VETERINARY STUDENT PERCEPTIONS ON VIRTUAL AND

ONLINE LEARNING PLATFORMS COMPARED TO IN-PERSON

SETTINGS DURING THE COVID-19 PANDEMIC

A Thesis

by

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ABSTRACT

The emergence of COVID-19 as a global pandemic in the spring of 2020 resulted in significant changes to content delivery for institutes of higher learning. Much of this change required the shift from in-person to virtual, or online content delivery. The purpose of this study was to elicit veterinary student perceptions regarding the shift to virtual and online learning platforms and associated student performance on course letter grades during the COVID-19 pandemic, using a paper-based anonymous survey. The participants of this study were veterinary students enrolled in the first (1VM), second (2VM), and third (3VM) year of the pre-clinical veterinary curriculum at Texas A&M University's College of Veterinary Medicine and Biomedical Sciences (CVMBS). The data showed a larger number of students utilized course office hours and scored higher on exams for courses delivered in-person, and preferred in-person when compared to online courses. Certain strategies utilized during COVID-19 which students warranted keeping in the curriculum post pandemic, as indicated in open-ended survey questions, included the option to attend courses online (either synchronous or via recorded sessions) vs in-person when needed, smaller group sizes for in-person laboratory sessions, and recorded lecture and lab sessions made available for study and review. Conversely, the primary COVID-19 strategy students indicated should be removed from the curriculum post pandemic was breakout rooms during Zoom sessions.

DEDICATION

      This project is dedicated to the veterinary students enrolled at Texas A&M University during the COVID-19 pandemic. Their perseverance in the face of great adversity exhibited resilience and maturity. Well done, classes of 2022, 2023, and 2024.

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Contributors

This work was supervised by a thesis committee consisting of Dr. Karen Cornell [advisor] Department of Veterinary Small Animal Clinical Sciences, Dr. Kristin Chaney [advisor] Department of Veterinary Integrative Biosciences, Mrs. Johna Wright [advisor], and later by Dr. Teresa Isbell [committee chair] of the Department of Medical Education.

The statistical analysis performed using Graphad was provided by Dr. Bradley Simon of the Department of Veterinary Small Animal Clinical Sciences.

All other work conducted for the thesis was complete by the student independently.

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1. INTRODUCTION

1.1. Purpose

The purpose of this study to elicit veterinary student perceptions regarding the shift to virtual and online learning platforms and associated student performance on course letter grades during the COVID-19 pandemic using a paper-based anonymous survey. The findings from the fall 2020 survey were utilized to consider modifications to content delivery for the spring 2021 semester, as COVID social distancing restrictions were maintained. The current findings were additionally utilized in strategic planning for future course modifications post-COVID. Prior to the necessary COVID-19 course modifications, the Doctor of Veterinary Medicine (DVM) program did not provide synchronously online course options for professional students.

1.2. Problem Addressed in Study

With the emergence of COVID-19 as a global pandemic in early spring of 2020, many institutes of higher education were forced to alter content delivery from in-person to virtual, or online content delivery. This was not unique to higher education and impacted primary schools as well as a host of other learning services. In addition to the abrupt change in content delivery, many individuals within both the student and instructor populations experienced stress (Vatier et al., 2021), illness, loss of wages or unemployment (Hensher, 2020), and other significant changes in daily life.

Due to the rapid changes required in education to comply with pandemic requirements for biosecurity and social distancing, it was difficult to know whether all modifications were effective, data driven and in-line with best pedagogical practices. Some platforms selected for

content delivery were rarely utilized pre-COVID, while others were developed as a result of COVID, resulting in a lack of appropriate validation as teaching tools prior to utilization.

With more than nine months of experience with content delivery through COVID-19 driven changes at the time of data collection, there was adequate data available to assess the positive impact, and areas in which content delivery was lacking impact.

This study was performed with more than nine months of content delivery through COVID-19 driven changes at the time of data collection, allowing students to provide perceptions on the positive impact of the educational modifications as well as places where content delivery less impactful. The survey hoped to identify what was working well and areas needing change related to COVID-driven educational content delivery. Both subjective (opinions/perceptions) and objective data (hours allotted to studying, comfort level asking questions asked in class, number of office hours attended, and letter grades of A, B, C, D, or F, for courses delivered during the fall of 2020, were collected in the form of a voluntary, in-class, student survey.

1.3. Research Questions

Courses delivered during COVID-19 modifications were categorized by in-person or online/virtual. The listed research questions were posed to students related only to courses delivered during COVID-19 restrictions.

1. What are veterinary student perceptions (variable) regarding virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?

2. How do course letter grade averages (variable) of virtual/online learning platforms compare to in-person lecture settings during the COVID-19 pandemic?

3. What is the perceived office hour accessibility to the instructor (variable) between virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?

4. What is the perceived accessibility to ask questions during the course lecture time period (variable) between virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?

5. What is the time allotted to class and exam preparation (variable) between virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?

1.4. Data Gathering Method

Data was collected with a voluntary, anonymous, in-class, paper survey. The survey was delivered to first (1VM), second (2VM), and third year (3VM) DVM students enrolled at Texas A&M University College of Veterinary Medicine and Biomedical Sciences (CVMBS). The students had experienced a minimum one semester of online, virtual, and hybrid content delivery.

All 1VM, 2VM, and 3VM students were enrolled in one of the six required courses in the Professional and Clinical Skills course series. These courses offered in-person learning environments during the pandemic in which attendance was required and presented the opportunity to distribute surveys in an effective manner.

1.5. List of Definitions

For the purposes of this study, virtual content delivery was defined as education delivered synchronously with scheduled course times, and in such a manner that allowed real-time, two-way discussions between instructor and student available to all students attending the session.

Examples of this method of content delivery include lectures and other group learning opportunities delivered via Zoom. In comparison to virtual content delivery, online content delivery was defined as content delivered asynchronously, which did not support real-time, two-way discussions between instructor and student that could not be experienced by all students simultaneously. Hybrid content delivery was defined as content delivered as a mixture of students on-site and physically present in the classroom and students attending virtually via Zoom or similar remote platform. Traditional, in-person content delivery was defined as content that is delivered to all students who are present in the same physical location, experiencing face-to-face instruction.

1.6. Significance of Study

The significance of this study was to collect and analyze both subjective and objective information related to curricular modifications due to COVID-19. The information was used to determine the pandemic-prescribed changes that should be continued, eliminated, or further modified once COVID-19 restrictions were lifted within the professional CVMBS program.

2. LITERATURE REVIEW

2.1. What is Known

The emergence of COVID-19 as a global pandemic resulted in significant instructional change for institutes of higher education. Instructional changes were especially impactful on programs that rely heavily on hands-on laboratories, and clinical instruction, such as medical and veterinary medical schools. Several institutions (Ehrlich et al., 2020) reported their responses to COVID-19 public safety measures as potential model templates for pre-clinical and clinical instruction.

As with most change, both positive and negative effects were noted, as virtual learning cannot yet capture all facets of face-to-face laboratory instruction (Chatziralli et al., 2020; Carolan et al., 2020; Ehrlich et al., 2020). The effects were felt by the student learner as well as faculty and staff. Faculty and staff tasked with creating the altered educational experience were presented with a monumental instructional challenge while concurrently navigating their own personal experiences and responses to managing altered daily life,due to COVID-19 (Vatier et al., 2021). Faculty were often asked to create new learning modules in the face of a lack of experience (Vatier et al., 2021) and knowledge related to online learning platforms.

In contrast to pre-existing online/virtual courses with established infrastructure and technical support, many COVID-19 instructional changes were "emergency remote teaching" with rapid deployment, lack of infrastructure, and limited technical support (Rapanta et al., 2020). In addition to these challenges, COVID-19 also impacted many in the field of higher education through increased workload and evolving external stressors. These factors negatively impacted faculty and created the opportunity for a trickle-down effect on students (Rapanta et al.,

2020). Faculty, staff and students all struggled with navigating the challenges from the effects of isolation and defining the dividing line of work-life balance when working/learning from home (Quinn et al., 2020; Rose, 2020).

Historically most medical institutes of higher education have delivered content in a face-to-face manner for both laboratory and lecture materials. Prior to COVID-19 these content delivery methods have been a topic of discussion related to the millennial student. It has been proposed face-to-face, highly structured content delivery is not necessarily best suited for the millennial student (Ruzycki et al., 2019) as they tend to prefer self-study and incorporation of technology over face-to-face traditional content delivery for the lecture setting. Ruzycki (2019) suggested using the "Five R's" strategy when developing educational experience for millennials: rapport, relaxed environment, rationale related to expectations, relevance, and research-based teaching methodologies. Although the change from face-to-face content delivery to hybrid, online, or virtual delivery should have theoretically improved learning for the millennial student, there has not been a preponderance of evidence to support this thought.

Ruzycki (2019) and Henry (2020) acknowledged the need for rapport between instructor and student to facilitate impactful learning. Students who began their transition to COVID-modified teaching after experiencing in-person learning had opportunities to meet professors face-to-face and build rapport prior to the modifications required for biosecurity and social distancing. Students who entered veterinary or medical school during, or after, the fall of 2020 experienced very little, to no opportunity to build rapport by traditional means and may have experienced a negative impact on learning.

Reported content delivery preferred by millennials (Ruzycki, 2019) pre-COVID included access to online resources and activities incorporating modern technology. There is no peer-

reviewed evidence to support medical education solely distributed via online or virtual content delivery which conflicts with the "Five R's" strategy of research-driven educational approaches. Based on the previously reported preferences for online resources and incorporation of technology, educators have trended towards content delivery focused on decreased reliance on sole didactic content delivery, technology incorporation, and student-centered active learning experiences (Rose, 2020). These changes were more substantial as a response to COVID-19. Although the millennial student preferences of more frequent assessment of knowledge and individual feedback may have been supported in the COVID-19 classroom restructured setting (Carolan et al., 2020; Thieman et al., 2020), it would be fair to assume most students did not experience a relaxed learning environment, due to the stressors associated with a global pandemic.

2.2. What is Not Known

Millennial students prefer relaxed learning environments, technology incorporation, rationale, rapport, and relevance (Ruzycki, 2019); many of these concepts have been studied and the impacts documented. Content delivery modifications as a result of COVID-19 have incorporated the preferences of incorporation of technology and students' ability to learn in a physical setting of their choice (an important component of a relaxed learning environment).

What is not known is how the lack of accountability, and significant laxity in the learning environment, for content delivered virtual or online compared to in-person delivery, due to COVID-19 strategies impacted student outcomes such as grades. Survey data has been reported assessing student satisfaction, indicating significant negative effects on clinical examinations, written examinations, and preparedness (Choi et al., 2020). Surveys assessing instructor perspective indicated a statistically significant increase in very poor teaching practices during the

pandemic (Chatziralli et al., 2020), communication challenges, technophobia and need for faculty training (Rajab et al., 2020).

The duration of COVID-19 teaching changes has been open-ended as there is no definite end to restrictions and limitations on in-person learning and educators must do their due diligence to evaluate what is working well and what strategies should be re-evaluated. Medical educators (Khamees et al, 2020) recognize the value of clinical experiences and understand that solutions must be developed and assessed to support student learning as crisis such as COVID-19 are unpredictable and must be navigated with best practices and personal/individual safety in mind.

To date, no research has been published examining the long-term effects of COVID-19 teaching strategies on veterinary students within the United States using objective data such as student exam performance or clinical skills assessments, coupled with the subjective data such as student well-being and learning preference. The lack of information on the impact of unreliable internet, financial constraints, computer access, level of technology available, poor learning interactions due to platform for colleges and institutions has not been measured (i.e. Mac versus Windows based).

It is both the duty of individual faculty and the higher education community to examine the teaching strategies developed during the COVID-19 pandemic adopting successful strategies and continuing their refinement (Carolan et al., 2020; Chatziralli et al., 2020; Ehrlich et al., 2020; Quinn et al., 2020; Rose, 2020), supporting medical education and student well-being and match the educational needs of a changing world. A priority of this study was to determine, in a timely manner, what should be addressed related to changes in content delivery prior to the start of the spring 2021 semester due to continued COVID restrictions to support student success,

knowledge retention, and student access to support in learning and understanding of challenging content.

2.3. Summary of Research Questions

The goal of this study was to provide answers related to: 1) veterinary student perceptions on virtual/online learning platforms during the COVID-19 pandemic compared to in-person lecture settings, both during the COVID-19 pandemic, 2) course letter grade averages with respect to virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic, 3) the perceived office hour accessibility to the instructor between virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic, 4) the perceived accessibility for students to ask questions during the course lecture time period between virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic, and 5) the time allotted to class and exam preparation between virtual/online learning platforms compared to in-person lecture settings during the COVID-19 pandemic.

3. METHODS

This non-experimental, retrospective survey study was designed to elicit veterinary student perceptions regarding the shift to virtual and online learning platforms and associated student performance on course letter grades during the COVID-19 pandemic.

3.1. Study Population

The participants of this study were veterinary students enrolled in the first (1VM), second (2VM), and third (3VM) year of the pre-clinical veterinary curriculum at Texas A&M University's College of Veterinary Medicine and Biomedical Sciences (CVMBS). The 2VM, and 3VM students had experienced a minimum of one full semester of traditional veterinary-based content delivery within the veterinary program and a minimum of one full semester of COVID-19 adapted veterinary curriculum content delivery. The 1VM students did not have previous traditionally instructed veterinary content delivery due to entering the veterinary program during the COVID-19 pandemic.

3.2. Identification and Contact Method

Participants were identified through class rosters for the 1VM, 2VM, and 3VM veterinary curriculum and were verified for current enrollment through the Associate Dean of Professional Programs office.

A paper-based survey was distributed during a course with required face-to-face content delivery where the researcher was instructor of record. The course was taught as a six sequential course series which built upon each previous semester. The specific courses where survey distribution occurred were Professional & Clinical Skills I delivered to 1VM students, Professional & Clinical Skills III delivered to 2VM students and Professional & Clinical Skills V delivered to 3VM students.

3.3. Selection Method

Survey size calculation using the survey size calculator resulted in a need for a sample of 307 students from a population of 430 students, using an error rate of 0.03, or 3%. Applying a further estimated response rate of 90%, the number of students required for sampling was 342.

3.4. Methods to Reduce Coverage and Sampling Errors

Efforts to reduce coverage error included inclusion of only the Professional & Clinical Skills I (for 1VM students), Professional & Clinical Skills III (for 2VM students), and Professional & Clinical Skills V (for 3VM students) classes which required in-person attendance for distribution of paper surveys. Surveys were distributed at the beginning of class and collected once complete or at the end of the specified class period. All surveys were returned by the end of the specified class period. The sample calculator reduced sampling error by identifying an appropriate sample size.

3.5. Sampling Strategy

Related to sample selection, all students enrolled in the 1VM, 2VM, and 3VM Professional & Clinical Skills course were selected. The small population size and number of questions on the questionnaire coupled with the ease of in-class distribution of the survey created the need for all enrolled professional students to be selected for survey distribution.

3.6. Survey Plan

The survey letter (Appendix A) and survey (Appendix B) were delivered after the mid-semester grading period, once students had received a minimum of one exam per didactic course and additional written feedback related to their understanding of content. This allowed students to provide objective responses to the research questions, in addition to the subjective responses

for survey questions. All survey questions were assessed on an item abstract table (Appendix C) to evaluate for study fit and ensure survey questions were aligned with research questions.

The survey was divided into three categories (Demographics, Performance Characteristics, Course Characteristics). Survey questions included demographic data as well as current program year. Current program year allowed researchers to account for students with no pre-COVID veterinary didactic course experience. Objective data points such as letter grade averages for courses delivered in the fall of 2020, including online/virtual and in-person courses (categorical data) and number of hours spent studying for each course (categorical data represented in ranges), as well as subjective data such as student perception questions were included in the survey using Likert scales (categorical data). Students were asked to check the box representing their response to the presented question.

3.7. Survey Instrument (Validity and Reliability)

Two types of validity measures were applied to this survey. The first measure of validity evaluated was content validity, the second was internal consistency reliability. Four faculty members of the CVMBS provided expert opinions on the survey tool to be used as a measure of the impact of COVID-19 teaching strategy changes on students and their perceptions of learning.

Two of those faculty members have published survey research in addition to being content experts on education. One faculty member suggested the incorporation of the Myers Briggs personality test (MBTI), as all veterinary students were required to complete the assessment during the orientation week of veterinary school.

Utilizing the test-retest method of reliability would not be feasible for this survey for several reasons. The most important reason is the degree of survey fatigue veterinary students reach after the mid-semester mark. At the time of survey distribution, the students had received a

minimum of five surveys from main campus and the college over the previous three months assessing their satisfaction with COVID-19 teaching strategies, their desired testing location, evaluations of internet accessibility, and other factors. Several students commented on the quickly fading desire to respond to further surveys, including student evaluations of teaching that are released towards the end of every semester.

The average response rate for course evaluation surveys in 2019 was approximately 20-30% for several veterinary school student evaluations of teaching for instructors and course evaluations. Based on this response rate, low response rate for this study. Low response rate can affect the utilization for alternate forms of reliability such as changing order or response sets and changing wording. The most feasible measure of reliability was to use internal consistency reliability.

Two large categories were measured in this survey: student perception of online versus in-person instruction and actual student performance of online versus in-person instruction. The questions related to student perceptions included: preference for online vs in-person learning platforms, preference to choose between learning platforms, flexibility in choice, perceptions related to grasping concepts, exam performance and content retention. The questions related to actual performance included questions such as: student grade averages for courses delivered during the fall of 2020, instructor availability, and the ability to ask and receive answers for questions.

3.8. Survey Distribution

The survey packet included a one-page cover letter and survey which were stapled together. As this survey was distributed and collected in class, no envelope or packaging was

associated with the survey. Surveys were collected at completion of the class period. Students

were able to opt out of the study and follow-up data collection was not attempted.

The survey was deployed to first year (1VM), second year (2VM), and third year (3VM)

veterinary students. The only identifier on the survey was to discriminate between the 1VM,

2VM, and 3VM responses.

3.9. Informed Consent and Confidentiality

Approval was obtained through the university TAMU Institutional Review Board for

research involving human subjects. Consent was obtained from each participating student from

which data was collected. Students were advised the study was voluntary and responses would

be utilized during review of content delivery methods during COVID-19. No identifiers were

used to link individual student identification to survey responses. Completed and returned

surveys were coded by number at random when data entry occurred for data reference purposes.

3.10. Statistical Analysis

Data were analyzed using computer generated software (Graphad Prism 8). Frequency

and percentile distributions were reported for all question responses. All Likert type items were

used with a 5 or 4-point answer scale. Questions 18 – 27 utilized the 5-point scale, ranging from

"strongly agree" = 1, "agree" = 2, "neutral" = 3, "disagree" = 4, to "strongly agree" = 5.

Questions 15 and 17 utilized a 4-poimt scale from "significantly difficult" = 1, "moderately

difficult" = 2, "moderately convenient" = 3, to "significantly convenient" = 4.

Survey responses between 1VM, 2VM, and 3VM students were analyzed using a

Kruskal-Wallis test followed by a Dunn's test for multiple comparisons when appropriate.

Differences between online versus in-person survey responses were compared within semesters

using a Wilcoxon matched-pairs signed rank test. Statistical significance was set at $p < 0.05$.

4. RESULTS

Student demographics for 1VM, 2VM, and 3VM are reported in Table 4.1. 2VM students had significantly higher-grade averages for online courses when compared to 3VM (3 (2-4) and 3 (1-4), respectively, $p = 0.023$). Respondent demographics related to total student respondents, previous online or virtual course work, MBTI results, and highest degree earned (Table 4.1) were not analyzed between program years.

Table 4.1 Survey respondent demographics.

	1VM	2VM	3VM	Combined semesters
Number of students participating in the survey	150	151	129	430
Question 2: Received online or virtual courses / total responses (%)	122/149 (82)	135/151 (89)	110/129 (85)	367/429 (86)
Question 4a: Number of students per age group in years (%)				
20-25	136 (92)	119 (79)	94 (73)	349 (82)
26-35	10 (7)	30 (20)	33 (26)	73 (17)
46-50	2 (1)	2 (1)	1 (1)	5 (1)
51-55	0	0	0	0
> 56	0	0	0	0
Question 4b: Meyer Briggs Personality (number of students)				
Introvert : Extrovert	73 : 53	70 : 48	62 : 43	205 : 144
Intuition : Sensing	60 : 45	54 : 35	45 : 16	159 : 96
Feeling : Thinking	53 : 52	42 : 48	21 : 39	116 : 139
Perception : Judgement	17 : 88	24 : 71	11 : 50	52 : 209
Question 5 part 1: Acquired a degree Online only : In-person only : Online and in-person	1 : 98 : 24	3 : 112 : 15	0 : 99 : 17	4 : 309 : 56
Question 5 part 2: Highest degree (%)				
No degree obtained	10 (7)	11 (7)	0 (0)	21 (5)
Bachelors	134 (89)	127 (85)	109 (89)	370 (88)
Masters	6 (4)	10 (7)	13 (11)	29 (7)
Doctoral	0 (0)	2 (1)	0 (0)	2 (<1)
Fall 2020 Course average for Online (Question 8): In-person (Question 9)				
A	54 : 71	69 : 69	42 : 64	165 : 204
B	72 : 66	70 : 70	73 : 57	215 : 193
C	17 : 7	8 : 8	8 : 3	33 : 18
D/F	1 : 0	0 : 0	0 : 0	1 : 0

Student survey responses for 1VM, 2VM, and 3VM are reported in Table 4.2. There were no significant differences in questions 6-7,9,15,17-20, 23-26 when comparing 1VM, 2VM, and 3VM semesters. 2VM were less likely to perform better on exams with in-person platforms when compared to 1VM (3 (1-5) and 2 (1-5), respectively, $p = 0.006$). 2VM students were more likely

to perform better on exams with online platforms when compared to 1VM (3 (1-5) and 3 (1-5), respectively, p = 0.004) and 3VM (3 (1-5) and 3 (1-5), respectively, p = 0.036) students. A greater number of students utilized course office hours for in-person compared to online courses (71:32), respectively.

Table 4.2 Survey responses for instructor and course characteristics.

	1VM	2VM	3VM	Combined semesters
Question 10: Do you regularly utilize course office hours for courses delivered online or virtually? (%)				
Yes	14	7	11	32 (7)
No	136	143	117	396 (92)
Question 11: Categorize average instructor availability for course office hours for courses delivered online or virtually: (%)				
Not Available	6	7	21	34 (8)
<1 hour per week	17	21	43	81 (19)
1 to 3 hours per week	121	106	50	277 (64)
>3 hours per week	4	8	2	14 (3)
Question 12: Do you regularly utilize course office hours for courses delivered in-person? (%)				
Yes	38	15	18	71 (16)
No	111	134	110	355 (82)
Question 13: Categorize average instructor availability for course office hours for courses delivered in-person: (%)				
Not Available	9	6	16	31 (7)
<1 hour per week	8	19	26	53 (12)
1 to 3 hours per week	118	99	67	284 (66)
>3 hours per week	13	19	4	36 (8)
Question 14: Do you ask questions during class for courses delivered online or virtually? (%)				
Yes	62	64	63	189 (44)
No	88	86	64	238 (55)
Question 15: Categorize ease of asking questions and receiving responses during class for courses delivered online or virtually: (%)				
Significantly difficult	1	4	2	7 (2)
Moderately difficult	43	41	34	118 (27)
Moderately convenient	83	73	71	227 (53)
Significantly convenient	22	32	20	74 (17)
Question 16: Do you ask questions during class for courses delivered in-person? (%)				
Yes	64	53	59	176 (41)
No	86	97	69	252 (59)
Question 17: Categorize ease of asking questions and receiving responses during class for courses delivered in-person: (%)				
Significantly difficult	6	8	3	17 (4)
Moderately difficult	43	30	33	106 (25)
Moderately convenient	63	69	55	187 (43)
Significantly convenient	36	42	36	114 (26)
Question 18: I prefer the online/virtual learning platform to the in-person learning platform. (%)				
Strongly agree	9	20	17	46 (11)
Agree	25	31	29	85 (20)
Neutral	44	44	35	123 (29)
Disagree	58	34	32	124 (29)
Strongly disagree	14	21	15	50 (12)

Table 4.2 continued

Question 19: I prefer the in-person learning platform to the online/virtual learning platform. (%)				
Strongly agree	23	25	22	70 (16)
Agree	60	46	40	146 (34)
Neutral	56	48	44	148 (34)
Disagree	8	21	18	47 (11)
Strongly disagree	3	10	4	17 (4)
Question 20a: I prefer the ability to choose between the in-person learning platform and online/virtual learning platform for a given semester. (%)				
Strongly agree	74	69	65	208 (48)
Agree	50	47	44	141 (33)
Neutral	22	28	17	67 (16)
Disagree	2	5	2	9 (2)
Strongly disagree	2	1	0	2 (<1)
Question 20b: I would like the flexibility to attend either the in-person learning platform and online/virtual learning platform and alter on a daily basis if needed. (%)				
Strongly agree	82	73	57	212 (49)
Agree	49	41	50	140 (33)
Neutral	16	27	17	60 (14)
Disagree	1	9	3	13 (3)
Strongly disagree	2	0	1	3 (<1)
Question 21: I perform better on exams when I attend the online/virtual learning platform compared to the in-person learning platform. (%)				
Strongly agree				
Agree	5	20	7	32 (7)
Neutral	9	18	12	39 (9)
Disagree	72	69	56	197 (46)
Strongly disagree	50	29	39	118 (27)
	14	15	14	43 (10)
Question 22: I perform better on exams when I attend the in-person learning platform compared to the online/virtual learning platform. (%)				
Strongly agree	21	22	18	61 (14)
Agree	55	27	31	113 (26)
Neutral	66	80	66	212 (49)
Disagree	7	16	10	33 (8)
Strongly disagree	1	6	3	10 (2)
Question 23: I grasp concepts quicker when I attend the online/virtual learning platform compared to the in-person learning platform. (%)				
Strongly agree	1	15	8	24 (6)
Agree	7	17	16	40 (9)
Neutral	65	53	43	161 (37)
Disagree	63	52	47	161 (37)
Strongly disagree	14	13	14	41 (9)
Question 24: I grasp concepts quicker when I attend the in-person learning platform compared to the online/virtual learning platform. (%)				
Strongly agree	24	20	19	63 (15)
Agree	67	54	41	162 (38)
Neutral	53	57	53	163 (38)
Disagree	6	15	15	36 (8)
Strongly disagree	0	5	0	5 (1)

Table 4.2 continued

Question 25: I retain concepts longer when I attend the online/virtual learning platform compared to the in-person learning platform. (%)				
Strongly agree	0	10	6	16 (4)
Agree	9	16	13	38 (9)
Neutral	68	60	45	173 (40)
Disagree	60	50	47	157 (36)
Strongly disagree	13	14	16	43 (10)
Question 26: I retain concepts longer when I attend the in-person learning platform compared to the online/virtual learning platform. (%)				
Strongly agree	21	22	19	62 (14)
Agree	67	57	40	164 (38)
Neutral	58	55	56	169 (39)
Disagree	4	12	12	28 (6)
Strongly disagree	0	5	0	5 (1)
Question 27: Were there any COVID-19 teaching strategies, particularly helpful for your learning, that you would like to see incorporated into the curriculum permanently? (%)				
Yes	124	111	93	328 (76)
No	26	40	36	102 (24)
Question 28: Were there any COVID-19 teaching strategies, particularly detrimental for your learning, that you would like to see eliminated from the curriculum permanently? (%)				
Yes	111	103	60	274 (64)
No	39	48	69	156 (36)

Within-semester results are depicted in Table 4.3. 1VM students spent significantly more time studying for courses in-person when compared to online ($p < 0.0001$). 1VM and 3VM students reported higher course averages for in-person courses when compared to online courses ($p < 0.0001$ and $p < 0.0001$, respectively). 1VM, 2VM, and 3VM students were less likely to prefer online course when compared to in-person courses ($p < 0.0001$, $p = 0.035$, and $p = 0.013$, respectively).

1VM and 3VM students were less likely to perform better on exams when attending online classes when compared to in person ($p < 0.0001$ and $p < 0.0001$, respectively). 1VM, 2VM, and 3VM students were less likely to grasp concepts quicker when attending online courses when compared to in-person ($p < 0.0001$, $p < 0.0001$, and $p < 0.0001$, respectively). 1VM, 2VM, and 3VM students reported being less likely to retain concepts when attending online courses when compared to in-person ($p < 0.0001$, $p < 0.0001$, and $p < 0.0001$, respectively).

Table 4.3 Survey respondent demographics.

Question	Online	In person	*p* value	Semester (VM)	Total responses
6 vs 7	2 (1-5)	2 (1-5)*	<0.0001	1	148
	2 (0-5)	2 (1-5)	0.24	2	150
	2 (0-5)	2 (1-5)	0.067	3	129
8 vs 9	3 (1-4)	3 (2-4)*	<0.0001	1	144
	3 (2-4)	3 (2-4)	>0.99	2	146
	3 (1-4)	3 (1-4)*	<0.0001	3	129
15 vs 17	3 (1-4)	3 (1-4)	0.81	1	148
	3 (1-4)	3 (1-4)	0.39	2	149
	3 (1-4)	3 (1-4)	0.25	3	127
18 vs 19	3 (1-5)*	2 (1-5)	<0.001	1	150
	3 (1-5)*	3 (1-5)	0.036	2	150
	3 (1-5)*	3 (1-5)	0.013	3	128
21 vs 22	3 (1-5)*	2 (1-5)	<0.0001	1	150
	3 (1-5)	3 (1-5)	0.053	2	151
	3 (1-5)*	3 (1-5)	<0.0001	3	128
23 vs 24	4 (1-5)*	2 (1-4)	<0.0001	1	149
	3 (1-5)*	3 (1-5)	<0.0001	2	150
	3 (1-5)*	3 (1-4)	<0.0001	3	128
25 vs 26	3 (2-5)*	2 (1-4)	<0.0001	1	150
	3 (1-5)*	2 (1-5)	<0.0001	2	150
	3 (1-5)*	2 (1-4)	<0.0001	3	127

* significantly higher values when compared to online or in person within the respective category and semester

The most common themes emerging from student suggestions for COVID-19 teaching strategies that should be incorporated in the curriculum after COVID restrictions were lifted included offering students the option to attend simultaneously, virtually, or in-person (73 out of 430 students), requiring smaller groups for in-person laboratory/discussion experiences (65 out of 430 students), and providing recorded lecture and lab sessions (88 out of 430 students).

5. CONCLUSIONS

This study found students enrolled in the veterinary program at Texas A&M University preferred in-person to online learning, and overall student performance based on grade average for courses delivered during the fall of 2020 was higher for in-person compared to online courses. The preference for in-person to online/virtual learning is consistent with that published for medical and veterinary medical students (Hanafy et al., 2021; Dutta et al., 2021; Singal et al., 2021).

The emergence of COVID-19 as a global pandemic in the spring of 2020 led to unprecedented changes in education with the incorporation of technology to a scale that had never been experienced. Learning management platforms, web conferencing technology, and online testing services were utilized throughout all levels of learning from primary to higher education, continuing education and more. Through the use of these services, challenges were encountered (Hanafy et al, 2021; Rajab et al., 2020; Singal et al., 2021) and service providers were tasked with not only supporting a significant number of users, but also creating updates to address unexpected problems. One such unexpected problem was the emergence of Zoom-bombing, or uninvited guests and hackers, entering Zoom sessions to create distraction. Additional problems included those experiences by Mac users who were presented with interface issues when attempting to use features of some of the learning management systems, online testing services, or web conferencing technology. Technology problems were not confined to errors that affected content delivery. The incorporation of technology for online examinations was met with students developing methods to cheat (Hanafy et al., 2021; Lancaster & Cotarlan, 2021) and even circumvent proctoring software. Students engaging in academic dishonesty

without getting caught created a space of unaccountability related to the knowledge or skills expected of them. These factors had the potential to negatively affect the impact of technology-dependent (virtual, online, and hybrid) learning opportunities and may have played a role in students reporting more difficulty grasping concepts and scoring lower on exams/overall course grades when delivered online/virtual compared to in-person delivery for courses delivered in the fall of 2020.

As most of these tools relied on internet connection, there were additional problems when millions of users who were previously at work during the day began logging onto the internet to work or attend school from home. Common complaints were lack of adequate internet speed to view and interact in web conferences, complete lack of internet during high-demand/peak times, and lack of internet based on home location such as rural versus urban (Singal et al., 2021). This is another factor that may play a role in students reporting more difficulty grasping concepts and scoring lower on exams/overall course grades when delivered online/virtual compared to in-person delivery for courses delivered during the fall of 2020.

COVID-19 also had significant impacts on student mental health, to the degree that one study (Son et al., 2020) indicated 71% of responding students experienced COVID-19 driven increases in stress and anxiety. Social isolation, financial uncertainty, sleep deprivation, health concerns for self and family had negative effects on mental wellness (Son et al., 2020; Cao et al., 2020; Liu et al, 2020; Rajab et al., 2020; Singal et al., 2021). Students were more likely to attend office hours and seek assistance for courses attended in-person compared to those attended online which may be due to seeking face-to-face relationships during social isolation. Students attending in-person office hours had additional opportunities to foster the learner-teacher relationship which is an advantage of in-person learning opportunities (Beale et al., 2013).

Several studies cite the importance of the learner-teacher relationship (Henry et al., 2020; Ruzycki et al., 2020; Bernstein-Yamashiro & Noam, 2013) and its role in promoting student mastery of learning outcomes.

It is not clear why the 2VM students' performance was not significantly different between online/virtual and in-person content delivery. Factors could include decreased student-perceived intensity of courses, number of courses with laboratory components, number of lecture-based courses, and nature of content delivered. These factors, along with others not discussed in this study, carried a potential negative impact on COVID-19-modified learning opportunities as supported by the findings. The rapid shift to online, virtual, and remote learning, combined with other external factors related to the global pandemic led faculty to develop high impact educational opportunities to support student learning that merit continuation, as well as some practices considered less impactful that should likely be discontinued once COVID-19 restrictions are lifted.

The most commonly reported learning tool to be of negative to low impact in this study, with 124 out of 430 student responses, was the use of Zoom breakout rooms. Students listed numerous factors associated with the negative to low impact: being placed in random groups where students were not comfortable talking with one another, ease of distraction during allotted times, professors incorporating bathroom breaks into the 5 or 10-minute breakout discussion, students with stronger personalities leading the conversation off-topic or not allowing other students to participate, and so forth. Students reported these reasons led to muting, disengaging, and even disconnecting from the Zoom session during breakout room assignments.

COVID-19-modified teaching strategies, however, were not all potentially harmful or considered less impactful in this study. Requiring individuals to self-quarantine after becoming

ill or exposed to COVID-19 demonstrated a model of public safety and positive personal health choices. Many students responded the accessibility of synchronous online classes should be continued post-COVID, to continue promoting public and personal health. Prior to COVID-19, students and faculty alike would attend lecture and laboratory courses while ill often citing the stigma of weakness, or negative work/school environment towards staying home when il, or scheduling self-care appointments such as dentist or doctor office visits during scheduled course time. In addition, students felt this option would allow for improved mental health by creating opportunities to take mental health days.

Students also expressed the smaller lab and discussion group sizes, due to COVID-19 restrictions on room capacity and social distancing, were beneficial to student learning and created opportunities where instructors were more available during class time. Students perceived a greater opportunity for hands-on time with laboratory materials and equipment and had less fear of judgement by peers when asking questions.

The most common request from students for COVID-19 strategies to remain in the curriculum, was continued video capture of all lecture and laboratory sessions to be viewed asynchronously. Students expressed the ability to stop and pause recordings, re-watch areas where they experienced confusion, and the ability to verify their understanding/written notes though video review was important to their success. This finding was consistent with previous studies reviewing online lecture courses (Beale et al., 2013).

Limitations of this study were the reliance on student self-reporting of grades, which could not be verified, subjective assessment of knowledge retention, and a potential for inaccuracies in recollection related to objective survey questions.

Further research is needed to evaluate the impact of unreliable internet, financial constraints, computer access, level of technology available, poor learning interactions due to platform (i.e. Mac vs Windows based), and many other factors that affect student learning and faculty learning experience creation.

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APPENDIX A

SURVEY COVER LETTER

Dear 1VM/2VM/3VM Student,

You are being asked to participate in a survey investigating the impacts of COVID-19 on the veterinary school curriculum. The information provided in the survey will be used to assess content delivery intended for the upcoming Spring 2020 semester. We will use your responses to further incorporate teaching strategies that are working well for the modified curriculum and, within reason, decrease strategies that have negatively impacted content delivery.

You were selected to participate in this survey as you are currently enrolled in the 1VM, 2VM, or 3VM curriculum and have experienced a minimum of one semester of traditional content delivery and one semester content delivery modified by the impact of COVID-19. The responses you provide are anonymous with no personal identifiers requested other than year of curriculum enrollment and MBTI results.

This survey should take no more than ten minutes of your time. Please return the survey in the collection bin by the end of class today. Your participation in this survey is appreciated. Questions related to this survey should be directed to escallan@tamu.edu.

Sincerely,

Elizabeth Scallan, DVM, MBA, MS, CVA, CCRP

Assistant Professor

Director, Clinical Skills Laboratory

APPENDIX B

SURVEY

Student Perceptions Related to Online and Virtual Classroom Platforms

We are interested in your experiences with online and virtual classroom platforms compared to in-person classroom settings. Please assist us in improving course experience by answering the following questions. Participation is voluntary and has no impact on the course grade.

PART I. DEMOGRAPHICS

1. What is your current year of enrollment in the veterinary program?

☐ 1VM ☐ 2VM ☐ 3VM ☐ 4VM

2. Prior to the current Fall 2020 semester, have you received online or virtual classroom instruction?

☐ Yes ☐ No

3. Other than veterinary school, do you have current or previous veterinary related employment or experience? (Mark all that apply)

☐ General practice small animal   ☐ Small animal specialty center

☐ Graduate school/research

☐ General practice large animal   ☐ Large animal specialty center

☐ Exotic/wildlife center   ☐ Other Please specify_____

4. Student information:

A. Please indicate your age group.

☐ 20 – 25 years   ☐ 26 – 35 years   ☐ 36 – 45 years

☐ 46 – 50 years   ☐ 51 – 55 years   ☐ Over 56 years

B. Please indicate your Myers Briggs Personality Type: _____

5. Please indicate the degree(s) you have earned and if any have been via distance education ☐

Bachelors degree ☐ Received distance education   ☐ Received in-person content delivery☐

Masters degree   ☐ Received distance education   ☐ Received in-person content delivery

☐ Doctoral degree   ☐ Received distance education   ☐ Received in-person content delivery

PART II. PEROFRMANCE CHARACTERISTICS

6. For courses delivered online or virtually, on average, how many hours do you study in a week for each course?

☐ 0   ☐ 1-5   ☐ 5-10   ☐ 10-15   ☐ 15-20   ☐ >20

7. For courses delivered in-person, on average, how many hours do you study in a week for each course?

☐ 0   ☐ 1-5   ☐ 5-10   ☐ 10-15   ☐ 15-20   ☐ >20

8. For courses delivered online or virtually, what is your course grade average?

☐ A   ☐ B   ☐ C   ☐ D   ☐ F   ☐ Do not wish to answer

9. For courses delivered in-person, what is your course grade average?

☐ A   ☐ B   ☐ C   ☐ D   ☐ F   ☐ Do not wish to answer

PART III. INSTRUCTOR CHARACTERISTICS

10. Do you regularly utilize course office hours for courses delivered online or virtually?

☐ Yes   ☐ No

11. Categorize average instructor availability for course office hours for courses delivered online or virtually:

☐ Not available ☐ <1 hour per week ☐ 1-3 hours per week ☐ >3 hours per week

12. Do you regularly utilize course office hours for courses delivered in-person?

☐ Yes   ☐ No

13. Categorize average instructor availability for course office hours for courses delivered in-person:

☐ Not available. ☐ <1 hour per week ☐ 1-3 hours per week ☐ >3 hours per week

PART IV. COURSE CHARACTERISTICS

14. Do you ask questions during class for courses delivered online or virtually?

☐ Yes   ☐ No

15. Categorize ease of asking questions and receiving responses during class for courses delivered online or virtually:

☐ Significantly difficult ☐ Moderately difficult ☐ Moderately convenient

☐ Significantly convenient

16. Do you ask questions during class for courses delivered in-person?

☐ Yes   ☐ No

17. Categorize ease of asking questions and receiving responses during class for courses delivered in-person:

☐ Significantly difficult   ☐ Moderately difficult   ☐ Moderately convenient

☐ Significantly convenient

18. I prefer the online/virtual learning platform to the in-person learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

19. I prefer the in-person learning platform to the online/virtual learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

20a. I prefer the ability to choose between the in-person learning platform and online/virtual learning platform for a given semester.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

20b. I would like the flexibility to attend either the in-person learning platform and online/virtual learning platform and alter on a daily basis if needed.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

21. I perform better on exams when I attend the online/virtual learning platform compared to the in-person learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

22. I perform better on exams when I attend the in-person learning platform compared to the online/virtual learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

23. I grasp concepts quicker when I attend the online/virtual learning platform compared to the in-person learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

24. I grasp concepts quicker when I attend the in-person learning platform compared to the online/virtual learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

25. I retain concepts longer when I attend the online/virtual learning platform compared to the in-person learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

26. I retain concepts longer when I attend the in-person learning platform compared to the online/virtual learning platform.

☐ Strongly Agree ☐ Agree ☐ Neutral ☐ Disagree ☐ Strongly Disagree

27. Were there any COVID-19 teaching strategies, particularly helpful for your learning, that you would like to see incorporated into the curriculum permanently?

_____
_____
_____
_____
_____

28. Were there any COVID-19 teaching strategies, particularly detrimental for your learning, that you would like to see eliminated from the curriculum permanently?

_____
_____

_____
_____
_____
Additional comments:

_____
_____
_____
_____
_____

APPENDIX C

ITEM ABSTRACT

Survey Question	RQ1- What are veterinary student perceptions regarding virtual and online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?	RQ2- How do course letter grade averages of virtual and online learning platforms compare to in-person lecture settings during the COVID-19 pandemic?	RQ3- What is the perceived office hour accessibility to the instructor between virtual and online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?	RQ4- What is the perceived accessibility to ask questions during the course lecture time period between virtual and online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?	RQ5- What is the time allotted to class and exam preparation between virtual and online learning platforms compared to in-person lecture settings during the COVID-19 pandemic?	Other
SQ 1						✓
SQ 2						✓
SQ 3						✓
SQ 4						✓
SQ 5						✓
SQ 6					✓	
SQ 7					✓	
SQ 8		✓				
SQ 9		✓				
SQ 10			✓			
SQ 11			✓			
SQ 12			✓			
SQ 13			✓			
SQ 14				✓		
SQ 15				✓		
SQ 16				✓		
SQ 17				✓		
SQ 18	✓					
SQ 19	✓					
SQ 20 a/b	✓					
SQ 21	✓					
SQ 22	✓					
SQ 23	✓					
SQ 24	✓					
SQ 25	✓					
SQ 26	✓					