Uncovering Evidence: Transitioning from Face-to-Face to Online Learning

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ABSTRACT

Background: There is a need for evidence-based choices in integrating innovative teaching technologies into dental hygiene and dentistry education. By examining both the direct and indirect effects of these technologies, evidence-based insights to inform and enhance teaching practices in dental education can be determined. The aim of this study is to compare traditional lectures with online modules tailored to diverse learning style preferences, exploring how these approaches influence student engagement, retention, and recall. **Methods**: First-year dental hygiene and dentistry students were randomly assigned to one of two teaching conditions (In-person Lecture, Online Lecture) in a common communications course. Baseline measures of content achievement, Edmond's learning style preferences and comfort levels with learning online and in-person were assessed prior to their lecture using the pre-lecture assessment survey. Students completed post-lecture assessments immediately after the lecture and again six months later. **Results**: Regardless of the teaching condition, students showed significant improvement in their academic performance compared to the baseline measures. Their learning style preferences were found to be linked with higher engagement levels, a sense of accomplishment, and control over their learning environment. **Conclusions**: Teaching health sciences students presents challenges, especially when transitioning from traditional in-person classes to online learning, which may lack engagement for some. Accommodating diverse learning style preferences is crucial for maximizing technology's benefits in education and enhancing learning outcomes. A blended approach combining face-to-face and online lectures can optimize student learning experiences, emphasizing

the importance of considering varied preferences in educational strategies, particularly in the post-pandemic era.

Keywords: lecture; online learning; post-secondary education; student engagement; student learning; student learning style preferences; technology

CDHA Research Agenda category: capacity building of the profession

BACKGROUND

As higher education institutions adopted teaching technologies during the COVID-19 pandemic to improve the effectiveness and quality of teaching and learning, dedicated research capacity must be supported to allow for evidence-based decisions surrounding the use of innovative technologies to improve effective teaching and learning. Previous research that focused on technology and direct student learning outcomes and student engagement, provided a foundation to build on for the current study.[1] [2, 3, 4, 5] Based on previous research that identifies specific technology tools that enhance dental hygiene and dentistry student learning during COVID-19, it is imperative to assess both their direct and indirect impacts.[6] As seen in the current literature review that follows, research often emphasizes the indirect benefits of technology such as student and teacher self-reported perceptions of satisfaction and engagement). However, this focus too often comes at the expense of examining the concrete, measurable learning outcomes.

Dentistry and dental hygiene students spend numerous hours in lecture theatres and pre-clinic laboratories learning the theories and clinical techniques required to apply to clients/patients. In this age of modern dental hygiene and dentistry practice, with many

state-of-the-art technologies used in clinics (i.e., electronic patient records, cone-beam scanners, etc.), teaching students relies heavily on in-person lectures.[9] This is surprising in that innovative technologies are improving the effectiveness and quality of teaching such as telecommunications services,[10] communications or social software,[11] rich media in interactive training and learning,[12] webcasts,[13] and podcasts,[14] virtual learning environments,[15] sophisticated communications,[16] and virtual reality with haptic devices.[17] Prior to the COVID-19 pandemic, institutions were slower and more methodical about adopting innovative technologies to improve the effectiveness and quality of teaching and learning and if used, were implemented without fully considering their potential benefit for teaching and learning.[8] Pre-pandemic research in this area focuses on the benefits of innovative technologies and demonstrates indirect benefits for teaching and learning, relying more on soft measures such as perceptions of students' and teachers' satisfaction [18] and student self-reports such as attitudes, satisfaction, and interest, and perceptions of learning and engagement, [19-26] rather than hard measures of student learning outcomes.[8] As the COVID-19 pandemic swept across the world, dental and dental hygiene educators were forced to adapt quickly to remote learning.[27, 28] This meant implementing technology in the classroom in ways that had never been done before. However, there is little evidence-based research to support the use of this technology in such a drastic manner.[28, 29] One solution to move learning from the classroom to online, involves converting lecture content into online learning modules using voice-over PowerPoint presentations.[1] A 2016 study that looked at voice-over PowerPoint presentations found that students benefitted from this content delivery format as assessed through recognition and recall.[1] However, students' engagement in the content material was somewhat

limited. What was missing was an online learning process that provided a full suite of various ways of presenting course content that engages students' different learning preferences.[30, 31, 32] Learning preferences include verbal or linguistic, auditory, visual or spatial, and kinesthetic or physical.[33] Incorporating online content that caters to different learning preferences may enhance the overall learning experience for students. This approach is believed to effectively engage students and provide them with a significant learning experience.

Three important needs drove our current research: first, and foremost, to find an effective way of putting course material online that improves teaching by transitioning from in-person lectures to online learning, while also enhancing students' learning experience. Second, to help address issues that dental hygiene and dental administrators are currently facing - finding ways of economizing the access to scarce experts whose expertise is becoming more of a demand at many dental hygiene and dental schools globally as fewer experts are accepting academic careers.[7] The ultimate goal is to maximize specialists' skills on the clinical floor while ensuring that their students receive a quality education in lecture halls and preclinical laboratories.[8] Lastly, we aim to tackle the present and upcoming obstacles of education in the context of pandemics like COVID-19.

Therefore, the aim of this study was to evaluate the direct and indirect impacts of innovative teaching technologies on hard measures of student learning, specifically focusing on engagement, retention, and recall. To achieve this, a traditional face-to-face lecture on nonverbal communication was compared with an online module on the same

topic, designed to cater to diverse learning style preferences. The comparison assessed both teaching approaches in terms of their effects on 'hard' learning measures (e.g., retention and test performance) and 'soft' learning measures (e.g., student engagement and satisfaction).

METHODS

This study received ethics approval from the University of Manitoba Research Ethics Board HS22845 and all participants provided written informed consent.

Baseline assessment

In order to examine how student differences may affect the impact of teaching conditions on student learning, student demographics (gender and program of study) as well as Edmond's learning preferences[1] were identified. Several critical baseline measures were included to control for confounding effects. The students' awareness of the content material being presented, their perceived comfort level with both traditional and online teaching formats, and their perceptions of whether technology could enhance their learning were measured—key indicators of indirect or 'soft' learning measures. Specifically, indirect learning measures were assessed through five-point Likert scale questions (see Appendix 1).[34, 35]

It was crucial to assess students' prior knowledge of the lecture content (a direct or 'hard' learning measure). Given that self-reported knowledge can be unreliable, a pre-assessment was administered. [34, 35] The pre-assessment consisted of two parts: first, a five-minute free association task where students listed any words they associated with the term 'nonverbal communication'; second, a 21-item multiple-choice test, designed to

evaluate three of Bloom's levels of cognition: knowledge, comprehension, and application, with seven questions in each category:[36]

Post lecture assessments

After the lecture, a five-minute recall test was conducted to assess the students' understanding of the key content concepts. The same recognition test was given during the pre-assessment was given again after the lecture.

Student learning was also assessed through behavioural, emotional, and intellectual engagement through five-point Likert scale questions (see Appendix 1).[37] Behavioural engagement included students' self-report with time-on-task during the lecture, and emotional engagement assessed student's satisfaction with the lecture and students' recommendation to refer other students to the learning session.[37] Cognitive engagement was inferred through student achievement on various measures of recognition and recall.[37] The more a student was able to recognize and recall, the more they will have attended to the lecture. A self-report measure of cognitive engagement was also used.

All pre and post assessments were administered in person under supervision.

Lecture conditions

Two teaching conditions were created: (1) the traditional face-to-face lecture presentation with PowerPoint and, (2) the online learning module, both designed to accommodate the four primary learning preferences:

- Visual Learning: In the face-to-face condition, visual learners benefited from slides with diagrams and visual models of nonverbal communication presented on PowerPoint. Similarly, the online module featured models created on an electronic whiteboard using a Surface Pro, enhanced through Adobe After-effects and animated via Camtasia Studio.
- Auditory Learning: For auditory learners, the face-to-face lecture included verbal explanations and opportunities to ask questions and engage in discussion. In the online module, this was mirrored through voice recordings, YouTube videos, and RSA whiteboard animation videos.
- Kinesthetic Learning: In the face-to-face setting, kinesthetic learners engaged with physical gestures and body language demonstrated by the instructor, which reinforced the nonverbal communication topic. In the online module, students interacted with the content by selecting "hot boxes" that linked to additional resources, such as YouTube videos and glossaries, providing a more hands-on approach to learning.
- Verbal Learning: Verbal learners were supported in the face-to-face condition through the instructor's verbal presentation and the written content on the slides. The online module also catered to this style by providing written text on each slide, reinforcing the verbal learning style.

To control for lecture presentation differences, items on nonverbal communication were presented in both sessions. To maintain consistency across both teaching conditions, the same two instructors were responsible for delivering the content in both the face-to-face traditional lecture and the online asynchronous module. The

lecture content was identical for both conditions, ensuring that students in each group received the same material. The final version of the online learning module was uploaded to the Learning Management System (LMS) and made available to students during the experiment.

Classroom analog

The lecture theatre for the face-to-face lecture and the second lecture theatre for students viewing the online lecture on their individual laptop, were designed to provide realistic and controlled learning environment. Participants are often highly motivated to provide explanations for the outcome of the achievement event in a realistic classroom setting.[34, 35]

Procedure

Of the twenty-six second-year dental hygiene students and 29 first-year dental students enrolled in their respective programs, with the lecture on nonverbal communication embedded into their required coursework, making attendance mandatory, 25 second-year dental hygiene students and 27 first-year dental students consented to participate in the research component of the study, specifically the pre- and post- analysis, which was voluntary. As seen in Figure 1, all students met in one theatre for the scheduled lecture. For the first 20 minutes, they completed the pre-lecture assessment. Students were then randomly assigned (using a randomization table) to attend one of two teaching conditions: a face-to-face traditional lecture in the lecture theatre or an online learning module in a separate lecture theatre with students accessing the online asynchronous

module via their personal laptop with headphones. The hired research assistant facilitated the online asynchronous session to ensure that students had no technological challenges. Both sessions were conducted at the same time and for exactly one hour. Upon completion of the teaching module, all students completed the post-lecture assessments and were debriefed with the specific details of the study. Six months later, the students completed the six-month post-lecture recall and recognition tests.

Statistical analyses

As an exploratory study, a Pearson correlation was conducted on all variables. One-way (Lecture, Online) ANOVAs were conducted on dependent variables representing the pre-, post-lecture, and six-month post-lecture assessments. Student t-tests were employed to compare differences among these three lecture assessment times.

RESULTS

Demographics

A total of 25 second-year dental hygiene and 27 first-year dental students (32 female and 20 males) participated in the current study, 26 were randomly assigned in each of the two teaching conditions.

Baseline assessment: Controlling for confounding effects

To control for any prior maturation effects, pre-lecture recognition test items in which all students got the correct answer would be removed. However, none were identified; thus, all questions were retained in the final analysis.

To control potential confounding effects, statistical tests were done on students' awareness and experience with the content material presented and their perceived comfort level in learning from innovative technology. One-way ANOVAs (traditional vs. online lecture) were conducted on each of the dependent variables (see Table 1). No differences were found in students' self-reported awareness of "nonverbal communication." A quiz on the content in the form of a recall and recognition test was completed by students prior to the lecture.[19, 38] Again, no differences were identified between the two groups in terms of the recall or recognition tests, indicating that students in both conditions had similar minimal content knowledge. Further, no differences were found in students' perceived comfort level in learning from face-to-face lectures or an online format, or perceptions that technology can enhance their learning. Thus, the potential confounding variables identified in this study were controlled by randomly selecting students to the two teaching conditions.

Correlations

As an exploratory study, a Pearson correlation was conducted on all variables. Statistically significant correlations are reported below. First, Edmonds Learning Styles (LS) subscales Reading and Feeling ($r(51) = -0.53$, $p<.01$), as well as Auditory and Kinesthetic ($r(51) = -0.39$, $p<.05$), are inversely related. Students scoring high on one tend to score lower on the other scale. Second, high Visual scores correlate directly with student satisfaction with the presentation of the learning module ($r(51) = 0.40$, $p<.01$), student perceptions of being successful with ($r(51) = 0.29$, $p<.05$), and control of their learning ($r(51) = 0.32$, $p<.05$), as the result of the learning module, feelings of general ($r(51) = 0.50$, $p<.01$), and cognitive engagement ($r(51) = 0.37$, $p<.01$), the extent to which

they would refer other students to attend the learning module ($r(51) = 0.39$, $p<.01$), higher recall ($r(51) = 0.42$, $p<.01$), and lower cognitive MCQs scores ($r(51) = 0.31$, $p<.05$). Third, higher Reading scores are inversely correlated with recall scores ($r(51) = -0.35$, $p<.05$), whereas Auditory scores are inversely correlated with knowledge based MCQs ($r(51) = -0.39$, $p<.05$).

Perceptions of pre-lecture content knowledge correlated with comprehension-based MCQs ($r(51) = 0.65$, $p<.01$). Student perceptions of comfort level of learning from the way the content was presented, correlates with knowledge-based MCQs ($r(51) = 0.32$, $p<.05$), yet inversely with post-lecture comprehension-based MCQs six months later ($r(51) = -0.34$, $p<.05$).

Student perception of learning enhancement correlates directly with their perceptions of satisfaction ($r(51) = 0.48$, $p<.01$), perceived success ($r(51) = 0.38$, $p<.01$), and control with and in their learning ($r(51) = 0.38$, $p<.01$), the referral of the learning module to other students ($r(51) = 0.45$, $p<.01$), and feelings of being engaged generally ($r(51) = 0.60$, $p<.01$), as well as cognitively ($r(51) = 0.37$, $p<.01$). However, student perception of learning enhancement indirectly correlates long-term performance on comprehension ($r(51) = -0.31$, $p<.05$), and application MCQs ($r(51) = -0.31$, $p<.05$). Student perceptions of satisfaction correlated directly with perceived success ($r(51) = 0.59$, $p<.01$), and control ($r(51) = 0.52$, $p<.01$), with and in their learning, the referral of the learning module to other students ($r(51) = 0.57$, $p<.01$), and feelings of being engaged generally ($r(51) = 0.75$, $p<.01$), as well as cognitively ($r(51) = 0.69$, $p<.01$). Student perceptions of success is directly correlated to perceptions of control in their learning ($r(51) = 0.74$, $p<.01$). Students perceptions of success and control are correlated to the

referral of the learning module to other students ($r(51) = 0.59$, $p<.01$; $r(51) = 0.48$, $p<.01$), and feelings of being engaged generally ($r(51) = 0.57$, $p<.01$; $r(51) = 0.57$, $p<.01$), and application-based MCQs ($r(51) = 0.33$, $p<.05$; $r(51) = 0.36$, $p<.01$), yet inversely correlates with baseline recall scores ($r(51) = -0.31$, $p<.05$; $r(51) = -0.46$, $p<.01$). The referral of the learning module to other students is correlated to students' perceptions of being engaged generally ($r(51) = 0.57$, $p<.01$). Perceptions of general engagement were correlated with specific cognitive engagement ($r(51) = 0.68$, $p<.01$), yet inversely with total long-term recognition test scores ($r(51) = -0.29$, $p<.05$). Perceptions of specific cognitive engagement correlates inversely with baseline recall scores ($r(51) = -0.28$, $p<.05$).

Post-teaching assessment: Short and long term

A one-way ANOVA (traditional face-to-face lecture vs. online lecture) demonstrated no statistically significant differences in the short-term recall test (Table 1) or the recognition test, which assessed knowledge, comprehension, and application.

Indirect measures of learning included student engagement. Affective engagement was inferred by students' satisfaction with the presentation and their recommendation to encourage other students to attend a similar type of presentation in the future. As seen in Table 1 statistically significant differences were found between the two conditions in terms of students' satisfaction and recommendations. Students in the traditional face-to-face lecture versus online lecture condition had higher scores for both. Students' self-report assessed behavioural engagement on the extent to which they attended to the presentation during the full hour. Students in the traditional face-to-face lecture versus the online lecture condition recounted higher self-reports on behavioural engagement. Cognitive engagement

was inferred by students' perception of success and control over their learning as the result of the presentation and more specifically by a self-report on the extent to which the presentation impacted their cognitive engagement with the topic material. Once more, students in the traditional face-to-face lecture, as compared to the online lecture condition, reported higher scores of cognitive engagement.

The third research question focused on the long-term learning impact of the teaching methods. A one-way ANOVA (traditional face-to-face lecture vs. online lecture) demonstrated no differences in long-term recognition test scores or between baseline and long-term recognition test scores (Table 1). A closer look at most hard achievement measures shows a slight gain pattern for the online learning condition.

Overall learning across teaching methods

Given that minimal differences were observed between the two teaching conditions, the question remains whether students learned from the lecture, regardless of teaching condition. To test for this question, comparisons of learning between the baseline, post-learning module (immediately following the completion of the lecture) and long-term (six months later) assessments of recall and recognition were conducted by combining the teaching condition (face-to-face & online) assessment information. The unit of analysis is the achievement performance across the three testing times (baseline, post-learning module, and long-term). As seen in Table 2, differences are observed in terms of students learning regardless of the teaching conditions. The pattern is consistent: the post-learning module produces the highest achievement, followed by the long-term achievement test. Only in one case is the difference between the baseline and the long-term achievement test not statistically significant: comprehensive MCQs.

DISCUSSION

This study compared a traditional face-to-face lecture with an online module on nonverbal communication. It incorporated student learning preferences on student soft and hard measures of achievement and student engagement. This study focused on the interplay between student learning preferences and online/traditional teaching differences.[30, 32, 39] Although no statistically significant findings were demonstrated in either type of teaching condition, correlations were found. When it comes to student learning preferences, being a visual learner was related to satisfaction with the presentation, higher perceptions of success and control in the learning environment, higher levels of general and cognitive engagement, and higher referrals to others. Being more of a visual or reading learner is related to higher recall scores, but lower cognitive and knowledge-based test item performance for the visual and auditory learners, respectively.

While this study incorporates various teaching methods to address different learning preferences, it is important to acknowledge the ongoing debate around the validity of the learning preferences. Research has raised questions about the effectiveness of tailoring instruction to individual learning styles, suggesting that there is limited evidence to support the idea that such an approach improves learning outcomes.[40] That said, educators still find value in diversifying instructional methods to engage students through multiple modalities: visual, auditory, kinesthetic and verbal. This approach ensures that students are exposed to a richer learning environment that can enhance engagement and understanding across different learners.[41]

When it comes to the two teaching conditions, a close look at the data reveals strong patterns of higher scores by the online learning condition throughout most of the hard measures of achievement. However, none of these findings were significant either in the correlations or the teaching condition comparisons. The overall learning across both teaching methods indicates that students did learn from both teaching conditions. Hence, online teaching provides students with similar learning outcomes as the traditional face-to-face lecture on the various assessments of recall, recognition in terms of knowledge, comprehension, and application-type exam questions.[1] Due to the COVID-19 pandemic, there has been a swift transition to online learning. Fortunately, recent study results have shown that students can effectively learn in both traditional and online teaching settings.[29, 42] Additionally, online teaching can help academic faculty by allowing them to deliver content online providing more time to focus on their clinical academic responsibilities, and can improve work-life balance.[43, 44] Recent studies have shown that while faculty initially report an increased workload with online learning, many still prefer it significantly over face-to-face instruction because of student enthusiasm.[45]

There were several noteworthy findings in terms of students' subjective perceptions of their own achievement. These "softer" indicators were shown to have statistical significance in many cases. First, students reported higher behavioural and cognitive engagement when exposed to the face-to-face lecture vs. online teaching format. This is opposite to many of the pre COVID-19 research findings.[14-52] This seemed surprising given that students would have more control over their learning through the ability to stop, go back, move ahead and/or replay the online teaching module. The findings might suggest face-to-face in-person lectures may be positively impacting students' perceptions.

The COVID-19 pandemic forced didactic teaching of dental and dental hygiene students to an online format. Online learning and teaching, asynchronous and synchronous, perceptually lacks student engagement, and not all students are satisfied with this teaching environment.[46, 47, 48] However, the technology allowed students to attend classes, and some preferred the autonomy of this learning environment.[48] Perhaps the best way moving forward would be to consider a blended approach that includes both face-to-face in-person lectures and online synchronous and asynchronous lectures.[46, 49, 50]

Study limitations

There were various limitations for the current study. First, a small sample size provided less than ideal power for the study. As seen in terms of differences in means, there were patterns of higher scores by the online learning condition throughout most of the hard measures of achievement, yet higher scores by the traditional learning groups on soft measures supporting their perceptions of achievement. A larger sample size would be needed to tease out these differences.

Finding a topic area that is totally new to students would be ideal to test. Even though controls were set in place to adjust for prior knowledge on effective nonverbal communication, testing students who have no prior knowledge would provide a better indication of the impact differences of traditional versus technology-enhanced presentations.

Another area for improvement of this study is that it was conducted at a single university, which may limit the generalizability of the findings. The specific educational

environment and student demographics may not fully represent other institutions, which could affect the applicability of the results in broader contexts.

Applications for future education

With the current challenge for clinical specialists teaching in dentistry and dental hygiene, we need to find new means of capturing their expertise for student learning. Currently, many of our clinical specialists' teaching time is extremely valuable as there were fewer specialists in our health sciences due to the rewarding pressures of working outside of academia (i.e., private practice provides triple the salaries). Further, the current demands on these specialists' time in clinical settings is often in direct conflict with their classroom and clinical teaching, as they were often called away to emergency and operating wards. Hence, finding ways to maximize their teaching time and availing their expert knowledge assessable to students 24/7 through online formats is a paramount need in our health sciences programs.

Applications for future research

As we advance into the era of teaching through technology, we need to discover the specific elements that impact and enhance student online learning based on the various types of students that enter our programs. More research focus needs to attend to the different learning style preferences that students use to learn and to find matching technologies that enhance each of these different learning style preferences. Research also needs to move away from student perceptions of learning to more hard measures of recall and recognition and to go beyond the traditional recognition tests that assess

knowledge, comprehension and application and test for the impact of learning in terms of higher levels of learning including analysis, synthesis, and creativity.

CONCLUSIONS

Teaching students in the health sciences is a challenge that needs to encompass and support the variety of learning style preferences, especially when considering migrating courses from the traditional face-to-face format to online learning. In doing so, the efficiencies of teaching with technology can be more fully realized and the learning of students enhanced. It remains to be seen how technology in the classroom will continue to evolve in the post-pandemic world.

CONFLICTS OF INTEREST

The authors declared no conflict of interest.

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Table 1. Between group comparison of student soft and hard learning measures.

	Variable	ANOVA p-value	Online Group	Traditional Lecture Group
	Post-teaching Assessments			
1.	Perception that the presentation enhanced their learning	p =.03	M = 3.19, SD = .75	M = 3.85, SD = .73
2.	Students' satisfaction with the presentation	p=.05	M = 3.54, SD = 1.07	M = 4.00, SD = .57
3.	Recommendation to encourage other students to attend a similar type of presentation in the future	p=.05	M =3.54 , SD = .95	M = 4.00, SD = .75
4.	Students' self-report on the extent to which they feel engaged in the presentation	p=.05	M = 3.19, SD = 1.23	M = 3.77, SD = .86
5.	Students' perception of success	p=.04	M = 3.19, SD = .85	M = 3.65, SD = .69
6.	Students' perception of control	p=.05	M = 2.88, SD = 1.07	M = 3.42, SD = .90
7.	Students' cognitive engagement self-report	p=.05	M = 3.42, SD = .95	M = 3.85, SD = .54

Legend: F = degrees of freedom; MSE = mean sum of squares; p = alpha level; M = mean; SD = standard deviation.

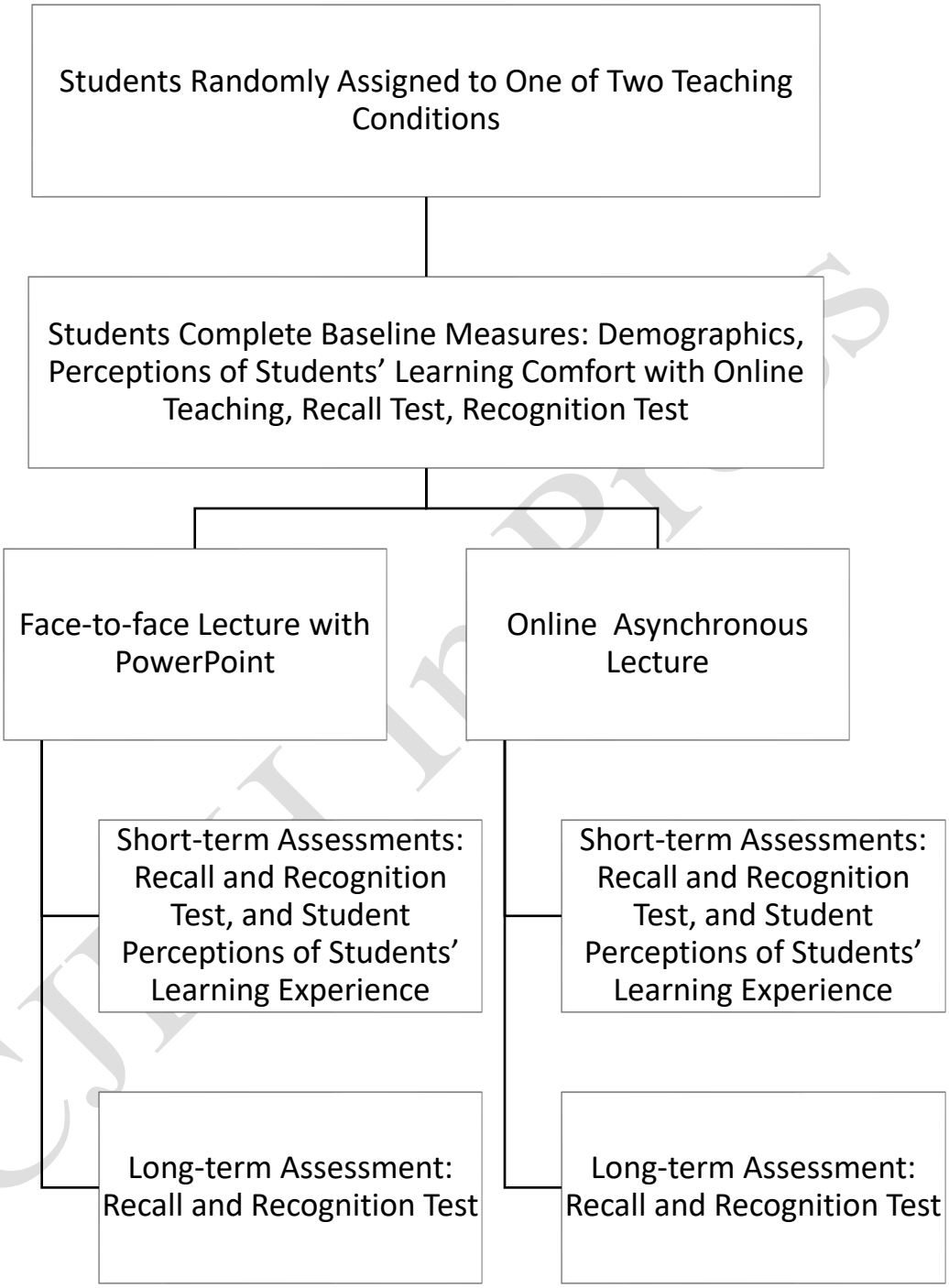
Table 2. ANOVAs conducted across teaching conditions on hard measures of learning.

Variable	ANOVA p-value	Baseline (a) Mean, (±SD)	Post Learning (b) Mean, (±SD)	Long-term Learning (6 months later) (c) Mean, (±SD)	LSD Comparisons
1. Recall	p < .0001	3.67, (+1.54)	9.98, (+3.41)	3.38, (± 5.68)	a vs. b: p<.001 a vs. c: p<.001 b vs. c: p<.001
2. Knowledge MCQs	p < .0001	2.90, (± 1.10)	5.71, (± 0 .97)	4.51, (± 1.33)	a vs. b: p<.001 a vs. c: p<.001 b vs. c: p<.001
3. Comprehension MCQs	p < .05	2.33, (+ 0.96)	2.82, (±0.89)	2.49, (± 1.14)	a vs. b: p<.01 a vs. c: p<.42 b vs. c: p<.09
4. Application MCQs	p < .0001	1.90, (± 1.27)	3.18, (+1.13)	2.49, (±1.14)	a vs. b: p<.01 a vs. c: p<.01 b vs. c: p<.01
5. MCQs Total	p < .0001	7.23, (± 2.11)	11.73, (+ 2.02)	9.49, (±2.96)	a vs. b: p<.01 a vs. c: p<.01 b vs. c: p<.01

Note: LSD *t-tests* were used for comparisons between each of the three achievement times; * = p<.01;

p = alpha level; M = mean; SD = standard deviation.

Figure 1. Linear flow diagram of the procedure.



Appendix 1: Survey Questions Used During the Study

Learning Preferences (Pre-learning condition)
Please complete the following questions in preparation for the upcoming lecture on Nonverbal Communication

Comfort Level Learning New Material in Different Learning Formats

Instructions: Circle the best answer for each of the following.

1. What is your perceived comfort level in learning from lectures presented in the traditional classroom?
    i. Very uncomfortable
    ii. Uncomfortable
    iii. Neutral
    iv. Comfortable
    v. Very comfortable

2. What is your perceived comfort level in learning from lectures presented in an online format?
    i. Very uncomfortable
    ii. Uncomfortable
    iii. Neutral
    iv. Comfortable
    v. Very comfortable

3. To what extent do you think that technology can enhance student learning?
    i. Not at all
    ii. Minimally
    iii. Somewhat
    iv. Quite a lot
    v. Very much so

Previous Knowledge About the Learning Content

4. What best describes your awareness of the term "nonverbal communication"?
    a. No awareness
    b. Limited awareness
    c. Some awareness
    d. Knowledgeable
    e. Very knowledgeable

5. If you are at all aware of this term, your awareness comes from (please circle):
    a. Previous lecture material: no yes
    b. Textbook material: no yes
    c. Personal experience: no yes
    d. Website material: no yes
    e. Other: _____ no yes

Previous Knowledge (Pre-learning condition)

In the next 5 minutes and in the page provided, record all the key words that you know concerning the term "nonverbal communication" for healthcare providers.

Learning Style Preferences (Pre-learning condition)

Instructions: This exercise is designed to identify how individuals learn most easily and nost efficiently. This is not a test. There are no right or wrong answers. You will hear 20 common English words. As you hear each word, observe your own immediate reaction – notice what goes on inside of your head. For each word, you will probably have one of four responses:

1. *You will see a picture of some object or activity.*
2. *You will picture the word spelled out in your mind.*
3. *You will hear the word and understand its meaning based on the sound.*
4. *You may have some physical or emotional feeling about the word, such as tightening of a muscle or a feeling such as warmth, etc.*

This is not a test of word association. It is not important what other word you think of. Rather the nature of your own immediate and instantaneous response to the word itself is important. For each word, circle only one of the four possibilities below.

Edmonds Learning Style Identification Exercise

1.	Picture	Spelling Sound	Feeling
2.	Picture	Spelling Sound	Feeling
3.	Picture	Spelling Sound	Feeling
4.	Picture	Spelling Sound	Feeling
5.	Picture	Spelling Sound	Feeling
6.	Picture	Spelling Sound	Feeling
7.	Picture	Spelling Sound	Feeling
8.	Picture	Spelling Sound	Feeling
9.	Picture	Spelling Sound	Feeling
10.	Picture	Spelling Sound	Feeling
11.	Picture	Spelling Sound	Feeling
12.	Picture	Spelling Sound	Feeling
13.	Picture	Spelling Sound	Feeling
14.	Picture	Spelling Sound	Feeling
15.	Picture	Spelling Sound	Feeling
16.	Picture	Spelling Sound	Feeling
17.	Picture	Spelling Sound	Feeling
18.	Picture	Spelling Sound	Feeling
19.	Picture	Spelling Sound	Feeling
20.	Picture	Spelling Sound	Feeling

Total: _____ _____ _____ _____

Nonverbal Communications Lecture Reflection (Post-learning condition)
Please complete the following questions based on the lecture on Nonverbal Communication.

Comfort Level Learning New Material in Different Learning Formats

1. What was your perceived comfort level in learning from today's presentation?
    i. Very uncomfortable
    ii. Uncomfortable
    iii. Neutral
    iv. Comfortable
    v. Very comfortable

2. To what extent do you think the format of the presentation today enhanced your learning?
    i. Not at all
    ii. Minimally
    iii. Somewhat
    iv. Quite a lot
    v. Very much so

Previous Knowledge About the Lecture Material

3. Now that you have received the lecture on the term "nonverbal communication", how aware were you of this content material prior to the lecture?
    a. No awareness
    b. Limited awareness
    c. Some awareness
    d. Knowledgeable
    e. Very knowledgeable

1. Your satisfaction with the presentation is best described as:
    i. Poor
    ii. Adequate
    iii. Average
    iv. Good
    v. Excellent

2. How successful do you feel over your learning as the result of the presentation?
    i. No success
    ii. Minimal success
    iii. Some success
    iv. Quite a lot of success
    v. Very much success

3. How much control do you feel over your learning as the result of the presentation?
    i. No control
    ii. Minimal control
    iii. Some control
    iv. Quite a lot of control
    v. Very much control

4. To what extent would you encourage other students to attend the presentation on "nonverbal communications"?

i. Not at all
ii. Minimally
iii. Somewhat
iv. Quite a lot
v. Very much so

5. Did you feel engaged in the presentation?
    i. Not at all
    ii. Minimally
    iii. Somewhat
    iv. Quite a lot
    v. Very much so

6. The extent to which the presentation impacted your cognitive engagement with the topic material is best described as:
    i. Not at all
    ii. Minimally
    iii. Somewhat
    iv. Quite a lot
    v. Very much so

Nonverbal Communications Lecture Recall (Post-learning condition)

In the next 5 minutes and in the page provided, record all the key words that you know concerning the term "nonverbal communication" for healthcare providers.