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First-person video experiences as a vicarious, virtual alternative to in-person basic science labs

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ABSTRACT

Objective: The global COVID-19 pandemic required the teaching of basic science instructional laboratories be done in a remote, online format termed emergency remote teaching (ERT). The aims of this study were to: (1) share strategies for ERT of basic science instructional laboratories and (2) assess student perceptions of the experience of virtual demonstrations that were recorded from the first-person perspective of the professor.

Methods: Laboratories for courses in gross anatomy, neuroanatomy, and clinical microbiology were adapted to ERT by creating videos that allowed the students to view the laboratory activities through the eyes and hands of the faculty. A unique 5-question survey instrument was created to collect students' perceptions of gross anatomy, neuroanatomy, and clinical microbiology virtual lab experiences. Percentage of responses were calculated for 4 close-ended questions. Qualitative content analysis was conducted on the single open-ended question. Two additional close-ended questions were used for assessing perception of gross anatomy labs only.

Results: Videos of gross anatomy, neuroanatomy, and clinical microbiology laboratory activities mimicked the student experience through the camera lens as labs were performed by faculty members engaged in either dissection, viewing structures or doing experiments, respectively. In all 3 basic science courses, over 70% of students strongly agreed or agreed that the videos created a sense of being in the laboratory.

Conclusion: Use of video technology allowed faculty to mimic the student experience of being in basic science laboratories, and, importantly, allowed the student to virtually participate in the learning experience.

Key Indexing Terms: Chiropractic; Education; COVID-19 [Supplementary Concept]

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INTRODUCTION

The SARS-CoV-2 novel coronavirus and the resulting global COVID-19 pandemic have disrupted higher education worldwide. In the United States, the first definitive case was reported in January, 2020.[1] Subsequently, most states shifted to remote, online emergency teaching and learning across all types of education. Healthcare education, typically composed of preclinical and clinical coursework and experiences, was likewise forced into an entirely online environment.[2]

This abrupt shift in March 2020 to emergency remote teaching (ERT) was difficult for students, faculty, staff, and administrators. ERT is distinct from online learning in that it is not designed to be online from beginning to end, and as such should be evaluated differently than a true online learning experience.[3] At the University of Western States (UWS), the burden of moving content and learning experiences online fell to faculty with the support of staff in the Center for Teaching and Learning. Prior to the pandemic, most of the preclinical curriculum was delivered via an entirely face-to-face (F2F) teaching model. The basic science courses, which cover foundational content in anatomy, physiology, biochemistry, neuroscience, microbiology, and pathology, were primarily taught F2F. The basic science courses in gross anatomy, neuroanatomy, and clinical microbiology have a lecture and laboratory component. Moving the lecture components online was time-consuming but relatively straightforward in recording PowerPoint (Microsoft Corp, Redmond, Washington, USA) presentations. Delivery of this content was made somewhat easier because the university had a well-established Moodle online learning management platform (Moodle Pty Ltd, West Perth, West Australia). Delivering the laboratory portions of the courses required developing creative approaches to substitute for the active learning

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that is the hallmark of F2F student laboratory experiences. Educators and students across the globe adapted to this online lecture environment, yet the move to ERT was initially demanding of time and resources.[4]

The F2F gross anatomy lab experience is a student whole-body cadaveric dissection experience spread over the first 3 sequential academic quarters in the degree program. The first course includes 60 hours of lab time to support student dissection of the back and extremities. The second course includes 30 hours of lab time to support student dissection of the head and neck. The third course includes 30 hours of lab time to support student dissection of the thorax, abdomen, pelvis, and perineum. In the first course, students are randomly assigned to groups of 6 per cadaver. These student dissection groups complete the entire whole-body dissection of their assigned cadaver through the 3-course sequence. Each 3-hour dissection lab session involves 3 instructors facilitating dissection of 10 cadavers by 60 students. Students benefit from seeing the anatomical variability among the 10 cadavers in the room. Faculty facilitate students' progress in dissecting, answer questions, and quiz students' knowledge and understanding of pertinent anatomy. Lab assessments in all 3 courses require students to identify tagged cadaveric structures in timed, circuit-based practical exams.

The lab portion of neuroanatomy is comprised of weekly 2-hour F2F sessions for 10 weeks during the third quarter of the program. Lab sections are comprised of 26 to 28 students. During lab, students participate in various activities using brain specimens. In contrast to gross anatomy, the instructor cleans, cuts, and, in some instances, prosects brain specimens prior to student use. No student dissection of brain specimens occurs. Typically, a lab session begins with an instructor-led demonstration of anatomical structures and landmarks on 1 or more specimens. Lecture content is incorporated into these demonstrations as the function of these structures is discussed in addition to relevant anatomical relationships. Students then work together in self-selected groups of 2 to 4 to identify pertinent structures on specimens. The instructor circulates the room and assists groups in locating structures and, like gross anatomy, quizzes students on structure and function. Students work with multiple brain specimens, approximately 25, to appreciate anatomical similarities and differences. Three times per quarter, a formative lab quiz is set up in which structures are tagged on specimens for students to identify. Summative lab assessments are nearly identical in structure to those employed in gross anatomy in which students are asked to identify tagged structures on various specimens during a timed exam.

Clinical microbiology laboratory is typically taught to sections of 26 to 28 students in the fifth quarter of the curriculum for 10 weeks. Each laboratory session is composed of 2 parts; (1) an exercise that is part of an ongoing process to teach students how bacteria are identified and (2) a standalone exercise to reinforce concepts taught in the lecture part of the course. In the typical F2F class the students perform all the exercises and techniques with direction and help from the faculty member. Students record results and prepare short lab reports. These lab reports serve as the assessment of the laboratory exercises.

Due to the rapid move to ERT these 3 laboratory courses were adapted to the online environment by faculty. Each faculty member devised a strategy to essentially become the hands and eyes of the student, allowing the student to experience the lab exercises vicariously through recording the actions and words of the faculty. This report details these various instructional approaches and the student perceptions of these vicarious experiences.

METHODS

Participants

The participants in this study were students at UWS enrolled in the first 5 quarters of the doctor of chiropractic program. These students were either currently taking, or had taken in the previous quarter, gross anatomy, neuroanatomy, and clinical microbiology. Surveys were constructed in SurveyMonkey (San Mateo, CA, USA) and were sent via university email to students. Completion of the survey was voluntary and anonymous, and no inducements were offered. This study, with the survey included, was identified as exempt by the UWS institutional review board (ORG 0001188).

Instructional Resources

Videography in the gross anatomy dissection lab and the neuroanatomy lab was completed using preexisting equipment. A conventional high-definition camcorder (Sony Handycam Model #HDR CX550; Sony, Tokyo, Japan) was affixed to a ceiling- mounted articulating arm. The camera mount and articulating arm allowed the camera to be placed in virtually any viewing position and viewing angle. To best mimic the F2F student experience, camera position presented the first-person perspective of the faculty member with the faculty member's hands in view.

For the laboratory portion of the gross anatomy course series, as the alternative to student dissection, the faculty member recorded himself completing each step of each dissection while narrating. The faculty member's hands and wrists are almost always evident in the field of view, creating the impression the viewer is virtually manipulating the dissection instruments. For the first gross anatomy course, the faculty member spent 74 hours creating videos of himself completing 16 regional dissections of the back, posterior neck, and extremities. This time included planning, preparation, recording, and clean-up. Time spent reviewing, editing, and posting the dissection recordings was in addition to these 74 hours. A total of 57 discrete videos, for a combined 25 hours of recorded dissection, were produced as the alternative to 49 hours of F2F student dissection in this course. In the second gross anatomy course, a total of 32 discrete videos of regional dissections of the head, cranial floor, anterolateral neck, and vertebral canal totaling 14 hours were produced as the alternative to 23 hours of F2F dissection time in this course. This effort required 40 hours of planning,

preparation, recording, and clean-up time by the faculty member. In the third gross anatomy course, a total of 39 discrete videos of regional dissections of the thorax, abdomen, pelvis, and perineum totaling 19 hours were produced as the alternative to 27 hours of F2F dissection time in this course. This effort required 51 hours of planning, preparation, recording, and clean-up time by the faculty member.

In all, gross anatomy courses, students' exposure to the prosected cadavers was supplemented by weekly synchronous sessions from the dissection lab. The faculty member used the camcorder as the webcam for live, interactive Zoom (Zoom Video Communications, Inc., San Jose, CA, USA) videoconferencing sessions. These sessions were conducted as interactive question-and-answer sessions as the instructor demonstrated anatomical structures and relationships. These weekly sessions also provided opportunities for students to see anatomical structures from perspectives different from what was presented in the recordings. URLs for each dissection recording were also embedded in the respective courses in the learning management system, Moodle.

To create a vicarious learning experience in the neuroanatomy lab course, the instructor created 15 videos, totaling 1 hour and 45 minutes. These videos consisted of the instructor pointing out landmarks and structures on various brain specimens while discussing functions and clinical relevance. These lab videos were created to simulate the in-person lab demonstrations that would typically occur in the F2F environment. Additionally, 8 activities that contained brain specimen images were created, each with its own answer key. These activities were provided to students to allow them to practice structure identification they would have experienced during in-person labs. Specimen preparation plus the planning, preparation, and editing of the videos and activities required 25 hours of effort by the faculty member.

The prelab discussion for clinical microbiology was recorded using Panopto recording software (Panopto, Seattle, WA, USA) and drawings were done on paper under a document camera. The discussion of concepts that underpin the lab exercises to be performed was similar to the F2F class, except for the lack of interaction and questions from students. The faculty member then moved to the lab bench and recorded herself performing the laboratory exercises much as the student would do in a F2F class. In the F2F typical microbiology laboratory setting, students spend a total of 20 hours in the laboratory. In the virtual setting the instructor created 30 videos totaling 4 hours. Preparing the laboratory materials, recording, and editing the videos required 30 hours of faculty effort. The recording was carried out using a cell phone mounted on a tripod directed at the lab bench.

The lab recordings for all 3 courses were uploaded to Panopto, the university's video recordings management system. These videos were accessible directly to students through a Panopto app. Student access via the Panopto app and Moodle was password restricted for all courses.

Survey Instrument

A survey was developed to determine students' perceptions about the emergency online laboratory courses. The survey consisted of 5 questions that were pertinent to all 3 classes. Four were closed-ended questions, and the final question was open-ended. Two additional closed-ended questions were used to survey gross anatomy students that had previously engaged in active student dissection in the F2F laboratory setting prior to the pandemic. The closed-ended questions provided students the opportunity to indicate their level of agreement using a 6-point Likert scale (strongly agree, agree, neither agree or disagree, disagree, strongly disagree, and don't know/not sure). The first question queried about the effectiveness of creating a sense of presence in the virtual laboratory environment. Question #2 asked the student to express their level of agreement with the understanding of class content as a result of the first-person faculty recordings. The third question focused on the perceived fairness of the assessments used in the virtual lab environment while the fourth question asked about how well assessment correlated with laboratory content. The final question was an open-ended invitation to provide additional comments regarding any aspect of the virtual laboratory experience. The 2 additional closed-ended questions pertinent only to the gross anatomy laboratory asked the student to indicate level of agreement with (1) whether the virtual experience was a satisfactory alternative to student dissection and (2) if they preferred student dissection to the virtual experience.

The face validity of the survey was established by the director of assessment at UWS. The internal consistency of the scaled, closed-ended questions in the survey was determined by calculating Cronbach's α. Cronbach's α for this group of survey questions was 0.78. This value indicates good internal consistency, particularly for a survey of this size with only 4 questions.[5]

Quantitative Data Analysis

Student responses to the Likert scale questions were collected. The responses to each question were tallied for each course. The percentage of responses for each of the 6 points on the Likert scale was computed.

Qualitative Data Analysis

Responses to the single open-ended survey item "Do you have any additional comments regarding the virtual video-based lab experience?" were analyzed through a stepwise process of content coding. This process involved open coding of responses, which identified labels based on content. Next, responses were grouped into similar categories. Finally, categorized responses were collapsed into overarching themes through the process of selective coding. This approach to qualitative data analysis has been previously described in detail elsewhere.[6,7]

RESULTS

Quantitative Results

The gross anatomy surveys received 81 responses from 164 students invited to participate, resulting in a 49.4%

Table 1 - Student Responses to 4 Survey Questions Common to Gross Anatomy, Neuroanatomy, and Clinical Microbiology Courses

Survey Item	Strongly Agree n %	Agree n %	Neither Agree Nor Disagree n %	Disagree n %	Strongly Disagree n %
Gross Anatomy					
No. 1: First person perspective and narration created a sense of being in the lab setting.	41/80 (51)	31/80 (39)	3/80 (4)	3/80 (4)	2/80 (3)
No. 2: First person perspective and narration facilitated my understanding of the material being taught in the lab.	52/81 (64)	25/81 (31)	0/81 (0)	4/81 (5)	0/81 (0)
No. 3: The assessments used in the virtual lab experience were fair.	21/80 (26)	37/80 (46)	13/80 (16)	7/80 (9)	2/80 (2)
No. 4: The assessments used in the virtual lab correlated well with the lab content.	40/81 (49)	38/81 (47)	3/81 (4)	0/81 (0)	0/81 (0)
Neuroanatomy					
No. 1: First person perspective and narration created a sense of being in the lab setting.	7/44 (15.9)	24/44 (54.5)	6/44 (13.6)	5/44 (11.3)	1/44 (2.2)
No. 2: First person perspective and narration facilitated my understanding of the material being taught in the lab.	18/43 (41.8)	20/43 (46.5)	2/43 (4.6)	3/43 (6.9)	0/43 (0)
No. 3: The assessments used in the virtual lab experience were fair.	19/44 (43.1)	21/44 (47.7)	4/44 (9)	0/44 (0)	0/44 (0)
No. 4: The assessments used in the virtual lab correlated well with the lab content.	22/44 (50)	19/44 (43)	3/44 (6.8)	0/44 (0)	0/44 (0)
Clinical Microbiology					
No. 1: First person perspective and narration created a sense of being in the lab setting.	17/27 (63)	8/27 30	1/27 0.04	1/27 0.04	0 0
No. 2: First person perspective and narration facilitated my understanding of the material being taught in the lab.	17/27 (63)	9/27 33	0 0	1/27 0.04	0 0
No. 3: The assessments used in the virtual lab experience were fair.	21/27 (78)	6/27 22	0 0	0 0	0 0
No. 4: The assessments used in the virtual lab correlated well with the lab content.	23/37 (85)	4/27 15	0 0	0 0	0 0

response rate. Responses to the 4 closed-ended items showed between 72% and 96% of students strongly agreed or agreed. Neuroanatomy surveys elicited 44 responses from 163 students for a 27% response rate. Between 70% and 93% of respondents strongly agreed or agreed with the 4 closed-ended questions. Twenty-seven of 122 students (22%) completed the survey regarding their perception of the virtual clinical microbiology lab. Over 90% of respondents strongly agreed or agreed with each of the 4 common closed-ended survey questions (Table 1). The 2 survey items unique to gross anatomy showed that 60% of respondents strongly agreed or agreed the virtual experience was a satisfactory replacement for the in-person experience but 95% prefer the in-person dissection experience (Table 2). The Likert scale option "don't know/not sure" was selected by 0% of the respondents for all items for all courses and is not included in Tables 1 or 2.

Qualitative Results

Across the surveys for all courses 90 responses to the open-ended item "Do you have any additional comments regarding the virtual video-based lab experience?" were received. The responses were first organized into 2 overarching themes of *positive experience* ($n = 52$) or *negative experience* ($n = 57$). Some responses were coded into both themes if they had elements of each. For example, the following response was coded into both themes, "In some ways it was nicer than being in person because you had [the instructor] with you the entire time. But it was also not hands on so you don't feel like you got the complete experience." The majority of responses in the positive experience theme were coded in a category of *thorough/explained well* ($n = 20$). An example of this category was "I enjoyed our virtual lab hosted by [the instructor]! She did a great job and explained everything in great detail." Other categories in the *positive experience* theme included: *well organized/easy to follow* ($n = 12$), *sense of connection/engagement with instructor* ($n = 11$), *good image and/or video quality/angles* ($n = 5$), and *time-saving/efficient/concise* ($n = 4$). The theme of *negative experience* was most populated by responses coded into the category of *inferior to in-person lab experience* ($n = 38$). A response that was coded into this category was "...It is certainly not the same as an in-person anatomy lab experience and

Table 2 - Student Responses to 2 Survey Questions Used Only for Gross Anatomy Courses

Survey Item	Strongly Agree n %	Agree n %	Neither Agree Nor Disagree n %	Disagree n %	Strongly Disagree n %
Gross Anatomy					
No. 5: The virtual, asynchronous video-based lab experience provided a satisfactory alternative to the in-person dissection experience.	20/80 (25)	28/80 (35)	9/80 (11)	14/80 (18)	9/80 (11)
No. 6: I prefer the in-person dissection experience over the virtual, asynchronous video-based lab experience.	64/81 (79)	13/81 (16)	4/81 (5)	0/81 (0)	0/81 (0)

there's no way I learned that material as well as I would have if it were in person." The remaining categories in this theme included *exam images difficult to orient to and/or identify* ($n = 17$) and *poor image and/or video quality* ($n = 2$) (Table 3).

DISCUSSION

Basic science lab courses traditionally active, in-person experiential learning environments, were abruptly shifted to the online environment during the COVID-19 pandemic. As classroom faculty, we sought to accomplish 2 goals with this report: (1) share the strategies and approaches used to move active instructional laboratory sessions to online experiences and (2) measure the perception of students regarding our vicarious laboratory instructional designs.

The effort required to move to the online remote environment was substantial. In particular, the 165 hours required to record real-time prosection of cadaveric specimens is most significant. Yet all 3 laboratories required extensive time investment as each faculty member performed all aspects of the laboratory learning activities typically performed by a student.

Table 3 - Categories and Themes From Content Analysis of the Single Open-Ended Question

Theme	Positive Experience	Number of Occurrences
Categories	thorough/explained well	20
	well organized/ easy to follow	12
	sense of connection & engagement with instructor	11
	good image and/or video quality/ angles	5
	time-saving/efficient/concise	4
Theme	**Negative Experience**	**No. of Occurrences**
Categories	inferior to in-person lab experience	38
	exam images difficult to orient to and/or identify	17
	poor image and/or video quality	2

Survey results indicate that students perceived the vicarious experiences as favorable. In all 3 courses, over 70% of students strongly agreed or agreed that the actions and narration of the faculty member created a sense of being in the laboratory. Though it is important that faculty can create this environment, it cannot be overlooked that F2F laboratory experiences provide more than academic content. Laboratories impart important lessons of teamwork and communication among students that are difficult to create in an online environment.[8] Moreover, a virtual demonstration of an activity, no matter how realistic, cannot replace the kinesthetic involvement associated with the in-person version of that same activity. The 3-dimensional nature of anatomy is lost in this format. Understanding anatomy in 3 dimensions is critical to clinical practice. This is reflected in the responses to the unique gross anatomy survey questions. These students had been part of dissection work groups of 5 to 6 students prior to the pandemic. These students were able to authentically compare the in-person and virtual experiences. Though 60% of these students strongly agreed or agreed the virtual dissection experience was a satisfactory alternative to the in-person dissection experience, 95% of these students indicated their preference for the in-person dissection experience. When reviewing the anonymized individual student survey responses, it became apparent that many students who disagreed about the virtual dissection experience being a satisfactory alternative strongly agreed in their preference for in-person dissection experiences. The strong preference for in-person dissection may have negatively skewed some respondents away from acknowledging the virtual dissection experience as satisfactory. The students in neuroanatomy and clinical microbiology were able only to assess the experience presented, as opposed to making a direct comparison.

Given the short timeline for administration during the COVID-19 pandemic, the survey was not piloted to students. However, the director of assessment reviewed the survey items and established face validity of the survey. The low survey response rate from students is a limitation of this study. Students were not incentivized to complete the surveys in any of the courses. The demands of an abrupt transition to ERT combined with significant challenges in life outside of the classroom may account

for the low response rate.[9] Although the 3-part gross anatomy course series provided an opportunity for the same students to compare the traditional F2F lab experience with the virtual lab experience, such was not the case in neuroanatomy and clinical microbiology. As such, this study is limited in its ability to address student perception regarding the effectiveness of the virtual lab instructional designs as alternatives to F2F instructional designs across more than 1 basic sciences discipline.

The global COVID-19 pandemic required universities to move rapidly into the online environment. This move was perceived by educators and students differently and involved challenges and opportunities. It is not known yet what the lack of hands-on learning in preclinical curricula will be for students; however, online education and other emerging technologies will likely continue to transform post-COVID healthcare education.[10]

CONCLUSION

Teaching basic science laboratories in an online environment during a global pandemic was perceived by students to be an acceptable substitute for the in-class laboratory opportunity. However, students with previous experience in basic science laboratory preferred the in-person learning experience.

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REFERENCES

1. Holshue ML, DeBolt C, Lindquist S, et al. First case of 2019 novel Coronavirus in the United States. *N Engl J Med*. 2020;382(10):929–936. doi:10.1056/NEJMoa2001191
2. Redinger JW, Cornia PB, Albert TJ. Teaching during a pandemic. *J Grad Med Educ*. 2020;12(4):403–405. doi:10.4300/JGME-D-20-00241.1
3. Hodges C, Moore S, Lockee B, et al. The difference between emergency remote teaching and online learning. EDUCAUSE Review. Published 2020. Accessed November 7, 2021. https://er.educause.edu/articles/2020/3/the-difference-between-emergency-remote-teaching-and-online-learning
4. Padhi KS, Balmuchu G, Acharya PS, et al. The perspectives of educators and learners on e-learning: a cross-sectional descriptive study in a medical school. *Adv Med Educ Pract*. 2021;12:1059–1066. doi:10.2147/AMEP.S326147
5. Glen S. Cronbach's Alpha: simple definition, use and interpretation. StatisticsHowTo.com: Elementary statistics for the rest of us. Published 2021. Accessed November 27, 2021. https://www.statisticshowto.com/probablity-and-statistics/statistics-definitions/cronbachs-alpha-spss
6. Miles MB, Huberman MA, Saldana J. *Qualitative Data Analysis: A Methods Sourcebook*. 3rd ed. Los Angeles, CA: Sage and Christensen; 2014.
7. Major CA, Burnham KD, Brown KA, et al. Evaluation of an online case-based learning module that integrates basic and clinical sciences. *J Chiropr Educ*. 2021;35 (2):192–198. doi:10.7899/JCE-20-3
8. Gamage KAA, Wijesuriya DI, Ekanayake SY, et al. Online delivery of teaching and laboratory practices: continuity of university programmes during COVID-19 pandemic. *Educ Sci*. 2020;10(10):291. doi:10.3390/edusci10100291
9. Besser A, Flett GL, Zeigler-Hill V. Adaptability to a sudden transition to online learning during the COVID-19 pandemic: understanding the challenges for students. *Scholarship Teach Learn Psychol*. 2022;8(2):85–105. doi:10.1037/stl0000198
10. Hayat AA, Keshavarzi MH, Zare S, et al. Challenges and opportunities from the COVID-19 pandemic in medical education: a qualitative study. *BMC Med Educ*. 2021;21(1):247. doi:10.1186/s12909-021-02682-z