

An Exploration of Anatomists' Views toward the Use of Body Painting in Anatomical and Medical Education: An International Study

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Previous research has explored the experiences of medical students using body painting as a learning tool. However, to date, faculty experiences and views have not been explored. This international qualitative study utilized a grounded theory approach with data collection through interviews with academics and clinicians who utilized body painting as part of their anatomical teaching. Twenty-six anatomists participated in the study from 14 centers worldwide. Three themes emerged from the data: (1) the efficacy of body painting, (2) the promotion of knowledge retention and recall, (3) considerations and practicalities regarding the use of body painting as a teaching tool. Subthemes show that body painting is used as an adjunct to the curriculum for teaching surface anatomy and peer examination. Benefits included diffusing the formal curricula, high student engagement and learning for future clinical practice. Body painting was advocated for promoting knowledge retention and recall, particularly learning through the process of cognitive load due to combining the use of color and kinesthetic learning with anatomical theory. Critical discussions surfaced on the topic of undressing in the classroom due to cultural and personal considerations possibly leading to unequal involvement and different learning experiences. Overall results support previous research showing that anatomists appreciate body painting as an effective, enjoyable, engaging and cost efficient adjunct to the multimodal anatomy curriculum. The role of cognitive load theory in learning anatomy through body painting emerged from the data as a possible theoretical framework supporting learning benefits from body painting and is suggested for further investigation. *Anat Sci Educ* 00: 000–000. © 2017 American Association of Anatomists.

Key words: gross anatomy education; medical education; medical students; body paint; art; surface anatomy

INTRODUCTION

Anatomy teaching in the modern medical curriculum is characterized by a multimodal approach in an integrated and regions based anatomy syllabus (Estai and Bunt, 2016). As with every subject also the teaching of anatomy is adapting to the needs of time and available resources (Heylings, 2002;

Drake et al., 2009; Regan de Bere and Petersen, 2012). One example of change in the culture of anatomical sciences education is the moving away from system based anatomy to a regional one (Drake et al., 2009; Estai and Bunt, 2016). Anatomy taught by a systems approach was traditionally carried out, and supported by whole body dissection. This teaching approach is not coherent anymore with the modern integrated and regional approach to anatomy teaching. It is well documented that the traditional anatomy laboratory in the United Kingdom has undergone a metamorphosis of its focus in recent years. Brought on by a reduction of time allocated to anatomy, a decline of trained faculty and a crisis in resources (Heylings, 2002; Raftery, 2007), higher education institutes in the United Kingdom have tried to adapt to these changes by eliminating dissection, and in some cases even moving away from integrating human specimens in the medical curriculum altogether (McLachlan and Regan De Bere,

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2004; Finn, 2015). This called for novel approaches to anatomical sciences education and lead to the emergence of innovative teaching techniques. Next to the use of pro-section complemented plastic models, ultrasound (Tshibwabwa and Groves, 2005; Finn et al., 2012, Griksaitis et al., 2012) and virtual teaching devices (Donnelly et al., 2009) one possible teaching modality that has seen a rise in medical schools and other health care related courses worldwide is learning and teaching anatomy through body painting and drawing sessions (Op Den Akker et al., 2002; McMenamin, 2008; Finn, 2010, 2015; Finn and McLachlan, 2010; Nanjundaiah and Chowdapurkar, 2012; Jariyapong et al., 2016). In anatomical education its process comprises the illustration of internal organs and structures onto the surface of the body in order to create a visual portrayal of anatomical detail (Op Den Akker et al., 2002).

Body painting is not a new technique, having been used by different cultures for centuries as a form of collective identity and in ritualized activities (Camphausen, 1997). Art and anatomy have complemented each other for generations and arguably began with a somewhat symbiotic relationship (Petherbridge, 1998; Finn, 2015). Most famously Leonardo Da Vinci's collaboration of scientific and artistic genius, depicted by anatomical drawings compelled anatomists to discover the detail and depth of the body (Kemp and Wallace, 2000). Similarly art of the Renaissance was heavily influenced by anatomy, whereby drawings of dissection immortalized new discoveries in science (Petherbridge, 1998). Texts featuring naturalistic forms of artistic interpretation through drawings and diagrams, still to this day complement anatomical education by providing an adjunct to dissection and a resource for learning (Petherbridge, 1998).

Body painting utilized in the setting of higher education is not a technique to replace dissection, it should rather be seen as an additional method to bridge a gap in resources (Sugand et al., 2010). Its concept is heavily based on kinesthetic learning rather than artistic precision or ability (Finn and McLachlan, 2010; Finn, 2015).

Research has shown that the enjoyable and multisensory experience promotes knowledge retention (Finn and McLachlan, 2010; Azer, 2011) and aids the integration of anatomy and clinical skills (McMenamin, 2008). Body painting can for example be integrated in living anatomy classes teaching students clinically relevant surface anatomy crucial for palpation and imaging techniques such as ultrasound (Tshibwabwa and Groves, 2005; Estai and Bunt, 2016). Its method relies on student engagement combining the practical nature of the task, guided by comprehensive instructions, with peer examination and staff guidance (Finn, 2010). This experience has shown to increase confidence in students for peer physical examination and prepares them for future clinical practice (McMenamin, 2008; Finn and McLachlan, 2010).

The current evidence base on the efficacy of body painting is limited. Published journal articles on body painting in an anatomy curriculum have so far focused on the student experience and performance. The aim of this unique qualitative study was to investigate the integration of body painting in teaching from the anatomists' point of view.

METHODS

Ethical approval was granted for this study by the ethics committee of the School of Medicine, Pharmacy and Health at Durham University in Durham, North East England.

Table 1.

Participant Demographics and Geography

Description	N (%)
Participants	
Total	26 (100)
Female	11 (42.3)
Male	15 (57.7)
Academic position	
Demonstrator/Doctor on academic rotation	3 (11.5)
Lecturer/Teaching fellow	6 (23.1)
Senior lecturer/Senior teaching fellow	8 (30.8)
Professor	9 (34.6)
Country of employment	
Ireland	1 (7.1)
United Kingdom	8 (57.1)
United States	3 (21.4)
Australia	1 (7.1)
Brazil	1 (7.1)

Purposive sampling, where the researchers actively select the most productive sample to answer the research question, was used to initially identify anatomists who were either involved in or aware of the use of body painting in medical education (Marshall, 1996). Participants were approached by email, were given information sheets and signed consent forms. Participants aided recruitment through the process of snowball sampling, whereby where existing participants suggest or recruit future participants from their colleagues or acquaintances, enabling the identification of further anatomists (Marshall, 1996). Recruitment proceeded until the point of thematic saturation, which was confidently reached after 26 interviews. It was made clear to participants that they were free to withdraw from the study at any point without any negative consequences. Participants were able to review transcripts before analysis at their request.

A total of 26 anatomists participated in the study from 14 centers worldwide. Participants were recruited from a range of educational backgrounds and levels of training (Table 1).

Data were collected throughout a series of semi-structured interviews conducted by two authors (G.M.F and N.E.C) between 2014 and 2016. Interview questions were based on a pre-defined framework (Table 2), which was validated during a pilot interview prior to data collection (Creswell, 2007; Merriam, 2009). The semi-structured approach allowed participants to freely discuss body painting but with some probing surrounding key issues pertinent to the research question. Participants were given choice of timing, source and location of interview in accordance with their convenience.

Table 2.

Interview Framework

Interview stems
<ul style="list-style-type: none">• Do you think body painting is an acceptable teaching modality?• Does your institution use body painting?• Why/why not?• What is it appropriate for teaching?• How frequently is body painting used?• Can you provide examples of use?• What is your motivation for use of body painting?
<ul style="list-style-type: none">• What are the pros and cons of body painting?• What are the potential barriers?• Are there any cultural issues or other considerations that need to be made when using body painting?
<ul style="list-style-type: none">• Do you think body painting can be used within clinical skills and peer examination?
For those who do not utilize body painting:
<ul style="list-style-type: none">• What is your knowledge of body painting and its use?• Does its use interest you?• What factors have influenced your decision not to use it?

Participants were given preference to interviews being conducted face-to-face, over the phone or using video conferencing. All interviews were digitally recorded and later transcribed verbatim by administrators within the department.

Authors were the only people able to link transcripts with participants. Transcripts were stored as electronic documents on a password protected computer in a locked room (DPA, 2005). All printed transcripts were safely destroyed after use (DPA, 2005). Data encryption prevented unauthorized access to documents. All personal data were treated as confidential and not transferred to other sources (DPA, 2005).

Grounded theory (GT) was used as both a methodology and a paradigm (Charmaz, 2006; Corbin and Strauss, 2014). GT is utilized by researchers to create a theory which is “grounded within the data,” thus it is used widely in areas that are considered more exploratory or discovery-oriented. GT and the use of semi-structured interviews enabled an exploratory stance to this study of views on the use of body painting within anatomy education. Utilizing GT enabled authors to move beyond a simple thematic analysis, in order to consider the relationship between themes within the data and subsequently build a theoretical framework (see Fig. 1). In line with GT methodology, open, axial and selective coding were performed (Corbin and Strauss, 2014). Open coding refers to the process of generating initial themes from data. Axial coding is the development and linking of themes. Finally, selective coding formalizes the relationship between themes and the formation of a theoretical framework, thus a theory is generated (Strauss and Corbin, 1998). Analysis was

an evolving process which began at the first interview and continued throughout data collection in iterative cycles (Corbin and Strauss, 2014) with constant comparison of transcripts. Data were analyzed by the authors. For reliability this process was done separately (Corbin and Strauss, 2014) before discussion and negotiation. Authors discussed their presuppositions in order to be reflexive. The most prominent codes were chosen as major themes (Merriam, 2009). Data were then reviewed to comprehend the relationships between the major themes and subthemes (Merriam, 2009). This phase of axial coding refined data and aimed specifically to provide insight into explaining themes grounded in the data, by interpreting and reflecting upon their meaning (DPA, 2005; Kuper et al., 2008; Merriam, 2009; Corbin and Strauss, 2014).

Subthemes from the axial coding phase were identified and organized into a coding paradigm (Creswell, 2007). Hypotheses were then generated to interlink original categories using selective coding (Creswell, 2007; Merriam 2009). Theory grounded in the data was therefore expressed and used to provide new insight into the value of body painting.

RESULTS

A number of themes emerged from the data; this article describes the results most pertinent to those considering the use of body painting as an adjunct to their anatomy curriculum and are reported below. Body painting was discussed in terms of its efficacy, the context of it being a tool for teaching surface anatomy within peer examination, as a modality through use of which retention of knowledge can improve based upon underpinning cognitive load theory, and its practicality. Three major themes (1) efficacy, (2) promoting retention and recall, and (3) considerations and practicalities are presented, along with their relevant sub-themes (see Fig. 2).

The Efficacy of Body Painting

The most prominent theme to arise from the data described the efficacy of body painting as a teaching and learning modality in anatomical education.

Appropriate use as a tool for learning surface anatomy. All participants recognized body painting to be primarily used in the teaching of surface anatomy and deemed it best used for such activity. Recognition of the need for adequate surface anatomy teaching in the syllabus was often explained. Body painting was highlighted to be a successful teaching technique on the whole but recognition of its appropriate use was stressed. “*It is useful for learning to do a clinical exam, surface anatomy, you know rib counting, you know learning clinical skills, that’s an advantage;*” “*it’s useful as a technique to teach surface anatomy, it can be useful, I have used it myself...Very recently we’ve set up separate practicals which have allowed us to explore surface anatomy and use different techniques for it; body painting being one of those and I’ve used body painting, students really enjoy it;*” or “*I think students like the novelty but we should be careful with novelty, I think it has to serve a purpose but yeah I enjoy it. I don’t think it is one size fits all with body painting but given the right topic and the right areas I think it serves a really good purpose. I can’t think of a better way of teaching triangles of the neck. You need to choose body painting for the right reasons and for the right type of learning, that’s what we need to worry about.*”

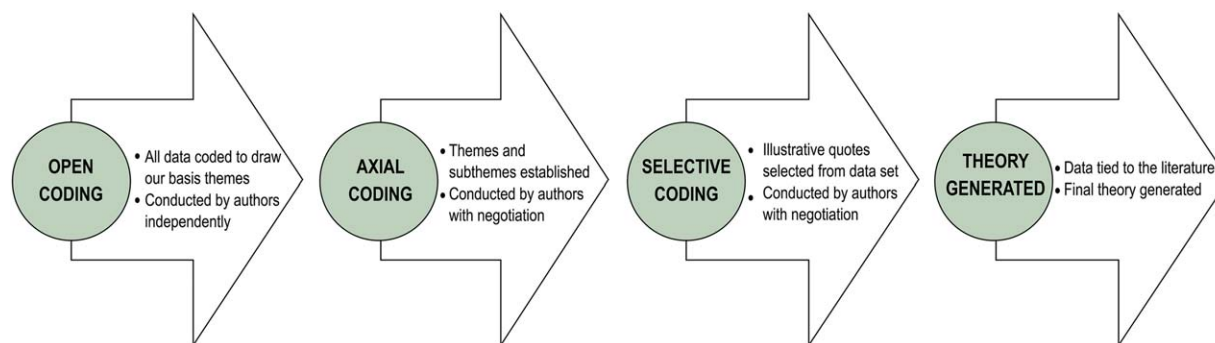


Figure 1.

The coding process for grounded theory.

A tool for bridging the theory: Practice gap. Participants advocated the use of body painting as a useful tool for bridging the gap between anatomical theory and clinical practice. *“I think it’s one of those sessions that is in-between the two [gross anatomy and clinical skills]. So I think it’s not pure hard core anatomy and it’s not hard core clinical skills. . . so it’s that kind of bridging concept between the two? So it’s kind of applying, you can’t learn that without a learning a bit [of anatomy], there are, you need to know there are four valves in the heart before you make sense to go and draw four splodges on somebody’s chest. So it’s that kind of bridging session, that’s how I see it;”*

“I mean for some students, yes it kind of makes sense, everything falls into place. . . some students still find it hard to get the anatomy concept and make the link to practice, I think painting helps but not for everything.”

Similarly, body painting was thought to be best used during holistic sessions which included other focuses of study, aimed at illustrating a specific learning outcome through a range of modalities. These included studying clinical examination, osteology and imaging. Body painting was regarded to be an example of living anatomy which gave depth and understanding to clinically relevant anatomy that was deemed essential for doctors in training. *“So I think it’s not pure hard core anatomy and it’s not hard core clinical skills where you’re examining somebody who’s a simulated patient, so it’s that kind of bridging concept between the two? . . . It’s applying anatomy”; “It’s a common criticism of teaching anatomy with cadaveric material that it desensitizes students, you know they get used to dead bodies and that probably not a good thing for a health care practitioner. It’s better to be familiar with the living body”; or “Most of our students when they qualify will not probably be interventionalists so they will be investigating the body from the outside. So they have to know the living body.”*

Body painting as an adjunct. Participants made it clear that body painting was an adjunct to the anatomy course and could never be used as a sole teaching method. Body painting must be used appropriately and for the right reasons. It was agreed that cadavers were essential to the study of medical anatomy and new techniques such as body painting were best used in conjunction with dissection room activities. *“I think you can have an impression of what’s underneath the skin but I don’t think you could teach any detailed anatomy without removing the skin. I’d be a powerful advocate of cadaveric anatomy.”*

Diffusing the formal curriculum. Body painting provided a new approach to anatomical learning and captured the interest of students by “relieving the tedium in an information rich syllabus”. This was thought to diffuse the formal anatomical curriculum by providing a fun activity, focused on student autonomy, which was enjoyed by most partakers. The high engagement during sessions was recognized by most participants and represented a major commendation of the

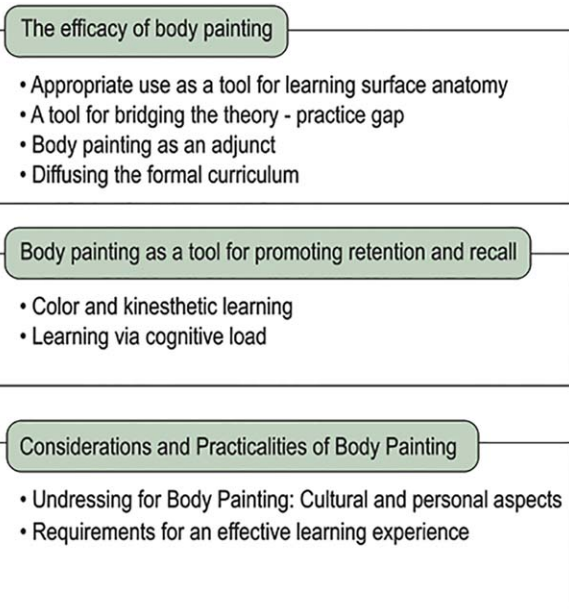


Figure 2.

The three main themes with subthemes.

modality. The identification of students smiling and engaging in the modality was often expressed. *“I think it’s fun; it’s a fun way of learning anatomy without having to be stressed;”* *“Whether you’re doing it or being painted on, you know students are more fully engaged; compare that with a lecture for instance, when I feel I’m doing well if 10% of the audience is with me. You know I think engagement levels are, for teaching sessions, they’re high;”* or *“There was a great deal of smiling going on in the lab and this was pretty new in my experience of anatomy teaching. I knew this was something that was well received and I could see the educational value.”*

Body Painting as a Tool for Promoting Retention and Recall

The perception that body painting increased memory retention and recall was discussed. Participants believed this to be associated with different aspects of the modality, however all with the end beneficial result. *“Body painting is a method of teaching in which anatomical organs or structures are illustrated on the surface of the body. As a means of increasing people’s memory retention on the knowledge of a structure.”*

Color and kinesthetic learning. A combination of the active nature of painting promoting kinesthetic learning, coupled with the use of colors and pattern recognition, were suggested to be promoting learning and more significantly, retention. *“We talk through what we are doing, they are handling the paints and brushes and they are listening and seeing. They are hearing but they are also touching and I felt that it was all quite powerful.”*

Learning and cognitive load. Participants identified that students often didn’t know they were learning and were surprised at their level of knowledge after sessions. This theme generated one of the stronger theoretical underpinnings of the results, learning through the process of cognitive load. *“The whole process is engaging different sets of areas in the brain. So color versus black and white, texture versus, you know the visual image- all of these go to different parts of the brain and the evidence is clear that information stored in multiple ways is more easily recalled than information stored in one way. There is also a cognitive load theory, and what that says, cognitive load theory says that you can only handle limited bits of new information at any one time. It seems to involve independent channels so if you are handling something at the same time as hearing about it, you can deal with a total of more bits of information because it’s processed by different routes. You can get up to a maximum of 12 different routes, body painting is a bit like that, and you know engaging different routes;”* *“I bumped into a student after an exam who was quite amazed by how much he knew and something he was particularly delighted about was the C5 distribution over the shoulder. He said I didn’t learn that, the only time we did that was when we did that body painting’, it was as if he’d picked it up by osmosis;”* *“You are teaching by stealth you know, often they don’t realize they’re learning;”* or *“For me it’s the way it promotes learning, it taps into everything and helps the student build the knowledge base they need to cement everything on. Sensory learning, application, acquisition, you know, the whole lot.”*

Considerations and Practicalities of Body Painting

Participants were asked about advantages and disadvantages of body painting. A major sub-theme that evolved was cultural and personal aspects influencing the use of body painting as a teaching tool. A discussion evolved on undressing in the classroom and its influence on the student learning experience. Both negative and positive aspects have shone through of which both are presented in this section.

Other points that were highlighted were practical aspects such as the need for sufficient time investment, creation of a positive learning environment, and on the positive side the low expenditures and high student engagement.

Undressing for body painting: Cultural and personal aspects. Skepticisms toward body painting in a classroom setting mostly concerned the necessity of undressing for body painting. Students are not necessarily equally involved during teaching sessions due to cultural, social and religious barriers concerning body image, nudity, gender, and embarrassment. *“Some students really struggle, people have cultural and psychological issues about undressing. Think about students from different ethnic backgrounds or students with eating disorders or disfiguring scars;”* *“I only saw what some of the group was doing as most were curtained off and didn’t want me going around looking at them as it would have been inappropriate;”* *“It’s mostly blokes that like to take their tops off.”*

The component of embarrassment through undressing can lead to unequal involvement in body painting sessions and hence to very different learning outcomes and experiences for students. However on the other hand, presuming students engage with the class, the interviewed anatomists have found this aspect of embarrassment to have positive components as well. Some of these being the preparation for dealing with challenging situations and creating empathy in future clinical practice. *“There is that element of embarrassment about the human body. I think staff feel that too. So that kind of prudeness [sic] that says ‘this is something which is taboo’ is disastrous for the actual practice of medicine and therefore something we wanted to help overcome. Body painting teaches students skills to cope with embarrassment so they build up a script to deal with challenging situations in future practice;”* *“They learn what it feels like to undress in front of another which is off-putting and to be put in that position will create empathy. Having this experience before they see patients is important;”* or *“With body painting nudity isn’t a hang-up, stripping off to teach anatomy is the norm, painting around the breast is the same as the hand. It’s a really good message to give to doctors as you don’t want them entering practice and being scared of examining patients. I think I have more hang-ups about exposing a patient than the current batch of students.”*

Requirements for an effective learning experience. Practical aspects that should be considered when carrying out anatomy body painting sessions were mentioned by participants as well. Barriers were most notably the previously mentioned need for student engagement in class, as well as time constraints and creating a suitable environment. Body painting can be messy and has to be carried out in a safe and warm environment where students feel comfortable to undress. When considering to carry out body painting sessions time is a key element in creating an effective learning moment. Some participants described high staff: student

ratios as being a negative aspect of facilitating body painting sessions, however, described utilizing voluntary staff to increase the workforce. *“The time given to anatomy is shrinking and logistically it’s time consuming- you have to make sure it’s effective. By not having enough time you can lose the value of body painting”*; *“You need to design a space that will work well, having the right environment is important”*; or *“You need a number of facilitators. Yeah I mean we have pretty good staff, you know we get a lot of, we’ve got permanent staff but we’ve got a lot of core medical trainees who come in on a voluntary basis and they actually bump the numbers up. I mean they’re not desperately reliable but when they’re there and we had sessions last term where the staff student ratio was one to four.”*

Positive aspects that were highlighted were high acceptability and positive feedback from students as well as body painting being an economical teaching tool. *“Collective costs of running are low”*; *“The acceptability of peer examination was much higher than we had anticipated and we were very pleased about that”*; or *“We have discovered more and more of what body painting can do and have had many years of positive student evaluation.”*

Interestingly the differentiation between art and body painting was classified under its appropriate use. It was considered important to empower students’ participation by stressing that works of art during sessions were not expected and that everyone was able to contribute. High verisimilitude between paintings and anatomy were not regarded as being a necessity for a positive learning experience. *“There is a difference between art and body painting, we are drawing lines here and painting in between, we aren’t training these people to become artists. I mean by the time they are 18, you know, if you can’t color in between the lines, what are you doing?”*

DISCUSSION

The suggestion of change in anatomical education is not a new concept (Regan de Bere and Petersen, 2012). It is well documented that a lack of cadavers, resources and curriculum time constraints has led a drive toward the inclusion of new modalities complementing traditional approaches to anatomy (Heylings, 2002; Finn, 2015). Anatomy education has been scrutinized in an attempt to make teaching relevant to the modern day practice of medicine and concentrating on the holistic approach of clinical practice; teaching students how to be physicians rather than concentrating on the complex structural science of the human body (Sugand et al., 2010).

Research has shown that body painting provides a modality that combines principles of traditional anatomy, teaching students predominantly surface landmarks, with more clinically relevant anatomy, such as clinical examination and interaction (Finn and McLachlan, 2010). Importantly it is documented that body painting should never be a sole modality for anatomical education, rather an adjunct, which used appropriately can have powerful effects on student learning (Sugand et al., 2010).

Body painting develops the older modality of line drawing, which has been used in anatomical education for several decades, by including color, depth and structure to the technique (Camphausen, 1997). Through the study some anatomists perceived line drawing to hold as much value as body painting and be more appealing due to its shorter time demand and less mess. In light of unremarkable results

yielded from quantitative studies aiming to demonstrate the impact of color on learning, anatomists still hold skeptical views regarding the benefits of body painting over line drawing (McMenamin, 2008). Cody (1995) advocates body painting as it provides clarity and vividness to anatomical structures.

The results of this study contradict such quantitative evidence and agree with authors who suggest that body painting, despite results, increases memory retention and information recall (Camphausen, 1997). This study suggests that the perceived ability of body painting to enhance learning is due to its multifactorial approach, which has been linked to efficient use of cognitive load, discussed subsequently.

Surface Anatomy and Body Painting

Surface anatomy is well documented as being an essential component of anatomical study (McLachlan and Regan De Bere, 2004; Finn, 2010; Standring, 2012; Azer, 2013). Over the last decade, body painting has been advocated as a tool for teaching surface anatomy within an integrated curriculum (Op Den Akker et al., 2002; McMenamin, 2008; Finn, 2010; Finn and McLachlan, 2010; Azer, 2013) and, as a mechanism for introducing students to peer examination (Finn, 2010; Finn and McLachlan, 2010; Azer, 2013). Additionally, surface anatomy has been utilized as a mechanism for aiding the development of communication skills and professionalism (Boon et al., 2002; Collett et al., 2009; Chou et al., 2010; Finn and McLachlan, 2010; Azer, 2013; Lachman and Pawlina, 2016). Within the data, participants made reference to the recent prominence of surface anatomy within gross anatomy curricula. Participants identified the need to make anatomy relevant for students as they move toward becoming practitioners who will deal mostly with the surface of the body when in clinical practice.

Surface anatomy and its associated clinical facets are often taught through body painting, whereby students illustrate internal structures onto the surface of the skin, building up a visual picture of what lies beneath in order to enhance learning (McLachlan and Regan De Bere, 2004). Body painting can be used to teach surface landmarks, positions of major organs (Op Den Akker et al., 2002; McMenamin, 2008) and clinical skills (Camphausen, 1997) as well as more complex concepts such as referred pain (Finn, 2015).

Interpersonal Learning through Body Painting

Peer examination. Surface anatomy often features in sessions which integrate gross anatomy and clinical examination, typically such sessions include peer examination. In clinical skills courses, anatomy underpins the development and retention of clinical knowledge and skills (Dangerfield et al., 2000). Peer examination typically includes high levels of application and recall of surface anatomy knowledge. Peer examination has become an increasingly popular method in medical education and in the creation of patient-centered doctors (Lempp and Seale, 2004; Finn and McLachlan, 2010). Traditionally peer examination scenarios mimic clinical encounters, offering students a method of education in which they can rehearse their future role as a doctor; this holds high face validity for students and is educationally important (Lempp and Seale, 2004; Finn and McLachlan,

2010). The opportunity provided in a typical body painting scenario is thought to hold a slightly different approach, whereby the typical doctor-patient role is not required however is alluded to. Instead this unique scenario requires a student to offer themselves as a volunteer with no direct role to hide behind providing a realistic and stimulating situation, whereby skills can be practiced and real empathy can develop (McMenamin, 2008).

Building empathy. Due to the embarrassing nature of partial undressing, body painting and any subsequent examination facilitates the student taking on the role of the patient. It is this scenario that participants describe as contributing to the development of empathy. Within the sessions students take part in realistic encounters, which evoke them to act in a professional manner and provide contextual learning by introducing them to the mindset of a doctor within clinical practice. Collett et al. (2009) report similar findings with the use of life models in teaching, their use aided in the development of professionalism and communication. Similarly, Lachman and Pawlina (2006) have identified the need to develop reflective practice and professionalism with integrated anatomy curricula. The present findings tap into the discussion on the influence of cultural and personal circumstances in the successful conduction of body painting sessions. Body painting for anatomy teaching requires bare skin to be painted on. This can be problematic in circumstances or cultures where undressing is frowned upon or is outside of the students' comfort zone. The results present two views, one sees body painting as a possible hindrance to learning due to the lack or discrepancy of involvement in body painting sessions, the other sees it as an advantage for later clinical practice as it stimulates dealing with difficult situations and as previously mentioned helps to form empathy in working with fellow students and later patients. Dealing with embarrassing situations is a challenge and is something which is rarely covered or practiced throughout medical school; having the opportunity for practicing and reflecting upon such situations as a junior student is suggested in this study to improve patient centered care and help students in preparation for practice.

The benefit for future clinical practice as expressed by anatomists in this current study is supporting previous findings when students were asked on the same topic (Finn and McLachlan, 2010). To carry out body painting sessions and have students engaged although it encourages undressing in the classroom is possible in our culture since students who do not feel up to it for whatever reasons can still participate by, for example, painting or providing instructions and feedback (Finn, 2010). In more eastern countries the necessity to undress can prohibit body painting altogether and therefore accounts for very little publications and hence assumable less usage of body painting. The few publications from countries like India, Thailand and Syria focus on painting or drawing body parts that are readily available without undressing such as the hands, neck and face (Nanjundaiah and Chowdapurkar, 2012; Jariyapong et al., 2016), or in the example of the study conducted in Syria by Alsaïd and Bertrand (2016) painting was done on paper. The difficulty to use body painting as an adjunct to anatomy teaching might explain the focus of publications and anatomists in more western countries where exposing bare skin is accepted. More publications and views of anatomists from Asia, Indonesia, South America, or African countries would be very welcome.

Bridging the theory-practice gap. Looking at the role of body painting in teaching surface anatomy, introducing peer

examination, learning about empathy, as well as building experience in dealing with difficult situations all lead to interpersonal learning and to the students' application of theory and preparation for working with patients and colleagues in clinical practice. These are important and help allude to the students new role of creating a competent practitioner (Collett and McLachlan, 2005). Moxham and Plaisant (2007) reported students' views on the importance of anatomy for clinical practice which is confirmed from the anatomists' point of view in this present study. Body painting has surfaced as a tool for bridging the gap between theory and practice and is therefore supportive of a curriculum moving away from hard-core sciences to a more clinically integrated approach as seen in many medical schools (Brauer and Ferguson, 2015).

Cognitive Load Theory and Body Painting

Cognitive load theory has become one of the world's most important concepts concerning instructional design (Sweller et al., 2011). Its ability to provide a highly effective framework for the design of educational material facilitates and encourages learning (Sweller et al., 2011). Design of effective instructional material, making efficient use of cognitive load, is thought to optimize intellectual performance (Sweller et al., 2011).

Cognitive load directly relates to working memory, dividing this facet into three components: intrinsic, exogenous and germane load (Sweller et al., 2011). These three components are separate but additive, and combined generate the total cognitive load needed to be processed by working memory (Plass et al., 2010). Information must be processed by working memory to be stored in long term memory and be classed as learnt (Plass et al., 2010). Intrinsic load relates to the processing of information in the brain, and although varied in different people, cannot be influenced by instructional design; exogenous load relates to the form information to be processed is presented and therefore can be modified (Plass et al., 2010). Germane load relates to the production of schemas by the brain in order to facilitate the processing of information (Sweller et al., 2011). Reducing exogenous and germane loads therefore reduced total cognitive load and facilitates learning through reducing working memory load (Sweller et al., 2011).

Information presented in pure text is considered to carry a high exogenous load and is hard to process by working memory (Sweller et al., 2011). Adding a diagram to such text, reduced exogenous load by storing some information on the paper, overall cognitive load is reduced and information is more efficiently processed by working memory (Sweller et al., 2011). Body painting has been shown by this study to take this concept a step further, by reducing exogenous load through relaying information to its student through a multi-faceted technique. Body painting deals with high elemental activity (Sweller et al., 2011): Students actively paint, read instructions, use touch perception and experience visual stimuli (Finn, 2015) when using this modality, processing information through several neurological pathways, and reducing exogenous load.

Germane load is similarly manipulated by the instructional design of body painting. Provision of comprehensive instructions, complemented by pictures, examples, and use of color, allow the systematic production of schemes which facilitate

learning (McMenamin, 2008; Finn et al., 2011). This orders the processing of information assisting the uptake of information and promoting memory retention.

Body painting therefore reduces cognitive load to minimum allowing information to be efficiently processed by working memory and stored long term, thereby increasing knowledge retention and information recall. This method optimizes intellectual performance in terms of surface anatomy teaching and in light of such results should be used with commendation. This highly effective way of learning is increasingly recommended in educational literature and with regards to body painting and its use is a major advantage.

Research similarly highlights that an enjoyable and fun environment stimulates learning (Finn and McLachlan, 2010). Body painting is renowned as a fun activity and its ability to “diffuse a formal curriculum” meets students and educators alike with enthusiasm and enjoyment throughout sessions (Finn, 2015). This positive environment increases engagement in teaching sessions and builds on its ability to optimize learning potential through efficient use of cognitive load by the further promotion of learning (Finn, 2015).

Body Painting and Its Place in the Anatomy Curriculum

Findings from this present study highlight the necessity of sufficient available time and access to locations that help create an environment suitable for painting, as well as helping students to feel at comfort. As also reported by Finn (2010), lack of these circumstances was deemed to counteract successful learning moments from body painting sessions. Low running costs have been mentioned as a positive aspect to utilizing body painting in the medical curriculum (Chapman et al., 2016). Results from studies exploring student experiences of body painting have interestingly been similarly represented in the results. Body painting is found to be a fun, enjoyable and interactive teaching experience (Finn and McLachlan, 2010). It challenges the rote learning approach of traditional anatomy classes and through this is found to provide a novel teaching experience (Finn and McLachlan, 2010). This aspect of the modality clearly contributes to its success as a teaching method.

Body painting is a form of living anatomy, and as an adjunct to traditional dissection, has been suggested in this study to provide a more realistic approach to the subject and allow students to experience a holistic view of the subject without being desensitized to death through the constant use of cadavers (McLachlan and Regan De Bere, 2004). Body painting utilizes living models who are able to maneuver and thus demonstrate functional anatomy (Bennett, 2014). Other methods such as the use of ultrasound and virtual anatomy tools similarly contribute to this cause and have created a field of anatomy (McLachlan and Regan De Bere, 2004), representing the task of the modern doctor.

This present study has presented findings from interviewing anatomists on their view of using body painting as a teaching tool. It is as such unique as previous studies focused on the student experience. The findings confirm previous results that body painting is a positively perceived and popular teaching tool. It highlights the relevance of utilizing body painting particularly for surface anatomy and is therefore a recommended tool for living anatomy sessions linking to the development of interpersonal skills and knowledge crucial for

future clinical practice. Cognitive load theory has emerged as an important model to support learning from body painting and opens up possibilities for future research.

Limitations of the Study

Due to the methodological framework, the main limitation of this study is subject to researcher bias and subjectivity. This may have influenced results and this must be accounted for in terms of accuracy of conclusions. The relatively large sample size could potentially have negated for some of this bias. The participant sample was international, however it mainly stemmed from western countries which may impact upon transferability of findings. Although academics interviewed had different ethnicities who taught multicultural groups of students, insight from, for example, Asian or African countries is lacking. Cultural and socioeconomic factors might be the reason for less usage of, and therefore lack of high quality publications on body painting from these countries.

CONCLUSIONS

In view of the results the following conclusions on the use of body painting in anatomy classes can be presented: (1) Body painting should be considered as a successful adjunct to anatomical education; (2) Body painting should be used appropriately for the teaching surface anatomy concepts; (3) Body painting should be used to bridge the gap between anatomy and clinical skills; (4) Body painting is a useful exercise within the context of peer examination; (5) Body painting assists in diffusing the formal learning environment; (6) The ability of this modality to contribute to students’ preparation for practice should be recognized by educators; and (7) Body painting appears to facilitate learning via the process of cognitive load. Dissection and the use of prosections remain the gold standard for teaching gross anatomy, however, modalities such as body painting are gaining increased prominence due to their ability to help contextualize surface and gross anatomy.

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