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# Comparison of Virtual Learning Tools and Traditional Learning via Cadaver Dissection Through the Practical Exam Grades in Gross Human Structural Biology Among First-Year Medical Students

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Grace Mendoza-Bardelosa, MD, FPDS, FPSAi

## ABSTRACT

**Background:** The Covid-19 pandemic necessitated a shift from traditional cadaver dissection (CD) to virtual learning tools (VLT) in Gross Human Structural Biology (GHSB) education. This study investigates the efficacy of VLT in replacing CD by comparing practical exam scores before and after the transition. Existing literature presents conflicting views on CD versus VLT, yet lacks specific examination of their impact on exam scores among first-year medical students in the Philippines.

**Methods:** This retrospective cohort study analyzes exam scores of first-year medical students enrolled at the FEU-NRMF Institute of Medicine during the academic years 2018-2019 and 2020-2021. Data obtained from departmental records underwent descriptive statistics, independent sample t-tests, and chi-square tests. A sample size of 266 students was determined to compare average grades and passing rates between VLT and CD groups.

**Results:** Students in the CD group (n=133) exhibited significantly higher mean exam scores ( $84.27 \pm 10.96$ ) compared to the VLT group (n=133) ( $79.25 \pm 11.79$ ) ( $p < 0.001$ ). The passing rate for CD students (81.2%) surpassed that of VLT students (68.42%) ( $p = 0.016$ ).

**Discussion:** This study emphasizes the effectiveness of hands-on CD in enhancing learning outcomes, with CD students demonstrating higher scores and passing rates than VLT students. While VLT offers accessibility, its limitations in practical competency raise concerns for medical education. Integrating diverse teaching modalities is crucial for comprehensive learning outcomes.

**Conclusion:** This paper provides evidence supporting the irreplaceable value of hands-on CD in GHSB education. Educators must balance the use of VLT with hands-on experiences to improve student learning outcomes, particularly in the context of evolving challenges such as the Covid-19 pandemic.

**Key words:** Cadaver dissection, virtual learning tools, gross human structural biology

**T**raditionally, cadaver dissection (CD) has been the primary method used to teach Anatomy, also known as Gross Human Structural Biology (GHSB), among first-year medical students at the FEU-Dr. Nicanor Reyes Medical Foundation Institute of Medicine (FEU-NRMF IM). CD is considered an essential experience and a ceremonial passage

for medical students, despite the challenges of accessibility and cost associated with obtaining cadavers. However, in the midst of the emergence of the Covid-19 pandemic and the subsequent lockdown measures implemented in the Philippines in March 2020, educational activities came to a halt. Two weeks after the declaration of the pandemic, classes resumed, but medical schools had to shift to online teaching, including GHSB at the FEU-NRMF IM. As a result, CD was no longer possible, and alternative tools and resources collectively referred to as Virtual Learning Tools (VLT) were used instead. These

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included the Anatomage table, Visible Bodies App, dissection videos, medical imaging slides, and other multimedia resources. The question arises: Are these VLT comparable to CD in teaching GHSB? Did the practical exam scores of students improve or decline as a result of this transition?

Several studies have compared CD and VLT, generating diverse views in terms of favoring one over the other and vice versa. Overall, these literatures present varying perspectives on the effectiveness of cadaver dissection versus virtual dissection in teaching anatomy. Some studies argue for the significance of cadaver dissection due to its hands-on experience (Memon), while others suggest the potential shift towards virtual dissection, especially in light of challenges posed by the Covid-19 pandemic (Onigbinde). Some studies demonstrate the positive impact of combining virtual and traditional dissection methods on learning outcomes, but additional investigation is needed to fully support and understand the long-term effects of this approach (Boscolo-Berto). Anyanwu and colleagues support for the inclusion of additional methods, such as innovative technologies, alongside cadaver-based instruction in medical students' gross anatomy subject. However, the Covid-19 pandemic compelled medical schools worldwide, including those in the Philippines, to shift to online teaching. The scarcity of cadavers and the reluctance of institutes to accept bodies during the pandemic have caused concerns about the future of cadaver-based anatomy education. An editorial even predicted that anatomy education would become cadaverless within a decade, with digital learning replacing traditional methods (Singal). Nonetheless, none of these studies have examined exam scores to compare the effectiveness of VLT and CD, which this paper aimed to address.

To date, there is a lack of studies comparing VLT and CD specifically in terms of exam scores among first-year medical students in the Philippines. This research bridges this gap by comparing the average practical exam grades and passing rates between VLT and CD. The findings of this paper will contribute to understanding the efficiency of different teaching methods (VLT vs. CD) in GHSB education. Understanding these methods' impact on exam scores and passing rates will aid educators in making informed decisions about teaching modalities, especially in situations where traditional methods like CD might be restricted. The results can guide

curriculum development and resource provision in medical education, potentially benefitting the future of medical students.

## **MATERIALS AND METHODS**

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This is a retrospective cohort study to analyze the exam scores of first-year medical students enrolled at the FEU-NRMF IM who undertook GHSB during the academic years 2018-2019 and 2020-2021. This study has been reviewed and was granted approval for implementation by the FEU-NRMF Institutional Ethics Review Board (FEU-NRMF IERC). The data for this study were sourced from the excel files maintained by the department of HSB from which access to these relevant files was requested and allowed.

The study gathered important information from each first-year medical student. This included their unique identification codes, academic year, and semester details when they took the GHSB course. Collected too were their average scores from the main practical exams in GHSB. Additionally, the researcher checked if students met specific criteria to ensure the data were accurate. Students were regular first-year medical students at FEU-NRMF IM who finished the course with a full academic load. This thorough data collection helped analyze and interpret the results effectively.

The dependent variables in this study were the major final practical exam grades and the passing rate. The major final practical exam grades refer to the scores obtained by first-year medical students in the GHSB exam during the academic years 2018-2019 and 2020-2021. These scores are numerical values representing students' performance in the practical assessment of GHSB. The passing rate is the percentage of first-year medical students who successfully passed the GHSB exam during the same academic years. It is calculated by dividing the number of students who passed the exam by the total number of students who took the exam and then multiplying by 100. The passing rate indicates the proportion of students who achieved a satisfactory level of performance in the practical assessment. The passing score for the GHSB exams is set at 75% or its numerical equivalent. The independent variables were cadaver dissection and virtual learning tools, while the control variable was the number of regular first-year medical students enrolled in Gross HSB at the FEU NRMF- IM.

The sample size calculation involved comparing the average grades and passing rates of two different teaching methods: VLT and CD. The parameters like the average grade for VLT (M1), the average grade for CD (M2), the passing rate for VLT (P1), and the passing rate for CD (P2) were considered. The sample size was determined by testing the hypothesis about the difference in passing rates between students taught using CD versus those taught using VLT. The researcher assumed that the passing rate for CD, based on records from 2018-2019, was 50%. The passing rate for VLT was hypothesized to be higher, at 65%. With a 5% margin of error (alpha error), 80% power, and a one-tailed alternative hypothesis, it was calculated that 133 students are needed in each group, for a total of 266 students across both groups.

## RESULTS

Descriptive statistics was used to summarize the exam scores and exam results of the students. Frequency and proportion were used for categorical variables and mean and standard deviation for normally distributed continuous variables. Independent Sample T-test and Chi-square test were used to determine the difference of mean and frequency, respectively, between students under VLT compared to students with CD. All statistical tests were two tailed tests. Shapiro-Wilk test was used to test the normality of the continuous variables. Students from two different school years were randomly selected according to the calculated sample size. Null hypotheses were rejected at 0.05 $\alpha$ -level of significance. Microsoft Excel and STATA 13.1 were used for data management and analysis, respectively.

The exam scores of students participating in CD, with a mean score of 84.27 and a standard deviation of 10.96, were notably higher than those of students using VLT, who had a mean score of 79.25 and a standard deviation of 11.79 ( $p < 0.001$ ).

There is a noticeable gap in the passing rates between the two semesters. Students in the CD group had an 81.2% passing rate, whereas those using VLT only reached 68.42% ( $p = 0.016$ ).

## DISCUSSION

The transition from traditional CD to VLT for teaching GHSB amid the Covid-19 pandemic has created quite a debate regarding its impact on medical education. The findings of this study contribute to this ongoing discussion by providing empirical evidence comparing the practical exam scores and passing rates between students taught using CD versus VLT at the FEU-NRMF Institute of Medicine.

### Effectiveness of Teaching Modalities

The significant difference observed in exam scores between students exposed to CD versus VLT emphasizes the effectiveness of hands-on cadaver dissection in enhancing student learning outcomes. The higher mean score among students who underwent CD suggests that the tactile experience and three-dimensional understanding gained through physical dissection may contribute to better comprehension and retention of anatomical knowledge. This supports with previous literature emphasizing the unique benefits of hands-on learning in anatomy education (Memon). On the other hand, students taught using VLT demonstrated lower average scores, indicating

**Table 1.** Average grade and passing rate of students under virtual learning tools compared to students with cadaver dissection.

| Variables                | Cadaver Dissection<br>(n=133) | Virtual Learning Tools<br>(n=133) | P-value |
|--------------------------|-------------------------------|-----------------------------------|---------|
| Frequency (%); Mean + SD |                               |                                   |         |
| Exam score               | 84.27 $\pm$ 10.96             | 79.25 $\pm$ 11.79                 | <0.001  |
| Exam result              |                               |                                   | 0.016   |
| Passed                   | 108 (81.2)                    | 91 (68.42)                        |         |
| Failed                   | 25 (18.8)                     | 42 (31.58)                        |         |

potential limitations in knowledge attainment compared to CD. While virtual tools present advantages such as accessibility and flexibility, they may not fully replicate the depth of understanding attained through direct anatomical exploration. This finding is consistent with Boscolo-Berto et al, who noted that the blend of virtual and traditional methods yielded superior learning results, suggesting that VLT alone may not suffice for comprehensive anatomical education.

### Passing Rates and Practical Competency

The difference in passing rates further emphasizes the impact of teaching modality on practical competency in GHSB. Students exposed to CD showed a significantly higher passing rate compared to those taught using VLT. This suggests that while VLT may aid theoretical understanding, it may fall short in adequately preparing students for practical assessments. Practical competency is important in medical education, as it correlates with clinical skills and patient care.

The lower passing rate among VLT students raises concerns about the efficacy of virtual methods in cultivating the hands-on skills essential for medical practice. The ability to transform knowledge from theory into practical application is a basic aspect of medical training, and the observed discrepancy stresses the importance of incorporating tactile learning experiences into anatomy education whenever possible.

### Implications for Medical Education

The outcomes of this paper have noteworthy implications for medical education, particularly amid the evolving landscape of online learning. While VLT offer practical alternatives to traditional methods, they should be supplemented with hands-on experiences whenever feasible to ensure comprehensive learning outcomes. Medical institutions must prioritize the integration of diverse teaching modalities to cater to the changing learning preferences and needs of students.

The results emphasize the importance of adaptability in medical learning, especially as a remedy to unforeseen challenges such as the Covid-19 pandemic. Educators and institutions must continue to innovate and explore new approaches to anatomy instruction while upholding the importance of traditional cadaver dissection.

### Limitations and Prospects

It is essential to recognize the limitations of this study, involving its retrospective design and reliance on exam scores as the primary outcome measure. Future research could use longitudinal or mixed-methods approaches to explore the long-term impact of different teaching modalities on student learning and clinical performance.

Qualitative assessments, such as student perceptions and satisfaction surveys, could provide valuable insights into their experiences and preferences regarding CD versus VLT. Investigating the role of additional resources, such as anatomical models and simulation technologies, in enhancing the effectiveness of virtual learning could develop our understanding of best academic strategies in anatomy education.

### CONCLUSION

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While virtual learning tools offer flexibility and accessibility, the findings of this study emphasize the irreplaceable value of hands-on cadaver dissection in anatomy education. By incorporating a diverse range of teaching modalities, educators can optimize student learning outcomes and ensure the continued excellence of medical education in the face of ever changing challenges.

### REFERENCES

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1. Onigbinde O, Chia T, Oyeniran OI & Ajagbe AO. (2021). The place of cadaveric dissection in post-COVID-19 anatomy education *Morphologie* 105: 259-66. <https://doi.org/10.1016/j.morpho.2020.12.004>
2. Memon I. (2018). Cadaver dissection is obsolete in medical training! A misinterpreted notion. *Medical Principles and Practice* 27(3): 201–10. <https://doi.org/10.1159/000488320>
3. Singal A, Bansal A & Chaudhary P. (2020). Cadaverless anatomy: Darkness in the times of pandemic Covid-19. *Morphologie* 104(346): 147–50. <https://doi.org/10.1016/j.morpho.2020.05.003>
4. Boscolo-Berto R, Tortorella C, Porzionato A, Stecco C, Picardi EEE, Macchi V & De Caro R. (2021). The additional role of virtual to traditional dissection in teaching anatomy: a randomised controlled trial. *Surg Radiol Anat* 43(4): 469–79. <https://doi.org/10.1007/s00276-020-02551-2>
5. Malhotra R, Malhotra M & Kumari R. (2016b). A comparative study of effectiveness of cadaver dissection versus computer assisted dissection. *J Anat Soc India*. <https://doi.org/10.1016/j.jasi.2017.01.010>
6. Anyanwu GE. (2010). Impact of the use of cadaver on student's ability to pass anatomy examination. *Anatomy* 4: 24–38. <https://doi.org/10.2399/ana.09.022>