

## A Review of the Research on the Use of Anatomical Dissection as a Teaching Tool in Medical Schools

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Discussions regarding using dissection to teach gross anatomy are characterized by a dearth of factual data. A literature search for such evidence turned up 16 studies that were pertinent. For more accurate information on the impact of cadaver dissection on cognitive learning outcomes, these were reviewed again. All of the studies that were compared had groups of students who had experienced various teaching methods, such as active dissection, learning from prosected material, or a mix of these methods plus digital teaching tools. Student groups that were compared had a wide range of study and course designs, and they weren't always homogeneous. In all research, assessments of anatomical knowledge were not uniform, and comparing learning experiences varied across multiple variables. The findings of the research that have been evaluated are challenging to understand and generalize. The review reveals a minor advantage for traditional dissection over prosection, taking into account the bias that must be anticipated for teachers who construct new course designs and compare these with conventional ones. To resolve the general issue of the little measurable impact of educational interventions and reach rational conclusions about the most effective way to teach gross anatomy, more complex research designs may be required. Such studies must use large enough sample numbers, approved assessment tools, and a description of the educational importance of any disparities. Future doctors depend too much on their

understanding of anatomy to let current trends in education determine how it is taught.

**KEYWORDS:** Education, Medical, Undergraduate, Anatomy, Dissection, Review.

## INTRODUCTION

Numerous publications have been written in support of this technique of teaching gross anatomy, largely by anatomists but also by surgeons [3] and students, in response to decreasing hours allocated to anatomical dissection<sup>1</sup> and the creation of new medical schools without dissection facilities [1,2]. [4,5] It has been frequently bemoaned in talks regarding dissection that there is a lack of factual information. We are left with the lowest level of evidence, which is emotional concerns and anecdotes, according to Bogduk [6]. The sole quantitative assessment of "dissection" published to date, [7] which is occasionally misquoted, [3,8] focuses only on dissection in high school courses (e.g. frog dissection). The dissection of human cadavers by medical students is not addressed in any of the studies that were evaluated.

In order to support the learning of gross anatomy through visual and tactile experience, anatomical dissection is the methodical exploration of a preserved human cadaver through the sequential division of tissue layers and the liberation of specific structures by removal of the regional fat and connective tissue. In this review, "dissection" will be used to describe instances in which students actively participate in this procedure, while "prosection" will be used to describe the analysis of cadavers or specimens that have already undergone dissection. The emphasis will be on the acquisition of anatomical knowledge because, to my knowledge, no study has yet attempted to evaluate anything other than cognitive learning outcomes (such as manual abilities) (i.e. learning in the cognitive domain).

It should be mentioned that studying human cadavers involves a complex learning process with elements that are challenging to measure and evaluate impartially.

Even learning about anatomy is a complicated process that may be challenging to study from an objective point of view. In order to propose alternatives for future educational research in this area, I will use the current review.

## METHODS

A thorough literature search was conducted that included scanning numerous databases (including MEDLINE, TimeLit, and PsycINFO) and doing ancestry searches (browsing references of relevant papers). Studies involving students other than undergraduate medical or dentistry students (such as physiotherapy students or residents) were disregarded.

A total of 16 papers [9–24] with factual information on prosection and dissection as instructional strategies were found in the literature review. There were no studies involving dental students. The study by Johnson [15] used two somewhat distinct research methodologies, of which only "approach 1" is discussed here because more data on the outcomes of the assessments were available for it. Every first author, with the exception of 1 radiologist, was an anatomist. 14 studies were conducted, with one in Australia, two in Nigeria, and the rest in the USA. [20,21]

## RESULTS

All of the studies we looked at compared groups of students who had been exposed to various teaching methods at the same medical school in varying combinations. These methods were typically included in standard academic curricula. Assessment was obviously unrelated to students' overall course grade only in 1 study [18]. The student groups under comparison either actively dissected, studied on prosected specimens, or received anatomy instruction through a combination of computerized (multimedia) teaching programs and tutorials using prosected specimens, frequently aided by peer teaching. One study [29] only matched two groups that engaged in generally comparable laboratory activities but spent varying amounts of time doing so. One study only [18] included a group that had no contact at all with cadavers.

In seven of the 16 investigations, comparison groups of students were chosen at random, making them truly experimental. The other studies were quasi-experimental since they used non-randomized control groups. Nnodim [22] employed a matched control group for the latter, and 2 other researchers [14, 24] used various academic years as "historical controls" for their studies. Sinclair [16] tested the IQ of several populations but came up empty-handed.

The contrasted groups varied in many of the studies not just in their participation in active dissection or in their contact with cadavers, but also in the amount of instruction time, the engagement of the instructor, and, for instance, in the availability of extra instructional materials. The instruction duration between groups wasn't exactly the same in any of the studies.

#### Assessment

In the research under evaluation, learning outcomes were either evaluated using written multiple-choice questions (MCQ) tests, hands-on laboratory exercises (referred to as "tag tests"), or both.

Tests with multiple-choice questions don't need to be explained further. The tag test includes labeling certain features on dissected cadavers and answering questions (in writing) about those structures. It is less common, at least in Europe.

The only author to make reference to an earlier evaluation of the level of difficulty and discrimination of his MCQ questions is Nnodim [22,23]. None of the other papers that were reviewed make an effort to demonstrate the validity or reliability of their assessment tools.

#### DISCUSSION

Sixteen studies on dissection as a means of teaching gross anatomy are included in the current study. I'll concentrate on the 14 studies that permit a contrast between the use of prosected specimens for instruction and conventional dissection. Prosection in particular was incorporated into numerous learning settings, therefore this must entail a generalization that is still up for debate.

Only 1 of the studies that were analyzed, [18], which was centered on the assessment of a computer program, contained a group that had no contact at all with cadavers. Therefore, it will be impossible to draw any conclusions concerning the effects of entirely giving up the use of cadavers in anatomy instruction.

This challenge is confirmed by the current review: Between comparable student groups, factors like instruction time and instructor participation frequently differ significantly, and only half of the research we analyzed used randomization. The question of whether non-randomized groups in other research were homogeneous in terms of students' pre-course

knowledge is raised by the significant variations in pretest knowledge identified in 1 of the 18 investigations.

Another issue is that there is no accepted method for evaluating anatomical information, which renders study findings essentially incomparable. Ideally, such a standard evaluation would test for fundamental anatomical information that is widely accepted and clinically applicable [25] and would be of demonstrated reliability and validity. [26] Although the validity of written MCQ exams is unquestionable, [27] to my knowledge, the reliability of the often utilized tag test (practical laboratory examination) has not yet been examined in a published study.

### **Options for future research**

Despite the complexity of the issues at stake, there are compelling arguments for basing medical education on empirical research. [28] Future study should compare two courses, such as one based on the dissection and/or prosection of human cadavers and another based on contemporary, computerized teaching materials with no cadaver contact. This is the approach taken by the majority of the studies evaluated here. If care is made to have large enough sample numbers, to maintain as many factors as possible constant between the two courses, and to validate evaluation tools, any attempt in this manner should be more fruitful. The second alternative involves conducting more fundamental research and observing pupils in non-classroom settings generated in a lab. This could be based on the anatomical computer model studies done by Garg et al. [29]. Such fundamental study may lower measurement mistakes and give more control over factors.

The third alternative is to look for methods of measuring various factors in a dissecting room's actual environment. This kind of "field experiment" might serve as a strategy for navigating a challenging educational situation. It enables the assessment of the relative contributions made by various variables and how they interact to affect students' learning outcomes (for statistical methods for handling such situations, see Norman and Schmidt [24]).

Analyzing the success of anatomical dissection as a teaching method in a scientifically valid manner will undoubtedly require sophisticated methodology (and funding for the same), but

this is true of other teaching methods as well. Accepting the challenge, anatomists should do more thorough and extensive academic study. Future doctors need anatomical knowledge, thus questions regarding how to teach it effectively shouldn't be left to heated debates or passing educational trends.

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