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Chiropractic students' perception of remote learning during the COVID-19 pandemic

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ABSTRACT

Objective: To investigate chiropractic students' preferences and perceptions of remote learning with a secondary aim of comparing individuals with and without learning challenges.

Methods: Following the mandatory period of remote education, a 33-question, mixed-methods, anonymous online survey was distributed from March to September 2021 to a single-campus chiropractic student body with an estimated sample study population of $N = 1375$. Demographic variables, self-reported learning challenges, technology skills, and perceptions of remote and on-ground learning delivery modalities were gathered. Percentages, measures of central tendency, and chi-square tests were performed on the data.

Results: There were 117 participants (8.5%), of whom 63.2% were female ($n = 74$) and 87.2% ($n = 102$) were aged 18–34 years. Self-identified learning challenges were present in 33.3% ($n = 39$) of participants, of whom 28 stated they had attention-deficit/hyperactivity disorder or attention-deficit disorder. More than 85.5% ($n = 100$) of participants agreed they were proficient with the necessary technology. For basic science classes with a lecture and lab component, 61.5% ($n = 72$) preferred on-ground labs and remote lectures. Participants agreed that remote lectures and on-ground labs were a good use of time (75.2% [$n = 88$] and 79.5% [$n = 93$], respectively). There was a significant χ^2 between individuals with and without learning challenges for the perception of "stimulating and interesting" ($p = .044$) and "attention" ($p = .001$) for on-ground lectures.

Conclusion: Chiropractic students preferred remote and on-ground education differentially for labs and lectures. On-ground labs provided greater perceived educational benefits; perceived benefits of remote lecture courses were only modestly supported. Students with self-identified learning challenges presented with some differences related to perception of on-ground lectures.

Key Indexing Terms: Chiropractic; Education; Distance

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INTRODUCTION

The coronavirus disease pandemic (COVID-19) affected not only human life but also the way education institutions deliver content.[1] The global spread of COVID-19 affected education for more than 1.6 billion students worldwide, disrupting the original teaching approaches of schools globally and necessitating a trend toward remote (online) education.[2] The shift in health care education from traditional forms of on-ground (in-person) teaching to remote learning via digital media, while present before the COVID-19 pandemic, was accelerated.[3] This has allowed students to gain easier and more effective access to a variety of information, although challenges such as feelings of social isolation, increased stress, difficulty maintaining attention, and technical problems have also been reported with remote learning.[4–6]

Excluding technical problems, the comfort of students with digital media may be a result of current trends showing that many adult students use social media daily.[7–9] Job demands have also shifted the need to be comfortable in a digital environment. In health care, for example, professionals are expected to practice in a dynamic workplace and be able to work with the latest technologies.[4] Given this familiarity and regular use of technology, it is not surprising that research indicates an increased registration in remote classes. In 2015, of all students in US higher education, 29.7% registered in remote classes,[10] while in 2017, remote class

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registration had increased to 68.0%.[11] Remote learning has been shown to save time, reduce costs, offer multimedia matching different learning styles, allow students to learn anywhere at any time outside the classroom, and overcome the shortage of faculty, and it has the potential to shift the learning process from passive teacher-centered learning to active learner-centered learning. The attributes of this shift to remote learning have enhanced a feeling of engagement with content because of learners' control of the media and instructors' presence.[12–15]

A study of dental students evaluated their readiness for remote learning, preferences, and perceptions. Results indicated most students possessed the necessary computer skills and access to the internet (27.8%–31.5% agree and 38.9%–50.0% strongly agree).[16] Furthermore, abbreviated and targeted remote lectures, termed *flash* and *procedural*, were beneficial to learning for most students, although not preferred by the majority. Also, most students preferred a combination of traditional teaching methods and remote learning. The author concluded that students viewed remote learning as a helpful supplement to their learning rather than a replacement for traditional teaching methods.[16]

Relevant to COVID-19 and educational responses, a study on the perceptions of remote study by pediatric postgraduate students during the COVID-19 pandemic explored the possible gains of remote learning.[17] In the study, nearly all (99.0%) of the participants felt that the sessions were tailored to their specific level of learning. The surveyed students reported that the remote sessions were interesting and enjoyable (95.0%). All participants ($n = 77$) felt that remote classes should be made part of the medical postgraduate curriculum. In the open comments, participants responded that the remote sessions broke monotonous routines, were a good utilization of time, and the material was easy to access. Given the perceived benefits to the students, feasibility, and low cost, the authors concluded that remote learning would be beneficial to pediatric postgraduate students beyond the COVID-19 lockdown.[17]

Student preferences and perceptions observed in remote education studies may be influenced by many factors, and the effectiveness of remote learning needs to be studied across disciplines, including chiropractic programs, and student populations. One population that may have received an unexpected benefit during the pandemic-induced switch to remote learning was students with self-identified learning challenges, such as attention-deficit hyperactivity disorder (ADHD) or dyslexia.[18–20] Although the results have been mixed, students with some forms of learning challenges experienced decreased stress and improved focus.[18–20] With 6.8% of the global adult population experiencing symptoms of ADHD alone, understanding the perceptions of remote learning compared with individuals without learning challenges could help institutions with strategies meet the needs of the entire student population.[21]

As the chiropractic profession becomes more diverse,[22] chiropractic institutions may need to adapt their teaching modalities to meet the needs of their students. Ethnic minority populations such as African Americans and Hispanics are 1.43 and 1.49 times more likely to identify with a learning challenge.[23] While many of the existing research studies demonstrate that performance from remote courses is as good as those taught through on-ground methods,[8,9,24] improved understanding of the preferences and perceptions of the shift to remote learning in response to the COVID-19 pandemic may help inform remote education following the pandemic. Therefore, this study aimed to investigate chiropractic students' preferences and perceptions of remote learning with the secondary aim of comparing individuals with and without learning challenges.

METHODS

The study authors and participants were from Life University. In response to the COVID-19 pandemic, the university offered remote course options from April 2020 through December 2021. A self-administered 33-question, mixed-methods, anonymous online survey was shared with Life University College of Chiropractic students who had taken remote classes for at least 2 consecutive quarters. Recruitment occurred by sharing the survey link through word of mouth, university electronic newsletters, social media, video displayed on campus televisions, and posting flyers around campus. The survey was available to complete from March 2021 through the 1st week of September 2021. Announcements concerning the survey were made continuously during the data collection period through the multiple recruitment channels, and no targeted reminders were sent to individual students regarding the survey. The study was approved by the Life University institutional review board through expedited review.

Participants were asked to complete the study only if they had taken remote classes for at least 2 consecutive quarters. An estimate of the number of eligible students consisted of an average of the total students during each of the quarters the survey was live, less the respective total number of students in 1st and 2nd quarters. All students within the 14-quarter chiropractic program begin clinic interactions and participated in courses with both lab and lecture as early as their 1st quarter. Labs could include basic science labs (mostly during quarters 1 through 6) or clinically oriented labs that begin quarter 1.

Upon clicking the survey link, participants were informed of their voluntary and anonymous rights as a participant through an initial informed consent statement at the beginning of the survey. Consent was acknowledged by choosing yes or no. If the participants answered yes, they were directed to the survey. If the participant answered no, they were thanked for their time and not advanced to the survey. Arbitrary participant numbers were assigned following the completion of the survey; no participant information was recorded that could identify the participant or be traced to a participant's unique internet protocol address.

Survey Design

The survey questions were adapted from previous COVID-19 educational research and other education surveys found in the peer-reviewed literature.[17,25–29] The survey was reviewed and refined by a volunteer group of academic administrators and faculty before administration of the survey. The survey refinement process underwent 2 rounds of edits with the investigators and volunteer university employees. Edits to those questions selected from the literature served as the 1st round; the 2nd round consisted of edits to the 1st-round draft. Given the need to maintain temporal relevance with the COVID-19 shift to remote learning, a formal pilot test was not conducted.

Apart from demographics, learning challenges, and a few perception questions, participants were asked to choose a Likert response (*strongly agree*, *agree*, *uncertain*, *disagree*, and *strongly disagree*) for closed-ended survey questions regarding the

different learning modalities. Four learning modalities were assessed: lecture on-ground, lecture remote, lab on-ground, and lab remote.

Open-ended questions were formatted using a blank space next to each question, allowing students to leave their comments and suggestions; no character limit was set. For clarity in the survey, the term *on-ground* was defined as any class offered in an on-site classroom setting, while the term *remote* referred to any form of classroom interaction that was not held within a university campus setting and employed digital or online interaction with the professor. Since the doctor of chiropractic program requires a certain number of practical hours, the survey was designed for lecture courses only, lab courses only, and courses with both lecture and lab.

The anonymous online survey consisted of 33 questions, to include the following:

- personal and sociodemographic data: age, gender, academic year, grade-point average (GPA)
- students' technology skills and accessibility
- preferences related to remote and on-ground learning modalities
- overall perception of the different learning modalities initiated by the university in response to the COVID-19 pandemic
- self-reported learning challenges, include ADHD/attention-deficit disorder (ADD), dyslexia, processing deficits, language processing disorder, auditory processing disorder, and impairments in vision and hearing

Data Analysis

Descriptive statistics of students' responses to different statements were obtained using Microsoft Excel version 2304 build 16.0.16327.20200, 64-bit (Microsoft Corporation, Redmond, WA, USA). Internal consistency in the form of Cronbach's alpha was performed on the 4 different learning modalities (lecture on-ground, lecture remote, lab on-ground, lab remote). Nine different questions asked participants about their perception of the different learning modalities, and Cronbach's alpha was calculated for each of the modalities using a numerical conversion of the Likert scale to the following: (1) *strongly disagree*, (2) *disagree*, (3) *neutral*, (4) *agree*, (5) *strongly agree*.

Using the same Likert to numerical score conversion as described in the Cronbach's alpha section, measures of central tendency were calculated for each of the Likert-type response questions. The median and mode were calculated and presented numerically and converted to Likert responses (Supplemental Table 1; available online accompanying this article). The threshold of significance for alpha was generally set at 0.7 for item consistency in a single survey administration.[30]

To compare learning modality preferences between the self-identified learning-challenged and non–learning-challenged participants, chi-square tests were performed. The chi-square tests were performed in Python (open source, version 3.9.13) with an α of .05. Likert responses were tallied for each of the learning modalities, and a chi-square test of independence was performed for each of the modality options with a standardized residual post hoc analysis performed on any significant test results. The null hypothesis, H0, was that there was no statistically significant difference in the learning modality perceptions between those with learning challenges and those without learning challenges.

Open-ended questions were coded using an inductive coding process. Categories (codes) were generated through a review of survey responses, and a hierarchical framework was applied that included categories and subcategories. The hierarchical framework allowed for greater granularity and review of response relationships. Some responses included multiple statements, resulting in more than 1 code for a single response.

RESULTS

The 33-item anonymous online survey was taken via JotForm (JotForm Inc, San Francisco, CA, USA), the present survey system within the university. The average time to complete the survey was 8 minutes 28 seconds for both open- and closed-ended questions. Considering the number of eligible students present during the time of survey availability, only 8.5% of the estimated eligible ($N = 1375$) student body completed the survey. For ease of reporting, Likert responses of *agree* and *strongly agree* were reported as *agree*; similarly, *disagree* and *strongly disagree* were condensed to *disagree*.

Cronbach's alpha is one of many methods of evaluating the reliability of data collected from an assessment instrument and is useful for item consistency.[30] When alpha meets the threshold of 0.7, it is generally accepted as having a good measure of single-administration reliability. Results in this study were greater than 0.8 for each of the modalities; exact numbers can be seen in Supplemental Table 2.

Demographic Information

Table 1 summarizes personal and sociodemographic data: age, gender, academic year (quarter), and GPA. There were 117 participants who completed the survey, of whom 63.2% ($n = 74$) were female and 87.1% ($n = 102$) were between the ages of 18 and 34 years. A GPA greater than 3.0 was reported in 89.7% ($n = 105$) of participants.

Technology Skills

Students agreed (84.6%, $n = 99$) that they had adequate personal technology resources. More than 85% of participants agreed they were proficient in their technology skills, regardless of the technology survey learning management system (Blackboard Anthology, Boca Raton, FL, USA), note taking, typing, and computer use (Supplemental Table 3).

Learning Modality Preferences

For classes with a lecture and lab component, 61.5% ($n = 72$) preferred on-ground lab and remote lectures for both basic science classes and clinically oriented classes (Table 2). When offered a choice for remote or on-ground lectures and lab classes, 39.3% ($n = 46$) preferred the remote lectures 75% of the time; 35% ($n = 41$) of students prefer the remote lab classes none of the time (Table 3).

Perception of Learning Modalities

Supplemental Table 3 illustrates participants' overall perception of the different learning modalities initiated by the university in response to the COVID-19 pandemic.

Table 1 - Demographics of Student Participants

Variable	Demographic	*n*	%
Sex	Male	40	34.2
	Female	74	63.2
	I prefer not to answer	3	2.6
Age, y	18–24	41	35.0
	25–34	61	52.1
	35–44	10	8.5
	45–54	2	1.7
	55+	3	2.6
Ethnicity	American Indian or Alaska Native	0	0.0
	Asian	6	5.1
	Black or African American	17	14.5
	Native Hawaiian or Other Pacific Islander	0	0.0
	Hispanic or Latino or Spanish Origin	19	16.2
	White, non-Hispanic	65	55.6
	Other	2	1.7
	Prefer not to answer	8	6.8
GPA	3.75+	42	35.9
	3.5–3.75	29	24.8
	3.0–3.5	34	29.1
	2.0–3.0	12	10.3
	Less than 2.0	0	0.0
Learning disability	ADHD/ADD	28	23.9
	Dyslexia	3	2.6
	Processing deficits	5	4.3
	Language processing disorder	1	0.9
	Auditory processing disorder	0	0.0
	Vision and hearing impairments	2	1.7
	None of the above	78	66.7
Grade quarter	Q1–3	11	9.4
	Q4–6	38	32.5
	Q7–9	20	17.1
	Q10–12	41	35.0
	Q13–14	7	6.0

Student survey responses highly agreed that pace, retention, and attention were among the many perceived benefits that the on-ground labs provided (85.5%, $n = 100$). Furthermore, student responses indicated that they perceived more effectiveness with the remote learning for labs (62.4%, $n = 73$) and that the procedural lab videos were just as useful as the on-ground lab sessions were (43.6%, $n = 51$). However, 57.3% ($n = 67$) of students also agreed that the lab remote learning allowed for self-directed learning.

For lectures, students agreed that they were more effective (66.7%, $n = 78$) and self-directed (88.0%, $n = 103$) when the lecture was remote. Within the other perceived domains surveyed, more students indicated a perceived benefit for remote lectures instead of on-ground lectures, although many were only a few percentage points apart. Attention to the professor was the one exception; more students agreed that they were more attentive with on-ground lectures (51.3%, $n = 60$). Overall, students agreed that they had more energy and were less tired with remote learning (75.2%, $n = 88$), and 95.7% ($n = 112$) agreed that

Table 2 - Learning Format Preference

Viewpoint	Education Option	*n*	%
Learning format preferred for basic science classes with lab	On-ground for lab and remote for lecture	72	61.5
	Remote for lab and lecture	20	17.1
	Remote for lab and on-ground for lecture	0	0.0
	On-ground for lab and lectures	25	21.4
Learning format preferred for clinically oriented classes with lab	On-ground for lab and remote for lecture	72	61.5
	Remote for lab and lecture	7	6.0
	Remote for lab and on-ground for lecture	2	1.7
	On-ground for lab and lectures	36	30.8

Table 3 - Choice of Remote over On-Ground Classes for Lecture and Lab

Education Option	Percentage of Time	*n*	%
Percentage of time choosing remote education when on-ground is available for lecture classes	None of the time	7	6.0
	1% to 25% of the time	21	17.9
	26% to 50% of the time	23	19.7
	51% to 75 % of the time	20	17.1
	Greater than 75% of the time	46	39.3
Percentage of time choosing remote education when on-ground is available for lab classes	None of the time	41	35.0
	1% to 25% of the time	34	29.1
	26% to 50% of the time	22	18.8
	51% to 75 % of the time	11	9.4
	Greater than 75% of the time	9	7.7

having lectures and lab videos available for all on-ground courses would be useful.

Responses to Open-Ended Questions

The coding of the open-ended questions resulted in 270 responses. Supplemental Tables 4 and 5 indicate the categories, subcategories, and frequency of statements. The category of perception of remote education during COVID-19 consisted of 7 subcategories, with the subcategory of "Perception of Remote Learning" having the greatest number of responses at 82.

Sample responses included the following:

- Enjoyed remote classes, it was great, an adventure, life-changing, makes everything easier, and great voice-over PowerPoint
- Allowed students to learn at their own pace

The category of recommendations for improving remote education had 4 subcategories. The subcategory "Mode of Course Delivery" included the greatest frequency of responses ($n = 69$).

Sample statements included:

- Prerecorded lecture and lab videos
- Technology improvement for instructors/more visual aids/better working mics, stop Blackboard app crashing on phones

Self-Identified Learning Challenged and Non–Learning Challenged

Self-identified learning challenges were present in 33.4% ($n = 39$) of participants, of whom 72% ($n = 28$) had ADHD/ADD (Table 1). Following chi-square tests of independence, 2 tests showed statistically significant differences in the perception of different learning modalities based on self-identified learning challenges or no learning challenges. The resulting χ^2 statistics, P values, and degrees of freedom can be seen in Supplemental Table 6.

The question, "I find the following learning modality interesting and simulating: lecture on-ground" was significant ($P = .044$). The category "strongly agree" had a post hoc residual value of ± 2.7 with learning challenge as negative and no learning challenge as positive. The results indicate that fewer people with a self-identified learning challenge "strongly agree" that they found on-ground lectures interesting and stimulating than was expected and thus more people without learning challenges "strongly agree" they found on-ground lectures interesting and stimulating than was expected if the null hypothesis was true.

The overall "strongly disagree" category had a residual value of ± 3.2, while the "disagree" category had a residual value of ± 2.6. For those individuals with a self-identified learning challenge, the "strongly disagree" category had a positive value residual, and the "disagree" category had a negative value residual. The opposite was true for those without a learning challenge: the "strongly disagree" category had a negative residual, and the "disagree" category had a positive residual.

Of those students with a self-identified learning challenge, fewer students selected the category "disagree" that on-ground lectures allowed them to keep their attention on the professor. Also, more students selected the category "strongly disagree" than would be expected if there was no difference in preference for on-ground lectures between the 2 groups of students. For those students without learning challenges, the opposite is true: more of the students selected the categories "disagree" and "less strongly disagree" than was expected.

DISCUSSION

The conditions of the COVID-19 pandemic limited traditional face-to-face education, and remote (online) education became the dominant method for academic activities for most students, including health care students. Several studies have measured the perceptions of medical and nursing students about remote learning, but only a few studies included chiropractic students.[31,32] This study aimed to assess the preferences and perceptions of chiropractic students at Life University for remote learning during the COVID-19 pandemic. A secondary aim was to compare individuals with and without learning challenges.

The results showed a preference for remote lectures and on-ground labs for both basic science classes and clinically oriented classes with lab portions. Students reported increased effectiveness in the use of the remote platform for lectures, and only about 20% indicated increased effectiveness for lab classes. In the open-ended answers, students showed a strong inclination for having lecture classes continue remotely, but students were strongly in favor of lab classes remaining on-ground. This is expected for lab classes because the chiropractic profession is dominantly dependent on hands-on techniques for patient care, which is fine-tuned through continuous practice. This is consistent with other studies that showed students found remote

classes less appealing due to the limitations attributed to learning clinical hands-on classes remotely.[33,34]

Previous studies looking at remote learning for medical-oriented education before COVID-19 showed mixed outcomes, with some reporting students' preference for remote learning[34,35] and others indicating otherwise.[36,37] While the present study data reflect that students prefer remote lecture classes, the perceived benefits of remote lectures (percentage difference scores) were only marginally higher than the perceived benefits for on-ground lectures. Some open-ended responses were more in line with studies of medical students, indicating the need for student choice relative to remote versus on-ground.[33,35]

As remote learning continues to evolve, the open-ended questions from the present study may provide pitfalls to be avoided in future course design. Students indicated struggling with the constant barrage of weekly quizzes and exams. Students' responses also indicated the need for synchronization in due dates for quizzes and assignments across classes. It was recommended that the learning management system content arrangement be the same across courses to make the learning environment more user-friendly, and recommendations were made for better technological training for the instructors.

There is some concern that the increase in remote learning in higher education environments will promote social isolation and stress.[5,6] In one study, the findings suggest that students experienced boredom, a sense of isolation, and time constraints, which may lead to a lack of attention during the remote learning encounter.[5] With persistently increasing rates of stress and depression extending beyond the COVID-19 pandemic, higher education learning environments should be established in a manner that mitigates depression and supports positive mental health.[38] Alternately, another study with medical students reported an improvement in mental health as a result of remote learning.[39] The results of the present study suggest that remote learning can be beneficial for students relative to the ability to create a better balance in life, especially for students with families; however, the increased number of exams and technology concerns may just add to the stress. Taking more exams and having technology failure issues are factors relevant to populations with learning challenges, who are at an increased risk for an inability to cope with added stress and anxiety.[23]

Students self-reporting learning challenges did not differ much in their preference responses when compared with students who reported no self-reported learning challenges. They had a slightly increased preference for remote lecture classes on a few of the questions. Two questions showed a statistically significant difference in those with learning challenges in relation to those without them. Responses by those participants with learning challenges for on-ground lectures were categorized as "less strongly agree" to be interesting and stimulating. Following that, their responses regarding on-ground lectures were also categorized as "less disagree" and "more strongly disagree" for allowing students with learning challenges to keep their attention on the professor's lecture or discussion. These results suggest that students with learning challenges may be less stimulated and less attentive to on-ground lectures than those without learning challenges. The open-ended answers were more revealing, and some statements were in alignment with findings from a review of the literature.[40] These open-ended responses agree with previous findings on the benefits of remote learning in students with self-identified learning challenges, namely, specific cognitive abilities (attention, self-regulation), competencies and academic abilities, and general attitudes and engagement in learning.[40–43]

Limitations

In this mixed-methods, anonymous online survey study, participants were chiropractic students from only 1 chiropractic university. Given the remote nature of much of the student body during the recruitment stage for the present study, the number of individuals completing the survey was small: only 117 individuals. The sample size only represented roughly 8.5% of the estimated eligible population, so the results may not be generalizable to the rest of the population. This may have been because the students were mostly off-campus at the time of data collection, and remote platforms and emails were dominantly used in the distribution of the flyers. Surveys conducted through online platforms and emails are reported to show lower response rates compared with hand-distributed surveys.[33,44]

There was also no way to assess compliance with survey instructions. Specifically, the investigators could not verify that the study participants had taken 2 consecutive courses of remote classes or that participants with a learning challenge had been formally diagnosed as having a learning challenge. The study was not designed to collect clinical data from the students who self-identified with learning challenges. A study design that incorporates clinical data may explore correlations between clinical characteristics and learning preferences in relation to remote or on-ground classroom learning experiences.

Another limitation of this study was that more female students completed the survey (63.2%), which may or may not have skewed the result toward an overly positive acceptance of remote learning. Some studies have indicated increased female engagement with remote learning compared with their male counterparts,[45,46] while others suggest that engagement is multifaceted for both genders and shows no gender specificity.[47–50] Findings regarding gender differences in online learning outcomes tend to be inconsistent. Further, the anonymous online delivery of the survey instrument may have resulted in individuals with greater technological skills being more likely to take the survey. This could account for the high level of comfort with technology reported by the students.

Relative to the survey design, Cronbach's test of survey questions that referenced each of the 4 modality subsections resulted in an alpha value of greater than 0.8, which suggests single-administration reliability with respect to item consistency. However, there was no pilot test of the survey prior to implementation, and there were some questions that may benefit from rewording for clarity if future iterations of the survey instrument were to be used. In addition, there was a lack of references to similar studies, especially regarding the experiences of chiropractic students with remote learning, in general, without the additional complications of COVID-19. Therefore, the results were analyzed and discussed in comparison with earlier studies done with health care students and not specifically chiropractic students.

CONCLUSION

Chiropractic students prefer remote and on-ground learning modalities differentially for labs and lectures. In general, students prefer remote lectures and on-ground labs. Students

overwhelmingly agreed that on-ground labs provided greater perceived educational benefits such as pace, retention, and attention, whereas results related to the perceived benefits of remote lecture classes were only modestly supportive. However, most students indicated that having lecture and lab videos available for all on-ground courses would be useful. Students with self-identified learning challenges did present with some differences related to the perception of on-ground lectures. The preferences and perceptions provided by the students in the closed- and open-ended question format may be used to inform future curriculum design.

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