Developing a Community of Practice Through Partnership

Learning communities involve groups of people coming together professionally and socially to construct knowledge (Stoll and Lewis, 2007). The pressure placed upon institutions during the Covid-19 pandemic has been conducive to those with different roles, experiences, and expertise in working together for mutual benefit of the entire scholarly community, including students, at those educational institutions. All members are identified for offering important contributions and have some degree of responsibility for the process and the outcomes (Wenger et al., 2002). In the present example, both students and staff had the right and the responsibility to initiate, build and share ideas.

Earlier in this article, the benefits of cognitive and social congruence were discussed in the context of peer-assisted learning applications. A strong degree of social congruence between peers enables the student partnership team to connect with students who feel isolated or anxious and are able to bring this to the attention of the faculty informally. Student partners have initiated their own strategies to help support students' well-being. They also led on a project to put together additional extracurricular online synchronous and asynchronous peer-led teaching sessions for second-year medical students to compensate for their lack of practical anatomy teaching due to Covid-19. Student partners have suggested establishing a mentorship scheme to support new medical students who are likely to have an atypical anatomy learning experience in the immediate post-Covid-19 era, which will help to develop their own professional development skills as well as engaging them with strategies to foster their own resilience behaviors (Badiali and Titus, 2010; Dickman and Schuster, 2020), reflective practice skills (Parsons and Stephenson, 2005) and emotional development (Hill et al., 2021). Although there is already some evidence demonstrating that peer-assisted pastoral support can be effective online (McGarrah Sharp and Morris, 2014) through partnership approaches (Hill et al., 2021), this is an important area worthy of further exploration in anatomy, especially since the growing of staff-student partnership communities has been difficult to achieve in other disciplines (Marquis et al., 2019).

DISCUSSION

Student partnership models and the process of content co-creation are not new in higher education, but there is a tendency for these types of activities to become diluted over time or revert back to tokenistic engagement, or to basic student representation (Peters and Mathias, 2018). The current context makes a strong case for up scaling genuine partnership communities in anatomy education to maintain engagement, since many examples currently only operate as small-scale initiatives (Mercer-Mapstone and Bovill, 2020). This proposition is not only fully in line with the United Kingdom perspective advocated by Advance HE but is also reflected in the international literature (Mercer-Mapstone et al., 2018). It is suggested that the partnership approach is most effective when there is a genuine need for innovative solutions to solve rapidly evolving problems (Healey and Healey, 2018). It makes sense that our students can become advisors and decision makers, working alongside us in such times as members of our institution rather than just educational consumers. However, a conscious "buy in" from many institutions is still warranted (Bovil, 2017; Holen et al., 2020).

The current evidence suggests that students will feel a strong sense of satisfaction and empowerment if their ideas and resources are used in formal curriculum teaching approaches (Peters and Mathias, 2018; Holen et al., 2020). However, to maximize the benefits of this model requires a genuine partnership to exist between students and staff (Border, 2017; Peters and Mathias, 2018). For this to work it will require a shift in hierarchical values for some institutions, where the majority of relationships between staff and students are formal and entrenched identities remain that echo neoliberal values (Mercer-Mapstone et al., 2018). The authors suggest that the pursuit for anatomists should be to stop thinking of staff and students in terms of their identities and to value their ideas and experiences to enable unique insight and benefits to projects and initiatives (Healey and Healey, 2018). However, an extensive systematic review on the topic indicates that partnership examples are, far too often, only extracurricular in nature and lack the reciprocity or inclusivity potential to create a true community of practice (Mercer-Mapstone et al., 2017; Matthews et al., 2019); a facet which is often attributed to regular F2F contact, but is not impossible to achieve online (Moule, 2006).

More recently there has been discussion of how approaches to anatomy education align to the framework, Universal Design for Learning (UDL) Particularly in terms of the incorporation of scholarship (Balta et al., 2019). Essentially this framework is about accessibility by providing multi-model resources that provide students with the flexibility to succeed that represent the needs of diversified cohorts (Mercer-Mapstone and Bovill, 2020). By adopting a co-produced strategy to online learning, many of the UDL guidelines are supported through the practices described in this article. The partnership model encourages the production of "multiple means of representation" and fits with the ideals of "multiple means of engagement." Therefore, it is clear that with the right approach, students can help us customize the display of information on anatomy modules' virtual learning environments (Fig. 2) and contribute to a range of more accessible learning opportunities, which reduces barriers in instruction (Dalton, 2017).

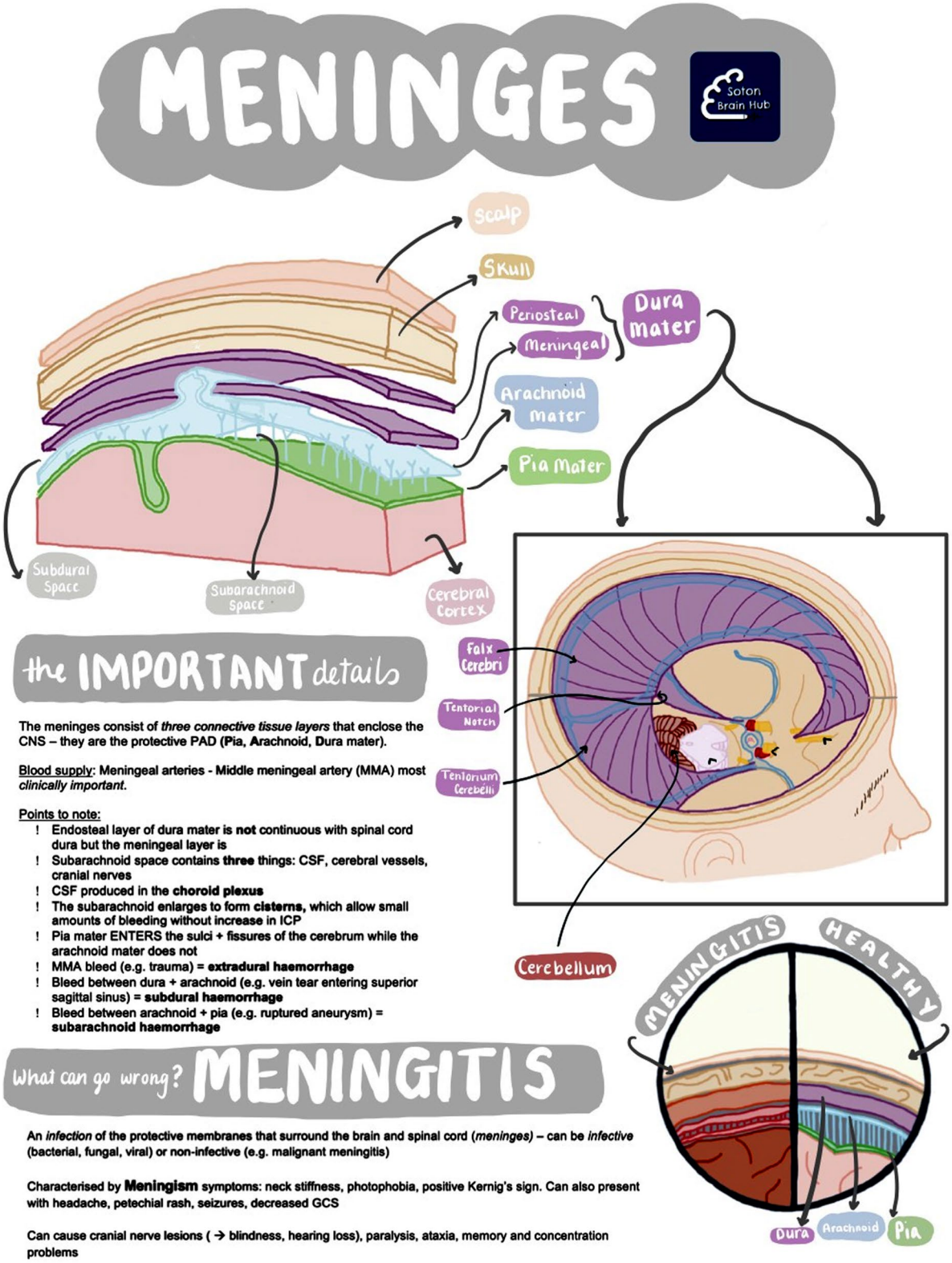

Figure 2.

Integrated clinical notes using Adobe Creative Cloud software. A senior medical student's condensed notes on the meninges available on Soton Brain Hub and used within the e-Booklet module resource. CSF, cerebrospinal fluid; CNS, central nervous system, GCS, Glasgow Coma Score; ICP, intracranial pressure; MMA, middle meningeal artery; PAD, pia, arachnoid, dura mater.

Limitations of the Study

This viewpoint provides a conceptual model for partnership in teaching and learning. Although it implies that the current educational territory is suitable for a partnership approach it does not discuss the specific circumstances or occasions where this approach is not appropriate. Nor does it discuss the tensions and challenges that can sometimes exist and how to address them. There is evidence of skepticism, especially when it comes to giving students more control (Murphy et al., 2017). Furthermore, there may also be examples of cognitive dissonance within this practice, because at its heart partnership work relies mostly on a creative process and is not about achieving specific quantifiable outputs. In some instances, this may be at odds with an institutions' key driver to measure success (Bovil et al., 2016; Healey and Healey, 2018).

CONCLUSION

Undertaking genuine student partnership that goes beyond the more basic interpretation of student engagement is clearly an untidy exercise where no single approach will work in all cases. But, at a time when the UK higher education sector is likely to evolve faster than it has ever done before, the essential framework for enhancing student success through partnership may well have a set of core values that are very appropriate and suitable to take on journey. With a partnership-led model for engagement, it might be possible to find solutions to many of the aspects and challenges of our new way of working, because it is very likely that anatomists will continue some of the practices forced upon them during the pandemic. The evolution of blended learning paradigms beyond the present circumstances is likely to provide additional benefits if they can embrace a student partnership and co-creation philosophy. By doing so, this will empower students to engage deeply, engendering a sense of belonging to anatomy (especially in difficult areas such as neuroanatomy) and demonstrate an ability to embrace new learning spaces for dialogue and enquiry in a post-Covid-19-world.

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