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**Background and Purpose:** The goal of this survey was to determine how Physical Therapy schools around the country teach Gross Anatomy to their students. **Subjects:** Faculty at 69 accredited Physical Therapy programs participated in this study. **Methods:** A 42 question survey was sent to 204 accredited programs electronically containing multiple-choice and open ended questions about six subcategories: demographics, four teaching methods and questions about the National Physical Therapy Examination (NPTE). We then compared some data to the last published survey from 1994 to understand what changes have occurred over the past nineteen years. **Results:** Dissection is the most popular teaching method used today in Physical Therapy programs. Computer-Based learning along with Prosection and Plastinate models are all used teaching methods in programs. Most programs used more than one teaching method in their curriculum. **Discussion:** Changes noted since 1994 include a decrease in the number of programs that use dissection, an increase in the use of computers and a change in who teaches Gross Anatomy. There is more commercially available anatomy software used by programs throughout the country.
Background

Gross Anatomy is a fundamental course in any Physical Therapy program’s curriculum. In fact, there is a correlation between professional GPA and passing the NPTE. The teaching of Gross Anatomy among accredited programs is highly variable based on several factors. Some of these factors may include: instructor qualification, accessibility to laboratory space, cadavers, fiscal requirements and potentially, computer technology. After a review of the literature in the past twelve years, twelve articles were found that pertained to Gross Anatomy and medical students. Four articles pertained to physical therapy students and five pertained to any students that learn Gross Anatomy. The most recent, comprehensive study focusing solely on accredited Physical Therapy programs was Mattingly and Barnes’ paper published in the *Journal of the American Physical Therapy Association* in 1994. In this study, the researchers focused on six main topics. These topics included: instructor qualifications, student numbers and ratios, curricular sequence and time allotted for the teaching of human anatomy, laboratory resources and activities, anatomy instructional activities and course content. Researchers discovered that all of the responding programs indicated that human cadavers were the primary method of teaching Gross Anatomy.

Due to the rising costs of running and operating a human cadaver anatomy lab, many programs have turned to alternative teaching methods to curb these costs. However, no recent literature exists that provides quantitative information regarding how many Physical Therapy programs use each method or why these programs may have shifted to a different teaching methods. A computer modulated learning module for Gross Anatomy has become a potential method of instruction in conjunction with a generation of students who are more technology savvy and have grown accustomed to using computers in their studies. The rapid growth of
technology has prompted schools to incorporate this new method of teaching into the Gross Anatomy curriculum.

In 1994, there were 123 accredited Physical Therapy programs in the country compared to 204 accredited Physical Therapy programs in the United States and territories in 2012 as found on the Commission on Accreditation in Physical Therapy Education (CAPTE) website. Due to the number of years since the Mattingly and Barnes survey was conducted, the improvement of technology in the past eighteen years and an increase in the number of Physical Therapy schools since 1994, another survey is warranted to provide important information regarding how Gross Anatomy is presently being taught in Physical Therapy programs. The purpose of this study is to update the literature on how Gross Anatomy is taught in Physical Therapy programs to day and to see what changes have occurred since Mattingly and Barnes’ paper was published in 1994.

Methods

An online survey was distributed electronically to gain information about how Physical Therapy schools teach Gross Anatomy in their respective programs. This study was IRB approved prior to sending out the surveys to participants. Physical Therapy schools were identified on the CAPTE website as accredited Physical Therapy schools. There were 204 schools identified through their website. Also on CAPTE’s website, programs were able to identify a Director with their name and email address. This information comprised the participants of the study. An email was sent to each Program Director with the unsigned informed consent document approved by the IRB explaining the purpose of our survey and with a link to the survey. Please refer to Appendix A for a complete copy of the 42-question survey. Participants were then able to complete the survey over a period of three weeks. Because of the
nature of the electronic survey, there is no official site for the project. Each participant required a computer with Internet access to complete the survey. There were 69 surveys completed, yielding a 34% response rate. However, due to the nature of the survey, some question did not have all 69 responses. Data collected from the survey did not have any identifying markers for the participants besides the unavoidable IP address, which we did not collect. Only individuals approved by the IRB either now or in the future will be able to access the data and it will only be used for statistical analysis to answer the proposed research question(s).

Once the data was collected, the data analysis involved SPSS and Chi-squared tests, to determine statistical relevance. Additionally, comparable data collected by Mattingly and Barnes in 1994 was compared to more recent data to see if any changes have occurred since their survey. A p value of 0.05 was set to be statically significant when comparing data.

Results

Demographics

Fifty-six percent of respondents claimed to be associated with public institutions (state-owned) with the remainder of the respondents claiming to be private (43.48%). No respondents claimed to be semi-private programs. In comparison, Mattingly and Barnes found that 44% of programs were associated with public institutions, 43.7% were associated with private institutions and 16% were associated with a semi-private institution. There has been a statistically significant change in the percent of private schools (p < 0.05) for programs associated with public and semi-private institutions.

Northeast programs accounted for 27.5% of respondents, Southeast programs accounted for 23.2%, Midwest programs accounted for 26.1% of respondents, Southwest programs
accounted for 17.4% of respondents and 4.3% of respondents were from the Western area of the United States.

With regards to faculty, only 20.59% of programs’ main instructor had a degree in PT (including PT, MPT, and DPT) with the other 2.94% having a MS in something and the remainder having a PhD (73.5%). This was further broken down into a PhD in a Health Related field (14.7%), PhD in Anatomy (44.12%), and PhD in something else (13.24%). In 1994, half of responding programs had Physical Therapists teaching Gross Anatomy (p < 0.05)².

Over one-fourth of instructors (27.54%) have more than 20 years experience teaching Gross Anatomy. The second highest amount was 11-20 years (26.09%), followed by 1-5 years (24.64%), 6-10 years (18.84) and finally less than 1 year (2.9%).

Most programs have between 31 and 50 students (57.35%) per class. Twenty percent of programs have less than 30 students per class (20.59%), 16.18% have 51 to 70 students per class and 5.89% have between 71 and 90 students per class.

**Gross Anatomy Lab Information**

Over forty-one percent of students spend between five to six hours per week in the lab (41.4%). The remainder of the students spent either three to four hours per week in lab (32.35%) or over six hours per week in lab (32.35%).

Physical Therapy programs can share the space of the Gross Anatomy labs with other programs (such as Physician’s Assistants or Nurses). Of our respondents, the majority of them (76.81%) share the lab space with other programs over just using the space themselves (23.19%). Mattingly and Barnes found only 36.2% of programs sharing the lab in 1994 (p < 0.05)². The four options for how programs taught Gross Anatomy were Dissection (92.6%), Prosection (31.9%), Plastination (50.7%) or Computer-Based Learning (50.7%). Only 30.4% of programs
use one method to teach Gross Anatomy in labs. The remainder of the programs use more than one: 23.2% use two methods, 27.5% use three methods, and 17.4% use all four methods. In 1994, one hundred percent of programs used Dissection as a teaching method ($p < 0.05$) and 18.4% used Computer-Based Learning ($p < 0.05$).

**Figure 1. Percentage of respondents who use different teaching methods (n=69):** Dissection is the major method used followed by Prosection and Computer-Based learning and then Plastinated Models.

**Figure 2. Number of methods used by respondents (n=69):** This shows that most programs use more than one method to teach.
Dissection Data

Most programs have students spend either three to four hours per week dissecting (35%) or five to six hours per week dissecting (38.33%) with the average numbers of cadavers available to students being 8.72. The majority of programs (87.5%) keep the number of students per cadaver at four to six. Four programs have one to three students per cadaver (6.25%), three programs have seven to nine students (4.69%) and only one program has ten to twelve students per cadaver (1.56%). Cadavers are obtained one of three ways: from centers where cadavers are donated (35.48%), in-house facilities (22.58%) or from regional or state medical facilities (41.94%).

Most programs believe that the cost of cadavers has gone up in the past five years (50.79%), with only 22.22% believing it has not or 26.98% that are unsure if it has. In contrast, Mattingly and Barnes found that more programs, 64.8% believed the costs of cadavers had gone up over the past 3 years and 35.2% thought they had not (p < 0.05 on both) 2.

The average cost of cadavers reported was $1,528.28. In 1994, the average cost was $1,063.58 2. If you adjust for inflation on the Bureau of Labor website, the 1994 average would be $1,652.64. Seventy percent of programs also responded that their budgets would continue to support the rising cost of cadavers while 21.67% were unsure and 8.33% said their budget would not allow for it. Mattingly and Barnes found in their study that 95.5% of programs’ budget could support the rising cost of cadavers and only 4.5% of programs would be unable to support it 2.

The majority of programs have always used cadaver as a teaching method for Gross Anatomy (96.8%), but there were two programs that have switched to using dissection and when asked why, one responded said they switched “to promote independent learning and greater participation by students.”
Prosection Data

Of the programs that responded that they use Prosection as a method of teaching, 44.19% of them have the lab instructors performing the dissection that the students learn off of. 30.23% of the programs have teaching assistance performing the dissection, while three programs use older students in the program to perform the dissection (6.98%) and two programs use medical students to perform the dissection (4.65%). The remainder of the programs actually has students currently taking Gross Anatomy to perform a dissection and then teaches it to their peers (13.95%).

Fifty-eight percent of programs that use Prosection have smaller, separated dissections such as an upper extremity, a lower extremity, or a hand or foot dissected for students to learn off of and the average number of full body dissections available for students in programs that use Prosection is five cadavers. About half of the programs (45%) offer students a chance to dissect cadavers later on in the curriculum.

Computer-Based Learning Data

There were seventeen different software programs used by respondents. Please see Appendix B for the lists of software programs used. The most used program is Blackboard (39.47%) followed by ADAM (15.79%), Anatomy TV and Primal (both 10.53%). Half of the programs use only one program, but 31.58% use two programs and 18.42% use three or more programs. The amount of time programs have used the software varies from one semester to over fifteen years with no clear average.

Plastinate Data
The number of plastinate models varied between the respondents. Four programs have up to two models (16%), while ten programs have between three and six models (40%). Thirty-six percent of programs have more than ten and eight percent have more than twenty models.

_Gross Anatomy and the NPTE_

The average first time pass rate for 2012 from the respondents was 93.81% (n=52). Five respondents were unsure of their pass rate and twelve programs chose not to answer the question. The average cumulative pass rate from 2009 to 2012 was 97.92% (n=54). One program was unsure and fourteen programs chose not to answer.

The opened ended question asking if performance in Gross Anatomy influences outcomes on the NPTE was transposed into four categories: No (6%), Not Sure (4%), Yes, Indirectly (18%) and Yes, Directly (72%) (n=50).

**Discussion**

Gross anatomy is considered a fundamental course in the curriculum of physical therapy students. It assists with understanding and further application of knowledge not only in future classes, but also in clinical practice. There are four main methods utilized by different Physical Therapy schools to teach Gross Anatomy. The most frequently used method is dissection (92.6%). This means that students are performing the dissection of the cadaver as they are learning the different anatomical structures. There was a statically significant decrease in the number of programs that use Dissection today compared to 1994.

Unlike Mattingly and Barnes, who found a “lack of a variety of commercially available software” there are sixteen different software programs in use today and some programs have even written their own. Computer-Based learning has become more popular due to the number
of reliable commercial software available to students. The technology improvements made over
the last nineteen years are evident in this change.

The findings of this study present mixed evidence of the cost of cadavers in Dissection
labs. Fewer programs today believe the cost has gone up, the inflation adjusted average cost of
cadavers is less today than in 1994. However, fewer programs believe their budget can continue
to support cadavers. The majority of respondents also report that they share the cadaver lab with
other health care professional students. This could be suggestive of methods to effectively utilize
resources, including cost and faculty sharing.

Some strengths of our study include the fact that we are extending this survey to every
CAPTE accredited Physical Therapy program in the United States and territories which will
allow us to include all types of students, learning styles, and programs since the survey will be
sent across the nation. Other strengths include the length of time since the last survey of this
type, nineteen years, the convenience of an online survey, and that there is minimal amount of
literature that specifically involves Physical Therapy programs and their teaching methods of
Gross Anatomy. Some limitations to our study involve the some incomplete surveys and the fact
that our return rate was only 34%. Another limitation to our study is that it was electronically
distributed. This electronic distribution could have caused participants to face technical
difficulties as well as lead them to report inaccurate answers because we are not there to allow
participants to ask face-to-face questions and subsequently receive immediate, accurate
responses.

Conclusion
Based on the findings gathered from our survey, we have the potential to contribute useful information regarding the most current methods of teaching Gross Anatomy used in accredited Physical Therapy programs. The most pronounced findings include:

1. Dissection remains to be the most commonly used method in accredited programs today. Although we found a statistically significant decrease in the use of dissection, the majority of programs have always used cadaver as a teaching method for Gross Anatomy (96.8%). This is still an overwhelming percentage of schools using dissection, but we believe the significant decrease to be attributed to the reported response in the 1994 survey that 100% of programs were using dissection. Two programs that have recently converted to utilizing dissection as a teaching method reported making the switch “to promote independent learning and greater participation by students.” As the foundational way of learning human anatomy, cadavers are firmly rooted as the gold standard of learning models.

2. More programs are utilizing computer-based learning as a method to help offset cost of cadavers. Advancements in technology over the past 19 years have allowed for computers and other 3-dimensional programs to be used in the laboratory setting. These advancements, in combination with a generation of students who have grown up using computers in their studies, has resulted in a statistically significant increase in the use of computer modulated programs as a teaching method. Gross Anatomy has been at the forefront of incorporating this new method of teaching into the curriculum.

3. Another method to promote cost sharing of cadaver labs is dividing lab time and resources among other healthcare students, such as Physician’s Assistant and Nurse Practitioner students. This enables the cadavers to be utilized to their full educational
potential, helping students in different forums to get the most out of their studies. For up and coming programs who want to use cadavers in the teaching of Gross Anatomy, but have some reserves about cost, the above mentioned methods could be potential ideas for them to successfully implement.

4. More research could be done focusing more specifically on the cost of running a cadaver lab. Why has the cost of cadavers decreased but more schools are unsure or cannot afford cadavers? Research looking at cost of the physical space of cadaver labs along with administration perception of using human cadavers in education could shed light on this finding.

References


**Appendix A – Survey**

Please respond to the following question regarding your program's Gross Anatomy lab. Responses provided will be completely confidential and anonymous. At the end of the survey you will be directed toward another survey to enter our drawing for one of two $50 Amazon gift cards.

1. In which region of the country is your program located?
   - [ ] Northeast
   - [ ] Southeast
   - [ ] Midwest
   - [ ] Southwest
   - [ ] West

2. In what type of Institution is your program?
   - [ ] Public
   - [ ] Private
   - [ ] Semi-Private

3. What is your relationship to the Gross Anatomy Course?
   - [ ] Chair or Department Head
   - [ ] Lab Coordinator
4. What is the level of education of the primary lab instructor?

- ☐ DPT
- ☐ MD
- ☐ PhD in Anatomy
- ☐ PhD in a Health Related Field
- ☐ PhD in something else
- ☐ Other:

5. How many years of experience does the primary lab instructor have teaching Gross Anatomy at your program?

- ☐ <1 year
- ☐ 1-5 years
- ☐ 6-10 years
- ☐ 11-20 years
- ☐ >20 years

6. Do students other than PT students use the lab?

- ☐ Yes
- ☐ No

7. If other students use the lab, who are they?

- ☐ MD Students
- ☐ DO Students
- ☐ PA Students
- ☐ Nursing Students
- ☐ AT Students
- ☐ NA – No other students use the lab
- ☐ Other:
8. How many direct contact hours per week do your students spend in Gross Anatomy lecture?

- □ <1 Hour
- □ 1-2 Hours
- □ 3-4 Hours
- □ 5-6 Hours
- □ >6 Hours

9. How many direct contact hours per week do your students spend in Gross Anatomy lab?

- □ <1 Hour
- □ 1-2 Hours
- □ 3-4 Hours
- □ 5-6 Hours
- □ >6 Hours

10. Are additional or "Open Lab" times available for students?

- □ Yes
- □ No

11. If you answered YES above, how many hours per week are offered?

- □ <1 Hour
- □ 2 Hours
- □ 3 Hours
- □ 4 Hours
- □ >4 Hours
- □ NA – not open lab times

12. How many students are in your Physical Therapy program per class?

- □ <30
- □ 31-50
- □ 51-70
- □ 71-90
- □ 91-120
- □ >120
13. How many semesters is the Gross Anatomy course taken?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ Other:

14. How many weeks are in each semester?

15. What method(s) of teaching are used in your Gross Anatomy labs for PT students? Please check every method that you employ. Later pages will ask question regarding your choices.

- ☐ Dissection
- ☐ Prosection
- ☐ Computer-Based Learning
- ☐ Plastinated Models
- ☐ Other:

**Dissection**

If you chose Dissection as a teaching method, please answer the following question. If you do NOT use Dissection as a teaching method, please scroll to the bottom of the page and click "Continue" to go to the next page.

16. How many direct contact hours per week do your do your students spend dissecting?

- ☐ 0-2 Hours
- ☐ 3-4 Hours
- ☐ 5-6 Hours
- ☐ Other:

17. How many cadavers or cadaver sections are available for student dissection?

- ☐ 1
- ☐ 2
- ☐ 3
- ☐ 4
- ☐ Other:

18. How many students are assigned per cadaver?

- ☐ 1-3
19. Where do you obtain the cadavers?

- Regional or in-state medical center
- In-house facility
- Centers where cadavers are donated
- Other:

20. What is the average cost per cadaver?
If you are unsure, please leave BLANK.

21. Has the cost of the cadavers increased in the last 5 years?

- Yes
- No
- Unsure

22. If the cost of cadavers has increased, does your budget support these rising costs and purchase of the same number of cadavers?

- Yes
- No
- Unsure

23. Has your institution always used dissection in the instruction of lab material in the Gross Anatomy course?

- Yes
- No

24. If you have NOT always used dissection, please comment on why your institution made the change in teaching methods?

**Prosection**
If you chose Prosection as a teaching method, please answer the following questions. If you do NOT use Prosection as a teaching method, please scroll to the bottom of the page and click "Continue" to go to the next page.

25. Who completes the dissections used by the PT students for the Gross Anatomy lab?
26. How many direct contact hours do your students spend in the labs working with the prosected cadavers per week?

- 0-2 Hours
- 3-4 Hours
- 5-6 Hours
- Other:

27. Do you have smaller, separated dissections from the cadavers? i.e. arm, leg, pelvis, ect.

- Yes
- No

28. If you do have separated dissection, please list what separate dissections are available.

29. If you do not use separate dissection, how many full body prosected cadavers are available in the lab?

- 1
- 2
- 3
- 4
- NA – we use separate dissection
- Other:

30. Do your students have the opportunity to dissect later in their curriculum?

- Yes
- No

31. If your students do have an opportunity, please describe what opportunities for dissections are available.

32. Has your institution always used prosection in the instruction of Gross Anatomy?

- Yes
33. If you have NOT always used prosection, please comment on why your institution made the change in teaching methods.

**Computer-Based Learning**
If you chose Computer-Based Learning as a teaching method, please answer the following questions. If you do NOT use Computer-Based Learning as a teaching method, please scroll to the bottom of the page and click "Continue" to go to the next page.

34. What program does your institution use?
This could include programs such as Blackboard or other outside purchased programs.

35. Could you please give 3 reasons why your program chose to use this program?

36. How many semesters has your institution used this program?

- □ 1
- □ 2
- □ 3
- □ Other:

**Plastinated Models**
If you chose Plastinated Models as a teaching method, please answer the following questions. If you do NOT use Plastinated Models as a teaching method, please scroll to the bottom of the page and click "Continue" to go to the next page.

37. How many models do you have?

- □ 0-2
- □ 3-4
- □ 5-6
- □ Other:

38. What types of models does the lab use?

- □ Full limbs
- □ Cross section
- □ Other:

39. Could you please give 3 reasons why your program chose to use plastinated models.

**Final Questions**
Please respond the final questions and submit the survey. If you do not wish to answer please scroll to the bottom and submit the survey. After you submit the survey a link will appear to bring you to another survey. This survey will ask for your name and email address to enter you
into our drawing for two $50 Amazon gift card. These surveys do not relate to each other and we will have no way to connect your entry for the drawing to your answers for the survey.

40. What was your program's 2012 first time pass rate on the NPTE?
41. What is your program's cumulative pass rate for the NPTE for the past 3 years?
42. Do you feel that performance in Gross Anatomy influences outcomes on the NPTE and why?
Please briefly explain your answer.

Appendix B – Commercial Anatomy Software

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