

**BODY PAINTING AS A USEFUL TECHNIQUE IN TEACHING ANATOMY FOR SCIENCES OF PHYSICAL ACTIVITY AND SPORTS STUDENTS**

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**Abstract:** Anatomical knowledge supports any approach to the knowledge on physical activities and sport activities. The present report is focused in a technic to improve the learning of surface anatomy through the body painting. We had considered many ways in which human anatomy could be taught in an updated way to sciences of physical activity and sport students. All strategies and didactic resources must optimize the overall the teaching processes. We tested several methodological techniques in anatomy teaching to several students. For this purpose, we used a route of practical session, where students painted their own bodies. For one semester, the first-year sport sciences students, enrolled in the Human Anatomy signature at the University of Cádiz participated in this study. To complete the teaching activity, students were divided into 2 groups with 40 students each. At the end of the course, the students were asked to complete a satisfaction questionnaire supplied to them such through an on-line platform. We included this activity in other anatomical students, as medical student, and we modified this experience according to the specific studies. No similar experiences were reported in these university students. On the basis of the results, we recommend the body painting activity as a useful tool for learning human anatomy.

**Keywords:** Anatomy teaching; body painting; learning teaching; sport and exercise activity.

**INTRODUCCIÓN**

Anatomy is a basic discipline for sciences of physical activity students which should understand the form and physiology of living bodies. Anatomy is not a dead discipline and that is the reason why we are looking for new strategies in which students can learn with real people like themselves. This is an argument defended by anatomists in recent years (1, 2). Anatomy is an interdisciplinary subject, influenced by many medical areas (3) and studied in many universities (4).

Anatomy is interpreted under different conception, for many considerations and even for several areas of the sciences (5). Anatomical knowledge supports basic medical practice (6, 7). But nursing and physiotherapy, artistic disciplines and exercise and sport activities are main areas, in which anatomical perspectives are essential for the development of their tasks (8, 9). Whether, anatomical concepts are essential in the physical examination of patients or the interpretation of diagnostic and surgical procedures (10, 11), these anatomical subjects become fundamental in the professionals which advise and work with the physical aspect of the whole body.

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Every knowledge area has a different interest in anatomical features. So, anatomical learning must be focused in the central aspects of the student interest (12). The holistic interest of medical student cannot be applied to sciences of physical activity and sports. The muscle-skeletal system needs to receive a special attention; beyond the basic understanding of muscles, but also to the specific areas related to precise articulated movement. This is integral particularly on surface anatomy, where the student must deduce the muscle implied, its location and contraction degree.

Nowadays, we have always questioned whether the level of knowledge acquired during anatomical training reaches acceptable levels. And this includes the opportunity of analyze methods (1, 6). The methodological revision needed to understand which activity has become obsolete or is fully accepted (3, 13). It would be more appropriate to disregard any pedagogical method, and prefer to modify some educational aspects. The careful choice of precise contents and the teaching strategies and didactic resources relevant to any explicit knowledge area is required. Docents must attempt to optimize the overall teaching-learning process (14).

At the University of Cádiz, the degree in Sciences of Physical Activity and Sport is a four years course. Particularly, human Anatomy runs for one semesters during the first year. The contents include: general morphology; muscle-skeletal system of trunk, upper and lower limbs; splanchnology, head and neuroanatomy. This subject was included after recent restructuring because of new curricula since 20011-2012.

The Anatomy course has been structured in theoretical lessons and practical sessions. The methodology of the practical lessons included practice with plastic and wax models, osteology, and videos and multimedia sessions. All these activities were designed to be carried out in small working groups. In addition to these core activities, we included as a new strategy the body painting (BP).

The BP took place during the two last academic year. It was carried out as part of the subject named Human Anatomy. This course comprises 48 hours of lectures for the whole student group of 80 students. For the practical classes students were divided into groups of approximately 20 alumni. At the end, each student received 24 hours of practical classes.

In this scenario, we designed a surface anatomy workshop, in which students worked through in pairs (15, 16). Each student adopted an active role, drawing on each other's bodies. With this role-play, our purpose is to investigate how we consolidate the acquired knowledge of the students, manipulating the structures on situ in the living body. Similar experiences were carried out in medical student in recent years (17, 18, 19). The excellent results encourage us to include this activity for other student, trying to improve the arsenal of teaching strategies. We expect that BP can enhance the study of reference key points for the physical activity and sport. No other similar teaching experiences had been reported of the students of sport and physical activity.

In an effort to integrate human anatomy, we must strive to provide our students with a better understanding of surface anatomy, which is essential in most branches of the anatomy interested sciences. It is an essential part for sciences of physical activity and sports student to learn skills that will be carried out in the analytical practice of movements (20, 21).

**Material and Methods**

80 first year students (60% females, 40% males) of Sport and physical activity, registered in the Human Anatomy subject at the University of Cádiz (Spain). All of them agreed to participate in the study. The practical session of BP took place at the end of the semester, once they had almost completed the theoretical knowledge of the subject program. Accordingly to docent organization, students were divided into 2 groups each of 40, regardless of gender. Every session lasted for two hours. Three members of staff who had been involved in the preparation of the general guidelines and protocols were present.

Students were previously informed about this workshop, being instructed to wear comfortable clothing that would allow them to carry out the experience. Table 1 shows the list of the structures to be drawn and the surface projections of the major muscle masses, bone protuberances and organs. These items were chosen by the teacher staff. The teachers guided the students, indicating key reference points, in order to reproduce the anatomical structures, detecting and correcting mistakes. Within each group of 38-41 students, they worked in pairs and the time allocated to the session -2 hours- allowed them to complete 8 drawing tasks. Every student served both as a painter and model, so they adopted both active and passive model roles. Given the peculiar

characteristics of this practical lesson, student with objections to nudity were offered the possibility of restricting painting to their limbs, back, neck and abdomen. Female participants could choose to wear two-piece swim wear.

Starting from drawings provided by the teachers, students drew the requested structures step by step using cheap and simple materials (non-toxic markers with washable ink). In general, students were able to draw reference points, selected anatomical structures.

Once this practical session had taken place, to evaluate the course, the students were asked to complete a questionnaire. This was a satisfaction questionnaire supplied to each participant through an on-line platform, Virtual Campus, offered by the University of Cádiz to its students, using free Moodle software. The formal subject Human Anatomy had virtual support on the internet by means of a course open exclusively to students registered in our subject.

The questionnaire developed for this course included 7 items (table 2). Respondents answered questions on a 5-point Likert scale, where 5= strongly agree and 1= strongly disagree. The questionnaire measured the level of importance conceded by each student to each item. The mean  $\pm$ SEM were calculated by using SPSS v.24.

### Results

During the sessions, teachers received an optimal perception of the activity. The practical lessons were carried out as designed. The students developed their roles according to the instructions. The teachers did not observed problems derived from nudity or non-adequate comments or attitudes.

Firstly, a surprising outcome was to be able to explore physically the main muscles and bone protuberances for the student. Students were amused to verify the correct position and distribution of the studied structures. During the drawing session, they were bewildered to discover their lack of real knowledge about reference, points and the concrete orientations of anatomical muscular sizes. This fact was widely observed when students were projecting the diaphragm, non-main muscles and inner organs. Other way, the main muscles and gross bone protuberances were easily interpreted by students. Often, the students asked the teachers for help to successfully complete all the requested items.

This experience could have been embarrassing for some of them and so we were prepared for this situation. Some students were reluctant to be painted by a partner. When this occurred, the embarrassment caused by partially undressing was avoided because they chose to be painted on their backs and/or necks. No one student rejected to participate in the practical lesson.

Item 1 analyzed the subjective value of this activity for the students. They considered this activity with a high value. Students returned a completed survey, which results are shown in Table 3. It is remarkable that the item most valued by students were the numbers 4 and 7. About the seventh item, the participants recommended this activity for classmates in future courses. None of the students selected the minimum value; only four students (4.81%) chose value 2 on the Likert scale and 45 participants gave the maximum value.

With regard to whether they would like to repeat the experience (item 2 and 3), there was a significant difference between carrying it out within the subject of anatomy (item 2 = 4.01) or in another subject (item 3= 3.71). This workshop cannot be assimilated by other disciplines. This type of activity is closely related to the anatomical content.

Items 4, 5 and 6 measured the value of such a practice for the students' perception of their anatomical knowledge. Students believed this activity helped them to identify erroneous concepts concerning anatomy. They considered that the activity measured their level of knowledge.

### Discussion

The experience described in this paper was a complementary proposal to other traditional teaching methods. Several authors reported similar experiences

in other sciences, mainly in medical teaching (15, 17). But, to the best of our knowledge, this is a novel teaching practice in these university students. Sport and physical activity student need a special approach to the human body.

The use of BP to assist student learning was proved as a positive educational experience. Its efficacy as an alternative tool has been evaluated (21). The introduction of BP in medical teaching was a powerful method in which we can include relevant anatomical concepts. As similar experiences, which used human models as the central tool (22).

Thanks to this experience we decided to include this surface anatomy workshops based on BP. The questionnaire results showed this was a positive experience. The educational value of the sessions was highlighted by the students. Our anatomy teaching model used the traditional methods, but also trying to integrate new strategies.

During the sessions we confirmed that a basic knowledge of anatomy was required to implement successfully the activity. Thus, the workshops were programmed at the end of the semester, when students had already received all the lectures and they completed the practical contents. In the workshop, many students asked the teachers for help to find correct anatomical positions and points of reference. Therefore, the teacher became a facilitator and a resource. But the students were responsible for their own learning, the main principle of student-centered learning (9, 23). BP enabled students to use the information contained in an illustration, going from a two-dimensional representation to a three-dimensional one.

Teaching surface anatomy was both useful and necessary for an increase of anatomical knowledge. Students gained a better perspective on the human body and a more adequate understanding of the structures. We started from basic knowledge to understand the movement of the body. We must ask ourselves if our tasks and teaching methods are the most suitable to make this happen. This search for strategies to improve results should be a constant in our educational approaches (14, 24).

BP teaching technique was reported as a highly valuable method of helping students improve their three-dimensional view of anatomical structures (6). This technique enabled students to establish the position of the main muscles, joints and bone protrusions which had previously been presented during the theoretical and practical lectures. In this sense, as Wilhelmsson et al. expressed "students create meaning in anatomy through visualization" (23).

Some of previous experiences reported them concerning the attitude of the student towards participating in them, because they found it embarrassing (19, 20). In our case, the result was surprising. Very few students expressed reluctance about being painted by a partner. In this case, the embarrassment caused by partially undressing was avoided because they chose to be painted on their backs and/or necks. To our purpose, the level of undressing was easily to achieve with no special conditions and taking care the respect to the participants.

Another aspect to value is the economic cost versus the efficiency in this kind of experiences. As our data shown, high scores in the survey that value BP workshop contrasting to the low economic cost of the experience. Practical lessons in anatomy often required the use of corpses and expensive anatomical models and facilities. This supposed an important economic effort in the teaching of practical anatomy to sport science students. In front to this scenario BP provided quality practical anatomical Knowledge with a reduced cost due to the simplicity of the elements used: the body of the students themselves and paintings.

Furthermore, as in other experiences, we noticed that students enjoyed and relaxed, which promoted a positive learning environment (16). They also defined it as an amusing experience. But in any moment, we lost the formal academic context; this professional approach helped to kept in mind the academic experience in a serious and comfortable climate.

Due to above BP appeared as a new efficient and cheap tool in the teaching of

**Table 1.** List of the structures to be drawn and surface projections of the major muscles, bones and organs.

1.	Triangles of the neck: clavicle, sternocleidomastoid, escalenus, trapezius, digastric muscle, the larynx, trachea, thyroid cartilage, thyroid gland, inner and outer jugular vein.
2.	Thorax wall: manubrium, the body, and the xiphoid process, Sternal angle, the second pair of costal cartilages, ribs, the left and right clavicles, pectoralis major muscle, costal margin, costal angle, serratus anterior muscle.
3.	Thorax projections: heart and lung projections, main bronchus projections.
4.	Diaphragm: expiration and inspiration, projections on anterior and posterior trunk.
5.	Abdominal wall: umbilicus, alba linea, rectus abdominis muscles, tendinous intersections, linea semilunaris, external oblique muscle, iliac crest of ilium, the anterior superior iliac spine, the inguinal ligament.
6.	Abdominal wall projections: liver, spleen, appendix, stomach, duodenum, pancreas
7.	Back: trapezius muscle, medial border of scapula, vertebral spines, latissimus dorsi muscle, median furrow, iliac crest, kidney projections.
8.	Upper limbs: musculus deltoideus, biceps brachii, triceps brachii, brachius, brachioradialis, flexores carpi.
9.	Lower limbs: musculus sartorius, quadriceps femoris, adductor magnus, semimembranosus, semitendinosus, biceps femori, gastrocnemius, soleus.

**Table 2.** Satisfaction questionnaire.

1. About this surface anatomy session, how do you feel about this experience? Has it been instructive as well as amusing?
2. I would like to repeat this experience to improve my gross anatomy knowledge
3. I would like to repeat a similar experience in another subject
4. This activity has allowed me to measure my level of knowledge
5. This activity has helped me to identify concepts and/or erroneous ideas concerning anatomy
6. This activity has strengthened my learning about the normal conditions of the human body
7. I recommend this activity for classmates in future courses

**Table 3.** Results obtained in satisfaction questionnaire.

Items	Mean (SD)
1	4.05±0.75
2	3.91±0.80
3	3.71±0.40
4	4.15±0.55
5	4.03±0.35
6	4.2±0.64
7	4.05±0.07

practical anatomy. But we must not forget BP limitations. First, it only provided a superficial anatomy view, very practice and illustrative but not completed of joints and muscle-skeletal system. And second, these incomplete view lead us to think about BP as a complementary practice not enough to satisfy totally the need for practical anatomical knowledge in sciences of physical activity and sports students.

Any strategies to transfer the perceived information from memory to the resolutions of problems must be explored in teaching practice. It is even more in the anatomical learning process (12). We propose BP as a tool to overcome this situation, so that previously learned knowledge about normal body structures can be used properly in the analysis of sport and physical activity structures and movements.

Our conclusion, attending to the relationship between students' satisfaction, anatomic learning level and economic cost of BP is it can be incorporated as practical subject for sport, medicine or any other health sciences. Always as complementary work to the traditional way to teach practical anatomy (Table 1,2,3).

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