Formal Proposal for Licensing 3D Human Anatomy Software

For

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INTRODUCTION

BACKGROUND

Since mid-March of 2020, the COVID-19 virus has caused schools to close and switch to online and virtual solutions. As a result, students at the University of British Columbia Okanagan (UBCO) campus, enrolled in hands-on lab-based classes, are deprived of learning resources that would normally be available. Anatomy courses are among the courses most severely affected. These courses would typically include a lecture component, and an in-person component. The in-person lab component would facilitate learning through student interaction of three-dimensional (3D) anatomical models. Due to COVID restrictions, the lack of in-person learning resources causes greater reliance on learning (and teaching) from online and textbook human anatomy images – drastically undercutting student comprehension of the course material. The purpose of this investigation is to determine whether a 3D anatomy software is necessary for remote learning of anatomy courses, which applications are available, and which applications are appropriate.

STATEMENT OF PROBLEM

The lack of hands-on learning resources available to students enrolled in anatomy courses leads to a more superficial understanding of the subject. These are some of the implications as a result:

1. Lack of learning resources will lower student satisfaction of the course, ultimately lowering teaching evaluation scores.
2. Students become more stressed from the lack of perceived knowledge, which can negatively impact self-efficacy and GPA

3. Superficial understanding from students reduces competency, and will result in a negative reflection on UBCO

SCOPE

To assess the feasibility of licensing a 3D anatomy application for students and faculty members at UBCO, these are the areas in which I plan to inquire:

1. Are 3D anatomy models necessary for remote learning?
2. How large is the demand for virtual 3-dimensional learning and teaching aids?
3. What 3D anatomy applications are available?
4. What are the associated costs for licensing and implementing these applications at an institution of learning?
5. How detailed and appropriate are these anatomy models as a learning aid?
6. How interoperable are these applications?

METHODS

Primary data sources were collected from an online survey, online and email interviews, and email discussions. The online survey was six questions long and was available to students and professors in the HMKN 391 Advanced Functional Anatomy class. The survey gathered data regarding the usage of learning resources, the learning resources available, and demand for additional resources. 3 students participated in the six-question interview, of which 2 were completed via Zoom, and 1 via email. The interview provided qualitative data on learning resource availability. Emails discussions were used to determine costs of 3D anatomy application licensing. I will explore available 3D anatomy applications, and assess the feasibility of their implementation. Secondary sources were used to understand the available 3D anatomy applications available, the features of each application, and each application's interoperability.

DATA SECTION

IMPACT OF REMOTE LEARNING ANATOMY

Remote learning of anatomy courses provides unique challenges to student such as being overwhelmed by the content, the teaching quality, and perceptions of teaching support – affecting student performance (Barbagallo et al.). Remote learning of anatomy loses the hands-on practical experience, which is of particular relevance in studies of anatomy. Hands-on experience is considered the gold standard, and early anecdotal studies suggest that the remote learning format is not capable of replacing the face-to-face aspect and hands-on experience, ultimately causing a decrease in student enrollment of such courses (Brassett et al.).

AVAILABLE LEARNING RESOURCES

The purpose of the interview and survey is to obtain primary data regarding the usage of education resources, the resources available in an anatomy class in a COVID pandemic, and qualitative data on the learning resources. The survey was available to the student, professors and teaching assistants of an Advanced Functional Anatomy class. Of the 129 people in the class, there were 22 participants in the online survey. Interviews were conducted with 3 students via Zoom and email.

DEMOGRAPHICS

Questions 1 and 2 of the survey ensured that the participants of the sample were a part of the anatomy class and indicated their role in the class. Of the 22 participants, all indicated they

were students of the class.

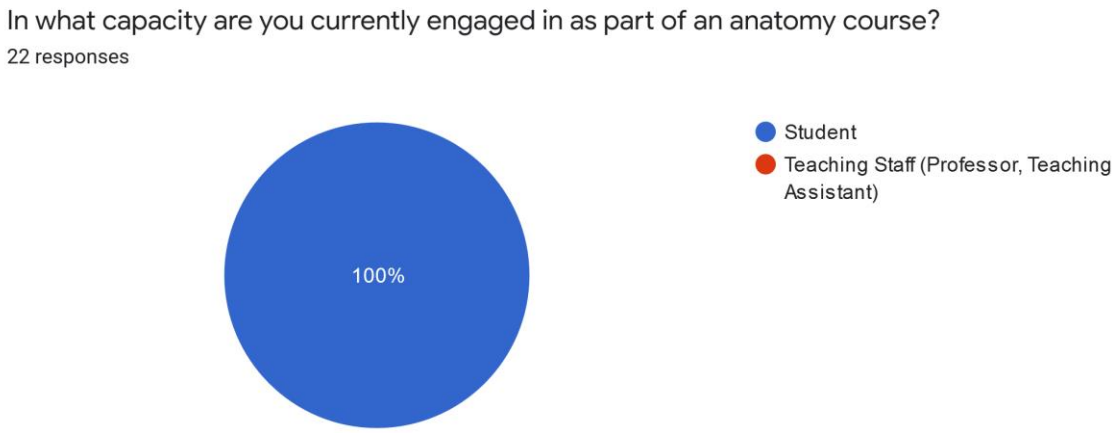

Figure 1. This question corresponded with question 2 of the online survey. Data indicates the demographic of the participants polled.

Online Classroom Environment and Satisfaction

The next survey question (**Figure 2**) was conducted on the learning resources that were available to individuals in the class. Apart from text, images, and videos which were provided in online video lectures and notes, all other resources were sourced individually. This question provides valuable insight into which resources the individuals found important.

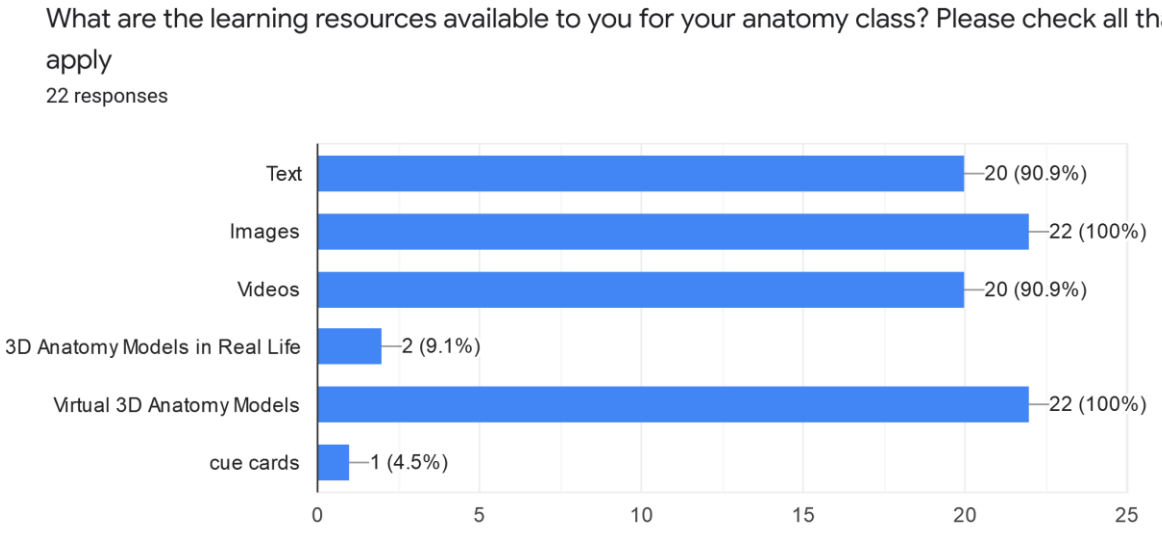

Figure 2. The learning resource used by the 22 survey participants in HMKN 391. Table corresponds with data from question 3 of the online survey.

Figure 3 shows the satisfaction of the learning resources from the online survey participants. 16 (or 72.7%) of the participants felt that learning resources available were adequate, while 5 (or 22.7%) felt neutral on the subject, and 1 participant (or 4.5%) felt that the learning resources were inadequate. This data provides valuable insight on whether additional resources were required on top of available resources. This conflicts with interview data as all

participants had indicated that they prefered in-person models (Ma).

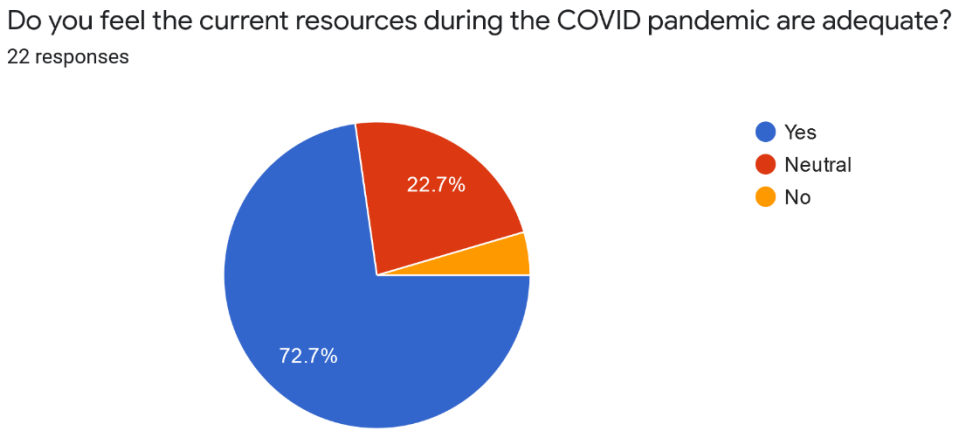

Figure 3. Perceptions of learning resources adequacy among the 22 survey participants. Data corresponds with question 4 of the online survey.

The last questions (question 5 & 6) of the survey indicate the perceptions of missing learning resources. As seen in Figure 4, of all polled individuals, all 22 indicated that they were aware of unavailability the in-person lab components. This is supported in data from the interviews. All interview participants had indicated that they prefered lack of labs and in-person models, there was “less practical/hands-on learning” (Ma *Zoom Interview with Chan & Shaheer*) or “has affected is the inability for us to see models in real life of the muscles” (Ma *Email Interview with Sydney*). It was also noted that due to the lack of in-person models they were “unable to palpate muscles” (Ma *Zoom Interview with Chan & Shaheer*).

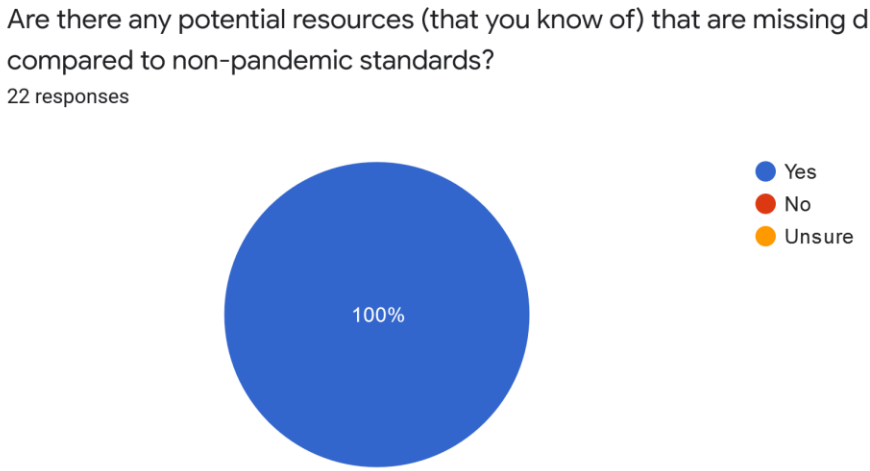

Figure 4. Knowledge of learning resources missing during the COVID pandemic. This coincides with question 5 of the survey.

Applications

The popular 3D anatomy applications are Complete Anatomy, Muscle Premium, and Human Anatomy Atlas. Complete Anatomy was published by 3D4Medical from Elsevier, while Muscle Premium and Human Anatomy Atlas were both published by Visible Body.

Features

In terms of features, both Human Anatomy Atlas by Visible Body and Complete Anatomy by 3D4Medical were similar. They both provided 3D anatomical models of the nervous, muscular, skeletal, and circulatory systems (3D4Medical *Learn the basics in seconds*), in addition to other features (Visible Body *Human Anatomy Atlas*) irrelevant to the Functional Anatomy course. Muscle Premium was less feature-rich but focused on the skeletal, muscular, nervous, and blood supply (Visible Body *Muscle Premium*).

Interoperability

Interoperability is a crucial component in deciding which application is appropriate as it may limit availability to some individuals. While all applications are available on the Windows,

Mac, Android, and iPhone/iPad operating systems, there some difference in hardware requirements. Complete Anatomy is the most hardware heavy with a minimum requirement of Windows 10 and 3GB of memory for PC, iOS 11 for iPad, macOS10.13 for Macs, and Android 7.0 with 2GB memory for android and Chromebook products (3D4Medical *System requirements for Complete Anatomy*). In comparison, Muscle Premium is less hardware-intensive and has minimum requirements of iOS Windows 7 with 2GB of memory, OS X 10.10.0 on Macs, iOS 13.0 on iPhones/iPads, and Android 4.4 (Visible Body *Muscle Premium System Requirements*). Human Anatomy Atlas is the least hardware demanding. Its minimum requirements are Windows 7 or newer with 2 GB of memory, OS X 10.9.0 for Mac, iOS 8.0 for iPad and iPhones, and Android 2.3 or newer for Android and Chromebook (Visible Body *Human Anatomy Atlas System Requirements*).

Cost

Costs for licensing these applications are currently unknown. The email liaison from 3D4Medical, has declined to provide price estimates for licensing Complete Anatomy for the UBC Faculty of Health Science citing that I should "have someone from your faculty contact us for a proposal". Email discussions with Visible Body are also at a standstill with no reply after initial contact with the sales representative.

Conclusion

Summary and Interpretations

To determine whether 3D anatomy software was appropriate for remote learning anatomy courses, this report explored the necessity of 3D anatomy applications and which software would be appropriate. Early anecdotal studies on remote learning anatomy courses indicated 3D anatomy software were a required alterative, yet not as effective as in-person resources (Brassett

et al.). These studies were further supported by the primary survey and interview data. Survey results indicate that students considered 3D anatomy applications necessary, and with it, the majority found the available learning materials to be adequate. However, students interviewed stated that due to remote learning the course was lacking hands-on learning and affected their ability to learn from palpating on other people (Ma). This is consistent with findings that show that in-person models are the gold standard in anatomy courses (Brassett, et al., 2020).

An examination into the available 3D anatomy software determined that Human Anatomy Atlas the most recommended. While all applications examined provided the features required for the Advanced Functional Anatomy course, Human Anatomy Atlas was required the least demanding computer hardware, while still being available on all operating systems.

LIMITATIONS

This study had numerous limitations. Due to the small sample size, the collected primary data does not accurately represent the students, and faculty staff opinions were not represented; application licensing costs were not taken into account; and application recommendation did not account for user interface.

RECOMMENDATIONS

- Usage of 3D Anatomy software is highly recommended for remote learning anatomy courses based on primary data
- Human Anatomy Atlas was most interoperable of the applications examined, however, licensing costs and user interface were not accounted for.

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APPENDIX A: SURVEY

SURVEY INTRODUCTION

I am an undergraduate student engaged in a technical writing class. The purpose of this survey is to obtain primary data for an investigation into the sentiment on currently available learning resources in anatomy courses at UBC Okanagan during the COVID-19 pandemic. The collected data will be used to write a formal report that will be addressed to the administrative body of the Health Science faculty. This survey contains 6 questions and should require no more than 5 minutes. Your responses will remain anonymous. I appreciate your participation.

SURVEY QUESTIONS

1. Are you a currently apart of an anatomy class?
    a. Yes
    b. No

2. In what capacity are you currently engaged in the anatomy class?
    a. Student
    b. Professor / Teaching Assistant
    c. Other: _____

3. What current resources are available to your class? Please check all that apply.
    - Text
    - Images
    - Videos
    - Real life 3D anatomy models
    - Virtual 3D anatomy models
    - Other: _____

4. How do you feel about the current resources during the COVID pandemic are adequate?
    a. Yes
    b. No
    c. Maybe

5. Are there any potential resources (that you know of) that are missing during the pandemic compared to non-pandemic standards?
    a. Yes
    b. No
    c. Unsure

6. If you answered yes to question 5, what resources currently are unavailable?

APPENDIX B: INTERVIEW

INTERVIEW QUESTIONS

1. In what capacity are you engaged in an anatomy course?
2. Is your anatomy class lacking in any learning resources? If yes, what are they and how do you feel this is affecting your learning/teaching ability?
3. How do you feel about the current resources your anatomy class has access to?
4. In your opinion, what are some potential solutions if your class is lacking resources?
5. Would your anatomy class benefit from the licensing of a virtual 3D anatomy application?
6. How would the 3D anatomy software potentially benefit your class?